**DEPARTMENT OF CIVIL ENGINEERING**
**ANNA UNIVERSITY, CHENNAI**

## OUR VISION:

Department of Civil Engineering, Anna University, shall strive hard to develop and impart technical knowledge and professional skills required for Civil Engineering practice through excellence in teaching, research and consultancy to address sustainable infrastructure development needs at local, national and International levels.

## OUR MISSION:

Department of Civil Engineering, Anna University shall contribute to technological and development by

1. Providing a firm scientific and technological base in Civil Engineering to achieve self-reliance.
2. Providing quality education through innovation in teaching practices at par with global standards.
3. Nurturing leadership and entrepreneurship qualities with ethical values.
4. Developing and disseminating latest knowledge and technologies in emerging areas of Civil Engineering.
5. Sharing intellectual resources and infrastructure facilities through collaborative partnership.
6. Ensuring supporting conditions for enhancing the employability skills.



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**UNIVERSITY DEPARTMENTS**

**REGULATIONS – 2015**

**CHOICE BASED CREDIT SYSTEM**

**B. E. CIVIL ENGINEERING**

## PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) :

I. To prepare students for successful careers in Civil Engineering field that meets the needs of Indian and multinational companies.

II. To develop the confidence and ability among students to synthesize data and technical concepts and thereby apply it in real world problems.

III. To develop students to use modern techniques, skill and mathematical engineering tools for solving problems in Civil Engineering.

IV. To provide students with a sound foundation in mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyse engineering problems and to prepare them for graduate studies.

V. To promote students to work collaboratively on multi-disciplinary projects and make them engage in life-long learning process throughout their professional life.

## PROGRAMME OUTCOMES (POs):

On successful completion of the programme,

1. Graduates will demonstrate knowledge of mathematics, science and engineering.
2. Graduates will demonstrate an ability to identify, formulate and solve engineering problems.
3. Graduate will demonstrate an ability to design and conduct experiments, analyze and interpret data.
4. Graduates will demonstrate an ability to design a system, component or process as per needs and specifications.
5. Graduates will demonstrate an ability to visualize and work on laboratory and multidisciplinary tasks.
6. Graduate will demonstrate skills to use modern engineering tools, software and equipment to analyze problems.
7. Graduates will demonstrate knowledge of professional and ethical responsibilities.
8. Graduate will be able to communicate effectively in both verbal and written form.
9. Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.
10. Graduate will develop confidence for self education and ability for life-long learning.

## PEOs & POs

The B.E. Civil Engineering Program outcomes leading to the achievement of the objectives are summarized in the following Table.

| Programme Educational Objectives | Programme Outcomes | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | a | B | c | d | e | f | g | h | i | j | k |
| I | X | X | | X | X | | | | | | X |
| II | | X | X | | | | | | | | |
| III | | | | X | | | X | | | | |
| IV | X | | | | X | | | | | | |
| V | | | | | | X | | X | X | X | |

| | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR 1 | SEM 1 | Foundational English | | | | ✓ | | | | ✓ | | | | | | | |
| | | Mathematics - I | ✓ | | | | | | | | | | | | | | |
| | | Engineering Physics | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| | | Engineering Chemistry | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| | | Engineering Graphics | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | | |
| | | Basic Electrical and Electronics Engineering | | | | | | | | | | | | | | | |
| | | Basic Sciences Laboratory | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | SEM 2 | Technical English | | | | ✓ | | | | ✓ | | | | | | | |
| | | Mathematics – II | ✓ | | | | | | | | | | | | | | |
| | | Physics for Civil Engineering | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| | | Chemistry for Civil Engineering | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| | | Engineering Mechanics | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | | |
| | | Computing Techniques | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | | | | | | |
| | | Computer Practices Laboratory | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | | | | | | |
| | | Engineering Practices Laboratory | ✓ | ✓ | | | | ✓ | ✓ | | | | | | | | |
| | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| YEAR | SEM 3 | Transform Techniques and Partial | 3 | 2 | 1 | 2 | 1 | | 1 | | | 1 | | 1 | 2 | 1 | 1 |



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| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Differential Equations | | | | | | | | | | | | | | | |
| | | Engineering Geology | 2 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | | Strength of Materials–I | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 3 | 2 | 2 |
| | | Fluid Mechanics | 3 | 2 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 3 | 3 |
| | | Construction Materials | 3 | 2 | 3 | 2 | 1 | 2 | 1 | 3 | 2 | 1 | 2 | 1 | 3 | 3 | 3 |
| | | Environmental Science and Engineering | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 3 | 1 | 1 | 1 |
| | | Strength of Materials Laboratory | 3 | 2 | | 3 | 3 | 3 | 2 | 3 | | | | 2 | 3 | 3 | 3 |
| | | Construction Materials Laboratory | 3 | 3 | | | 3 | 2 | | | | 1 | | | 3 | 3 | 3 |
| | | | | | | | | | | | | | | | | | |
| | **SEM 4** | Numerical Methods | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | | | 1 | 2 | 3 | 3 | 2 |
| | | Applied Hydraulic Engineering | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 3 | 3 | 2 | 3 |
| | | Soil Mechanics | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 2 | 3 |
| | | Strength of Materials–II | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 3 | 2 | 2 |
| | | Plane and Geodetic Surveying | 3 | 2 | 2 | 1 | 3 | 2 | | 2 | | | | 2 | 3 | 2 | 3 |
| | | Construction Techniques and Practices | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 3 | 3 |
| | | Plane and Geodetic Surveying | 1 | 1 | 2 | | 3 | 2 | | 2 | | | | 1 | 2 | 2 | 2 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Laboratory | | | | | | | | | | | | | | | |
| | | Hydraulic Engineering Laboratory | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 2 | 1 |
| | | Computer Aided Building Drawing | 3 | | | 3 | 3 | 2 | 1 | 3 | | | | 3 | 3 | 3 | 3 |
| | | | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **YEAR 3** | **SEM 5** | Design of Reinforced Cement Concrete Structures | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 3 | 3 |
| | | Water Supply Engineering | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 3 |
| | | Highway Engineering | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| | | Structural Analysis – I | 3 | 3 | 2 | 2 | 1 | 2 | 3 | 1 | 1 | | 1 | 2 | 3 | 2 | 2 |
| | | Open Elective I | | | | | | | | | | | | | | | |
| | | Professional Elective I | | | | | | | | | | | | | | | |
| | | Highway Engineering Laboratory | | 3 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| | | Soil Mechanics Laboratory | 1 | 2 | 3 | 3 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 3 | 3 |
| | | | | | | | | | | | | | | | | | |
| | **SEM 6** | Design of Steel and Timber Structures | 2 | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 |
| | | Structural Analysis–II | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 1 | 1 | 1 | 2 | 3 | 2 | 2 |
| | | Structural Design and Drawing | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 2 | 3 |
| | | Wastewater | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Engineering | | | | | | | | | | | | | | | |
| | | Professional Elective II | | | | | | | | | | | | | | | |
| | | Open Elective-II* | | | | | | | | | | | | | | | |
| | | Survey Camp (2 weeks–During V semester) | | 1 | 2 | | 3 | 2 | | 1 | | | | 2 | 3 | 3 | 3 |
| | | Water and Waste Water Analysis Laboratory | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 |
| | | | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **YEAR 4** | **SEM 7** | Estimation, Costing and Valuation Engineering | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| | | Irrigation Engineering | 3 | 2 | | 2 | 2 | 3 | 3 | 3 | 1 | 2 | 3 | 2 | 3 | 3 | 2 |
| | | Foundation Engineering | 2 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 3 | 2 | 3 | 3 |
| | | Employability Skills | 1 | 1 | 1 | 1 | | | | | | | | | 2 | 1 | 2 |
| | | Professional Elective- III | | | | | | | | | | | | | | | |
| | | Creative and Innovative Project (Activity Based - Subject Related) | 3 | 2 | 1 | 3 | | 3 | 2 | 2 | 2 | 1 | 1 | 3 | 3 | 3 | 3 |
| | | Industrial Training (4 weeks During VI semester–Summer) | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | 3 | 3 | 3 | 3 |
| | | Irrigation and | 1 | 2 | 3 | 2 | | 2 | 2 | 2 | | 2 | | 2 | 2 | 3 | 3 |



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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Environmental Engineering Drawing | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | **SEM 8** | Professional Elective IV | | | | | | | | | | | | | | | |
| | | Professional Elective V | | | | | | | | | | | | | | | |
| | | Professional Elective VI | | | | | | | | | | | | | | | |
| | | Project Work | 3 | 2 | 1 | 3 | | 3 | 2 | 2 | 2 | 1 | 1 | 3 | 3 | 3 | 3 |

## Professional Electives (PE)

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Computer Aided Design of Structures | | | | | | | | | | | | | | | |
| Design of Plate and Shell Structures | 3 | 2 | 3 | | | 1 | | | 1 | 1 | | 1 | 1 | 1 | 2 |
| Design of Pre-stressed Concrete Structures | 3 | 2 | 3 | | | 1 | | | 1 | 1 | | 1 | 1 | 1 | 2 |
| Industrial Structures | 3 | 2 | 2 | | | 1 | | | 1 | 1 | | 2 | 1 | 2 | 2 |
| Maintenance, Repair and Rehabilitation of Structures | 3 | 2 | 3 | | | 1 | | | 1 | 1 | | 1 | 1 | 1 | 2 |
| Power Plant Structures | 3 | 2 | 3 | | | 1 | | | 1 | 1 | | 1 | 1 | 1 | 2 |
| Prefabricated Structures | 3 | 2 | 3 | | | 1 | | | 1 | 1 | | 1 | 1 | 1 | 2 |
| Tall Structures | 3 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 3 | 1 | 1 | 3 | 2 | 2 |
| Structural Dynamics and Earthquake Engineering | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 3 | 2 | 3 |
| Geo-Environmental Engineering | 3 | 1 | 3 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | 1 | 3 | 2 | 2 | 3 |
| Introduction to Soil Dynamics and Machine Foundations | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 3 | 1 | 3 | 1 | 3 | 2 | 2 | 3 |
| Pavement Engineering | | 3 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 |
| Rock Engineering | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 3 | 1 | 3 | 1 | 3 | 2 | 2 | 3 |
| Ground improvement Techniques | 3 | 3 | 2 | 3 | 3 | 1 | 2 | 3 | 1 | 2 | 2 | 3 | 2 | 3 | 3 |
| Traffic Engineering and Management | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 |
| Transport and Environment | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 |
| Transportation Planning and Systems | 2 | 3 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 |
| Urban Planning and Development | 3 | 1 | 2 | 3 | 2 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| Railways, Airports and Harbour Engineering | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 2 | 1 | 2 | 3 | 3 | 3 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Engineering Ethics and Human Values | | | | | | | | | | | | | | | |
| Air Pollution and Control Engineering | 3 | 3 | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| Environmental and Social Impact Assessment | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| Industrial Wastewater Engineering | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 |
| Municipal Solid Waste Management | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 |
| Disaster Management | | | | | | | | | | | | | | | |
| Hydrology and Water Resources Engineering | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 |
| Integrated Water Resources Management | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 3 | 2 | 3 | 1 | 2 | 2 | 2 | 2 |
| Participatory Water Resources Management | 2 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 | 1 | 1 | 3 | 3 | 1 | 3 |
| Coastal Engineering | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| Groundwater Engineering | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 |
| Water Resources Systems Engineering | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| Geoinformatics Applications for Civil Engineers | 2 | 2 | 3 | 3 | 3 | 2 | | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| Cartography | | | | | | | | | | | | | | | |
| Total Station and GPS Surveying | 3 | 3 | 3 | 1 | 3 | | | 3 | 3 | | 2 | 3 | | | |
| Geographic Information System | 2 | 3 | 1 | | 3 | 1 | 2 | 2 | 1 | 2 | 1 | | 1 | 2 | 2 |
| Digital Cadastre | | | | | | | | | | | | | | | |
| Advanced Surveying | | | | | | | | | | | | | | | |
| Human Rights | | | | | | | | | | | | | | | |
| Foundation Skills In Integrated Product Development | | | | | | | | | | | | | | | |



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**REGULATIONS – 2015**

**CHOICE BASED CREDIT SYSTEM**

**CURRICULA AND SYLLABI I - VIII SEMESTERS**

## SEMESTER I

| S.No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | HS7151 | Foundational English | HS | 4 | 4 | 0 | 0 | 4 |
| 2. | MA7151 | Mathematics I | BS | 4 | 4 | 0 | 0 | 4 |
| 3. | PH7151 | Engineering Physics | BS | 3 | 3 | 0 | 0 | 3 |
| 4. | CY7151 | Engineering Chemistry | BS | 3 | 3 | 0 | 0 | 3 |
| 5. | EE7151 | Basic Electrical and Electronics Engineering | ES | 3 | 3 | 0 | 0 | 3 |
| 6. | GE7152 | Engineering Graphics | ES | 5 | 3 | 2 | 0 | 4 |
| **PRACTICAL** | | | | | | | | |
| 7. | BS7161 | Basic Sciences Laboratory | BS | 4 | 0 | 0 | 4 | 2 |
| | | | **TOTAL** | **26** | **20** | **2** | **4** | **23** |

## SEMESTER II

| S.No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | HS7251 | Technical English | HS | 4 | 4 | 0 | 0 | 4 |
| 2. | MA7251 | Mathematics–II | BS | 4 | 4 | 0 | 0 | 4 |
| 3. | PH7254 | Physics for Civil Engineering | BS | 3 | 3 | 0 | 0 | 3 |
| 4. | CY7253 | Chemistry for Civil Engineering | BS | 3 | 3 | 0 | 0 | 3 |
| 5. | GE7151 | Computing Techniques | ES | 3 | 3 | 0 | 0 | 3 |
| 6. | GE7153 | Engineering Mechanics | ES | 4 | 4 | 0 | 0 | 4 |
| **PRACTICAL** | | | | | | | | |
| 7. | GE7161 | Computer Practices Laboratory | ES | 4 | 0 | 0 | 4 | 2 |
| 8. | GE7162 | Engineering Practices Laboratory | ES | 4 | 0 | 0 | 4 | 2 |
| | | | **TOTAL** | **29** | **21** | **0** | **8** | **25** |

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## SEMESTER III

| S.No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | AG7306 | Engineering Geology | ES | 3 | 3 | 0 | 0 | 3 |
| 2. | CE7301 | Construction Materials | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | CE7302 | Strength of Materials–I | ES | 3 | 3 | 0 | 0 | 3 |
| 4. | CE7351 | Fluid Mechanics | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | GE7251 | Environmental Science and Engineering | HS | 3 | 3 | 0 | 0 | 3 |
| 6. | MA7358 | Transform Techniques and Partial Differential Equations | BS | 4 | 4 | 0 | 0 | 4 |
| **PRACTICAL** | | | | | | | | |
| 7. | CE7261 | Strength of Materials Laboratory | ES | 4 | 0 | 0 | 4 | 2 |
| 8. | CE7311 | Construction Materials Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| | | | **TOTAL** | **27** | **19** | **0** | **8** | **23** |

## SEMESTER IV

| S.No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | CE7353 | Plane and Geodetic Surveying | PC | 4 | 4 | 0 | 0 | 4 |
| 2. | CE7401 | Applied Hydraulic Engineering | PC | 4 | 2 | 2 | 0 | 3 |
| 3. | CE7402 | Construction Techniques and Practices | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | CE7403 | Soil Mechanics | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | CE7404 | Strength of Materials–II | PC | 3 | 3 | 0 | 0 | 3 |
| 6. | MA7354 | Numerical Methods | BS | 4 | 4 | 0 | 0 | 4 |
| **PRACTICAL** | | | | | | | | |
| 7. | CE7362 | Plane and Geodetic Surveying Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 8. | CE7411 | Hydraulic Engineering Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 9. | CE7611 | Computer Aided Building Drawing | EEC | 4 | 0 | 0 | 4 | 2 |
| | | | **TOTAL** | **33** | **19** | **2** | **12** | **26** |

## SEMESTER V

| S.No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | CE7501 | Design of Reinforced Cement Concrete Structures | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | CE7502 | Highway Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | CE7503 | Structural Analysis – I | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | CE7504 | Water Supply Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | | Open Elective I* | OE | 3 | 3 | 0 | 0 | 3 |
| 6. | | Professional Elective I | PE | 3 | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | |
| 7. | CE7511 | Highway Engineering Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 8. | CE7512 | Soil Mechanics Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| | | | **TOTAL** | **26** | **18** | **0** | **8** | **22** |

## SEMESTER VI

| S.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | CE7601 | Design of Steel and Timber Structures | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | CE7602 | Structural Analysis–II | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | CE7603 | Structural Design and Drawing | PC | 5 | 3 | 0 | 2 | 4 |
| 4. | CE7604 | Wastewater Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | | Professional Elective II | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | | Open Elective II* | OE | 3 | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | |
| 7. | CE7612 | Water and Waste Water Analysis Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 8. | CE7613 | Survey Camp (2 weeks – During V Semester) | EEC | 0 | 0 | 0 | 0 | 2 |
| | | | **TOTAL** | **24** | **18** | **0** | **6** | **23** |

## SEMESTER VII

| S.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | CE7701 | Estimation, Costing and Valuation Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | CE7702 | Foundation Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | CE7703 | Irrigation Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | HS7551 | Employability Skills | HS | 3 | 3 | 0 | 0 | 3 |
| 5. | | Professional Elective III | PE | 3 | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | |
| 6. | CE7711 | Creative and Innovative Project (Activity Based - Subject Related)[#] | EEC | 4 | 0 | 0 | 4 | 2 |
| 7. | CE7712 | Irrigation and Environmental Engineering Drawing | PC | 4 | 0 | 0 | 4 | 2 |
| 8. | CE7713 | Industrial Training (4 weeks During VI Semester – Summer) | EEC | 0 | 0 | 0 | 0 | 2 |
| | | | **TOTAL** | **23** | **15** | **0** | **8** | **21** |

## SEMESTER VIII

| S.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | | Professional Elective IV | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | | Professional Elective V | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | | Professional Elective VI | PE | 3 | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | |
| 4. | CE7811 | Project Work[#] | EEC | 20 | 0 | 0 | 20 | 10 |
| | | | **TOTAL** | **29** | **9** | **0** | **20** | **19** |

**TOTAL NO. OF CREDITS: 182**

*Course from the curriculum of other UG Programmes.

[#]The Contact periods will not appear in the slot time table

## HUMANITIES AND SOCIAL SCIENCES (HS)

| S.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | HS7151 | Foundational English | HS | 4 | 4 | 0 | 0 | 4 |
| 2. | HS7251 | Technical English | HS | 4 | 4 | 0 | 0 | 4 |
| 3. | GE7251 | Environmental Science and Engineering | HS | 3 | 3 | 0 | 0 | 3 |
| 4. | HS7551 | Employability Skills | HS | 3 | 3 | 0 | 0 | 3 |

## BASIC SCIENCES (BS)

| S.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | MA7151 | Mathematics – I | BS | 4 | 4 | 0 | 0 | 4 |
| 2. | PH7151 | Engineering Physics | BS | 3 | 3 | 0 | 0 | 3 |
| 3. | CY7151 | Engineering Chemistry | BS | 3 | 3 | 0 | 0 | 3 |
| 4. | BS7161 | Basic Sciences Laboratory | BS | 4 | 0 | 0 | 4 | 2 |
| 5. | MA7251 | Mathematics – II | BS | 4 | 4 | 0 | 0 | 4 |
| 6. | PH7254 | Physics for Civil Engineering | BS | 3 | 3 | 0 | 0 | 3 |
| 7. | CY7253 | Chemistry for Civil Engineering | BS | 3 | 3 | 0 | 0 | 3 |
| 8. | MA7358 | Transform Techniques and Partial Differential Equations | BS | 4 | 4 | 0 | 0 | 4 |
| 9. | MA7354 | Numerical Methods | BS | 4 | 4 | 0 | 0 | 4 |

## ENGINEERING SCIENCES (ES)

| S.No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | EE7151 | Basic Electrical and Electronics Engineering | ES | 3 | 3 | 0 | 0 | 3 |
| 2. | GE7152 | Engineering Graphics | ES | 5 | 3 | 2 | 0 | 4 |
| 3. | GE7151 | Computing Techniques | ES | 3 | 3 | 0 | 0 | 3 |
| 4. | GE7153 | Engineering Mechanics | ES | 4 | 4 | 0 | 0 | 4 |
| 5. | GE7161 | Computer Practices Laboratory | ES | 4 | 0 | 0 | 4 | 2 |
| 6. | GE7162 | Engineering Practices Laboratory | ES | 4 | 0 | 0 | 4 | 2 |
| 7. | AG7306 | Engineering Geology | ES | 3 | 3 | 0 | 0 | 3 |
| 8. | CE7302 | Strength of Materials–I | ES | 3 | 3 | 0 | 0 | 3 |
| 9. | CE7261 | Strength of Materials Laboratory | ES | 4 | 0 | 0 | 4 | 2 |

Attested



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## PROFESSIONAL CORE (PC)

| S.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | CE7351 | Fluid Mechanics | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | CE7301 | Construction Materials | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | CE7311 | Construction Materials Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 4. | CE7401 | Applied Hydraulic Engineering | PC | 4 | 2 | 2 | 0 | 3 |
| 5. | CE7403 | Soil Mechanics | PC | 3 | 3 | 0 | 0 | 3 |
| 6. | CE7404 | Strength of Materials – II | PC | 3 | 3 | 0 | 0 | 3 |
| 7. | CE7353 | Plane and Geodetic Surveying | PC | 4 | 4 | 0 | 0 | 4 |
| 8. | CE7402 | Construction Techniques and Practices | PC | 3 | 3 | 0 | 0 | 3 |
| 9. | CE7411 | Hydraulic Engineering Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 10. | CE7362 | Plane and Geodetic Surveying Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 11. | CE7501 | Design of Reinforced Cement Concrete Structures | PC | 3 | 3 | 0 | 0 | 3 |
| 12. | CE7504 | Water Supply Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 13. | CE7502 | Highway Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 14. | CE7503 | Structural Analysis I | PC | 3 | 3 | 0 | 0 | 3 |
| 15. | CE7511 | Highway Engineering Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 16. | CE7512 | Soil Mechanics Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 17. | CE7601 | Design of Steel and Timber Structures | PC | 3 | 3 | 0 | 0 | 3 |
| 18. | CE7602 | Structural Analysis II | PC | 3 | 3 | 0 | 0 | 3 |
| 19. | CE7603 | Structural Design and Drawing | PC | 5 | 3 | 0 | 2 | 4 |
| 20. | CE7604 | Waste Water Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 21. | CE7612 | Water and Waste Water Analysis Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 22. | CE7701 | Estimation, Costing and Valuation Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 23. | CE7703 | Irrigation Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 24. | CE7702 | Foundation Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 25. | CE7712 | Irrigation and Environmental Engineering Drawing | PC | 4 | 0 | 0 | 4 | 2 |

## PROFESSIONAL ELECTIVES (PE)

| S.No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | AI7071 | Integrated Water Resources Management | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | AI7072 | Participatory Water | PE | 3 | 3 | 0 | 0 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Resources Management | | | | | | |
| 3. | AI7451 | Hydrology and Water Resources Engineering | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | CE7001 | Advanced Surveying | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | CE7002 | Air Pollution and Control Engineering | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | CE7003 | Coastal Engineering | PE | 3 | 3 | 0 | 0 | 3 |
| 7. | CE7004 | Computer Aided Design of Structures | PE | 3 | 3 | 0 | 0 | 3 |
| 8. | CE7005 | Design of Plate and Shell Structures | PE | 3 | 3 | 0 | 0 | 3 |
| 9. | CE7006 | Design of Prestressed Concrete Structures | PE | 3 | 3 | 0 | 0 | 3 |
| 10. | CE7007 | Digital Cadastre | PE | 3 | 3 | 0 | 0 | 3 |
| 11. | CE7008 | Environmental and Social Impact Assessment | PE | 3 | 3 | 0 | 0 | 3 |
| 12. | CE7009 | Geo-Environmental Engineering | PE | 3 | 3 | 0 | 0 | 3 |
| 13. | CE7010 | Geographic Information System | PE | 3 | 3 | 0 | 0 | 3 |
| 14. | CE7011 | Geoinformatics Applications for Civil Engineers | PE | 3 | 3 | 0 | 0 | 3 |
| 15. | CE7012 | Ground Improvement Techniques | PE | 3 | 3 | 0 | 0 | 3 |
| 16. | CE7013 | Groundwater Engineering | PE | 3 | 3 | 0 | 0 | 3 |
| 17. | CE7014 | Industrial Structures | PE | 3 | 3 | 0 | 0 | 3 |
| 18. | CE7015 | Industrial Wastewater Engineering | PE | 3 | 3 | 0 | 0 | 3 |
| 19. | CE7016 | Introduction to Soil Dynamics and Machine Foundations | PE | 3 | 3 | 0 | 0 | 3 |
| 20. | CE7017 | Maintenance, Repair and Rehabilitation of Structures | PE | 3 | 3 | 0 | 0 | 3 |
| 21. | CE7018 | Municipal Solid Waste Management | PE | 3 | 3 | 0 | 0 | 3 |
| 22. | CE7019 | Pavement Engineering | PE | 3 | 3 | 0 | 0 | 3 |
| 23. | CE7020 | Power Plant Structures | PE | 3 | 3 | 0 | 0 | 3 |
| 24. | CE7021 | Prefabricated Structures | PE | 3 | 3 | 0 | 0 | 3 |
| 25. | CE7022 | Railways, Airports and Harbour Engineering | PE | 3 | 3 | 0 | 0 | 3 |
| 26. | CE7023 | Rock Engineering | PE | 3 | 3 | 0 | 0 | 3 |
| 27. | CE7024 | Structural Dynamics and Earthquake Engineering | PE | 3 | 3 | 0 | 0 | 3 |
| 28. | CE7025 | Tall Structures | PE | 3 | 3 | 0 | 0 | 3 |
| 29. | CE7026 | Total Station and GPS Surveying | PE | 3 | 3 | 0 | 0 | 3 |
| 30. | CE7027 | Traffic Engineering and Management | PE | 3 | 3 | 0 | 0 | 3 |
| 31. | CE7028 | Transport and Environment | PE | 3 | 3 | 0 | 0 | 3 |
| 32. | CE7029 | Transportation Planning and Systems | PE | 3 | 3 | 0 | 0 | 3 |
| 33. | CE7030 | Urban Planning and Development | PE | 3 | 3 | 0 | 0 | 3 |
| 34. | CE7031 | Water Resources Systems Engineering | PE | 3 | 3 | 0 | 0 | 3 |
| 35. | GE7071 | Disaster Management | PE | 3 | 3 | 0 | 0 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 36. | GE7074 | Human Rights | PE | 3 | 3 | 0 | 0 | 3 |
| 37. | GE7351 | Engineering Ethics and Human Values | PE | 3 | 3 | 0 | 0 | 3 |
| 38. | GI7009 | Cartography | PE | 3 | 3 | 0 | 0 | 3 |
| 39. | GE7072 | Foundation Skills In Integrated Product Development | PE | 3 | 3 | 0 | 0 | 3 |

## EMPLOYABILITY ENHANCEMENT COURSES (EEC)

| S.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | CE7611 | Computer Aided Building Drawing | EEC | 4 | 0 | 0 | 4 | 2 |
| 2. | CE7613 | Survey Camp (2 Weeks During V Semester) | EEC | 0 | 0 | 0 | 0 | 2 |
| 3. | CE7711 | Creative and Innovative Project (Activity Based - Subject Related)# | EEC | 4 | 0 | 0 | 4 | 2 |
| 4. | CE7713 | Industrial Training (4 weeks During VI semester – Summer) | EEC | 0 | 0 | 0 | 0 | 2 |
| 5. | CE7811 | Project Work | EEC | 20 | 0 | 0 | 20 | 10 |

## SUMMARY

| S.No | Subject Area | Credits per Semester | | | | | | | | Credits Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | |
| **1** | **HS** | 4 | 4 | 3 | | | | 3 | | **14** |
| **2** | **BS** | 12 | 10 | 4 | 4 | | | | | **30** |
| **3** | **ES** | 7 | 11 | 8 | | | | | | **26** |
| **4** | **PC** | | | 8 | 20 | 16 | 15 | 11 | | **70** |
| **5** | **PE** | | | | | 3 | 3 | 3 | 9 | **18** |
| **6** | **OE** | | | | | 3 | 3 | 0 | | **6** |
| **7** | **EEC** | | | 0 | | | 4 | 4 | 10 | **18** |
| | **Total** | **23** | **25** | **23** | **24** | **22** | **25** | **21** | **19** | **182** |
| **8** | **Non-Credit/Mandatory** | | | | | | | | | |

**HS7151** **FOUNDATIONAL ENGLISH** **L T P C**
**4 0 0 4**

**COURSE DESCRIPTION:**
This course aims at developing the language skills necessary for the first year students of Engineering and Technology.

**OBJECTIVES:**

- To develop the four language skills – Listening, Speaking, Reading and Writing.
- To improve the students' communicative competence in English.
- To teach students the various aspects of English language usage.

**CONTENTS**

**UNIT I GREETING AND INTRODUCING ONESELF 12**
**Listening**- Types of listening – Listening to short talks, conversations; **Speaking** – Speaking about one's place, important festivals etc. – Introducing oneself, one's family/ friend; **Reading** – Skimming a passage– Scanning for specific information; **Writing**- Guided writing - Free writing on any given topic ( My favourite place/ Hobbies/ School life, writing about one's leisure time activities, hometown, etc.); **Grammar** – Tenses (present and present continuous) -Question types - Regular and irregular verbs; **Vocabulary** – Synonyms and Antonyms.

**UNIT II GIVING INSTRUCTIONS AND DIRECTIONS 12**
**Listening** – Listening and responding to instructions; **Speaking** – Telephone etiquette - Giving oral instructions/ Describing a process – Asking and answering questions; **Reading** – Reading and finding key information in a given text - Critical reading - **Writing –**Process description( non-technical)- **Grammar** – Tense (simple past& past continuous) - Use of imperatives – Subject – verb agreement – Active and passive voice; - **Vocabulary** – Compound words – Word formation – Word expansion ( root words).

**UNIT III READING AND UNDERSTANDING VISUAL MATERIAL 12**
**Listening**- Listening to lectures/ talks and completing a task; **Speaking** –Role play/ Simulation – Group interaction; **Reading** – Reading and interpreting visual material;**Writing**- Jumbled sentences – Discourse markers and Cohesive devices – Essay writing (cause & effect/ narrative);**Grammar** – Tenses (perfect), Conditional clauses –Modal verbs; **Vocabulary** –Cause and effect words; Phrasal verbs in context.

**UNIT IV CRITICAL READING AND WRITING 12**
**Listening**- Watching videos/ documentaries and responding to questions based on them; **Speaking**Informal and formal conversation;**Reading** –Critical reading (prediction & inference);**Writing**–Essay writing ( compare & contrast/ analytical) – Interpretation of visual materials;**Grammar** – Tenses (future time reference);**Vocabulary** – One word substitutes (with meanings) – Use of abbreviations & acronyms – Idioms in sentences.

**UNIT V LETTER WRITING AND SENDING E-MAILS 12**
**Listening**- Listening to programmes/broadcast/ telecast/ podcast;**Speaking** – Giving impromptu talks, Making presentations on given topics- Discussion on the presentation;**Reading** –Extensive reading;**Writing**- Poster making – Letter writing (Formal and E-mail) ;**Grammar** – Direct and Indirect speech – Combining sentences using connectives;**Vocabulary** –Collocation;

**TEACHING METHODS:**
Interactive sessions for the speaking module.
Use of audio – visual aids for the various listening activities.
Contextual Grammar Teaching.

Attested



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**EVALUATION PATTERN:**
Internals – 50%
End Semester – 50%

**TOTAL: 60 PERIODS**

**LEARNING OUTCOMES:**

- Students will improve their reading and writing skills
- Students will become fluent and proficient in communicative English
- Students will be able to improve their interpersonal communication

**TEXTBOOK:**

1. Richards, Jack.C with Jonathan Hull and Susan Proctor **New Interchange : English for International Communication. (level2, Student's Book)** Cambridge University Press, New Delhi: 2010.

**REFERENCES:**

1. Bailey, Stephen. **Academic Writing: A practical guide for students**. New York: Rutledge,2011.
2. Morgan, David and Nicholas Regan. **Take-Off: Technical English for Engineering**. London: Garnet Publishing Limited, 2008.
3. Redston, Chris & Gillies Cunningham **Face2Face** (Pre-intermediate Student's Book & Workbook) Cambridge University Press, New Delhi: 2005
4. Comfort, Jeremy, et al. **Speaking Effectively : Developing Speaking Skills for Business English.** Cambridge University Press, Cambridge: Reprint 2011.

| MA7151 | MATHEMATICS – I<br>(Common to all branches of B.E. / B.Tech. Programmes in I Semester) | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |

**OBJECTIVES:**

- The goal of this course is for students to gain proficiency in calculus computations. In calculus, we use three main tools for analyzing and describing the behavior of functions: limits, derivatives, and integrals. Students will use these tools to solve application problems in a variety of settings ranging from physics and biology to business and economics.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

**UNIT I DIFFERENTIAL CALCULUS 12**

Representation of functions - New functions from old functions - Limit of a function - Limits at infinity - Continuity - Derivatives - Differentiation rules - Polar coordinate system - Differentiation in polar coordinates - Maxima and Minima of functions of one variable.

**UNIT II FUNCTIONS OF SEVERAL VARIABLES 12**

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Errors and approximations – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

**UNIT III INTEGRAL CALCULUS 12**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

**UNIT IV MULTIPLE INTEGRALS 12**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

**UNIT V DIFFERENTIAL EQUATIONS 12**

Method of variation of parameters – Method of undetermined coefficients – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

**TOTAL :60 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Understanding of the ideas of limits and continuity and an ability to calculate with them and apply them. |
| **CO2** | Improved facility in algebraic manipulation. |
| **CO3** | Fluency in differentiation. |
| **CO4** | Fluency in integration using standard methods, including the ability to find an appropriate method for a given integral. |
| **CO5** | Understanding the ideas of differential equations and facility in solving simple standard examples. |

**TEXTBOOKS:**


1. James Stewart, "Calculus with Early Transcendental Functions", Cengage Learning, New
2. Delhi, 2008.
3. Narayanan S. and Manicavachagom Pillai T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 9th Edition, New Delhi, 2014.
5. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.


**REFERENCES:**


1. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
4. Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education, New Delhi, 2nd Edition, 5th Reprint, 2009.
5. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.


**PH7151 ENGINEERING PHYSICS L T P C**

**(Common to all branches of B.E. / B.Tech. Programmes) 3 0 0 3**

**OBJECTIVE:**

- To introduce the concept and different ways to determine moduli of elasticity and applications.
- To instill the concept of sound, reverberation, noise cancellation, and ultrasonic generation, detection and applications
- To inculcate an idea of thermal properties of materials, heat flow through materials and

quantum physics

- To promote the basic understanding of interferometers, principles and applications of lasers, optical fibers and sensors
- To establish a sound grasp of knowledge on the basics, significance and growth of single crystals

**UNIT I PROPERTIES OF MATTER 9**

Elasticity – Poisson's ratio and relationship between moduli (qualitative) - stress-strain diagram for ductile and brittle materials, uses - factors affecting elastic modulus and tensile strength - bending of beams - cantilever - bending moment - Young's modulus determination - theory and experiment - uniform and non-uniform bending - I shaped girders - twisting couple - hollow cylinder - shaft - torsion pendulum - determination of rigidity modulus- moment of inertia of a body (regular and irregular).

**UNIT II ACOUSTICS AND ULTRASONICS 9**

Classification of sound - loudness and intensity - Weber-Fechner Law - standard intensity and intensity level - decibel - reverberation - reverberation time - calculation of reverberation time for different types of buildings – sound absorbing materials - factors affecting acoustics of buildings : focussing, interference, echo, echelon effect, resonance - noise and their remedies. Ultrasonics: production - magnetostriction and piezoelectric methods - detection of ultrasound - acoustic grating – ultrasonic interferometer - industrial applications – Non-destructive testing - ultrasonic method: scan modes and practice.

**UNIT III THERMAL AND MODERN PHYSICS 9**

Thermal expansion - thermal stress - expansion joints - bimetallic strips - thermal conductivity- heat conductions in solids – flow of heat through compound media - Forbe's and Lee's disc method: theory and experiment- Black body radiation – Planck's theory (derivation) – Compton effect – wave model of radiation and matter – Schrödinger's wave equation – time dependent and independent equations – Physical significance of wave function – particle in a one dimensional box.

**UNIT IV APPLIED OPTICS 9**

Interference - Michelson interferometer: construction, working, determination of wave length and thickness - anti-reflection coating - air wedge and its applications - Lasers – principle and applications – Einstein's coefficients – $CO_2$ and Nd:YAG laser - semiconductor lasers: homo junction and hetro junction - construction and working – applications. Optical fibres - classification (index & mode based) - principle and propagation of light in optical fibres - acceptance angle and numerical aperture - fibre optic communication system - active and passive sensors.

**UNIT V CRYSTAL PHYSICS 9**

Single crystalline, polycrystalline and amorphous materials – Single crystals: unit cell, crystal systems, Bravais lattices, ditections and planes in a crystal, Miller indices - interplanar distance for a cubic crystal - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - structure and significance of NaCl, CsCl, ZnS and graphite - crystal imperfections: point defects, line defects – Burger vectors, dislocations and stacking faults – Growth of single crystals: Bridgman and Czochralski methods.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME:**

| | |
|---|---|
| **CO1** | The students will understand different moduli of elasticity, their determination and applications. |
| **CO2** | The students will gain knowledge on the properties of sound, noise cancellation, and production, detection and applications of ultrasonics |
| **CO3** | The students will acquire sound knowledge on thermal expansion and thermal conductivity of materials. Further they will gain an idea of quantum physics. |
| **CO4** | The students will gain knowledge on interferometers, lasers and fiber optics |
| **CO5** | The students will secure knowledge on the basics of crystal structures and their significance. Further they gain basic ideas of growing single crystals. |

**TEXTBOOKS:**


1. Gaur R.K. and Gupta S.L., “Engineering Physics”, Dhanpat Rai Publications (2013)
2. Palanisamy P.K., “Engineering Physics”, Scitech Publications (P) Ltd. (2006).
3. Arumugam M., “Engineering Physics”, Anuradha Publications (2000)


**REFERENCES:**


1. Serway R.A. and Jewett, J.W. “Physics for Scientists and Engineers with Modern Physics”. Brooks/cole Publishing Co. (2010).
2. Tipler P.A. and Mosca, G.P., “Physics for Scientists and Engineers with Modern Physics”. W.H.Freeman, (2007).
3. Markert J.T.,Ohanian, H. and Ohanian, M. “Physics for Engineers and Scientists”. W.W.Norton & Co. (2007).


**CY7151 ENGINEERING CHEMISTRY**

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

**OBJECTIVE:**

- To develop an understanding about fundamentals of polymer chemistry.
- Brief elucidation on surface chemistry and catalysis.
- To develop sound knowledge photochemistry and spectroscopy.
- To impart basic knowledge on chemical thermodynamics.
- To understand the basic concepts of nano chemistry.

**UNIT I POLYMER CHEMISTRY** **9**

Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension.

**UNIT II SURFACE CHEMISTRY AND CATALYSIS** **9**

Adsorption-Types of adsorption-adsorption of gases on solids- adsorption from solutions-Types of isotherms–Frendlich adsorption isotherm,Langmuir adsorption isotherm.Industrial applications of adsorption. Catalysis: Characteristics and types of catalysts-homogeneous and heterogeneous, auto catalysis. Enzyme catalysis -factors affecting enzyme catalysis, Michaelis-Menton equation.Industrial applications of catalysts.

**UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY** **9**

Photochemistry: Laws of photochemistry-Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law. Photo processes-internal conversion, inter-system crossing, fluorescence, phosphorescence, chemiluminescence and photo-sensitization. Spectroscopy: Electromagnetic spectrum-absorption of radiation-electronic, vibrational and rotational transitions. Width and intensities of spectral lines.Spectrophotometric estimation of iron.UV-Vis and IR spectroscopy- principles, instrumentation (Block diagram) and applications.

**UNIT IV CHEMICAL THERMODYNAMICS** **9**

Second law: Entropy-entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Free energy and work function: Helmholtzand Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius Clapeyron equation; Maxwell relations-Van’t Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation- variation of chemical potential with temperature and pressure.



**9**

**UNIT V NANOCHEMISTRY**

Basics-distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Preparation of nanoparticles – sol-gel and solvothermal.preparation of carbon nanotube by chemical vapour deposition and laser ablation.Preparation of nanowires by VLS growth, electrochemical deposition and electro spinning.Properties and uses of nanoparticles, nanoclusters, nanorods, nanotubes and nanowires.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME:**

| | |
|---|---|
| **CO1** | Will be familiar with polymer chemistry, surface chemistry and catalysis. |
| **CO2** | Will know the photochemistry, spectroscopy and chemical thermodynamics. |
| **CO3** | Will know the fundamentals of nano chemistry. |

**TEXTBOOKS**


1. Jain P. C. & Monica Jain., "Engineering Chemistry", DhanpatRai Publishing Company (P) Ltd, New Delhi, 2014.
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2014


**REFERENCES**


1. Pahari A., Chauhan B., "Engineering Chemistry", Firewall Media, New Delhi, 2012.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.
3. AshimaSrivastava. Janhavi N N, Concepts of Engineering Chemistry", ACME Learning Private Limited., New Delhi., 2010.
4. Vairam S., Kalyani P., Suba Ramesh., "Engineering Chemistry", Wiley India Pvt Ltd., New Delhi., 2011.


**EE7151 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To impart the knowledge on basic concepts of electrical circuits and electrical machines.
- To impart the knowledge on basic concepts of electronic components, devices and circuits

**UNIT I BASIC CONCEPTS AND DC CIRCUITS 9**

Ohm's law - Electrical resistance - Series / Parallel resistive circuits - Star/Delta transformations - Kirchoff's law - Node and Mesh analysis - Thevenin's and Norton's theorem.

**UNIT II A.C.CIRCUITS 9**

RMS and average value of periodic waves - Form factor - Phase and Phase difference - Simple RC.RL and RLC circuits - series and parallel resonance - power and power factor - introduction to three phase systems – power measurement in 3 phase system.

**UNIT III D.C. MACHINES 10**

Construction details of DC machines - principle of operation of DC generator - EMF equation - principle of DC motor - Back EMF - Voltage and torque equation - Principle of transformer - construction and type - EMF equation - Tests on transformer - Equivalent circuit - Induction motor - Construction and basic principle of operation - Starting and Running torques.

**UNIT IV ELECTRONIC COMPONENTS AND DEVICES 9**

Operating principle and characteristics of Simple PN Junction Diodes, Zener diode, Bipolar Junction transistor - Field Effect Transistors – UJT – SCR.

**UNIT V ANALOG CIRCUITS 8**

Rectifier and Power Supply Circuits, clipper, clamper using diodes, Operational Amplifiers (Ideal) - properties and typical circuits like differentiator, integrator, summer, comparator.

**TOTAL : 45 PERIODS**

**COURSE OUTCOME:**

| | |
|---|---|
| **CO1** | ability to use the various electrical machines like AC/ DC, electronic components and applications of analog circuits |

**REFERENCES:**


1. Theraja, B.L., "A Text Books of Electrical Technology ", S.S.Chand and Co., New Delhi, 1998.
2. Edminister J.A., "Theory and Problems on Electric circuits ", McGraw Hill International Edition, 1994.
3. Kosow, I.L., " Electrical Machinery and Transformers ", 4th Edition, Prentice Hall of India, 1991.
4. Nagrath I.J. and Kothari D.P., "Theory and Problems of Basic Electrical Engineering", Prentice Hall of India, 1998.
5. Millman.J. and Grabel.S., Integrated Electronics, Tata McGraw Hill, 1995.
6. Horowits.P. and Hill.W., The Art of Electronics, McGraw Hill, 1995.


| **GE7152** | **ENGINEERING GRAPHICS** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **2** | **0** | **4** |

**OBJECTIVES:**

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.

**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 FREE HANDSKETCHING 14**

Basic Geometrical constructions, Curves used in engineering practices-Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 14**

Orthographic projection- principles-Principal planes-First angle projection-Projection of points.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 and trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principalplanes by rotating object method.

**UNIT III PROJECTION OF SOLIDS 14**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method and auxiliary plane method.

Attested



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**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 14**

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

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 15**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems.
Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method and vanishing point method.

**COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY) 3**

Introduction to drafting packages and demonstration of their use.

**L=45+T=30, TOTAL :75 PERIODS**

**COURSE OUTCOME:**

| | |
|---|---|
| **CO1** | On Completion of the course the student will be able to |
| **CO2** | Perform free hand sketching of basic geometrical shapes and multiple views of objects. |
| **CO3** | Draw orthographic projections of lines, Planes and Solids |
| **CO4** | Obtain development of surfaces. |
| **CO5** | Prepare isometric and perspective views of simple solids. |

**TEXTBOOKS:**


1. N.D.Bhatt and V.M.Panchal, “Engineering Drawing”, Charotar Publishing House, 50thEdition, 2010.


**REFERENCES:**


1. K.R.Gopalakrishna., “Engineering Drawing” (Vol I&II combined) Subhas Stores, Bangalore, 2007
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. M.B.Shah and B.C.Rana, “Engineering Drawing”, Pearson, 2nd Edition, 2009
4. K.Venugopal and V.Prabhu Raja, “Engineering Graphics”, New Age International (P)Limited ,2008.
5. K. V. Natarajan, “A text book of Engineering Graphics”, 28th Edition, Dhanalakshmi Publishers, Chennai, 2015.
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
7. N.S Parthasarathy and Vela Murali, “ Engineering Drawing”, Oxford University Press, 2015


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 scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

Attested



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**BS7161** **BASIC SCIENCES LABORATORY** **L T P C**
(Common to all branches of B.E. / B.Tech Programmes) **0 0 4 2**

**PHYSICS LABORATORY: (Any Seven Experiments)**

**OBJECTIVE:**

- To inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- To induce the students to familiarize with experimental determination of velocity of ultrasonic waves, band gap determination and viscosity of liquids.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of young's modulus
3. Uniform bending – Determination of young's modulus
4. Lee's disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo E.M.F of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
9. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Post office box -Determination of Band gap of a semiconductor.
12. Spectrometer- Determination of wavelength using gating.
13. Viscosity of liquids - Determination of co-efficient of viscosity of a liquid by Poiseuille's flow

**COURSE OUTCOME:**

| | |
|---|---|
| **CO1** | Upon completion of the course, the students will be able to determine various moduli of elasticity and also various thermal and optical properties of materials |
| **CO2** | To determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids. |

**CHEMISTRY LABORATORY:**

**(Minimum of 8 experiments to be conducted)**

1. Estimation of HCl using $Na_2CO_3$ as primary standard and Determination of alkalinity in water sample.
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. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of poly vinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.

Attested



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14. Determination of CMC.
15. Phase change in a solid.

**TOTAL: 60 PERIODS**

**TEXTBOOKS:**

1. Vogel's Textbook of Quantitative Chemical Analysis ($8^{TH}$ edition, 2014)
2. Laboratory Manual- Department of Chemistry, CEGC, Anna University (2014).

**HS7251 TECHNICAL ENGLISH L T P C**
**4 0 0 4**

**OBJECTIVES:**

- To enable students acquire proficiency in technical communication.
- To enhance their reading and writing skills in a technical context.
- To teach various language learning strategies needed in a professional environment.

**CONTENTS**

**UNIT I ANALYTICAL READING 12**

**Listening**- Listening to informal and formal conversations; **Speaking** – Conversation Skills (opening, turn taking, closing )-explaining how something works-describing technical functions and applications; **Reading** –Analytical reading, Deductive and inductive reasoning; **Writing**- vision statement–structuring paragraphs.

**UNIT II SUMMARISING 12**

**Listening**- Listening to lectures/ talks on Science & Technology; **Speaking** –Summarizing/ Oral Reporting, **Reading** – Reading Scientific and Technical articles; **Writing**- Extended definition –Lab Reports – Summary writing.

**UNIT III DESCRIBING VISUAL MATERIAL 12**

**Listening**- Listening to a panel discussion; **Speaking** – Speaking at formal situations; **Reading** – Reading journal articles - Speed reading; **Writing**-data commentary-describing visual material-writing problem-process- solution-the structure of problem-solution texts- writing critiques

**UNIT IV WRITING/ E-MAILING THE JOB APPLICATION 12**

**Listening**- Listening to/ Viewing model interviews; **Speaking** –Speaking at different types of interviews – Role play practice ( mock interview); **Reading** – Reading job advertisements and profile of the company concerned; **Writing**- job application – cover letter –Résumé preparation.

**UNIT V REPORT WRITING 12**

**Listening**- Viewing a model group discussion; **Speaking** –Participating in a discussion - Presentation; **Reading** – Case study - analyse -evaluate – arrive at a solution; **Writing**– Recommendations- Types of reports (feasibility report)- designing and reporting surveys- – Report format.- writing discursive essays.

**TEACHING METHODS:**

Practice writing
Conduct model and mock interview and group discussion.
Use of audio – visual aids to facilitate understanding of various forms of technical communication.
Interactive sessions.

**EVALUATION PATTERN:**

Internals – 50%
End Semester – 50%

**TOTAL: 60 PERIODS**

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**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Students will learn the structure and organization of various forms of technical communication. |
| **CO2** | Students will be able to listen and respond to technical content. |
| **CO3** | Students will be able to use different forms of communication in their respective fields. |

**TEXTBOOK:**

1. Craig, Thaine**. Cambridge Academic English: An integrated skills course for EAP(Student's Book)Level: Intermediate** Cambridge University Press, New Delhi: 2012

**REFERENCES:**


1. Laws, Anne. **Presentations.** Hyderabad: Orient Blackswan, 2011.
2. Ibbotson, Mark. **Cambridge English for Engineering**. Cambridge University Press, Cambridge,New Delhi: 2008
3. Naterop, Jean B. and Rod Revell. **Telephoning in English**. Cambridge: Cambridge University Press, 2004.
4. Rutherford, Andrea J. **Basic Communication Skills for Technology**. New Delhi: Pearson Education, 2001.
5. Bailey, Stephen. **Academic Writing A practical Guide for Students**. Routledge, London: 2004.
6. Hewings, Martin**. Cambridge Academic English: An integrated skills course for EAP(Student's Book)Level: Intermediate** Cambridge University Press, New Delhi: 2012.


| **MA7251** | **MATHEMATICS – II (Common to all branches of B.E. / B.Tech. Programmes in I Semester)** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **4** | **0** | **0** | **4** |

**OBJECTIVES:**

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of the electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

**UNIT I MATRICES 12**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

**UNIT II VECTOR CALCULUS 12**

Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

**UNIT III ANALYTIC FUNCTION 12**

Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions

$w = z+c,\ az,\ \frac{1}{z}, z^2$ - Bilinear transformation

**UNIT IV COMPLEX INTEGRATION 12**

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

**UNIT V LAPLACE TRANSFORMS 12**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem –— Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

**TOTAL : 60 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Upon successful completion of the course, students should be able to evaluate real and complex integrals using the Cauchy integral formula and the residue theorem |
| **CO2** | Appreciate how complex methods can be used to prove some important theoretical results. |
| **CO3** | Evaluate line, surface and volume integrals in simple coordinate systems |
| **CO4** | Calculate grad, div and curl in Cartesian and other simple coordinate systems, and establish identities connecting these quantities |
| **CO5** | Use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results. |

**TEXTBOOKS:**


1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 9th Edition, New Delhi, 2014.
2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.


**REFERENCES:**


1. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.
2. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, New Delhi, 2007.
3. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
4. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
5. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.




**PH7254 PHYSICS FOR CIVIL ENGINEERING**

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

**OBJECTIVE:**

- To introduce the basics of heat transfer through different materials, thermal performance of building and various thermal applications
- To impart knowledge on the ventilation and air conditioning of buildings
- To introduce the concepts of sound insulation and lighting designs
- To give an introduction to the processing and applications of new engineering materials
- To create an awareness on natural disasters and safety measures

**UNIT I THERMAL APPLICATIONS 9**

Principles of heat transfer, steady state of heat flow, conduction through compound media-series and parallel-conductivity of rubber tube and powder materials - heat transfer through fenestrations,

thermal insulation and its benefits - heat gain and heat loss estimation - factors affecting the thermal performance of buildings, thermal measurements, thermal comfort, indices of thermal comfort, climate and design of solar radiation, shading devices - central heating.

**UNIT II VENTILATION AND REFRIGERATION 9**

Requirements, principles of natural ventilation - ventilation measurements, design for natural ventilation - Window types and packaged air conditioners - chilled water plant - fan coil systems - water piping - cooling load - Air conditioning systems for different types of buildings - Protection against fire to be caused by A.C.Systems.

**UNIT III ACOUSTICS AND LIGHTING DESIGNS 9**

Methods of sound absorptions - absorbing materials - noise and its measurements, sound insulation and its measurements, impact of noise in multi-storeyed buildings. Visual field glare, colour - day light calculations - day light design of windows, measurement of day-light and use of models and artificial skies, principles of artificial lighting, supplementary artificial lighting.

**UNIT IV NEW ENGINEERING MATERIALS 9**

Composites - Definition and Classification - Fibre reinforced plastics (FRP) and fiber reinforced metals (FRM) - Metallic glasses - Shape memory alloys - Ceramics - Classification - Crystalline - Non Crystalline - Bonded ceramics, Manufacturing methods - Slip casting - Isostatic pressing - Gas pressure bonding - Properties - thermal, mechanical, electrical and chemical ceramic fibres - ferroelectric and ferromagnetic ceramics - High Aluminium ceramics.

**UNIT V NATURAL DISASTERS 9**

Seismology and Seismic waves - Earth quake 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**

**COURSE OUTCOME:**

| | |
|---|---|
| **CO1** | After completion of the course, the students will acquire knowledge about heat transfer through different materials, thermal performance of building and thermal insulation. |
| **CO2** | Gain knowledge on the ventilation and air conditioning of buildings |
| **CO3** | Understand the concepts of sound absorption, noise insulation and lighting designs |
| **CO4** | Know about the processing and applications of composites, metallic glasses, shape memory alloys and ceramics |
| **CO5** | Get an awareness on natural disasters such as earth quake, cyclone, fire and safety measures |

**REFERENCES:**


1. Mathur D.S., “Properties of Matter”, Chand and Co., New Delhi (2002).
2. William H. Severns and Julian R. Fellows, “Air conditioning and Refrigeration”, John Wiley and Sons, London (1988).
3. Stevens W.R., “Building Physics: Lighting”, Oxford New York: Pergaman Press (1969).
4. Leon Reiter, “Earthquake hazard analysis - Issues and insights”, Columbia University Press, (1991).
5. Hull B. and John, V., “Nondestructive Testing”, Mc.Millar Education Ltd., London (1988).
6. Eugine Hecht, “Optics”, Pearson Education Inc. (2002).
7. Alexander D., “Natural disaster”, UCL Press, London (1993).
8. Shearer P.M., “Introduction to Seismology”, Cambridge University Press (1999).
9. Kenneth G.Budinski and Michel K., Budinski, “Engineering Materials Properties and Selection”, Pearson, Singapore (2002).

**CY7253 CHEMISTRY FOR CIVIL ENGINEERING**

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

**OBJECTIVE:**

- To develop an understanding about the chemistry of building materials.
- Brief elucidation on corrosion and its control.
- To develop sound knowledge about the water science and technology.
- To impart basic knowledge on adhesives, abrasives, refractories and composites.
- To understand the basic concepts of chemical and instrumental methods of analysis.

**UNIT I CHEMISTRY OF BUILDING MATERIALS 9**

Introduction-lime: types-manufacture and properties-cement-Portland cement, setting and hardening of cement, types of cement, analysis of cement and dolomite, special cement. Concrete-manufacture and its properties-gypsum plaster. Ceramic-clay products-white ware, stone ware and earthen ware. Glass-manufacture, types, properties and it uses. Fly ash-properties and uses.

**UNIT II CORROSION AND ITS CONTROL 9**

Introduction-chemical and electrochemical corrosions-mechanism of electrochemical and galvanic corrosions-concentration cell corrosion-passivity-soil, pitting, inter-granular, water line, stress and microbiological corrosions-galvanic series-factors influencing corrosion-measurement of corrosion rate. Corrosion control-material selection and design-electrochemical protection- sacrificial anodic protection and impressed current cathodic protection. Protective coatings- metallic coatings (hot dipping, metal cladding, galvanizing, tinning, electroplating, electroless plating), non-metallic inorganic coatings, organic coatings (paints).

**UNIT III ADHESIVES AND COMPOSITES 9**

Adhesives: Introduction on adhesive action, definitions, development of adhesive bond strength- physical and chemical factors influencing adhesive action- classification of adhesives-important synthetic adhesives. Composites – Introduction – definition – constitution-classification-applications of composite materials-fiber reinforced composites-properties of reinforced composites.

**UNIT IV ABRASIVES AND REFRACTORIES 9**

Abrasives: Definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: Definition, characteristics, classification, properties-refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of Refractories- general method; acidic Refractories-fire clay, silica; basic refractories - magnetite, dolomite; neutral refractories-silicon carbide, zircon.

**UNIT V WATER AND INSTRUMENTAL ANALYSIS 9**

Properties of water, sources, quality for different uses-significance of water quality parameter pH, EC, TDS, hardness, chloride, sulphate, iron, fluoride, nitrate, BOD, COD, and heavy metals (As, Hg, Cr, Pb) and their determination by titrimetry, electrometry, UV-visible, AAS, ICP-AES, softening of water by ion exchange method, municipal water treatment, principle, coagulations, filtration, and disinfection. Desalination by reverse osmosis method.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME:**

| | |
|---|---|
| **CO1** | Will be familiar with corrosion and its control. |
| **CO2** | Will know the characterization techniques. |
| **CO3** | Will know the water quality analysis for industrial applications. |

**TEXTBOOKS:**


1. Jain P.C. and Monica Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2014.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd.,

New Delhi, 2012.

**REFERENCES:**

1. Kannan P., Ravikrishnan A., “Engineering Chemistry”, Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2014
2. Gurdeep R. Chatwal, Sharma K. Anand, Instrumental methods of Chemical Analysis, Himalaya Publishers, New Delhi, 2014
3. Mary Jane Shultz “Engineering Chemistry”. Cengage Learning India private Ltd., New Delhi., 2007.
4. Ashima Srivastava., Janhavi N. N., ‘‘Concepts of Engineering Chemistry”., ACME Learning Private Limited., New Delhi., 2010.
5. Vairam S, Kalyani P, Suba Ramesh., “Engineering Chemistry”. Wiley India Pvt. Ltd., New Delhi., 2011.

| GE7151 | COMPUTING TECHNIQUES (Common to all branches of Engineering and Technology) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVE:**

- To learn programming using a structured programming language.
- To provide C programming exposure.
- To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

**UNIT I INTRODUCTION** **9**

Introduction to Computers – Computer Software – Computer Networks and Internet - Need for logical thinking – Problem formulation and development of simple programs - Pseudo code - Flow Chart and Algorithms.

**UNIT II C PROGRAMMING BASICS** **9**

Introduction to C programming – Fundamentals – Structure of a C program – Compilation and linking processes - Constants, Variables – Data Types – Expressions - Operators –Decision Making and Branching – Looping statements – Solving Simple Scientific and Statistical Problems.

**UNIT III ARRAYS AND STRINGS** **9**

Arrays – Initialization – Declaration – One dimensional and two dimensional arrays - Strings- String operations – String Arrays - simple programs- sorting- searching – matrix operations.

**UNIT IV POINTERS** **9**

Macros - Storage classes –Basic concepts of Pointers– Pointer arithmetic - Example Problems - Basic file operations

**UNIT V FUNCTIONS AND USER DEFINED DATA TYPES** **9**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion –Enumerators – Structures – Unions

**TOTAL :45 PERIODS**

**COURSE OUTCOME:**

| | |
|---|---|
| **CO1** | At the end of the course, the student should be able to Write C program for simple applications |
| **CO2** | Formulate algorithm for simple problems |
| **CO3** | Analyze different data types and arrays |
| **CO4** | Perform simple search and sort**.** |
| **CO5** | Use programming language to solve problems |

**TEXTBOOKS:**

1. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013
2. Ashok N. Kamthane, "Computer programming", Pearson Education, 2007.
3. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

**REFERENCES:**

1. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006
2. Byron S Gottfried, "Programming with C", Schaums Outlines, Second Edition, Tata McGraw-Hill, 2006.
3. R.G. Dromey, "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007

**GE7153 ENGINEERING MECHANICS** **L T P C**
**4 0 0 4**

**OBJECTIVES:**

- The objective of this course is to inculcate in the student the ability to analyze any problem in a simple and logical manner and to predict the physical phenomena and thus lay the foundation for engineering applications.

**UNIT I STATICS OF PARTICLES** **12**

Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles -Forces in a Plane , Resultant of Forces , Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors.

Equilibrium of a Particle- Newton's First Law of Motion, Space and Free-Body Diagrams , Forces in Space, Equilibrium of a Particle in Space.

**UNIT II EQUILIBRIUM OF RIGID BODIES** **12**

Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point ,Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

**UNIT III DISTRIBUTED FORCES** **16**

Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration , Theorems of Pappus-Guldinus, Distributed Loads on Beams, Center of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies , Determination of Centroids of Volumes by Integration.

Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration , Polar Moment of Inertia , Radius of Gyration of an Area , Parallel-Axis Theorem , Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates , Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

**UNIT IV FRICTION** **8**

The Laws of Dry Friction. Coefficients of Friction, Angles of Friction, Wedges, Wheel Friction. Rolling Resistance, Ladder friction.

**UNIT V DYNAMICS OF PARTICLES** **12**

Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion -Equations of Motions , Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force , Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact, Method of Virtual Work - Work of a Force, Potential Energy, Potential Energy and Equilibrium.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Upon completion of this course, Students will be able to construct meaningful mathematical models of physical problems and solve them. |
| **CO2** | Apply the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D. |
| **CO3** | Apply the concepts of frictional forces at the contact surfaces of various engineering systems. |
| **CO4** | Apply the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces. |
| **CO5** | Apply the various methods to determine the resultant force an its equilibrium acting on a particle in 2D and 3D. |

**TEXTBOOKS:**


1. Beer,F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", McGraw-Hill Education (India) Pvt. Ltd. 10th Edition, 2013.


**REFERENCES:**


1. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
2. J.L. Meriam & L.G. Karige, Engineering Mechanics: Statics (Volume I) and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
3. P. Boresi & J. Schmidt, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
4. Irving H. Shames, G. Krishna Mohana Rao, Engineering Mechanics - Statics and Dynamics, Fourth Edition – PHI / Pearson Education Asia Pvt. Ltd., 2006.
5. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)




| **GE7161** | **COMPUTER PRACTICES LABORATORY** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **0** | **0** | **4** | **2** |

**OBJECTIVES:**

- To understand the basic programming constructs and articulate how they are used to develop a program with a desired runtime execution flow.
- To articulate where computer programs fit in the provision of computer-based solutions to real world problems.
- To learn to use user defined data structures.

**LIST OF EXPERIMENTS**

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts

4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions
9. Program using Recursive Function
10. Program using structures and unions.

**TOTAL :60 PERIODS**

**COURSE OUTCOME:**

| | |
|---|---|
| **CO1** | At the end of the course, the student should be able to Write and compile programs using C programs. |
| **CO2** | Write program with the concept of Structured Programming |
| **CO3** | Identify suitable data structure for solving a problem |

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

- Write and compile programs using C programs.
- Write program with the concept of Structured Programming
- Identify suitable data structure for solving a problem
  Demonstrate the use of conditional statement.

**LABORATORY REQUIREMENTS FOR BATCH OF 30 STUDENTS**

30 Systems with C compiler

**GE7162** **ENGINEERING PRACTICES LABORATORY** **L T P C**
**(Common to all Branches of B.E. / B.Tech. Programmes)** **0 0 4 2**

**OBJECTIVE:**

- To provide exposure to the students with hands-on experience on various Basic Engineering Practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP – A (CIVIL & ELECTRICAL)**

**1. CIVIL ENGINEERING PRACTICES** **15**

**PLUMBING**

Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.

• Laying pipe connection to the suction side of a pump.

• Laying pipe connection to the delivery side of a pump.

• Practice in connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

**WOOD WORK**

- Sawing, planning and making joints like T-Joint, Mortise and Tenon joint and Dovetail joint.

**STUDY**

- Study of joints in door panels and wooden furniture
- Study of common industrial trusses using models.

**2. ELECTRICAL ENGINEERING PRACTICES** **15**

- Basic household wiring using Switches, Fuse, Indicator and Lamp etc.,
- Stair case light wiring
- Tube – light wiring
- Preparation of wiring diagrams for a given situation.
- Study of Iron-Box, Fan Regulator and Emergency Lamp

**GROUP – B (MECHANICAL AND ELECTRONICS)**

**3. MECHANICAL ENGINEERING PRACTICES WELDING** **15**

• Arc welding of Butt Joints, Lap Joints, and Tee Joints

• Gas welding Practice.

• Basic Machining - Simple turning, drilling and tapping operations..

• Study and assembling of the following:

a. Centrifugal pump
b. Mixie
c. Air Conditioner.

**DEMONSTRATION ON FOUNDRY OPERATIONS.**

**4. ELECTRONIC ENGINEERING PRACTICES** **15**

• Soldering simple electronic circuits and checking continuity.

• Assembling electronic components on a small PCB and Testing.

• Study of Telephone, FM radio and Low Voltage Power supplies.

**TOTAL : 60 PERIODS**

**OUTCOME:**

| | |
|---|---|
| **CO1** | Ability to fabricate carpentry components and to lay pipe connections including plumbing works. |
| **CO2** | Ability to use welding equipment's to join the structures |
| **CO3** | Ability to do wiring for electrical connections and to fabricate electronics circuits |

Attested



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**AG7306** **ENGINEERING GEOLOGY** **L T P C**
**3 0 0 3**

**OBJECTIVES:**

- At the end of this course the students will be able to understand the importance of geological knowledge such as earth, earthquake, volcanism and the action of various geological agencies. The students of civil engineering will realize the importance of this knowledge in projects such as dams, tunnels, bridges, roads, airport and harbor. The knowledge of geophysical methods and remote sensing techniques are useful to know the various surface and subsurface features. Based on this, civil engineers can choose the types of foundations and other related aspects.

**UNIT I PHYSICAL GEOLOGY 9**

Geology in civil engineering – branches of geology – structure of earth and its composition – weathering of rocks – scale of weathering – soils - landforms and processes associated with river, wind, groundwater and sea – relevance to civil engineering. Plate tectonics

**UNIT II MINEROLOGY 9**

Physical properties of minerals – Quartz group, Feldspar group, Pyroxene - hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals.

**UNIT III PETROLOGY 9**

Classification of rocks, distinction between Igneous, Sedimentary and Metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.

**UNIT IV STRUCTURAL GEOLOGY AND GEOPHYSICAL METHODS 9**

Geological maps – attitude of beds, study of structures – folds, faults and joints – relevance to civil engineering. Geophysical methods – Seismic and electrical methods for subsurface investigations.

**UNIT V GEOLOGICAL INVESTIGATION 9**

Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings. Coastal protection structures. Investigation of Landslides and earthquakes - causes and mitigation, seismic zonation – seismic zones of India.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

The students completing this course, the students expected to be able to:

| | |
|---|---|
| **CO1** | Understand the internal structure of earth and its relation to earthquake, volcanism and the various geological agents. |
| **CO2** | Have better understanding of the role of minerals in engineering properties of construction materials and foundation rocks. Will also realize the importance of rocks as construction materials, foundation and road aggregates. |
| **CO3** | Appreciate the role of geological structures in the design and construction of major civil engineering projects such as dams, tunnels, bridges, roads, airportandharbours,apartfromlearningthesignificanceofengineeringpropertiesof rocks. |
| **CO4** | Gain knowledge on the role of geological mapping, remote sensing and geophysics for surface and sub surface investigations. In addition, the student |

| | |
|---|---|
| | Will also gain knowledge on borehole logging methods and their applications. |
| **CO5** | Useallthegeologicalknowledgeindesignandconstructionofmajorcivilengineeringstructures,inadditiontomitigatinggeologicalhazardssuchas earthquakes, landslides and Tsunami that affect civil engineering structures. |

**TEXTBOOKS:**


1. Varghese, P.C., Engineering Geology for Civil Engineering PHI Learning Private Limited, New Delhi, 2012.
2. Venkatareddy. D. Engineering Geology, Vikas Publishing House Pvt. Ltd. 2010.
3. KVGK Gokhale, Principles of Engineering Geology, BS Publications, Hyderabad 2011.
4. N. Chenna Kesavulu. Textbook of Engineering Geology, Macmillan India Ltd., 2009.
5. Parbin Singh. A Text book of Engineering and General Geology, Katson publishing house, Ludhiana 2009.


**REFERENCES:**


1. Muthiayya, V.D.(1969), " A Text of Geology", Oxford IBH Publications, Calcutta.
2. Blyth F.G.H. and de Freitas M.H., Geology for Engineers, Edward Arnold, London, 2010.
3. F.G.Bell. Fundamentals of Engineering Geology, B.S. Publications. Hyderabad 2011.
4. Dobrin, M.B An introduction to geophysical prospecting, McGraw-Hill, New Delhi, 1988.


**CO – PO Mapping – ENGINEERING GEOLOGY**

| PO/PSO | | Course Outcome | | | | | Over all Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| **PO1** | Knowledge of Engineering Sciences | 2 | 2 | 2 | | | 2 |
| **PO2** | Proble2 analysis | | | 2 | 2 | 3 | 2 |
| **PO3** | Design/develop2ent of solutions | | | 3 | | 3 | 3 |
| **PO4** | Investigation | | 2 | 3 | 3 | 3 | 3 |
| **PO5** | 2odern Tool Usage | | 2 | | 2 | | 2 |
| **PO6** | Individual and Tea2work | | 2 | 2 | | 2 | 2 |
| **PO7** | Communication | | | | | 1 | 1 |
| **PO8** | Engineer and Society | 2 | | | 2 | 2 | 2 |
| **PO9** | Ethics | | | | 2 | 2 | 2 |
| **PO10** | Environment and Sustainability | 2 | | | 2 | 2 | 2 |
| **PO11** | Project Management and Finance | | | | 2 | 2 | 2 |
| **PO12** | Life Long Learning | | | | 2 | 2 | 2 |
| **PSO1** | Knowledge of Civil Engineering discipline | | 2 | | 2 | 2 | 2 |
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | | | | 2 | 2 | 2 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | | | 2 | | 2 | 2 |

Attested



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**CE7301 CONSTRUCTION MATERIALS L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To introduce students to various materials commonly used in civil engineering construction and their properties.

**UNIT I STONES – BRICKS – CONCRETE BLOCKS 9**

Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for special use – Refractory bricks – Cement, brick and Concrete hollow blocks – Light weight concrete blocks.

**UNIT II LIME – CEMENT – AGGREGATES – MORTAR 9**

Lime – Preparation of lime mortar – Cement – Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration – Compressive strength – Tensile strength – Fineness– Soundness and consistency – Setting time – Industrial byproducts – Fly ash – Aggregates – Natural stone aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – Abrasion Resistance – Grading – Sand Bulking.

**UNIT III CONCRETE 9**

Concrete – Ingredients – Manufacturing Process – Batching plants – RMC – Properties of fresh concrete – Slump – Flow and compaction Factor – Properties of hardened concrete– Compressive, Tensile and shear strength – Modulus of rupture – Tests – Mix specification – Mix proportioning – BIS method – High Strength Concrete and HPC – Self compacting Concrete – Other types of Concrete – Durability of Concrete.

**UNIT IV TIMBER AND OTHER MATERIALS 9**

Timber – Market forms – Industrial timber– Plywood – Veneer – False ceiling materials – Panels of laminates – Steel – Aluminum and Other Metallic Materials – Composition – Aluminium composite panel – Uses – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Bitumens.

**UNIT V MODERN MATERIALS 9**

Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products – Refractories – Composite materials – Types – Applications of laminar composites – Fibre textiles – Geomembranes and Geotextiles for earth reinforcement - colour coated sheets, insulated wall panels. floor finish materials for residential/industrial buildings

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- The students will be able to will be able to understand the properties of natural and advanced building materials and manufacturing of cement, brick, mortar, concrete.

| | |
|---|---|
| **CO1** | Identify the good quality of brick for construction. |
| **CO2** | Design the concrete mixes for different exposure conditions |
| **CO3** | Understand material properties of cement and aggregates. |
| **CO4** | Study the market forms of timber and steel. |
| **CO5** | Recognize the good practices of thermal insulation sand air conditioning of building. |

**TEXTBOOKS:**


1. Varghese.P.C, Construction Materials, Prentice Hall Inc., 2007.
2. Rajput.R.K., Engineering Materials, S. Chand and Company Ltd., 2008.
3. Shetty.M.S., Concrete Technology (Theory and Practice), S. Chand and Company Ltd., 2008
4. Gambhir.M.L., Concrete Technology, Third Edition, Tata McGraw–Hill Education, 2004

5. Duggal.S.K., Building Materials, Third Edition, New Age International, 2008.

**REFERENCES:**

1. Jagadish.K.S, Alternative Building Materials Technology, New Age International, 2007.
2. Relevant Indian Standard Codes of Practice
3. IS456 – 2000: Indian Standard specification for plain and reinforced concrete.
4. IS4926–2003 : Indian Standard specification for ready–mixed concrete
5. IS383–1970: Indian Standard specification for coarse and fine aggregate from natural sources for concrete
6. IS1542–1992: Indian standard specification for sand for plaster.

**CO–PO Mapping – CONSTRUCTION MATERIALS**

| PO/PSO | | Course Outcome | | | | | Over all Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 3 | 3 | 2 | 3 |
| PO2 | Problem analysis | 2 | | | | | 2 |
| PO3 | Design/development of solutions | | 3 | | | | 3 |
| PO4 | Investigation | 2 | | | | 2 | 2 |
| PO5 | Modern Tool Usage | | 1 | | | | 1 |
| PO6 | Individual and Teamwork | | | 2 | | | 2 |
| PO7 | Communication | | | | 1 | | 1 |
| PO8 | Engineer and Society | 3 | | | 3 | 3 | 3 |
| PO9 | Ethics | 2 | | | | 2 | 2 |
| PO10 | Environment and Sustainability | | 1 | | | | 1 |
| PO11 | Project Management and Finance | | | | 2 | | 2 |
| PO12 | Life Long Learning | | | | | 1 | 1 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 2 | | | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 3 | | | | 3 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 3 | 3 | | 3 | 3 |

**CE7302 STRENGTH OF MATERIALS – I L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To learn fundamental concepts of stress, strain and deformation of solids with applications to bars, beams and thin shells.
- To know the mechanism of load transfer in beams, the induced stress resultants and deformations.
- To understand the effect of torsion on shafts and springs.

- To analyse a computer two dimensional state of stress and plane trusses.

**UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 10**

Rigid and deformable bodies – Stability, strength and stiffness - Axial and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Biaxial state of stress – Elastic Constants - Stresses and deformation of thin cylindrical and spherical shells – Stresses at a point - Stresses on inclined planes – Principal stresses and principal planes – Mohr's circle of stress.

**UNIT II ANALYSIS OF PLANE TRUSSES 8**

Stability and equilibrium of plane frames – Perfect frames - Types of trusses – Analysis of forces in truss members – Method of joints – Method of tension co-efficient – Method of sections.

**UNIT III BENDING OF BEAMS 10**

Beams – Types and transverse loading on beams – Shear force and bending moment in beams – Cantilever beams – Simply supported beams and over-hanging beams - Theory of simple bending – Bending stress distribution – Load carrying capacity – Proportioning of sections – Leaf springs – Flitched beams – Shear stress distribution.

**UNIT IV TORSION 8**

Theory of simple torsion - Stresses and deformation in circular and hollow shafts – Stepped shafts – Shafts fixed at both ends – Stresses and deflection in helical springs- introduction to torsion of rectangular sections-warping

**UNIT V DEFLECTION OF BEAMS 9**

Double Integration method – Macaulay's method – Area moment method – Conjugate beam method for computation of slopes and deflections in determinate beams- deflection due to shear.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

The students willable to

| | |
|---|---|
| **CO1** | The students will have thorough understanding of the fundamental concepts of stress and strains in one dimensional and two dimensional states. |
| **CO2** | The ability to analyse determinate beams and plane stresses |
| **CO3** | A sufficient knowledge in designing shafts to transmit required power and springs for its maximum energy storage capacities. |
| **CO4** | Thorough understanding of concepts of torsion to analyse the stresses and deformation in shafts |
| **CO5** | Knowledge in determining the deflection of beams various methods. |

**TEXTBOOKS:**


1. Egor. P.Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi 2001
2. Vazirani.V.N, Ratwani.M.M, Duggal .S.K Analysis of Structures: Analysis, Design and Detailing of Structures-Vol.1, Khanna Publishers, New Delhi 2014.
3. Rajput.R.K. Strength of Materials, S.Chand & Company Ltd., New Delhi 2014.
4. Elangovan.A, Porul Valimaiyiyal I, Anna University, 2011
5. Timoshenko.S.P. and Young .D.H., Elements of Strength of Materials, V Edition, Affiliated East-West Press Pvt. Ltd., New Delhi, 2002.
6. Basavarajaiah, B.S. and Mahadevappa, P., Strength of Materials, Universities Press, 2010.


**REFERENCES:**


1. Irwing H.Shames, James M.Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 2002
2. Beer. F.P. & Johnston.E.R."Mechanics of Materials", Tata McGraw Hill, New Delhi 2010.
3. James M.Gere., Mechanics of Materials, Thomas Canada Ltd., Canada, 2006.


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**CO – PO Mapping –STRENGTHOFMATERIALS**

| PO/PSO | | Course Outcome | | | | | Over all Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | | | | | 3 |
| PO2 | Problem analysis | | 2 | 3 | 3 | | 3 |
| PO3 | Design/development of solutions | | | 3 | 2 | 3 | 3 |
| PO4 | Investigation | | 2 | 3 | 2 | 3 | 3 |
| PO5 | Modern Tool Usage | | 2 | 2 | 2 | | 2 |
| PO6 | Individual and Teamwork | 3 | 3 | 3 | | | 3 |
| PO7 | Communication | 3 | | | | | 3 |
| PO8 | Engineer and Society | | | | 2 | 2 | 2 |
| PO9 | Ethics | 1 | | | | | 1 |
| PO10 | Environment and Sustainability | 1 | | | | | 1 |
| PO11 | Project Management and Finance | | | 2 | 2 | 2 | 2 |
| PO12 | Life Long Learning | | | | 1 | 1 | 1 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 2 | 2 | 2 | 2 | 2 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | 2 | 2 | 2 | 2 | 2 |

**CE7351 FLUID MECHANICS L T P C**
**3 0 0 3**



**OBJECTIVES**:

- To introduce the students to the mechanics of fluids through a thorough understanding of the properties of the fluids, behaviour of fluids under static conditions. The dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy.
- To expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on vanes.

**UNIT I FLUIDS PROPERTIES AND FLUID STATICS 9**

Scope of fluid mechanics - Definitions of a fluid - Methods of analysis - Dimensions and units - viscosity, density, perfect gas, vapour pressure and surface tension - Basic equation of fluid statics - Pressure measurements - Manometers. - Forces on plane and curved surfaces - Buoyancy and floatation - Stability of floating bodies - Relative equilibrium.

Attested

**UNIT II BASIC CONCEPTS OF FLUID FLOW 9**

(a) Kinematics – Methods of describing fluid motion - Classification of flows - Streamline, streak-line and path-lines - Stream function and velocity potentials - Flow nets; (b) Dynamics - Dimensional Concepts of System and Control volume - 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 and moment-of-momentum equations and their applications.

**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 Models.

**UNIT IV INCOMPRESSIBLE VISCOUS FLOW 9**

Laminar flow between parallel plates, and pipes - Development of laminar and turbulent flows in pipes - Reynolds experiment - Darcy-Weisbach equation - Moody diagram - Major and minor losses of flow in pipes - Pipes in series and in parallel.

**UNIT V BOUNDARY LAYERS AND TRANSPORT BY ADVECTION AND DIFFUSION 9**

Definition of boundary layers - Displacement, momentum and energy thickness - Laminar and turbulent boundary layers - Momentum integral equation – Steady molecular diffusion and conduction – Turbulent transport equations – Channel diffusion and Dispersions and Applications.

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES:**

- On completion of the course, the student is expected to be able to.

| | |
|---|---|
| **CO1** | Demonstrate the difference between solid and fluid, its properties and behavior in static conditions. |
| **CO2** | Apply the conservation laws applicable to fluids and its application through fluid Kinematics and dynamics. |
| **CO3** | Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies. |
| **CO4** | Estimate losses in pipe lines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel. |
| **CO5** | Explain the concept of boundary layer and its application to find the drag force excreted by the fluid on the flat solid surface. |



**TEXTBOOKS :**

1. Streeter, V.L. Wylie, E. B. and Bedford K.W, *Fluid Mechanics.* (9th ed) Tata McGraw Hill, New Delhi, 1998
2. Modi P.N and Seth Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House New Delhi. 2003

**REFERENCES :**

1. Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John-Wiley and Sons, Singapore, 1995.
2. Jain A. K. Fluid Mechanics. Khanna Publishers 1995.
3. Roberson J.A and Crowe C.T., Engineering Fluid Mechanics. Jaico Books Mumbai, 2000.

**CO – PO Mapping – FLUID MECHANICS**

| PO/PSO | | Course Outcome | | | | | Over all Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 3 | 3 | 3 | 3 |
| PO2 | Problem analysis | 2 | 2 | 2 | 3 | 3 | 2 |
| PO3 | Design/development of solutions | 1 | 1 | 3 | 3 | 2 | 3 |
| PO4 | Investigation | 1 | 1 | 2 | 2 | 2 | 2 |
| PO5 | Modern Tool Usage | 1 | 1 | 1 | 1 | 1 | 1 |
| PO6 | Individual and Teamwork | 1 | 1 | 1 | 1 | 1 | 1 |
| PO7 | Communication | 1 | 1 | 1 | 1 | 1 | 1 |
| PO8 | Engineer and Society | 2 | 2 | 2 | 3 | 3 | 2 |
| PO9 | Ethics | 1 | 1 | 1 | 1 | 1 | 1 |
| PO10 | Environment and Sustainability | 2 | 2 | 2 | 2 | 2 | 2 |
| PO11 | Project Management and Finance | 1 | 1 | 1 | 1 | 1 | 1 |
| PO12 | Life Long Learning | 2 | 2 | 2 | 3 | 3 | 2 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 2 | 3 | 3 | 3 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 1 | 1 | 2 | 3 | 3 | 3 |



**GE7251 ENVIRONMENTAL SCIENCE AND ENGINEERING** **L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth‟s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION 8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT III NATURAL RESOURCES 10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

**UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

**UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES:**

- On completion of the course, the student is expected to be able to.

| | |
|---|---|
| **CO1** | Understand the nature and facts about environment |
| **CO2** | Finding and implementing scientific, technological, economic and political solutions to environmental problems |
| **CO3** | Understand the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value. |
| **CO4** | Analyze dynamic processes and understand the features of the earth‟ s interior and surface. |
| **CO5** | Development and improvement in std. of living has lead to serious environmental disasters |

**TEXTBOOKS :**


1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2006).


**REFERENCES :**


1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
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 (2005)


**CO – PO Mapping – ENVIRONMENTAL SCIENCE AND ENGINEERING**

| PO/PSO | | Course Outcome | | | | | Over all Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| **PO1** | Knowledge of Engineering Sciences | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO2** | Problem analysis | 1 | 2 | 3 | 3 | 3 | 2 |
| **PO3** | Design/development of solutions | 1 | 1 | 2 | 3 | 3 | 2 |
| **PO4** | Investigation | 1 | 1 | 1 | 1 | 3 | 1 |
| **PO5** | Modern Tool Usage | 1 | 1 | 2 | 3 | 3 | 2 |
| **PO6** | Individual and Teamwork | 1 | 3 | 2 | 3 | 3 | 2 |
| **PO7** | Communication | 2 | 1 | 1 | 1 | 1 | 1 |
| **PO8** | Engineer and Society | 1 | 3 | 2 | 3 | 3 | 2 |
| **PO9** | Ethics | 1 | 1 | 1 | 1 | 1 | 1 |
| **PO10** | Environment and Sustainability | 1 | 1 | 2 | 3 | 3 | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PO11** | Project Management and Finance | 1 | 1 | 1 | 1 | 1 | 1 |
| **PO12** | Life Long Learning | 3 | 2 | 2 | 3 | 3 | 3 |
| **PSO1** | Knowledge of Civil Engineering discipline | 1 | 1 | 1 | 1 | 1 | 1 |
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 1 | 1 | 1 | 1 | 1 | 1 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 1 | 1 | 1 | 1 | 1 | 1 |

**MA7358 TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS**

**L T P C**
**4 0 0 4**

**OBJECTIVES:**

- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes;
- 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 transform techniques used in wide variety of situations in which the functions used are not periodic;
- To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems.

**UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12**

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions – Lagrange's Linear equation – Integral surface passing through a given curve – Classification of partial differential equations - Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

**UNIT II FOURIER SERIES 12**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.

**UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION 12**

Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in cartesian coordinates.

**UNIT IV FOURIER TRANSFORM 12**

Fourier integral theorem – Fourier transform pair - Sine and cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

**UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 12**

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and final value theorems – Formation of difference equation – Solution of difference equation using Z - transform.

**TOTAL : 60 PERIODS**

**COURSE OUTCOMES:**

Attested

- The students can able to solve the partial differential equations, find the Fourier

series analysis and solve the problems by using Fourier transform and Z transform techniques.

| | |
|---|---|
| **CO1** | Solve partial differential equations which arise in application problems. |
| **CO2** | Analyze the functions as an infinite series involving sine and cosine functions. |
| **CO3** | ObtainthesolutionsofthepartialdifferentialequationsusingFourierseries. |
| **CO4** | Obtain Fourier transforms for the functions which are needed for solving application problems |
| **CO5** | Manipulate discrete data sequences using Z transform techniques. |

**TEXTBOOKS:**


1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Erwin kreyszig, "Advanced Engineering Mathematics",John Wiley & Sons, 9th Edition, New Delhi, 2014


**REFERENCES:**


1. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, New Delhi, 2007.
2. Ramana, B.V. "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi, 11th Reprint , 2010.
3. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
4. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.


**CO –PO Mapping –TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS**

| PO/PSO | | Course Outcome | | | | | Over all Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 2 | 3 | 3 | 2 | 3 |
| PO2 | Problem analysis | 3 | 2 | 3 | 3 | 1 | 2 |
| PO3 | Design/development of solutions | 2 | 1 | 2 | 1 | 1 | 1 |
| PO4 | Investigation | 2 | 1 | 2 | 2 | 1 | 2 |
| PO5 | Modern Tool Usage | 1 | 1 | 2 | 1 | 1 | 1 |
| PO6 | Individual and Teamwork | | | | | | |
| PO7 | Communication | 1 | | 1 | | | 1 |
| PO8 | Engineer and Society | | | | | | |
| PO9 | Ethics | | | | | | |
| PO10 | Environment and Sustainability | | | 1 | | | 1 |
| PO11 | Project Management and Finance | | | | | | |
| PO12 | Life Long Learning | | | 1 | | | 1 |
| PSO1 | Knowledge of Civil | 3 | 2 | 3 | 2 | 1 | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Engineering discipline | | | | | | |
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 2 | 1 | 2 | 1 | 1 | 1 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | 1 | 2 | 1 | 1 | 1 |

**CE7261 STRENGTH OF MATERIALS LABORATORY L T P C**
**0 0 4 2**

**OBJECTIVES:**

- To study the mechanical properties of materials subjected to different types of loading.

**LIST OF EXPERIMENTS**

1. Tension test on mild steel rod
2. Compression test on wood
3. Double shear test on metal
4. Torsion test on mild steel rod
5. Impact test on metal specimen (Izod and Charpy)
6. Hardness test on metals (Rockwell and Brinell Hardness Tests)
7. Deflection test on metal beam
8. Compression test on helical spring
9. Deflection test on carriage spring

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to

| | |
|---|---|
| **CO1** | Apply the knowledge of testing steel rod subjected to tension and torsion |
| **CO2** | Explain the hardness of different metals |
| **CO3** | Exert the knowledge about the testing of helical spring and carriage spring |
| **CO4** | Acquire the knowledge about double shear test on metal and impact test on metal. |
| **CO5** | Obtain the practical knowledge about the deflection of the beam. |

**REFERENCES:**


1. Strength of Materials Laboratory Manual, Anna University, Chennai-600 025.
2. IS 432(Part I ) -1992 – Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement


**CO–PO Mapping- STRENGTH OF MATERIALS LABORATORY**

| PO/PSO | | Course Outcome | | | | | Over all Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| **PO1** | Knowledge of Engineering Sciences | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO2** | Problem analysis | 2 | 2 | 2 | 2 | 2 | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PO3** | Design/development of solutions | | | | | | |
| **PO4** | Investigation | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO5** | Modern Tool Usage | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO6** | Individual and Teamwork | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO7** | Communication | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO8** | Engineer and Society | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO9** | Ethics | | | | | | |
| **PO10** | Environment and Sustainability | | | | | | |
| **PO11** | Project Management and Finance | | | | | | |
| **PO12** | Life Long Learning | 2 | 2 | 2 | 2 | 2 | 2 |
| **PSO1** | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 | 3 |
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 3 | 3 | 3 | 3 | 3 | 3 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 3 | 3 | 3 | 3 | 3 |

**CE7311** **CONSTRUCTION MATERIALS LABORATORY** **L T P C**
**0 0 4 2**

**OBJECTIVE:**

- To facilitate the understanding of the behavior of construction materials.

**I. TEST ON CEMENT** **12**

1. Determination of fineness
2. Determination of consistency
3. Determination of initial and final setting time
4. Determination of specific gravity

**II. TEST ON FINE AGGREGATES** **12**

4. Grading of fine aggregates
5. Test for specific gravity and test for bulk density
6. Compacted and loose bulk density of fine aggregate

**III. TEST ON BRICKS** **12**

7. Test for compressive strength
8. Test for Water absorption
9. Determination of Efflorescence

**IV. TEST ON COARSE AGGREGATE** **12**

10. Determination of impact value of coarse aggregate
11. Determination of elongation index
12. Determination of flakiness index
13. Determination of aggregate crushing value of coarse aggregate

**V. TEST ON CONCRETE** **12**

14. Test for slump

15. Test for Compressive strength

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

- The students will have the required knowledge in the area of testing of construction materials and components of construction elements experimentally.

| | |
|---|---|
| **CO1** | Find the fineness, specific gravity, initial and final setting time of cement. |
| **CO2** | Find the grading, specific gravity and density of fine aggregate. |
| **CO3** | Find the compressive strength, water absorption and efflorescence of bricks. |
| **CO4** | Find the specific gravity, impact value, crushing value, elongation and flakiness index of coarse aggregate. |
| **CO5** | Find the slump of fresh concrete and compressive strength of hardened concrete. |

**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 drysieving.
3. IS 4031 (Part 3) – 1988 – Indian Standard methods for Determination of soundness
4. IS 4031 (Part 5) – 1988 – Indian Standard methods for Determination of initial and final setting times
5. IS 2386 (Part 1 to Part 6) – 1963 – Indian Standard methods for test for aggregate for concrete
6. IS 383– 1970 Indian Standard specification for coarse and fine aggregates from natural sources for concrete.


**CO – PO Mapping –CONSTRUCTION MATERIALS LABORATORY**

| PO/PSO | | Course Outcome | | | | | Over all Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| **PO1** | Knowledge of Engineering Sciences | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO2** | Problem analysis | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO3** | Design/development of solutions | | | | | | |
| **PO4** | Investigation | | | | | | |
| **PO5** | Modern Tool Usage | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO6** | Individual and Teamwork | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO7** | Communication | | | | | | |
| **PO8** | Engineer and Society | | | | | | |
| **PO9** | Ethics | | | | | | |
| **PO10** | Environment and Sustainability | 1 | 1 | 1 | 1 | 1 | 1 |
| **PO11** | Project Management and Finance | | | | | | |
| **PO12** | Life Long Learning | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PSO1** | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 | 3 |
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 3 | 3 | 3 | 3 | 3 | 3 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 3 | 3 | 3 | 3 | 3 |

**CE7353 PLANE AND GEODETIC SURVEYING L T P C**
**4 0 0 4**

**OBJECTIVES:**

- To introduce the rudiments of plane surveying and geodetic principles to Geoinformatics Engineers.
- To learn the various methods of plane and geodetic surveying to solve the real world problems.
- To introduce the concepts of Control Surveying
- To introduce the basics of Astronomical Surveying

**UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING 12**

Classifications and basic principles of surveying – Equipment and accessories for ranging and chaining – Methods of ranging – Chain traversing – Basic principles and applications of Plane Table and Compass - Levels and staves - Methods of levelling - Booking -Reduction - Curvature and refraction - Contouring.

**UNIT II THEODOLITE SURVEYING 12**

Horizontal and vertical angle measurements - Temporary and permanent adjustments – Heights and distances–Tacheometric surveying – Trigonometric levelling – Horizontal curves in route surveying – classification, functions and requirements - methods of setting out simple curves - setting out transition curves by offsets and angles

**UNIT III CONTROL SURVEYING AND ADJUSTMENT 12**

Horizontal and vertical control- Methods - Triangulation- Base line - Instruments and accessories – Corrections - Satellite station - Traversing - Gale‘s table. Concepts of measurements and errors – error propagation and linearization – adjustment methods – least square methods – angles, lengths and levelling network – simple problems.

**UNIT IV ASTRONOMICAL SURVEYING 12**

Astronomical terms and definitions - Motion of sun and stars - Celestial coordinate systems – different time systems - Nautical Almanac - Apparent altitude and corrections - Field observations and determination of time, longitude, latitude and azimuth by altitude and hour angle method

**UNIT V MODERN SURVEYING 12**

Total Station : Advantages - Fundamental quantities measured – Parts and accessories – working principle – On board calculations –Field procedure - Errors and Good practices in using Total Station

GPS: System components – Signal structure – Selective availability and antispoofing – receiver components – Planning and data acquisition – Data processing - Errors in GPS - Applications

**Total : 60 PERIODS**

**COURSE OUTCOMES:**

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

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| | |
|---|---|
| **.CO1** | Introduce the rudiments of various surveying and its principles. |
| **CO2** | Imparts concepts of Theodolite Surveying and computation of area and volume calculation. |
| **CO3** | Understand the procedure for establishing horizontal and vertical control and its adjustment procedure. |
| **CO4** | Introduce the basics of Electronic Surveying |
| **CO5** | Initiate the knowledge in Route surveying, Hydrographic surveying and Field Astronomical surveying. |

**TEXTBOOKS** :


1. T.P. Kanetkar and S.V.Kulkarni, Surveying and Levelling, Parts1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008
2. Dr.B.C.Punmia, Ashok K.Jain and Arun K Jain, Surveying Vol.I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2005
3. S.S.Bhavikatti, Surveying Theory and Practice, I.K.International Publishing House Pvt. Ltd, New Delhi, 2010


**REFERENCES:**


1. R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2. James M.Anderson and Edward M. Mikhail, Surveying Theory and Practice, Tata McGraw Hill Education Private Limited, New Delhi, 2012
3. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004
4. S.K. Roy, Fundamentals of Surveying, Second Edition, Prentice‘ Hall of India 2004
5. K.R. Arora, Surveying Vol I & II, Standard Book house , Twelfth Edition. 2013


## CO – PO Mapping – PLANE AND GEODETIC SURVEYING

| PO/PSO | | Course Outcome | | | | | Over all Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** | |
| **PO1** | Knowledge of Engineering Sciences | 2 | 3 | 3 | 3 | 1 | 3 |
| **PO2** | Problem analysis | 2 | 3 | 2 | 2 | 3 | 2 |
| **PO3** | Design/development of solutions | 1 | 2 | 1 | 2 | 2 | 2 |
| **PO4** | Investigation | 1 | 1 | 1 | 2 | 2 | 1 |
| **PO5** | Modern Tool Usage | 2 | 2 | 3 | 3 | 3 | 3 |
| **PO6** | Individual and Teamwork | 2 | 2 | 1 | 3 | 2 | 2 |
| **PO7** | Communication | | | | | | |
| **PO8** | Engineer and Society | 2 | 2 | 1 | 2 | 2 | 2 |
| **PO9** | Ethics | | | | | | |
| **PO10** | Environment and Sustainability | | | | | | |
| **PO11** | Project Management and Finance | | | | | | |
| **PO12** | Life Long Learning | 1 | 1 | 2 | 2 | 2 | 2 |
| **PSO1** | Knowledge of Civil Engineering discipline | 3 | 3 | 2 | 2 | 3 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 1 | 3 | 1 | 2 | 1 | 2 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | 3 | 3 | 2 | 3 | 3 |

**CE7401 APPLIED HYDRAULIC ENGINEERING L T P C**
**2 2 0 3**

**OBJECTIVES:**

- To introduce the students to various hydraulic engineering problems like open channel flows and hydraulic machines. At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering.

**UNIT I UNIFORM FLOW 12**

Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Fundamental equations - Velocity distribution in open channel - Steady uniform flow: Chezy equation, Manning equation - Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force.

**UNIT II VARIED FLOWS 12**

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

**UNIT III RAPIDLY VARIED FLOWS 12**

Application of the energy equation for RVF - Critical depth and velocity - Critical, Sub-critical and Super-critical flow - Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation - Surges.

**UNIT IV TURBINES 12**

Turbines - Classification - Reaction turbines - Francis turbine, Radial flow turbines, draft tube and cavitation - Propeller and Kaplan turbines - Impulse turbine - Performance of turbine - Specific speed - Runaway speed - Similarity laws.

**UNIT V PUMPS 12**

Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitations in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Flow separation conditions - Air vessels, indicator diagrams and its variations - Savings in work done - Rotary pumps: Gear pump.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to

| | |
|---|---|
| **CO1** | Describe the basics of open channel flows, its classifications and analysis of Uniform flow in steady state conditions with specific energy concept and its application |
| **CO2** | 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. |

| | |
|---|---|
| **CO3** | 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. |
| **CO4** | Design turbines and explain the working principle |
| **CO5** | Differentiate pumps and explain the working principle with characteristic curves and design centrifugal and reciprocating pumps. |

**TEXTBOOKS:**


1. Jain. A.K., Fluid Mechanics, Khanna Publishers, Delhi, 2010.
2. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 19th edition, 2013.
3. Subramanya K., Flow in open channels, Tata McGraw Hill, New Delhi, 2000.


**REFERENCES:**


1. Ven Te Chow, Open Channel Hydraulics, McGraw Hill, New York, 2009.
2. Rajesh Srivastava, Flow through open channels, Oxford University Press, New Delhi, 2008.
3. Mays L. W., Water Resources Engineering, John Wiley and Sons (WSE), New York, 2005.


**CO – PO Mapping – APPLIED HYDRAULIC ENGINEERING**

| PO/PSO | | Course Outcome | | | | | Over all Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| **PO1** | Knowledge of Engineering Sciences | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO2** | Problem analysis | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO3** | Design/development of solutions | 2 | 2 | 2 | 3 | 3 | 2 |
| **PO4** | Investigation | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO5** | Modern Tool Usage | 1 | 2 | 1 | 1 | 1 | 1 |
| **PO6** | Individual and Teamwork | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO7** | Communication | 1 | 1 | 1 | 1 | 1 | 1 |
| **PO8** | Engineer and Society | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO9** | Ethics | 1 | 1 | 1 | 1 | 1 | 1 |
| **PO10** | Environment and Sustainability | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO11** | Project Management and Finance | 1 | 1 | 1 | 1 | 1 | 1 |
| **PO12** | Life Long Learning | 3 | 3 | 3 | 3 | 3 | 3 |
| **PSO1** | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 | 3 |
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 2 | 2 | 2 | 2 | 2 | 2 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | 2 | 3 | 3 | 3 | 3 |

Attested



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**CE7402 CONSTRUCTION TECHNIQUES AND PRACTICES L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To make the students aware of the various techniques and practices on various stages of concreting, masonry works, service requirements, rehabilitation works and careful selection of suitable construction equipment.

**UNIT I CONCRETE TECHNOLOGY 12**

High grade cements – Advances in manufacture of cement – concrete chemicals and applications – concepts of mix design – statistical quality control of concrete – Mix Design as per BIS and ACI methods – Process of manufacture of concrete – Batching – Mixing – Transporting – Placing – Compaction – Curing – Finishing – Testing of fresh and hardened concrete – Non-destructive testing.

**UNIT II CONSTRUCTION PRACTICES 10**

Types of Foundations – Shallow and Deep Foundations – Well Foundations – Anchors – Stones masonry – Brick masonry – Composite masonry – Cavity walls – diaphragm Walls – Flooring – Formwork – Centering and Shuttering – Sheet piles – Slip and moving forms – Roofs and roof covering – Joints in Concrete – contraction / construction / expansion joints-Plastering and Pointing – Shoring – Scaffolding– Underpinning – Submerged Structures.

**UNIT III SERVICE REQUIREMENTS 8**

Painting, Distempering and white washing – Fire Protection – Thermal insulation – Ventilation and air conditioning – Acoustics and Sound insulation – Damp proofing – Termite proofing.

**UNIT IV REPAIR AND REHABILIATION WORKS 7**

Causes of damage and deterioration in masonry and concrete structures – Symptoms and Diagnosis – Common types of repairs – Grouting – Case studies on Repair and / or Rehabilitation works of Buildings and Bridges- special materials for repair work

**UNIT V CONSTRUCTION EQUIPMENT 8**

Selection of equipment for earthwork, concreting, material handling and erection of structures – Dewatering and pumping equipments- RMC–transit mixers/placement techniques/pumping of concrete

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- Students completing the course will have understanding of different construction techniques and practices. They will be able to plan the requirements for substructure and super structure in any construction project.

| | |
|---|---|
| **CO1** | Initiate the technology involved in mix design and process of manufacturing of concrete |
| **CO2** | Acquiring the knowledge about the construction of different foundations & shuttering |
| **CO3** | Understand the importance of painting, fire protection, Acoustic and sound insulations, damp proofing and termite proofing. |
| **CO4** | Enhanced the data about the repair and rehabilitations of various structures |
| **CO5** | Selection of equipment for various work such as earth work, concreting, material handling, dewatering, erection of structures |

Attested

**TEXTBOOKS:**


1. Varghese.P.C., Building Constructions, PHI Learning Private Limited, 2007
2. Shetty.M.S., Concrete Technology(Theory and Practice), S.Chand & Company Ltd., 2008.
3. Santhakumar.A.R., Concrete Technology, Oxford University Press ,India, 2006.


**REFERENCES:**


1. Arora, S.P. and Bindra, S.P., Building Construction, Dhanpat Rai and Sons, 1997
2. Punmia, B.C., Building Construction, Laxmi Publications (P) Ltd., 1993
3. Peurifoy, R.L., Form work for Concrete Structures, McGraw Hill Book Co., 1999.
4. Gambhir, M.L., Concrete Technology, Tata McGraw Hill Publishing Co., 2004
5. Neville A.M., Properties of Concrete, Fourth edition, Pearson Education Ltd. 2004.
6. Peurifoy, R.L, Schexnayder,C.J., Shapira,A., Schmitt. R., Construction Planning, Equipment and Methods, Tata McGraw-Hill, 2010.


**CO – PO Mapping – CONSTRUCTION TECHNIQUES AND PRACTICES**

| PO/PSO | | Course Outcome | | | | | Over all Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 3 | 3 | 3 | 3 |
| PO2 | Problem analysis | 3 | | | 3 | | 3 |
| PO3 | Design/development of solutions | 3 | 3 | 3 | 3 | 3 | 3 |
| PO4 | Investigation | 2 | 3 | 3 | 3 | 3 | 3 |
| PO5 | Modern Tool Usage | 2 | 3 | 3 | 3 | 3 | 3 |
| PO6 | Individual and Teamwork | 2 | | | 2 | | 2 |
| PO7 | Communication | | | | 1 | | 1 |
| PO8 | Engineer and Society | 2 | 2 | 2 | 2 | 2 | 2 |
| PO9 | Ethics | 1 | | 1 | | | 1 |
| PO10 | Environment and Sustainability | 2 | 1 | 3 | 2 | | 2 |
| PO11 | Project Management and Finance | 1 | | 1 | | 2 | 1 |
| PO12 | Life Long Learning | 2 | 2 | 2 | 2 | 2 | 2 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 2 | | 3 | | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 3 | | | 3 | 3 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 3 | | 3 | 3 | 3 |

Attested

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**CE7403** **SOIL MECHANICS** **L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification. To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils. To impart knowledge of design of both finite and infinite slopes.

**UNIT I SOIL CLASSIFICATION AND COMPACTION 9**

Formation of soil - Soil description – Particle – Size shape and colour – Composition of gravel, sand, silt, clay particles – Particle behaviour – Soil structure – Phase relationship – Index properties – Significance – BIS classification system – Unified classification system – Compaction of soils – Theory, Laboratory and field tests – Field Compaction methods – Factors influencing compaction of soils.

**UNIT II EFFECTIVE STRESS AND PERMEABILITY 9**

Soil - water – Static pressure in water - Effective stress concepts in soils – Capillary phenomena– Permeability interaction – Hydraulic conductivity – Darcy's law – Determination of Hydraulic Conductivity – Laboratory Determination (Constant head and falling head methods) and field measurement pumping out in unconfined and confined aquifer – Factors influencing permeability of soils – Seepage - Two dimensional flow – Laplace's equation – Introduction to flow nets – Simple problems. (Sheet pile and wier).

**UNIT III STRESS DISTRIBUTION AND SETTLEMENT 9**

Stress distribution in homogeneous and isotropic medium – Boussinesq theory – (Point land, Line land and udl) Use of New marks influence chart –Components of settlement — Immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – Computation of rate of settlement. - √t and log t methods– e-log p relationship.

**UNIT IV SHEAR STRENGTH 9**

Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – Measurement of shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Cyclic mobility – Liquefaction.

**UNIT V SLOPE STABILITY 9**

Stability Analysis - Infinite slopes and finite slopes – Total stress analysis for saturated clay – Friction circle method – Use of stability number – Method of slices – Fellenious and Bishop's method - Slope protection measures.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- Students are able to classify the soil and assess the engineering properties, based on index properties. Students understand the basic concepts soil mechanics and able to design both finite and infinite slopes.

| | |
|---|---|
| **CO1** | Graduates will demonstrate an ability to identify various types of soils and its properties, formulate and solve engineering Problems |
| **CO2** | Graduate will show the basic understanding of flow through soil medium and its impact of engineering solution |
| **CO3** | Graduate to understand about the basic concept of stress distribution in loaded soil medium and soil settlement due to consolidation |

| | |
|---|---|
| **CO4** | Graduate will show the understanding of shear strength of soils and its impact of engineering solutions to the loaded soil medium and also will<br>Be aware of contemporary issues on shear strength of soils. |
| **CO5** | Graduates will demonstrate an ability to design both finite and infinite slopes, component and process as per needs and specifications. |

**TEXTBOOKS:**


1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2015
2. Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age Ltd. International Publisher New Delhi (India) 2006.
3. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2011.


**REFERENCES:**


1. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations". Prentice-Hall, 2006.
2. Coduto, D.P., "Geotechnical Engineering – Principles and Practices", Prentice Hall of India Pvt.Ltd. New Delhi, 2010.
3. Das, B.M., "Principles of Geotechnical Engineering". Brooks / Coles / Thompson Learning Singapore, 8th Edition, 2013.
4. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 2005.


**CO –PO Mapping–SOIL MECHANICS**

| PO/PSO | | Course Outcome | | | | | OverallCorrelation ofCOstoPOs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| **PO1** | Knowledge of Engineering Sciences | 2 | 3 | 3 | 2 | 3 | 3 |
| **PO2** | Problem analysis | 3 | 2 | 3 | 3 | 3 | 3 |
| **PO3** | Design / development of solutions | 2 | 3 | 2 | 3 | 2 | 2 |
| **PO4** | Investigation | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO5** | Modern Tool Usage | 3 | 3 | 2 | 2 | 2 | 2 |
| **PO6** | Individual and Teamwork | 2 | 2 | 2 | 1 | 1 | 2 |
| **PO7** | Communication | 1 | 1 | 1 | 1 | 1 | 1 |
| **PO8** | Engineer and Society | 1 | 1 | 2 | 1 | 1 | 1 |
| **PO9** | Ethics | 1 | 1 | 1 | 1 | 1 | 1 |
| **PO10** | Environment and Sustainability | 1 | 1 | 1 | 1 | 1 | 1 |
| **PO11** | Project Management and Finance | 2 | 2 | 2 | 2 | 1 | 2 |
| **PO12** | Life Long Learning | 3 | 3 | 3 | 3 | 3 | 3 |
| **PSO1** | Knowledge of Civil Engineering discipline | 3 | 2 | 2 | 2 | 2 | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 3 | 2 | 2 | 2 | 3 | 2 |
| **PSO3** | Conceptualization and evaluation of Engineering solutions to Civil engineering issues | 2 | 3 | 3 | 3 | 2 | 3 |

**CE7404 STRENGTH OF MATERIALS – II L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To learn the computation of deflection of beams and trusses using energy principles and to know the concept of analysis of indeterminate beams.
- To estimate the load carrying capacity of columns and analysis of three dimensional state of stress.
- To understand the concept of theories of failure of materials, unsymmetrical bending, shear center and fracture of materials.

**UNIT I ENERGY PRINCIPLES 9**

Strain energy and strain energy density – Strain energy in axial force - Shear, flexure and torsion – Castigliano's and Engessor's theorems – Principle of virtual work – Application of energy theorems for computing deflections in beams – Maxwell's reciprocal theorem.

**UNIT II INDETERMINATE BEAMS 9**

Propped Cantilever and Fixed Beams – Fixed end moments reactions, slope and deflection for standard cases of loading –– Continuous beams – support reactions and moments – Theorem of three moments – Shear Force and Bending Moment Diagrams.

**UNIT III COLUMNS 9**

Behaviour of short and long columns. Euler's theory of long columns – Critical loads for prismatic columns with different end conditions - Rankine-Gordon Formula - Eccentrically loaded long columns -Eccentrically loaded short columns - middle third rule – Core of section.

**UNIT IV STATE OF STRESS IN THREE DIMENSIONS 9**

Determination of principal stresses and principal planes – Volumetric strain – Theories of failure – Principal stress, principal strain, shear stress, strain energy and distortion energy theories – Application in analysis of stress, load carrying capacity and design of members. Interaction problems - Interaction curves.

**UNIT V ADVANCED TOPICS 9**

Unsymmetrical bending of beams - symmetrical and unsymmetrical sections, shear centre – stresses on curved beams for simple solid sections – Winkler Bach Formula – Thick cylinders – Compound cylinders - residual stresses, stress concentration, fatigue.torsion of thin walled sections

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- Students will have thorough knowledge in analysis of indeterminate beams and use of energy method for estimating the slope and deflections of beams and trusses.
- They will be in a position to assess the behavior of columns, beams and failure of materials.

| | |
|---|---|
| **CO1** | Understand the concept of energy principle and apply the same for the determination of slope and deflection in beams. |
| **CO2** | Gain knowledge in analysis of propped cantilever, fixed beams and continuous beams. |
| **CO3** | Study the behavior of columns and determine the critical load carrying capacity |
| **CO4** | Determine the principle stresses and principle plane for the three dimensional strata of stress and study the various theories of failures |
| **CO5** | Locate the shear center for beam section and determine the stresses due to unsymmetrical bending of beams and thick cylinders |

**TEXTBOOKS:**


1. Rajput.R.K. Strength of Materials, S.Chand & Company Ltd., New Delhi 2014.
2. Elangovan.A, Porul Valimaiyiyal-II, Anna University, 2011.
3. Punmia, B.C.,Theory of Structures (SMTS) Vol.I and II, Lakshmi Publishing Pvt. Ltd., New Delhi,2004.


**REFERENCES:**


1. Malhotra, D.R. Gupta, H.C., The Strength of Materials, Satya Prakashan, No. (Tech.India Publications), New Delhi 1995.
2. William A.Nash, Schaum's Outline Series, McGraw Hill International Editions, Fifth Edition, 2011.
3. Rattan S.S., Strength of Materials, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.


**CO –PO Mapping–STRENGTH OF MATERIALS – II**

| PO/PSO | | Course Outcome | | | | | Over all Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| **PO1** | Knowledge of Engineering Sciences | 3 | | | | | 3 |
| **PO2** | Problem analysis | | 2 | 3 | 3 | | 3 |
| **PO3** | Design/development of solutions | | | 3 | 2 | 3 | 3 |
| **PO4** | Investigation | | 2 | 3 | 2 | 3 | 3 |
| **PO5** | Modern Tool Usage | | 2 | 2 | 2 | | 2 |
| **PO6** | Individual and Teamwork | 3 | 3 | 3 | | | 3 |
| **PO7** | Communication | 3 | | | | | 3 |
| **PO8** | Engineer and Society | | | | 2 | 2 | 2 |
| **PO9** | Ethics | 1 | | | | | 1 |
| **PO10** | Environment and Sustainability | 1 | | | | | 1 |
| **PO11** | Project Management and Finance | | | 2 | 2 | 2 | 2 |
| **PO12** | Life Long Learning | | | | 1 | 1 | 1 |
| **PSO1** | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 2 | 2 | 2 | 2 | 2 | 2 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | 2 | 2 | 2 | 2 | 2 |

**MA7354 NUMERICAL METHODS L T P C**
**4 0 0 4**

**OBJECTIVES:**

- To provide the mathematical foundations of numerical techniques for solving linear system, eigenvalue problems, interpolation, numerical differentiation and integration and the errors associated with them;
- To demonstrate the utility of numerical techniques of ordinary and partial differential equations in solving engineering problems where analytical solutions are not readily available.

**UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 12**

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 methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method – Eigen values of a matrix by Power method and by Jacobi's method.

**UNIT II INTERPOLATION AND APPROXIMATION 12**

Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae – Least square method - Linear curve fitting.

**UNIT III NUMERICAL DIFFERENTATION AND INTEGRATION 12**

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

**UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12**

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

**UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12**

Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit (Crank-Nicholson) methods - One dimensional wave equation by explicit method.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

- Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions.
- Applynumericalmethodstoobtainapproximatesolutionstomathematicalproblems.
- Derivenumericalmethodsforvariousmathematicaloperationsandtasks,suchasinter

polation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.

- Analyse and evaluate the accuracy of common numerical methods.

| | |
|---|---|
| **CO1** | Demonstration and understanding of common numerical methods and how they are used to obtain approximate solutions |
| **CO2** | Application of numerical methods to obtain approximate solutions to mathematical problems. |
| **CO3** | Derivation of numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations. |
| **CO4** | Analysis and evaluating the accuracy of common numerical methods. |

**TEXT BOOKS:**


1. Grewal, B.S. and Grewal,J.S., "Numerical methods in Engineering and Science", Khanna Publishers, New Delhi, 9th Edition, 2007.
2. Sankara Rao . K, " Numerical Methods for Scientists and Engineers" PHI Learning Pvt Ltd. New Delhi, 2007.


**REFERENCES:**


1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education Asia, New Delhi, 1st Edition, 2007.
2. Gerald, C.F. and Wheatley, P.O., "Applied Numerical Analysis", Pearson Education Asia, New Delhi, 6th Edition, 2006.
3. Laurene V. Fausett, "Applied Numerical Analysis using MATLAB", Pearson Education, New Delhi, 1st print, 2nd Edition, 2009.
4. S. R. K. Iyengar, R. K. Jain, Mahinder Kumar Jain, "Numerical Methods for Scientific and Engineering Computation", 6th Edition, New Age International Publishers, New Delhi, 2012.


**CO –PO Mapping – NUMERICAL METHODS**

| PO/PSO | | Course Outcome | | | | Over all Correlation of COs to POs |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | |
| **PO1** | Knowledge of Engineering Sciences | 3 | 3 | 3 | 3 | 3 |
| **PO2** | Problem analysis | 2 | 2 | 3 | 3 | 3 |
| **PO3** | Design/development of solutions | 2 | 1 | 2 | 3 | 2 |
| **PO4** | Investigation | 3 | 2 | 3 | 3 | 3 |
| **PO5** | Modern Tool Usage | 2 | 3 | 1 | 1 | 2 |
| **PO6** | Individual and Teamwork | 1 | 2 | 2 | 1 | 2 |
| **PO7** | Communication | 2 | | | 2 | 2 |
| **PO8** | Engineer and Society | | | 1 | | 1 |
| **PO9** | Ethics | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **PO10** | Environment and Sustainability | | | | | |
| **PO11** | Project Management and Finance | 1 | 1 | | 1 | 1 |
| **PO12** | Life Long Learning | 3 | 2 | 1 | 2 | 2 |
| **PSO1** | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 |
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 3 | 3 | 2 | 3 | 3 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | 2 | 2 | 3 | 2 |

**CE7362 PLANE AND GEODETIC SURVEYING LABORATORY L T P C**
**0 0 4 2**

**OBJECTIVE:**

- To familiarize with the various surveying instruments and methods.

**EXCERCISES:**

1. Determination of area of polygon by base line method using chain
2. Chain traversing
3. Fly levelling
4. Check levelling
5. Study of theodolite and its accessories
6. Measurement of horizontal and vertical angles using theodolite
7. Determination of tacheometric constants
8. Determination of elevation of an object using single plane method when base is accessible/ inaccessible
9. Determination of distance and difference in elevation between two inaccessible points using double plane method.
10. Heights and distances by stadia tacheometry
11. Heights and distances by tangential tacheometry
12. Study of Total station and GPS(demonstration only)

**TOTAL : 60 PERIODS**

**COURSE OUTCOMES:**

- On completion of the course, the student is expected to be able to.

| | |
|---|---|
| **CO1** | Use conventional surveying tools such as chain/tape, compass, plane table inthe Field of civil engineering applications |
| **CO2** | Preparation of planimetric map |
| **CO3** | Establishment of Vertical control points |
| **CO4** | Imparts knowledge in computation of distance and elevation using horizontal and vertical angles |
| **CO5** | Acquiring knowledge in advance surveying equipments |

**REFERENCES:**


1. T.P.Kanetkar and S.V.Kulkarni, Surveying and Levelling, Parts1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008
2. Dr.B.C.Punmia, Ashok K.Jain and Arun K Jain, Surveying Vol.I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2005
3. James M.Anderson and Edward M. Mikhail, Surveying Theory and Practice, Tata McGraw Hill Education Private Limited, New Delhi, 2012
4. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004
5. S.K. Roy, Fundamentals of Surveying, Second Edition, Prentice‘ Hall of India 2004
6. K.R. Arora, Surveying Vol I & II, Standard Book house , Tenth Edition, 2008


**CO–PO Mapping–PLANE AND GEODETIC SURVEYING LABORATORY**

| PO/PSO | | Course Outcome | | | | | Over all Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 1 | 2 | 1 | 2 | 1 | 1 |
| PO2 | Problem analysis | 1 | 2 | 1 | 2 | 1 | 1 |
| PO3 | Design/development of solutions | 1 | 1 | 2 | 2 | 2 | 2 |
| PO4 | Investigation | | | | | | |
| PO5 | Modern Tool Usage | 2 | 3 | 3 | 2 | 2 | 3 |
| PO6 | Individual and Teamwork | 2 | 3 | 3 | 2 | 2 | 2 |
| PO7 | Communication | | | | | | |
| PO8 | Engineer and Society | 1 | 2 | 2 | 2 | 1 | 2 |
| PO9 | Ethics | | | | | | |
| PO10 | Environment and Sustainability | | | | | | |
| PO11 | Project Management and Finance | | | | | | |
| PO12 | Life Long Learning | 1 | 1 | 2 | 1 | 1 | 1 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 1 | 2 | 2 | 1 | 2 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 1 | 2 | 2 | 2 | 2 | 2 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | 2 | 2 | 2 | 2 | 2 |

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

**CE7411** **HYDRAULIC ENGINEERING LABORATORY** **L T P C**
**0 0 4 2**

**OBJECTIVE:**

- Students should be able to verify the principles studied in theory by performing the experiments in lab.

**LIST OF EXPERIMENTS**

**A. Flow Measurement**

1. Calibration of Rotameter
2. Calibration of Venturimeter / Orificemeter
3. Bernoulli's Experiment

**B. Losses in Pipes**

4. Determination of friction factor in pipes
5. Determination of min or lossess

**C. Pumps**

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

**D. Turbines**

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

**E. Determination of Metacentric height**

12. Determination of Metacentric height of floating bodies

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to

| | |
|---|---|
| **CO1** | Apply Bernoulli equation for calibration of flow measuring devices |
| **CO2** | Measure friction factor in pipes and compare with Moody diagram |
| **CO3** | Determine the performance characteristics of Rotodynamic pumps |
| **CO4** | Determine the performance characteristics of positive displacement pumps |
| **CO5** | Determine the performance characteristics of turbines |

**REFERENCES:**


1. Sarbjit Singh. Experiments in Fluid Mechanics, PHI Learning Private Ltd., New Delhi 2009
2. Hydraulic Laboratory Manual, Centre for Water Resources, Anna University, 2004.
3. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics. Standard Book House, New Delhi, 19th edition, 2013.
4. Subramanya, K. Fluid Mechanics, Tata McGraw - Hill pub. Co., 1992.

**CO–PO Mapping–HYDRAULIC ENGINEERING LABORATORY**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 2 | 3 | 3 | 3 | 3 | 3 |
| PO2 | Problem analysis | 2 | 2 | 3 | 3 | 3 | 3 |
| PO3 | Design/development of solutions | 1 | 1 | 2 | 2 | 2 | 2 |
| PO4 | Investigation | 3 | 3 | 3 | 3 | 3 | 3 |
| PO5 | Modern Tool Usage | 1 | 1 | 1 | 1 | 1 | 1 |
| PO6 | Individual and Teamwork | 2 | 2 | 3 | 3 | 3 | 2 |
| PO7 | Communication | 1 | 1 | 1 | 1 | 1 | 1 |
| PO8 | Engineer and Society | 2 | 2 | 2 | 2 | 2 | 2 |
| PO9 | Ethics | 1 | 1 | 1 | 1 | 1 | 1 |
| PO10 | Environment and Sustainability | 2 | 2 | 2 | 2 | 2 | 2 |
| PO11 | Project Management and Finance | 1 | 1 | 1 | 1 | 1 | 1 |
| PO12 | Life Long Learning | 2 | 2 | 2 | 2 | 2 | 2 |
| PSO1 | Knowledge of Civil Engineering discipline | 2 | 3 | 3 | 3 | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 1 | 1 | 2 | 2 | 2 | 2 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 1 | 1 | 1 | 1 | 1 | 1 |



**CE7611 COMPUTER AIDED BUILDING DRAWING L T P C**
**0 0 4 2**

**OBJECTIVES:**

- To introduce the students to draft the plan, elevation and sectional views of buildings in accordance with development and control rules satisfying orientation and functional requirements as per National Building Code.

**LIST OF EXPERIMENTS**

1. Principles of planning, orientation and complete joinery details (Paneled and Glazed Doors and Windows)
2. Buildings with load bearing walls
3. Buildings with sloping roof
4. R.C.C. framed structures.
5. Industrial buildings – North light roof structures
6. Building Information Modeling

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

- The students will be able to draft the plan, elevation and sectional views of the buildings, industrial structures, framed buildings using computer softwares.

| | |
|---|---|
| **CO1** | Describe the plan, orientation and complete joinery details. |
| **CO2** | Develop the plan, elevation and sectional view of the loading bearing structures. |
| **CO3** | Develop the plan, elevation and sectional view of the framed structures. |
| **CO4** | Develop the plan, elevation and sectional view of the industrial structures. |
| **CO5** | Demonstrate the process of Building Information Modelling. |

**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. Shah.M.G., Kale.C.M. and Patki.S.Y., Building Drawing with an Integrated Approach to Built Environment, Tata McGraw Hill Publishers Limited, 2007.
2. Verma.B.P., Civil Engineering Drawing and House Planning, Khanna Publishers, 2010.
3. Marimuthu V.M., Murugesan R. and Padmini S., Civil Engineering Drawing-I, Pratheeba Publishers, 2008.
4. 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.


**CO–PO Mapping – COMPUTER AIDED BUILDING DRAWING**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 3 | 3 | 3 | 3 |
| PO2 | Problem analysis | | | | | | |
| PO3 | Design/development of solutions | | | | | | |
| PO4 | Investigation | 3 | 3 | 3 | 3 | 3 | 3 |
| PO5 | Modern Tool Usage | 3 | 3 | 3 | 3 | 3 | 3 |
| PO6 | Individual and Teamwork | 2 | 2 | 2 | 2 | 2 | 2 |
| PO7 | Communication | 1 | 1 | 1 | 1 | 1 | 1 |
| PO8 | Engineer and Society | 3 | 3 | 3 | 3 | 3 | 3 |
| PO9 | Ethics | | | | | | |
| PO10 | Environment and Sustainability | | | | | | |
| PO11 | Project Management and Finance | | | | | | |
| PO12 | Life Long Learning | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 3 | 3 | 3 | 3 | 3 | 3 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 3 | 3 | 3 | 3 | 3 |

**CE7501 DESIGN OF REINFORCED CEMENT CONCRETE STRUCTURES L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To introduce the various philosophies of R.C. design and to study in detail the limit state design of structural elements such as beams, columns and footings

**UNIT I DESIGN CONCEPTS AND WORKING STRESS DESIGN OF BEAMS 10**

Various design concepts - Concept of elastic method, ultimate load method and limit state method – Advantages of Limit State method over other methods – Limit State philosophy as detailed in current IS Code. Design of rectangular beam section by working stress method.

**UNIT II LIMIT STATE DESIGN OF BEAMS 10**

Design of singly and doubly reinforced rectangular and flanged beams – use of design aids for flexure – Behaviour of R.C. beams in shear and torsion – Shear and torsional reinforcement – Limit State design of R.C. members for combined bending, shear and torsion – Use of design aids. Design requirement for bond and anchorage as per IS code. Serviceability requirements, importance of cracked and uncracked section.

**UNIT III LIMIT STATE DESIGN OF SLABS 10**

Behaviour of one way and two way slabs - design of one way simply supported, cantilever and continuous slabs. Design of two-way slabs for various edge conditions.-Introduction to flat slab - Types of staircases - design of dog-legged staircase.

**UNIT IV LIMIT STATE DESIGN OF COLUMNS AND FOOTING 10**

Types of columns – design of short columns for axial load, combined axial load with uniaxial and biaxial bending - use of design aids. Design of footing for masonry and reinforced walls – design of axially and eccentrically loaded square and rectangular footings – design of combined rectangular footings for two columns only- Introduction to strap footing, raft/mat foundation.



**UNIT V MASONRY MEMBERS 5**

Determination of permissible stresses on masonry, load carrying capacity of masonry walls and pillars - Design of masonry walls, pillars and footings as per IS Codes.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- The student shall be in a position to design the basic elements of reinforced concrete structures.

| | |
|---|---|
| **CO1** | Explain the various design concepts and design a beam under flexure by working stress method and draw the reinforcement details. |
| **CO2** | Design the beam under shear and torsion, Calculate the anchorage and development length and check the serviceability requirements for RC structural elements. |
| **CO3** | Design a RC slab and staircase and draw the reinforcement details. |

| | |
|---|---|
| **CO4** | Design short columns and strip, isolated and combined footings and draw the reinforcement details |
| **CO5** | Design a Masonry wall, pillar and footings |

**TEXTBOOKS:**


1. Sinha.S.N., Reinforced Concrete Design, Second Edition, Tata McGraw Hill Publishing Company, 2002.
2. Varghese.P.C., Limit State Design of Reinforced Concrete, Second Edition Prentice Hall Inc., 2010,
3. Gambhir. M.L., Fundamentals of Reinforced Concrete Design, Prentice Hall Inc., 2006.
4. Anand.S.Arya, Masonry and Timber Structures including Earthquake Resistant Design, Nem Chand and Bros., 2006.


**REFERENCES:**


1. IS 456–2000, Indian Standard – Plain and Reinforced Concrete – Code of Practice, Fourth Edition.
2. IS 1905–1987, Indian Code of Practice for Structural use of Unreinforced Masonry.
3. National Building Code of India 2005 (NBC 2005), Bureau of Indian Standards.
4. Dayaratnam.P., Limit State Design of Reinforced Concrete Structures, Oxford, IBH Publishing Company Pvt. Ltd., 2008.
5. Unnikrishna Pillai and Devdass Menon, Reinforced Concrete Design, Tata McGraw Hill Publishing Company Ltd., 2005


**CO –PO Mapping- DESIGN OF REINFORCED CEMENT CONCRETE STRUCTURES**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| **PO1** | Knowledge of Engineering Sciences | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO2** | Problem analysis | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO3** | Design/development of solutions | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO4** | Investigation | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO5** | Modern Tool Usage | 1 | 2 | 2 | 2 | 3 | 2 |
| **PO6** | Individual and Teamwork | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO7** | Communication | 1 | 1 | 1 | 1 | 1 | 1 |
| **PO8** | Engineer and Society | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO9** | Ethics | 2 | 1 | 1 | 1 | 1 | 1 |
| **PO10** | Environment and Sustainability | 2 | 1 | 1 | 1 | 2 | 2 |
| **PO11** | Project Management and Finance | 1 | 1 | 1 | 1 | 1 | 1 |
| **PO12** | Life Long Learning | 3 | 2 | 2 | 2 | 3 | 2 |
| **PSO1** | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 | 3 |
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 3 | 3 | 3 | 3 | 3 | 3 |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 3 | 3 | 3 | 3 | 3 |

**CE7502** **HIGHWAY ENGINEERING** **L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To give an overview / basis of highway engineering with respect to the development, planning, design, construction and maintenance of highways.

**UNIT I HIGHWAY PLANNING AND ALIGNMENT**

**8** History of road development in India – Classification of highways – Institutions for Highway planning, design and construction at different levels – factors influencing highway alignment – Road ecology - Engineering surveys for alignment, objectives, conventional and modern methods.

**UNIT II GEOMETRIC DESIGN OF HIGHWAYS** **10**

Typical cross sections of Urban and Rural roads — Cross sectional elements – Horizontal curves, super elevation, transition curves, widening of curves – Sight distances – Vertical curves, gradients, hairpin bends – Lateral and vertical clearance at underpasses - IRC standards-Road signs and safety.

**UNIT III DESIGN OF FLEXIBLE AND RIGID PAVEMENTS** **9**

Design principles – pavement components and their role - Design practice for flexible and rigid pavements (IRC methods only).

**UNIT IV HIGHWAY CONSTRUCTION AND MAINTENANCE** **10**

Highway construction materials, properties, testing methods – Construction practice including modern materials and methods of concrete and flexible pavements, Highway drainage – Special considerations for hilly roads; Evaluation and Maintenance of pavements.

**UNIT V HIGHWAY ECONOMICS AND FINANCE** **8**

Introduction, Highway User Benefits, Highway Costs, Vehicle Operation Costs, Economic analysis, Highway projects under Public-Private Sector Participation, Bidding process, Highway finance.

**TOTAL: 45**

**PERIODS**

**COURSE OUTCOMES:**

- The students completing this course would have acquired knowledge on planning, design, construction and maintenance of highways as per IRC standards and other methods.

| | |
|---|---|
| **CO1** | Understand the concepts and standards adopted in Planning, Design and construction of Highways and its related infrastructures. |
| **CO2** | Apply the knowledge of science and engineering fundamentals in designing the geometrics for an efficient Highway network and design concepts. |
| **CO3** | Designing various types of pavements to meet specified needs of safety, efficiency and long time sustainability by adopting various design standards. |
| **CO4** | Select appropriate methods for construction, evaluation and maintenance of roadways. |
| **CO5** | Understand the bidding processes and types of highway projects and analyze the economic, financial aspects of the highway projects , |

**TEXTBOOKS:**

1. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering, Scitech Publications (India), Chennai, 2010
2. Veeraragavan. A, Khanna.K and Justo.C.E.G. Highway Engineering, Nem Chand & Bros Publishers, 2014
3. Subhash C Saxena, Textbook of Highway and Traffic Engineering., CBS Publishers, 2014

**REFERENCES:**

1. Partha Chakroborty and Animesh Das Principles of Transportation Engineering, PHI Learning Pvt. Ltd., 2005
2. Kadiyali. L. R. Principles and Practice of Highway Engineering, Khanna Technical Publications, Delhi, 1997.
1. Indian Road Congress (IRC), Guidelines and Special Publications on Planning and Design of Highways.
2. C.Venkatramaiah., Transportation Engineering-Highway Engineering, Universities Press ` (India) Private Limited, Hyderabad, 2015
3. R.Srinivasa Kumar., Textbook of Highway Engineering Universities Press (India) Private Limited, Hyderabad, 2011
4. Sharma.S.K Principles , Practices and Design of Highway Engineering, S.Chand and Company Ltd.1995
5. Clarkson.H Oglesby and R.Gary Hicks, Highway Engineering, John Wileysons, 1992.
6. O"Flaherty.C.A Highways, Butterworth – Heinemann, Oxford,2006

**CO –PO Mapping –HIGHWAY ENGINEERING**

| PO/PSO | | Course Outcome | | | | | Overall Correlatin of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| **PROGRAMOUTCOMES(PO)** | | | | | | | |
| **PO1** | Knowledge of Engineering Sciences | 3 | 3 | 2 | 2 | | 3 |
| **PO2** | Problem analysis | | | 3 | 3 | 2 | 3 |
| **PO3** | Design/development of solutions | | 3 | 3 | 2 | 1 | 3 |
| **PO4** | Investigation | 2 | | 2 | 2 | 1 | 2 |
| **PO5** | Modern Tool Usage | | | 2 | 2 | | 2 |
| **PO6** | Individual and Teamwork | | | 2 | | 2 | 2 |
| **PO7** | Communication | | | | | 1 | 1 |
| **PO8** | Engineer and Society | 3 | | | 3 | 3 | 3 |
| **PO9** | Ethics | 3 | | 3 | 3 | 3 | 3 |
| **PO10** | Environment and Sustainability | 1 | 1 | 2 | 3 | 1 | 2 |
| **PO11** | Project Management and Finance | | | 2 | 3 | 3 | 3 |
| **PO12** | Life Long Learning | | 2 | 3 | 3 | 3 | 3 |
| **PROGRAMSPECIFICOUTCOMES(PSO)** | | | | | | | |
| **PSO1** | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 2 | 3 |
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 2 | 3 | 3 | 3 | 2 | 3 |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | | | | 3 | 3 | 3 |

**CE7503 STRUCTURAL ANALYSIS – I L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To introduce the students to basic theory and concepts of classical methods of structural analysis and to find the deflection of determinate plane frames.

**UNIT I DEFLECTION OF DETERMINATE FRAMES 9**

Principles of virtual work for deflections - Deflections of pin-jointed plane frames and rigid plane frames –Williott's diagram.

**UNIT II SLOPE DEFLECTION METHOD 9**

Slope deflection equations- Analysis of continuous beams and rigid frames - Support settlements.

**UNIT III MOMENT DISTRIBUTION METHOD 9**

Stiffness and carry over factors – Distribution and carry over of moments - Analysis of continuous Beams - Plane rigid frames with and without sway – Support settlement.

**UNIT IV MATRIX FLEXIBLITY METHOD 9**

Equilibrium and compatibility - Determinate vs. indeterminate structures - Static and Kinematic Indeterminacy - primary structure - Compatibility conditions - Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames

**UNIT V MATRIX STIFFNESS METHOD 9**

Element and global stiffness matrices– Co-ordinate transformations – Rotation matrix - Compatibility matrix – transformations of stiffness matrices, load vectors and displacement vectors – Analysis of Continuous Beams – Analysis of pin-jointed plane frames and rigid frames by direct stiffness method.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- Students will have the knowledge of analysing a structure using the classical methods and are able to draw the shear force and bending moment diagrams.

| | |
|---|---|
| **CO1** | Analyze the pin-jointed plane and space frames. |
| **CO2** | Analyse the continuous beams and rigid frames by slope defection method. |
| **CO3** | Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway |
| **CO4** | Analyse the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method |
| **CO5** | 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, Vikas Publishing House Pvt. Ltd., NewDelhi-4, 2010.

2. Bhavikatti, S.S, Structural Analysis, Vol.2, Vikas Publishing House Pvt. Ltd., NewDelhi-4, 2013.
3. Punmia.B.C, Ashok Kumar Jain & Arun Kumar Jain, Theory of structures, Laxmi Publications, New Delhi, 2004.
4. Hibbeler, R.C., Structural Analysis, VII Edition, Prentice Hall, 2012.

**REFERENCES:**

1. William Weaver, Jr and James M.Gere, Matrix analysis of framed structures, CBS Publishers & Distributors, Delhi, 1995
2. Vaidyanathan,R & Perumal P, Structural Analysis, Vol.1 & 2, Laxmi Publications, New Delhi,2004
3. Pandit G.S. and Gupta S.P., Structural Analysis – A Matrix Approach, Tata McGraw Hill Publishing Company Ltd., 2006
4. Reddy .C.S, "Basic Structural Analysis", Tata McGraw Hill Publishing Company, 2005.
5. Negi L.S. and Jangid R.S., Structural Analysis, Tata McGraw Hill Publishing Co. Ltd. 2004.

**CO –PO Mapping- STRUCTURAL ANALYSIS – I**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | | 3 | | 3 | 3 |
| PO2 | Problem analysis | 3 | 3 | 2 | 3 | 2 | 3 |
| PO3 | Design/development of solutions | | 3 | 1 | 2 | 2 | 2 |
| PO4 | Investigation | 2 | 2 | | 2 | | 2 |
| PO5 | Modern Tool Usage | 1 | | | | | 1 |
| PO6 | Individual and Teamwork | | | 1 | 2 | 2 | 2 |
| PO7 | Communication | 3 | | | | | 3 |
| PO8 | Engineer and Society | 1 | | | | | 1 |
| PO9 | Ethics | | 1 | 1 | | | 1 |
| PO10 | Environment and Sustainability | | | | | | |
| PO11 | Project Management and Finance | | | 1 | 1 | 1 | 1 |
| PO12 | Life Long Learning | | | | | 2 | 2 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | | | | | 2 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | | | | | 2 |

**CE7504 WATER SUPPLY ENGINEERING L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To equip the students with the principles and design of water treatment and distribution.

**UNIT I SOURCES OF WATER 9**

Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics, Surface and Groundwater – Impounding Reservoir – Development and selection of source – Source Water quality – Characterization – Significance – Drinking Water quality standards.

**UNIT II CONVEYANCE FROM THE SOURCE 9**

Water supply – intake structures – Functions; Pipes and conduits for water – Pipe materials – Hydraulics of flow in pipes – Transmission main design – Laying, jointing and testing of pipes – appurtenances – Types and capacity of pumps – Selection of pumps and pipe materials.

**UNIT III 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 - Residue Management –Construction, Operation and Maintenance aspects.

**UNIT IV ADVANCED WATER TREATMENT 9**

Water softening – Desalination- R.O. Plant – demineralization – Adsorption - Ion exchange– Membrane Systems – RO Reject Management - Iron and Manganese removal - Defluoridation - Construction and Operation & Maintenance aspects – Recent advances.

**UNIT V WATER DISTRIBUTION AND SUPPLY 9**

Requirements of water distribution – Components – Selection of pipe material – Service reservoirs – Functions – Network design – Economics – Analysis of distribution networks -Computer applications – Appurtenances – Leak detection.
Principles of design of water supply in buildings – House service connection – Fixtures and fittings, systems of plumbing and types of plumbing.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to

| | |
|---|---|
| **CO1** | Understand the various components of water supply scheme |
| **CO2** | Design of intake structure and conveyance system for water transmission |
| **CO3** | Understand the process of conventional treatment of water and design of water treatment system. |
| **CO4** | Able to Understand and design the various advanced treatment system and knowledge about the recent advances in water treatment process |
| **CO5** | ability to design and evaluate water distribution system and water supply in buildings |

**TEXTBOOKS:**


1. Garg, S.K. Environmental Engineering, Vol.I Khanna Publishers, New Delhi, 2010.
2. Modi, P.N., Water Supply Engineering, Vol.I Standard Book House, New Delhi, 2010.
3. Punmia, B.C.,Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi, 2010.


Attested

**REFERENCES:**


1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development,




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Government of India, New Delhi, 2013.
2. Syed R. Qasim and Edward M. Motley Guang Zhu, Water Works Engineering Planning, Design and Operation, Prentice Hall of India Learning Private Limited, New Delhi, 2009.

**CO –PO Mapping- WATER SUPPLY ENGINEERING**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | | 3 | 3 | | 3 | 3 |
| PO2 | Problem analysis | 3 | 2 | 2 | 2 | 2 | 2 |
| PO3 | Design/development of solutions | | 2 | 3 | | 3 | 3 |
| PO4 | Investigation | 3 | | | | 2 | 2 |
| PO5 | Modern Tool Usage | | 2 | | 3 | | 3 |
| PO6 | Individual and Teamwork | | 2 | 2 | | | 2 |
| PO7 | Communication | 1 | | | | | 1 |
| PO8 | Engineer and Society | 3 | | | | 3 | 3 |
| PO9 | Ethics | 2 | | | | | 2 |
| PO10 | Environment and Sustainability | | 3 | 3 | 3 | | 3 |
| PO11 | Project Management and Finance | | | | | 2 | 2 |
| PO12 | Life Long Learning | | | | 2 | | 2 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 2 | 2 | 2 | 3 | 2 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | | | | | 3 |



**CE7511 HIGHWAY ENGINEERING LABORATORY** **L T P C**
**0 0 4 2**

**OBJECTIVE :**

- To learn the principles and procedures of testing of highway materials

**EXCERCISES :**

**I TEST ON AGGREGATES**

a) Specific Gravity
b) Los Angeles Abrasion Test
c) Water Absorption of Aggregates

**II TEST ON BITUMEN**

a) Specific Gravity of Bitumen
b) Penetration Test
c) Viscosity Test

d) Softening Point Test
e) Ductility Test

**III TESTS ON BITUMINOUS MIXES**

a) Stripping Test
b) Determination of Binder Content
c) Marshall Stability and Flow Values

**IV DEMONSTRATION OF FIELD TESTING EQUIPMENT**

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

- Student would have knowledge to characterize various pavement materials and learn the concept and of testing the highway materials as per the IRC specifications through hands on experience.

| | |
|---|---|
| **CO1** | Understand the concept behind testing of Highway Materials as per the Indian Standards |
| **CO2** | Characterize and perform tests to determine properties of Aggregates used in road construction |
| **CO3** | Characterize and perform tests to determine properties of Bitumen used in road construction |
| **CO4** | Design and analyze the mix proportions to construct a road and perform tests to assess its strength and suggest its usage in road construction |
| **CO5** | Understand the various test done to evaluate the riding and construction quality of the roads through demonstration of equipment's in the field. |

**REFERENCES:**


1. Highway Materials and Pavement Testing, Nem Chand and Bros., Roorkee, Revised Fifth Edition,2009
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.


**CO –PO Mapping –HIGHWAY ENGINEERING LABORATORY**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| **PO1** | Knowledge of Engineering Sciences | | | | | | |
| **PO2** | Problem analysis | | | 3 | 3 | 2 | 3 |
| **PO3** | Design/development of solutions | | 3 | 3 | 2 | 1 | 3 |
| **PO4** | Investigation | | | 2 | 2 | 1 | 2 |
| **PO5** | Modern Tool Usage | | 2 | 3 | 2 | 2 | 2 |
| **PO6** | Individual and Teamwork | 2 | 2 | | | | 2 |
| **PO7** | Communication | | | | | 1 | 1 |
| **PO8** | Engineer and Society | 3 | | | 3 | 3 | 3 |
| **PO9** | Ethics | | | 3 | 3 | 3 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PO10** | Environment and Sustainability | 1 | 1 | 2 | 3 | 1 | 2 |
| **PO11** | Project Management and Finance | | | 2 | 3 | 3 | 3 |
| **PO12** | Life Long Learning | | 2 | 3 | 3 | 3 | 3 |
| **PSO1** | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 2 | 3 |
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 2 | 3 | 3 | 3 | 2 | 3 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | 3 | 2 | 3 | 3 | 3 |

**CE7512** **SOIL MECHANICS LABORATORY** **L T P C**
**0 0 4 2**

**OBJECTIVE:**

- To develop skills to test the soils for their index and engineering properties and to characterise the soil based on their properties.

**EXERCISES:**

**1. DETERMINATION OF INDEX PROPERTIES** **20**

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

**2. DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS** **8**

a. Field density Test ( Sand replacement method)
b. Determination of moisture – density relationship using standard proctor compaction test.

**3. DETERMINATION OF ENGINEERING PROPERTIES** **28**

a. Permeability determination (constant head and falling head methods)
b. One dimensional consolidation test (Determination of co-efficient of consolidation only)
c. Direct shear test in cohesionless soil
d. Unconfined compression test in cohesive soil
e. Laboratory vane shear test in cohesive soil
f. Tri-axial compression test in cohesionless soil (Demonstration only)
g. California Bearing Ratio Test

**4. TEST ON GEOSYNTHETICS (Demonstration only)** **04**

a. Determination of tensile strength and interfacial friction angle.
b. Determination of apparent opening sizes and permeability.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

- Students are able to conduct tests to determine both the physical and engineering properties of soils and to characterize the soil based on their

properties.

| | |
|---|---|
| **CO1** | Students are able to conduct tests to determine the index properties of soils |
| **CO2** | Students are be to determine the in situ density and compaction characteristics. |
| **CO3** | Students are able to conduct tests to determine the compressibility, permeability and shear strength of soils. |
| **CO4** | Students are able to understand the various tests on Geo synthetics. |

**REFERENCES:**


1. "Soil Engineering Laboratory Instruction Manual" published by Engineering College Co-operative Society, Anna University, Chennai, 2010.
2. Saibaba Reddy, E. Ramasastri, K. "Measurement of Engineering Properties of Soils", New age International (P) limited publishers, New Delhi, 2008.
3. Lambe T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 1951. Digitized 2008.
4. IS Code of Practice (2720) Relevant Parts, as amended from time to time, Bureau of Indian Standards, New Delhi.
5. G.Venkatappa Rao and Goutham .K. Potable, "Geosynthetics Testing – A laboratory Mannual", Sai Master Geo environmental Services Pvt. Ltd., 1st Edition 2008.


**CO –PO Mapping –SOIL MECHANICS LABORATORY**

| PO/PSO | | Course Outcome | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | |
| **PO1** | Knowledge of Engineering Sciences | 2 | 1 | 3 | 1 | 1 |
| **PO2** | Problem analysis | 2 | 2 | 3 | 2 | 2 |
| **PO3** | Design/development of solutions | 3 | 3 | 3 | 2 | 3 |
| **PO4** | Investigation | 3 | 3 | 3 | 3 | 3 |
| **PO5** | Modern Tool Usage | 1 | 1 | 1 | 2 | 1 |
| **PO6** | Individual and Teamwork | 3 | 3 | 3 | 3 | 3 |
| **PO7** | Communication | 1 | 2 | 1 | 1 | 1 |
| **PO8** | Engineer and Society | 1 | 1 | 1 | 1 | 1 |
| **PO9** | Ethics | 1 | 1 | 1 | 1 | 1 |
| **PO10** | Environment and Sustainability | 1 | 1 | 1 | 1 | 1 |
| **PO11** | Project Management and Finance | 1 | 1 | 1 | 1 | 1 |
| **PO12** | Life Long Learning | 3 | 3 | 3 | 3 | 3 |
| **PSO1** | Knowledge of Civil Engineering discipline | 3 | 2 | 2 | 2 | 2 |
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 3 | 3 | 3 | 2 | 3 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 2 | 3 | 3 | 3 |

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**CE7601 DESIGN OF STEEL AND TIMBER STRUCTURES L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To learn the limit state design of steel components subjected to tension, compression and bending and timber structures.

**UNIT I SECTIONS AND JOINTS 12**

Types of steel structures – Properties of rolled steel sections and Light gauge steel sections – Riveted and bolted connections – Failures of joints – Single and multiple bolted lap and butt joints under axial and eccentric loading – Strength of fillet and butt welded joints – Design of riveted, bolted and welded joints- HSFG bolts

**UNIT II TENSION MEMBERS 8**

Design of simple and built-up members subjected to tension –Effective area of angles connected to gussets – shear lag-lug angles.

**UNIT III COMPRESSION MEMBERS 8**

Maximum slenderness ratio of various compression members – IS code provision for compression members – Design of simple and built-up compression members with lacings and battens – Design of column bases.

**UNIT IV BEAMS 11**

Design of simple beams based on strength and stiffness as per IS code – Design of built–up beams and curtailment of flange plates –Flange splice and web splice- Design of plate girder and stiffeners- design of brackets

**UNIT V TIMBER 6**

Study of properties and strength of natural and laminated timber – Allowable stresses in compression, tension and flexure as per IS Code – Types of joints with nails and bolts – Design of simple compression members as per IS code– Design of beams for strength and stiffness as per IS code.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- The students will have knowledge on the design of structural steel members subjected to compressive, tensile and bending forces, as per current code and also know to design Timber Members.

| | |
|---|---|
| **CO1** | Recognise the design philosophy of steel structures and identify the different failure modes of bolted and welded connections and determine the design strengths |
| **CO2** | Design members subjected to tension and identify the critical failure mode |
| **CO3** | Select the most suitable shape and size for compression members according to specific design criteria |
| **CO4** | Design beams with and without lateral restraint subjected to high and low shear |
| **CO5** | Design timber beams and columns |

**TEXTBOOKS:**


1. Subramanian.N, Design of Steel Structures, Oxford University Press, 2008.
2. Punmia, Ashok Kumar Jain, B.C.Punmia, Comprehensive design of Steel Structures, Laxmi Publications, 2005.
3. Duggal.S.K, Limit State Design of Steel Structures, Tata McGraw Hill Publishing Company, 2010.
4. S. Ramamrutham and R. Narayanan, Design of Steel Structures -, Dhanpat Rai Publishing

Company, 2003

**REFERENCES:**


1. Narayanan.R.et.al. Teaching Resource on Structural Steel Design, INSDAG, Ministry of Steel Publications, 2002.
2. Shah.V.L. and Veena Gore, Limit State Design of Steel Structures IS 800–2007 Structures Publications, 2009.
3. Bhavikatti.S.S, Design of Steel Structures By Limit State Method as per IS:800–2007, IK International Publishing House Pvt. Ltd., 2009.
4. IS 800-2007 Indian Standard for General Construction in Steel — Code of Practice.
5. IS 883-1994 Indian Standard for Design of Structural Timber in Building - Code of Practice.


**CO –PO Mapping –DESIGN OF STEEL AND TIMBER STRUCTURES**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 2 | 2 | 2 | 3 | 2 | 2 |
| PO2 | Problem analysis | 2 | 2 | 2 | 2 | 3 | 2 |
| PO3 | Design/development of solutions | 3 | 3 | 3 | 3 | 3 | 3 |
| PO4 | Investigation | | | | | 2 | 2 |
| PO5 | Modern Tool Usage | | 2 | 2 | 2 | | 2 |
| PO6 | Individual and Teamwork | | | | 2 | | 2 |
| PO7 | Communication | | | | | 1 | 1 |
| PO8 | Engineer and Society | | | | 2 | | 2 |
| PO9 | Ethics | | | | 2 | | 2 |
| PO10 | Environment and Sustainability | 2 | | | 2 | | 2 |
| PO11 | Project Management and Finance | | 2 | 2 | 2 | | 2 |
| PO12 | Life Long Learning | 2 | 2 | 2 | 3 | 3 | 2 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 2 | 2 | 2 | 2 | 2 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 2 | 2 | 2 | 2 | 2 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | | | | 3 | 3 | 3 |

**CE7602 STRUCTURAL ANALYSIS – II L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To learn the method of drawing influence lines and its uses in various applications like beams, bridges and plane trusses.
- To analyse the arches, suspension bridges and space trusses.
- Also to learn Plastic analysis of beams and rigid frames.

**UNIT I MOVING LOADS AND INFLUENCE LINES 9**

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

**UNIT II INFLUENCE LINES FOR INDETERMINATE STRUCTURES 9**

Muller Breslau's principle – Application of Muller Breslau's principle to determinate beams and continuous beams.

**UNIT III ARCHES 9**

Arches - Structural forms – Examples of arch structures – Types of arches – Analysis of three hinged, two hinged and fixed arches - Parabolic and circular arches – Settlement and temperature effects- introduction to folded plates.

**UNIT IV SUSPENSION BRIDGES 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 – Beams curved in plan.

**UNIT V PLASTIC ANALYSIS 9**

Statically indeterminate structures – Beams in pure bending – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism - Static and kinematic methods – Upper and lower bound theorems -Plastic analysis of indeterminate beams and frames.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- The student will have the knowledge of influence line and its uses in analysis of beams, stiffening girder in bridges and plane trusses.

| | |
|---|---|
| **CO1** | Draw influence lines for statically determinate structures and calculate critical stress resultants. |
| **CO2** | Understand Muller Breslau principle and draw the influence lines for statically Indeterminate beams. |
| **CO3** | Analyse three hinged, two hinged and fixed arches |
| **CO4** | Analyse the suspension bridges with stiffening girders |
| **CO5** | Understand the concept of plastic analysis and determine the collapse load / plastic moment capacity for indeterminate beams and frames. |

**TEXTBOOKS:**


1. Bhavikatti,S.S, Structural Analysis, Vol.1, Vikas Publishing House Pvt. Ltd., NewDelhi-4, 2010.
2. Bhavikatti,S.S, Structural Analysis, Vol.2, Vikas Publishing House Pvt. Ltd., NewDelhi-4, 2013.
3. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, Theory of structures, Laxmi Publications, 2004.
4. Vazrani.V.N And Ratwani,M.M, Analysis of Structures, Vol.II, Khanna Publisers,2015.
5. Vaidyanathan.R and Perumal.P, Structural Analysis, Vol.2, Laxmi Publications, 2015.


**REFERENCES:**


1. Negi.L.S and Jangid R.S ., Structural Analysis , Tata McGraw-Hill Publishers, 2004.
2. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co. Ltd. 2002.
3. Gambhir.M.L., Fundamentals of Structural Mechanics and Analysis, PHI Learning Pvt. Ltd., 2011.
4. Prakash Rao D.S., Structural Analysis, Universities Press, 1996.


Attested



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**CO –PO Mapping- STRUCTURALANALYSIS – II**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | | 3 | | | 3 |
| PO2 | Problem analysis | | | 3 | 3 | 3 | 3 |
| PO3 | Design/development of solutions | | 3 | | 3 | 3 | 3 |
| PO4 | Investigation | | | 2 | | | 2 |
| PO5 | Modern Tool Usage | | 1 | 2 | 2 | | 2 |
| PO6 | Individual and Teamwork | 3 | 3 | | | | 3 |
| PO7 | Communication | | | 2 | 2 | | 2 |
| PO8 | Engineer and Society | | | | 1 | 2 | 2 |
| PO9 | Ethics | 1 | | | | | 1 |
| PO10 | Environment and Sustainability | 1 | | | | | 1 |
| PO11 | Project Management and Finance | | | 2 | 1 | 1 | 1 |
| PO12 | Life Long Learning | | | | 2 | 2 | 2 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 2 | 2 | 2 | 2 | 2 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | 2 | 2 | 2 | 2 | 2 |

**CE7603 STRUCTURAL DESIGN AND DRAWING L T P C**
**3 0 2 4**

**OBJECTIVES:**

- This course aims at providing students with a solid background on the principles of structural engineering design. Students will be acquire the knowledge of liquid retaining structures, bridges components, retaining wall and industrial structures.

**UNIT I INTRODUCTION AND PLANNING 9+6**

Introduction - Planning and Design Process – Types of Loading – Dead , Live, Wind and Earthquake loads - Fabrication Drawing of Simple Riveted, Bolted and Welded Connections.

**UNIT II LIQUID STORAGE STRUCTURES 9+6**

RC Water Tanks- On ground – Circular, underground- Rectangular – Hemispherical Bottomed Steel Water Tank –-Design and Drawing

**UNIT III DESIGN OF BRIDGE COMPONENTS 9+6**

IRC Specifications and Loading – Solid Slab RC Bridge – Steel Foot-over Bridge- Design and Drawing.

Attested

**UNIT IV RETAINING WALLS 9+6**



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RC Cantilever and Counterfort Retaining Walls – Horizontal Backfill with Surcharge – Design of Shear Key- Design and Drawing.

**UNIT V INDUSTRIAL STRUCTURES 9+6**

Steel Roof Trusses – Roofing Elements – Purlins – crane/gantry girders- Self supported Chimney - Design and Drawing.

**TOTAL (45+30) : 75 PERIODS**

**COURSE OUTCOMES:**

- Attheendofthecoursethestudentacquireshandsonexperienceindesignandpreparation of structural drawings for concrete / steel structures normally encountered in Civil Engineering practice.

| | |
|---|---|
| **CO1** | Calculate the basic loadings for a building structure, design and draw the steel connections |
| **CO2** | Design and draw the structural elements for liquid storage structures |
| **CO3** | Design and draw the structural elements for bridge components |
| **CO4** | Design and draw the structural elements for Retaining walls |
| **CO5** | Design and draw the industrial structures components |

**TEXTBOOKS:**


1. Krishnaraju N, Structural Design and Drawing, Universities Press, 2009.
2. Punmia B.C, Ashok Kumar Jain and Arun Kumar Jain, Comprehensive Design of Steel Structures, Laxmi Publications Pvt. Ltd., 2003.


**REFERENCES:**


1. Krishnamurthy D, Structural Design and Drawing Vol I, II and III, CBS Publishers, 2010.
2. Shah V L and Veena Gore, Limit State Design of Steel Structures IS 800-2007, Structures Publications, 2009.
3. IS 456(2000) Indian Standard Plain and Reinforced Concrete -Code of Practice, Bureau of Indian Standards, New Delhi.
4. SP34 Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi.
5. IS 800 (2007) Indian Standard General Construction In Steel — Code of Practice, Bureau of Indian Standards, New Delhi.
6. IS 875 Part 1 (2003) Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Code of Practice - Dead Load, Bureau of Indian Standards, New Delhi.
7. IS 875 Part 2 (2003) Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Code of Practice - Imposed Load, Bureau of Indian Standards, New Delhi.
8. IS 875 Part 3 (2003) Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures, Code of Practice - Wind Load, Bureau of Indian Standards, New Delhi.
9. IS 3370 Part 1 (2009) Indian Standard Concrete Structures for Storage of Liquids - Code of Practice – General Requirements, Code of Practice, Bureau of Indian Standards, New Delhi.
10. IS 3370 Part 2 (2009) Indian Standard Concrete Structures for Storage of Liquids - Code of Practice - Reinforced Concrete Structures, Code of Practice, Bureau of Indian Standards, New Delhi.


Attested



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11. IS 3370 –Part 4 (2008) Indian Standard Code of Practice for Concrete Structures for The Storage of Liquids - Design Tables, Code of Practice, Bureau of Indian Standards, New Delhi.
12. IS 804 (2008) Indian Standard Specification for Rectangular Pressed Steel Tanks, Code of Practice, Bureau of Indian Standards, New Delhi.
13. IS 805 (2006) Indian Standard Code of Practice for Use of Steel in Gravity Water Tanks, Code of Practice, Bureau of Indian Standards, New Delhi.
14. IRC 112-2011, Code of Practice for Concrete Road Bridges, The Indian Roads Congress, New Delhi.
15. IRC 6 -2014, Standard Specifications and Code of Practice for Road Bridges Section: II - Loads and Stresses, The Indian Roads Congress, New Delhi.

**CO –PO Mapping- STRUCTURAL DESIGN AND DRAWING**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 2 | 3 | 3 | 3 | 3 | 3 |
| PO2 | Problem analysis | 3 | 3 | 3 | 3 | 3 | 3 |
| PO3 | Design/development of solutions | 3 | 3 | 3 | 3 | 3 | 3 |
| PO4 | Investigation | 3 | 3 | 3 | 3 | 3 | 3 |
| PO5 | Modern Tool Usage | 1 | 1 | 1 | 1 | 1 | 1 |
| PO6 | Individual and Teamwork | 1 | | | | | 1 |
| PO7 | Communication | 1 | | | | | 1 |
| PO8 | Engineer and Society | 2 | 2 | 2 | 2 | 2 | 2 |
| PO9 | Ethics | | 1 | 1 | 1 | 1 | 1 |
| PO10 | Environment and Sustainability | 1 | 1 | 1 | 1 | 1 | 1 |
| PO11 | Project Management and Finance | | 1 | 1 | 1 | 1 | 1 |
| PO12 | Life Long Learning | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 2 | 2 | 2 | 2 | 2 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 2 | 2 | 2 | 2 | 2 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | | | | 3 | 3 | 3 |

**CE7604 WASTEWATER ENGINEERING L T P C**

**3 0 0 3**

**OBJECTIVE:**

- The objectives of this course is to help students develop the ability to apply basic understanding of physical, chemical, and biological phenomena for successful design, operation and maintenance of sewage treatment plants.

**UNIT I PLANNING AND DESIGN OF SEWERAGE SYSTEM 9**

Characteristics and composition of sewage-- population equivalent -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 II PRIMARY TREATMENT OF SEWAGE 9**

Objectives – Unit Operations and Processes – Selection of treatment processes –- Onsite sanitation - Septic tank- Grey water harvesting – Primary treatment – Principles, functions and design of sewage treatment units - screens - grit chamber-primary sedimentation tanks – Construction, Operation and Maintenance aspects.

**UNIT III SECONDARY TREATMENT OF SEWAGE 10**

Objectives – Selection of Treatment Methods – Principles, Functions, - Activated Sludge Process and Extended aeration systems -Trickling filters - other treatment methods – Sequencing Batch Reactor – Membrane Bioreactor - UASB – Waste Stabilization Ponds – Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment – Construction, Operation and Maintenance aspects.

**UNIT IV DISPOSAL OF SEWAGE 9**

Standards for– Disposal - Methods – dilution – Self purification of surface water bodies Oxygen sag curve – deoxygenation and reaeration - Land disposal – Sewage farming – sodium hazards - Soil dispersion system.

**UNIT V SLUDGE TREATMENT AND DISPOSAL 8**

Objectives - Sludge characterization – Thickening – Sludge digestion – Biogas recovery – Sludge Conditioning and Dewatering – ultimate residue disposal – recent advances.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to

| | |
|---|---|
| **CO1** | Understand on the characteristics and composition of sewage, ability to estimate sewage generation and design sewer system including sewage pumping stations |
| **CO2** | Select type of treatment system and able to perform basic design of the unit operations that are used in sewage treatment, knowledge of septic tank design |
| **CO3** | Gain knowledge of selection of treatment process and biological treatment process |
| **CO4** | Acquire knowledge of advance treatment technology and reuse of sewage |
| **CO5** | Understand the, self-purification of streams and sludge and septage disposal methods. |

**TEXTBOOKS:**


1. Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers,New Delhi, 2015.
2. Duggal K.N., “Elements of Environmental Engineering” S.Chand and Co. Ltd., New Delhi, 2014.
3. Punmia, B.C., Jain, A.K., and Jain.A.K.., Environmental Engineering, Vol.II, Laxmi Publications, 2010.


**REFERENCES:**


1. Manual on Sewerage and Sewage Treatment Systems Part A,B and C, CPHEEO, Ministry

of Urban Development, Government of India, New Delhi, 2013.

2. Metcalf and Eddy- Wastewater Engineering–Treatment and Reuse, Tata Mc.Graw-Hill Company, New Delhi, 2010.
3. Syed R. Qasim "Wastewater Treatment Plants", CRC Press, Washington D.C.,2010
4. Gray N.F, "Water Technology", Elsevier India Pvt. Ltd., New Delhi, 2006.

**CO –PO Mapping – WASTE WATER ENGINEERING**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | | 3 | 3 | 2 | 2 | 3 |
| PO2 | Problem analysis | | | | | 2 | 2 |
| PO3 | Design/development of solutions | 2 | 3 | 3 | 3 | 3 | 3 |
| PO4 | Investigation | 3 | 2 | 2 | 2 | 2 | 2 |
| PO5 | Modern Tool Usage | | 2 | | 3 | 2 | 2 |
| PO6 | Individual and Teamwork | | 2 | 2 | | | 2 |
| PO7 | Communication | 1 | | | | | 1 |
| PO8 | Engineer and Society | 3 | 3 | | | 3 | 3 |
| PO9 | Ethics | | | | | 3 | 3 |
| PO10 | Environment and Sustainability | 3 | 3 | 3 | 3 | 3 | 3 |
| PO11 | Project Management and Finance | 3 | | | 2 | 2 | 2 |
| PO12 | Life Long Learning | | | | 3 | 3 | 3 |
| PSO1 | Knowledge of Civil Engineering discipline | | 3 | 3 | 3 | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 3 | 3 | 2 | 2 | 3 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 3 | 3 | 3 | 3 | 3 |

**CE7612 WATER AND WASTEWATER ANALYSIS LABORATORY L T P C**
**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**:

1. Sampling and preservation methods for water and wastewater (Demonstration only)
2. Measurement of Electrical conductivity and turbidity

3. Determination of fluoride in water by spectrophotometric method /ISE
4. Determination of iron in water by AAS (Demo)
5. Determination of Sludge Volume Index in waste water
6. Determination of Sulphate in water
7. Determination of Optimum Coagulant Dosage by Jar test apparatus
8. Determination of available Chlorine in Bleaching powder and residual chlorine in water
9. Estimation of suspended, volatile and fixed solids
10. Determination of Dissolved Oxygen
11. Estimation of B.O.D.
12. Estimation of C.O.D.
13. Determination of Ammonia Nitrogen in wastewater
14. Determination of coliform (Demonstration only)
15. Gram staining of bacteria

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

☐ On completion of the course, the student is expected to attain knowledge for

| | |
|---|---|
| **CO1** | Able to do calibration and standardize the equipment |
| **CO2** | Able to collection of proper sample for analysis |
| **CO3** | Knows the sample preservation methods |
| **CO4** | Performs field oriented testing of water, wastewater |
| **CO5** | Performs coliform analysis |

**REFERENCES:**


1. Standard methods for the examination of water and wastewater, APHA, 21st Edition, Washington, 2005
2. Guide manual: Water and wastewater


**CO–PO Mapping – WATER AND WASTE WATER ANALYSIS LABORATORY**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| **PO1** | Knowledge of Engineering Sciences | 2 | 2 | 1 | 3 | 2 | 2 |
| **PO2** | Problem analysis | 1 | 1 | 1 | 3 | 3 | 2 |
| **PO3** | Design/development of solutions | 1 | 1 | 1 | 3 | 3 | 2 |
| **PO4** | Investigation | 1 | 1 | 1 | 3 | 3 | 2 |
| **PO5** | Modern Tool Usage | 2 | 1 | 1 | 3 | 3 | 2 |
| **PO6** | Individual and Teamwork | 1 | 1 | 2 | 3 | 2 | 2 |
| **PO7** | Communication | 1 | 1 | 1 | 2 | 2 | 2 |
| **PO8** | Engineer and Society | 1 | 2 | 2 | 2 | 2 | 2 |
| **PO9** | Ethics | 2 | 2 | 2 | 3 | 3 | 3 |
| **PO10** | Environment and Sustainability | 2 | 2 | 2 | 2 | 2 | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PO11** | Project Management and Finance | 1 | 2 | 2 | 3 | 2 | 2 |
| **PO12** | Life Long Learning | 3 | 2 | 2 | 3 | 2 | 3 |
| **PSO1** | Knowledge of Civil Engineering discipline | 2 | 2 | 2 | 3 | 2 | 2 |
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 2 | 2 | 2 | 3 | 2 | 2 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 1 | 2 | 2 | 3 | 2 | 2 |

**CE7613** **SURVEY CAMP** **L T P C**
**(2 Weeks - During V Semester )** **0 0 0 2**

Two weeks Survey Camp will be conducted during winter vacation to expose on filed surveying such as Triangulation, Vertical control by spirit levelling and Contouring.

**OUTCOMES:**

- On completion of the course, the student is expected to be able to

| | |
|---|---|
| **CO1** | Familiarize in handling different survey instruments. |
| **CO2** | Apply modern surveying techniques in field to establish horizontal control. |
| **CO3** | Understand the surveying techniques infield to establish vertical control network. |
| **CO4** | Exposed to different survey adjustment techniques. |
| **CO5** | Familiarize in setting outwork different computation process. |

**CO –PO Mapping –SURVEY CAMP**

| | **PO/PSO** | **Course Outcome** | | | | | **Overall Correlation of Cos to POs** |
|---|---|---|---|---|---|---|---|
| | | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** | |
| **PO1** | Knowledge of Engineering Sciences | | | | | | |
| **PO2** | Problem analysis | 1 | 1 | 1 | 3 | 1 | 1 |
| **PO3** | Design/development of solutions | 1 | 1 | 2 | 2 | 2 | 2 |
| **PO4** | Investigation | | | | | | |
| **PO5** | Modern Tool Usage | 3 | 3 | 3 | 2 | 3 | 3 |
| **PO6** | Individual and Teamwork | 2 | 2 | 3 | 2 | 2 | 2 |
| **PO7** | Communication | | | | | | |
| **PO8** | Engineer and Society | 1 | 1 | 2 | 1 | 1 | 1 |
| **PO9** | Ethics | | | | | | |
| **PO10** | Environment and Sustainability | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PO11** | Project Management and Finance | | | | | | |
| **PO12** | Life Long Learning | 3 | 1 | 2 | 1 | 2 | 2 |
| **PSO1** | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 | 3 |
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | | 3 | 2 | 3 | 3 | 3 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | | 3 | 2 | 3 | 3 | 3 |

**CE7701 ESTIMATION, COSTING AND VALUATION ENGINEERING L T P C**
**3 0 0 3**

**OBJECTIVE:**

- The students will acquire knowledge in estimation, tender practices, contract procedures, and valuation and will be able to prepare estimates, call for tenders and execute works.

**UNIT I QUANTITY ESTIMATION 9**

Philosophy – Purpose – Methods of estimation – Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, roads, canals and hydraulic structures using computer softwares.

**UNIT II RATE ANALYSIS AND COSTING 9**

Standard Data – Observed Data – Schedule of rates – Market rates – Assessment of Man Hours and Machineries for common civil works – Rate Analysis – Cost Estimates using Computer softwares.

**UNIT III SPECIFICATIONS AND TENDERS 9**

Specifications – Detailed and general specifications – Constructions – Sources – Types of specifications – TTT Act 2000 – Tender notices – types – tender procedures – Drafting model tenders , E-tendering-Digital signature certificates- Encrypting -Decrypting – Reverse auctions.

**UNIT IV CONTRACTS 9**

Contract – Types of contracts – Formation of contract – Contract conditions – Contract for labour, material, design, construction – Drafting of contract documents based on IBRD / MORTH Standard bidding documents – Construction contracts – Contract problems – Arbitration and legal requirements.

**UNIT V VALUATION 9**

Definitions – Various types of valuations – Valuation methods – Valuation of land – Buildings – Valuation of plant and machineries.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- The student will be able to estimate the quantity and cost for a typical structure and will be prepare the tender and contract document. The student will be able to perform valuation for building and land.

| | |
|---|---|
| **CO1** | Explain the basic concept of quantity estimation for building, roads, canals and hydraulic structures by manual and software packages. |

| | |
|---|---|
| **CO2** | Acquire the knowledge to calculate rate analysis and man-hours required for the common civil works by manual and software packages. |
| **CO3** | Develop the specification for the materials used in construction, online and Offline tender procedures and tender document preparation and report preparation. |
| **CO4** | Acquire the knowledge of construction contracts and contract document preparation. |
| **CO5** | Identify the valuation for building, land and plant and machineries, calculation Of rent, mortgage and lease. |

**OUTCOMES:**

- The student will be able to estimate the quantity and cost for a typical structure and will be prepare the tender and contract document.
- The student will be able to perform valuation for building and land.
- Acquire the knowledge to calculate rate analysis and man-hours required for the common civil works by manual and software packages
- Identify the valuation for building, land and plant and machineries, calculation of rent, mortgage and lease.
- Acquire the knowledge of construction contracts and contract document preparation.

**TEXTBOOKS:**


1. B.N Dutta 'Estimating and Costing in Civil Engineering', UBS Publishers & Distributors (P) Ltd, 2010.
2. B.S.Patil, 'Civil Engineering Contracts and Estimates', University Press, 2006
3. D.N. Banerjee, 'Principles and Practices of Valuation', V Edition, Eastern Law House, 1998


**REFERENCES:**


1. Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD
2. Tamil Nadu Transparencies in Tenders Act, 1998
3. Arbitration and Conciliation Act, 1996
4. Standard Bid Evaluation Form, Procurement of Good or Works, The World Bank, April 1996
5. Standard Data Book for Analysis and Rates, IRC, New Delhi, 2003


**CO – PO Mapping - ESTIMATION, COSTING AND VALUATION ENGINEERING**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| **PO1** | Knowledge of Engineering Sciences | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO2** | Problem analysis | 3 | 2 | 1 | 1 | 2 | 2 |
| **PO3** | Design/development of solutions | 3 | 3 | 2 | 1 | 2 | 3 |
| **PO4** | Investigation | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO5** | Modern Tool Usage | 3 | 3 | 1 | 1 | 3 | 3 |
| **PO6** | Individual and Teamwork | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO7** | Communication | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO8** | Engineer and Society | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO9** | Ethics | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO10** | Environment and Sustainability | 3 | 3 | 2 | 2 | 2 | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PO11** | Project Management and Finance | 3 | 3 | 2 | 2 | 2 | 2 |
| **PO12** | Life Long Learning | 3 | 3 | 3 | 3 | 3 | 3 |
| **PSO1** | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 | 3 |
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 3 | 3 | 3 | 3 | 3 | 3 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 3 | 3 | 3 | 3 | 3 |

**CE7702 FOUNDATION ENGINEERING L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To impart knowledge to plan and execute a detail site investigation programme, to select geotechnical design parameters and type of foundations. Also to familiarize the students for the geotechnical design of different type of foundations and retaining walls.

**UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9**

Scope and objectives – Methods of exploration – Auguring and boring – Wash boring and rotary drilling – Depth and spacing of bore holes – Soil samples – Representative and undisturbed – Sampling methods – Split spoon sampler, Thin wall sampler, Stationary piston sampler – Penetration tests (SPT and SCPT) – Data interpretation - Strength parameters and Evaluation of Liquefaction potential - Selection of foundation based on soil condition- Bore log report.

**UNIT II SHALLOW FOUNDATION 9**

Introduction – Location and depth of foundation – Codal provisions – Bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – Factors affecting bearing capacity – Bearing capacity from in-situ tests (SPT, SCPT and plate load) - Allowable bearing pressure – Seismic considerations in bearing capacity evaluation. Determination of Settlement of foundations on granular and clay deposits – Total and differential settlement – Allowable settlements – Codal provision – Methods of minimizing total and differential settlements.

**UNIT III FOOTINGS AND RAFTS 9**

Types of Isolated footing, Combined footing, Mat foundation – Contact pressure and settlement distribution – Proportioning of foundations for conventional rigid behaviour – Minimum depth for rigid behaviour – Applications – Floating foundation – Special foundations – Seismic force consideration – Codal provision

**UNIT IV PILE FOUNDATION 9**

Types of piles and their functions – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – Static formula – Dynamic formulae (Engineering news and Hileys) – Capacity from insitu tests (SPT and SCPT) – Negative skin friction – Uplift capacity- Group capacity by different methods (Feld's rule, Converse – Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test (routine test only), Under reamed piles – Capacity under compression and uplift – Codal provision.

**UNIT V RETAINING WALLS 9**

Plastic equilibrium in soils – Active and passive states – Rankine's theory – Cohesionless and cohesive soil – Coulomb's wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann Graphical method – Pressure on the wall due to line load – Stability analysis of retaining walls – Codal provision.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- Students are able to plan, execute a detailed site investigation programme, selection of appropriate geotechnical design parameters and type of foundations. Students are capableofcarryingoutgeotechnicaldesignfordifferenttypesoffoundations and retaining walls.

| | |
|---|---|
| **CO1** | Graduate will demonstrate an ability to plan and execute a detailed site investigation to select geotechnical design parameters and type of foundation |
| **CO2** | Graduate will demonstrate an ability to design shallow foundations, its component or process as per the needs and specifications. |
| **CO3** | Graduate will demonstrate an ability to design combined footings and raft foundations, its component or process as per the needs and specifications. |
| **CO4** | Graduate will demonstrate an ability to design deep foundations, its component or process as per the needs and specifications. |

**TEXTBOOKS:**


1. Murthy, V.N.S., “Soil Mechanics and Foundation Engineering”, CBS Publishers and Distributers Ltd., New Delhi, 2015.
2. Gopal Ranjan and Rao A.S.R. “Basic and Applied soil mechanics”, New Age International (P) Ltd, New Delhi,2006.
3. Arora, K.R. “Soil Mechanics and Foundation Engineering”, Standard Publishers and Distributors, New Delhi, 2011.
4. Varghese, P.C.,”Foundation Engineering”, Prentice Hall of India Private Limited, New Delhi, 2005.
5. Sahashi K Gulhati, Manoj Datta, “Geotechnical Engineering”, Tata McGraw-Hill Education, 2005.


**REFERENCES:**


1. Das, B.M. “Principles of Foundation Engineering” (Eigth edition), Thompson Asia Pvt. Ltd., Singapore, 2013.
2. Kaniraj, S.R. “Design aids in Soil Mechanics and Foundation Engineering”, Tata McGraw Hill publishing company Ltd., New Delhi, 2002.
3. Punmia, B.C., “Soil Mechanics and Foundations”, Laxmi Publications Pvt.Ltd., New Delhi, 2005.
4. Venkatramaiah, C., “Geotechnical Engineering”, New Age International Publishers, New Delhi, 2007 (Reprint)
5. IS Code 6403 : 1981 (Reaffirmed 1997) “Bearing capacity of shallow foundation”, Bureau of Indian Standards, New Delhi.
6. IS Code 8009 (Part 1):1976 (Reaffirmed 1998) “Shallow foundations subjected to symmetrical static vertical loads”, Bureau of Indian Standards, New Delhi.
7. IS Code 8009 (Part 2):1980 (Reaffirmed 1995) “Deep foundations subjected to symmetrical static vertical loading”, Bureau of Indian Standards, New Delhi.
8. IS Code 2911 (Part 1) : 1979 (Reaffirmed 1997) “Concrete Piles” Bureau of Indian Standards, New Delhi.
9. IS Code 2911 (Part 2) : 1979 (Reaffirmed 1997) “Timber Piles”, Bureau of Indian Standards, New Delhi.
10. IS Code 2911 (Part 3) : 1979 (Reaffirmed 1997) “Under Reamed Piles”, Bureau of Indian Standards, New Delhi.
11. IS Code 2911 (Part 4) : 1979 (Reaffirmed 1997) “Load Test on Piles”, Bureau of Indian Standards, New Delhi.
12. IS Code 1904: 1986 (Reaffirmed 1995) “Design and Construction of Foundations in Soils”, Bureau of Indian Standards, New Delhi.

13. IS Code 2131: 1981 (Reaffirmed 1997) “Method for Standard Penetration test for Soils”, Bureau of Indian Standards, New Delhi.
14. IS Code 2132: 1986 (Reaffirmed 1997) “Code of Practice for thin – walled tube sampling for soils”, Bureau of Indian Standards, New Delhi.
15. IS Code 1892 (1979): Code of Practice for subsurface Investigation for Foundations. Bureau of Indian Standards, New Delhi.
16. IS Code 14458 (Part 1) : 1998 “Retaining Wall for Hill Area – Guidelines, Selection of Type of Wall” , Bureau of Indian Standards, New Delhi.
17. IS Code 14458 (Part 2) : 1998 “Retaining Wall for Hill Area – Guidelines, Design of Retaining/Breast Walls” , Bureau of Indian Standards, New Delhi.
18. IS Code 14458 (Part 3) : 1998 “Retaining Wall for Hill Area – Guidelines, Construction Of Dry Stone Walls” , Bureau of Indian Standards, New Delhi.

**CO–PO Mapping – FOUNDATION ENGINEERING**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 2 | 2 | 2 | 3 | 3 | 2 |
| PO2 | Problem analysis | 3 | 3 | 3 | 3 | 3 | 3 |
| PO3 | Design/development of solutions | 3 | 3 | 3 | 3 | 3 | 3 |
| PO4 | Investigation | 3 | 3 | 3 | 3 | 3 | 3 |
| PO5 | Modern Tool Usage | 1 | 1 | 1 | 1 | 1 | 1 |
| PO6 | Individual and Teamwork | 1 | 1 | 1 | 1 | 1 | 1 |
| PO7 | Communication | 1 | 1 | 1 | 1 | 1 | 1 |
| PO8 | Engineer and Society | 2 | 2 | 2 | 1 | 2 | 2 |
| PO9 | Ethics | 1 | 1 | 1 | 1 | 1 | 1 |
| PO10 | Environment and Sustainability | 1 | 2 | 1 | 1 | 1 | 1 |
| PO11 | Project Management and Finance | 1 | 1 | 2 | 2 | 2 | 2 |
| PO12 | Life Long Learning | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 2 | 2 | 2 | 2 | 2 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 3 | 3 | 3 | 3 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 2 | 2 | 3 | 3 | 3 |

**CE7703 IRRIGATION ENGINEERING L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To introduce the students to the concept of soil-plant characteristics and their water requirements.
- To understand the necessity of planning an irrigation system to provide water at the right

time and right place.

**UNIT I IRRIGATION PRINCIPLES 9**

Need for irrigation – Advantages and ill effects – Development of irrigation – National Water Policy – Tamil Nadu scenario - Physical properties of soil that influence soil moisture characteristics – Concept of soil water potential and its components: Gravitational and Osmotic pressures- Retention of water in soils - Concept of available water – Movement of water into and within the soils – Measurement of soil moisture content.

**UNIT II CROP WATER REQUIREMENT 8**

Necessity and importance– Crop and crop seasons in India –Duty, Delta, Base Period– Factors affecting Duty-Irrigation efficiencies– Consumptive use of water-Irrigation requirements of crops - Standards for irrigation water- Planning and Development of irrigation projects.

**UNIT III DIVERSION AND IMPOUNDING STRUCTURES 9**

Head works –Weirs and Barrages –Types of impounding structures - Factors affecting, location of dams -Forces on a dam -Design of Gravity dams; Earth dams, Arch dams – Spillways -Energy dissipaters.

**UNIT IV CANAL IRRIGATION 11**

Classification of canals- Alignment of canals – Design of irrigation canals– Regime theories - Canal Head works – Canal regulators - Canal drops – Cross drainage works – Canal Outlets, Escapes –Lining and maintenance of canals – Other methods of Irrigation: Surface, Subsurface – Merits and Demerits.

**UNIT V IRRIGATION WATER MANAGEMENT 8**

Modernization techniques – Rehabilitation – Command Area Development - Systems of rice intensification - Water delivery systems - Participatory Irrigation Management – Farmers' organization and turn over – Water users' associations - Economic aspects of irrigation.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Describe the national water policy structure and soil plant water characteristics |
| **CO2** | Describe the basics of requirements and estimation of crop water |
| **CO3** | Design the various types of hydraulic structure includes dams, spillways and dissipaters |
| **CO4** | Design the components of irrigation canal includes canal drops and cross drainage works |
| **CO5** | Apply the concepts of Irrigation water management, water user association for participatory irrigation management |

**TEXTBOOKS:**


1. Sharma, R.K., and Sharma, T.K., "Irrigation Engineering", S. Chand and Company, New Delhi, 2008.
2. Michael, A.M., "Irrigation Engineering", Vikas Publishers, New Delhi, 2008.
3. Garg, S.K., "Irrigation Engineering," Laxmi Publications, New Delhi, 2008.


**REFERENCES:**


1. Arora, K.R., "Irrigation, Water Power and Water Resources Engineering", Standard Publishers Distributors, New Delhi, 2009.
2. Basak, N.N., "Irrigation Engineering", Tata McGraw-Hill Publishing Co, New Delhi, 2008.
3. Dilip Kumar Majumdar, "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
4. Punmia, B.C., "Irrigation and Water Power Engineering", Laxmi Publishers, New Delhi, 2008.

**CO–PO Mapping–IRRIGATION ENGINEERING**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of Cos to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | | | 3 | 3 | | 3 |
| PO2 | Problem analysis | | 1 | 3 | 3 | 1 | 2 |
| PO3 | Design/development of solutions | | | | | | |
| PO4 | Investigation | 2 | | 3 | | 2 | 2 |
| PO5 | Modern Tool Usage | | 2 | | | 2 | 2 |
| PO6 | Individual and Teamwork | | | | | 3 | 3 |
| PO7 | Communication | | | | | 3 | 3 |
| PO8 | Engineer and Society | | | 3 | 3 | 3 | 3 |
| PO9 | Ethics | | | | | 1 | 1 |
| PO10 | Environment and Sustainability | | 3 | | | 1 | 2 |
| PO11 | Project Management and Finance | | 2 | 3 | 3 | 3 | 3 |
| PO12 | Life Long Learning | 2 | 2 | | | | 2 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 3 | 3 | 3 | 2 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | | | 2 | 2 | 2 | 2 |

**HS7551 EMPLOYABILITY SKILLS L T P C**
**3 0 0 3**

**COURSE DESCRIPTION**

- This course aims to help the students acquire the employability skills necessary for the workplace situations. It also attempts to meet the expectations of the employers by giving special attention to language skills, presentation skills, group discussion skills and soft skills. This will be achieved through expert guidance and teaching activities focusing on employability skills.

**COURSE OBJECTIVES**

- To enhance the employability skills of students with a special focus on presentation skills, group discussion skills and interview skills
- To help them improve their reading skills, writing skills, and soft skills necessary for the workplace situations
- To make them employable graduates

**CONTENTS**

**UNIT I READING AND WRITING SKILLS 9**

Reading: skimming & scanning strategies – note making skills – interpreting visual material (charts

& tables) – critical reading – fast reading necessary for reading letters & files - preparing job applications - writing covering letter and résumé - applying for jobs online - email etiquette – writing official letters (placing an order, letters to consumers, etc. ) writing reports – collecting, analyzing and interpreting data

**UNIT II SOFT SKILLS 9**

Hard skills & soft skills – soft skills: self-management skills & people skills - training in soft skills - persuasive skills – sociability skills –interpersonal skills – team building skills – leadership skills – problem solving skills – adaptability - stress management – motivation techniques – life skills -

**UNIT III PRESENTATION SKILLS 9**

Preparing slides with animation related to the topic – organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice—presenting the visuals effectively – 5 minute presentation

**UNIT IV GROUP DISCUSSION SKILLS 9**

Participating in group discussions – understanding group dynamics - brainstorming the topic -–questioning and clarifying –GD strategies (expressing opinions, accepting or refusing others opinions, turn taking) – activities to improve GD skills – viewing recorded GD - mock GD

**UNIT V INTERVIEW SKILLS 9**

Interview etiquette – dress code – body language – mock interview -–attending job interviews – answering questions confidently – technical interview – telephone/Skype interview - practice in different types of questions – one to one interview &panel interview – FAQs related to job interview- Emotional and cultural intelligence.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- Students will be able to make presentations and participate in group discussions with high level of self-confidence.
- Students will be able to perform well in the interviews
- They will have adequate reading and writing skills needed for work place situations

| | |
|---|---|
| **CO1** | Students will be able to improve reading and writing skills |
| **CO2** | Students will be able to make presentations with high level of self-confidence |
| **CO3** | Students will be able to participate in group discussions with high level of self-confidence |
| **CO4** | Students will be able to perform well in the interviews |

**REFERENCES:**


1. Corneilssen, Joep. How to Prepare for Group Discussion and Interview. New Delhi: Tata-McGraw-Hill, 2009.
2. Dabreo, Desmond A. Group Discussion and Team Building. Mumbai: Better Yourself Books, 2004.
3. Ramesh, Gopalswamy, and Mahadevan Ramesh. The ACE of Soft Skills. New Delhi: Pearson, 2010.
4. Gulati, Sarvesh. Corporate Soft Skills. New Delhi: Rupa and Co. 2006.
5. Van Emden, Joan, and Lucinda Becker. Presentation Skills for Students. New York: Palgrave Macmillan, 2004.


**EXTENSIVE READING**


1. Covey, Stephen R. The 7 Habits of Highly Effective People. New York: Free Press, 2013.
2. Bagchi, Subroto. The Professional. New Delhi: Penguin Books India, 2009.


Attested



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**WEB RESOURCES**

1. www.humanresources.about.com
2. www.careerride.com
3. https://bemycareercoach.com/softskills

**CO–PO Mapping – EMPLOYABILITY SKILLS**

| PO/PSO | | Course Outcome | | | | Overall Correlation of Cos to POs |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | |
| PO1 | Knowledge of Engineering Sciences | 1 | | | | 1 |
| PO2 | Problem analysis | 1 | 1 | 1 | 1 | 1 |
| PO3 | Design/development of solutions | 1 | 1 | 1 | 1 | 1 |
| PO4 | Investigation | 1 | 1 | 1 | 1 | 1 |
| PO5 | Modern Tool Usage | | | | | |
| PO6 | Individual and Teamwork | | | | | |
| PO7 | Communication | | | | | |
| PO8 | Engineer and Society | | | | | |
| PO9 | Ethics | | | | | |
| PO10 | Environment and Sustainability | | | | | |
| PO11 | Project Management and Finance | | | | | |
| PO12 | Life Long Learning | | | | | |
| PSO1 | Knowledge of Civil Engineering discipline | 2 | 2 | 2 | 2 | 2 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 1 | 1 | 1 | 1 | 1 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 3 | 1 | 1 | 2 |



**CE7711** **CREATIVE AND INNOVATIVE PROJECT** **L T P C**
**(Activity Based - Subject Related)** **0 0 4 2**

**OBJECTIVE:**

- To use the knowledge acquired in Civil Engineering to do a mini project, which allows the students to come up with designs, fabrication or algorithms and programs expressing their ideas in a novel way.

**TOTAL: 60 PERIODS**

**STRATEGY**

To identify a topic of interest in consultation with Faculty/Supervisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design / fabrication or develop computer code.

Demonstrate the novelty of the project through the results and outputs.

**OUTCOME:**

At the end of the course, students are able to

| | |
|---|---|
| **CO1** | Identify civil engineering problems reviewing available literature. |
| **CO2** | Identify appropriate techniques to analyze complex civil engineering problems. |
| **CO3** | Apply engineering and management principles through efficient handling of project have a clear idea of his/her area of work and they are in a position to carry out the work In a systematic way. |

**CO–PO Mapping–PROJECT - I**

| PO/PSO | | Course Outcome | | | Overall Correlation of Cos to POs |
|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | |
| **PO1** | Knowledge of Engineering Sciences | 3 | 3 | 2 | 3 |
| **PO2** | Problem analysis | 1 | 3 | 2 | 2 |
| **PO3** | Design/development of solutions | 1 | 1 | 2 | 1 |
| **PO4** | Investigation | 3 | 3 | | 3 |
| **PO5** | Modern Tool Usage | | | | |
| **PO6** | Individual and Teamwork | 3 | 3 | 2 | 3 |
| **PO7** | Communication | 2 | | 2 | 2 |
| **PO8** | Engineer and Society | 2 | | 2 | 2 |
| **PO9** | Ethics | 2 | | 2 | 2 |
| **PO10** | Environment and Sustainability | 1 | 1 | 1 | 1 |
| **PO11** | Project Management and Finance | 1 | 1 | 1 | 1 |
| **PO12** | Life Long Learning | 3 | 3 | 3 | 3 |
| **PSO1** | Knowledge of Civil Engineering discipline | 3 | 3 | 1 | 3 |
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 3 | 3 | 1 | 3 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 3 | 1 | 3 |

**CE7712 IRRIGATION AND ENVIRONMENTAL ENGINEERING DRAWING L T P C**
**0 0 4 2**

**OBJECTIVE:**

- At the end of the semester, the student shall conceive, design and draw the irrigation and environmental engineering structures in detail showing the plan, elevation and sections.

## PART A: IRRIGATION ENGINEERING

**1. TANK COMPONENTS** **9**

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

**2. IMPOUNDING STRUCTURES** **6**

Design principles - Earth dam – Profile of Gravity Dam

**3. CROSS DRAINAGE WORKS** **6**

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

**4. CANAL REGULATION STRUCTURES** **9**

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

## PART B: ENVIRONMENTAL ENGINEERING

**1. WATER SUPPLY AND TREATMENT** **15**

Design and Drawing of flash mixer, flocculator, clarifier – Rapid sand filter – Service reservoirs – Pumping station – House service connection for water supply and drainage.

**4. SEWAGE TREATMENT & DISPOSAL** **15**

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

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

- The students after completing this course will be able to design and draw various units of municipal water treatment plants and sewage treatment plants.

| | |
|---|---|
| **CO1** | Design and draw the various irrigation structures |
| **CO2** | Design and draw the units of municipal water treatment plants and sewage treatment plants |

**TEXTBOOKS:**


1. Satya Narayana Murthy Challa, “Water Resources Engineering: Principles and Practice”, New Age International Publishers, New Delhi, 2002.
2. Garg, S.K., “Irrigation Engineering and Design of Structures”, New Age International Publishers, New Delhi, 1997.
3. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 1999.
4. Manual on “Sewerage and Sewage Treatment Systems- Part A, B and C” CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.


**REFERENCES:**


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, 2002.
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, 2010.
6. Qasim,S.R., Motley, E.M and Zhu.G. "Water works Engineering – Planning, Design and Operation", Prentice Hall, New Delhi, 2009.
7. Qasim, S. R. "Wastewater Treatment Plants, Planning, Design & Operation", CRC Press, New York, 2010

**CO–PO Mapping –IRRIGATION AND ENVIRONMENTAL ENGINEERING DRAWING**

| PO/PSO | | Course Outcome | | Overall Correlation of Cos to POs |
|---|---|---|---|---|
| | | CO1 | CO2 | |
| **PO1** | Knowledge of Engineering Sciences | 1 | 1 | 1 |
| **PO2** | Problem analysis | 2 | 2 | 2 |
| **PO3** | Design/development of solutions | 3 | 3 | 3 |
| **PO4** | Investigation | 2 | 2 | 2 |
| **PO5** | Modern Tool Usage | | | |
| **PO6** | Individual and Teamwork | 2 | 2 | 2 |
| **PO7** | Communication | 2 | 2 | 2 |
| **PO8** | Engineer and Society | 2 | 2 | 2 |
| **PO9** | Ethics | | | |
| **PO10** | Environment and Sustainability | 2 | 2 | 2 |
| **PO11** | Project Management and Finance | | | |
| **PO12** | Life Long Learning | 2 | 2 | 2 |
| **PSO1** | Knowledge of Civil Engineering discipline | 2 | 2 | 2 |
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 3 | 3 | 3 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 3 | 3 |

**CE7713** **INDUSTRIAL TRAINING** **L T P C**
**(4 Weeks During VI Semester – Summer)** **0 0 0 2**

**OBJECTIVE:**

- To train the students in field work so as to have a firsthand knowledge of practical problems in carrying out engineering tasks. To develop skills in facing and solving the field problems.

**STRATEGY:**

The students individually undertake training in reputed civil engineering companies for the specified

duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

**OUTCOMES:**

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

- The intricacies of implementation textbook knowledge into practice
- The concepts of developments and implementation of new techniques

| | |
|---|---|
| **CO1** | The intricacies of implementation textbook knowledge into practice |
| **CO2** | The concepts of developments and implementation of new techniques |
| **CO3** | Effectively implement skills in communication, writing and using multimedia tools |
| **CO4** | Prepare a report based on the experiences and projects carried with ability to apply knowledge of Mathematics, Science and Engineering Fundamentals |

**CO–PO Mapping –INDUSTRIAL TRAINING**

| PO/PSO | | Course Outcome | | | | Overall Correlation of Cos to POs |
|---|---|---|---|---|---|---|
| | | CO 1 | CO2 | CO3 | CO4 | |
| **PO1** | Knowledge of Engineering Sciences | 2 | 2 | 1 | 3 | 2 |
| **PO2** | Problem analysis | 3 | 3 | 2 | 3 | 3 |
| **PO3** | Design/development of solutions | 3 | 3 | 2 | 3 | 3 |
| **PO4** | Investigation | 3 | 2 | 1 | 2 | 2 |
| **PO5** | Modern Tool Usage | 2 | 2 | 1 | 3 | 2 |
| **PO6** | Individual and Teamwork | 3 | 3 | 2 | 3 | 3 |
| **PO7** | Communication | 3 | 3 | 2 | 2 | 3 |
| **PO8** | Engineer and Society | 2 | 2 | 2 | 2 | 2 |
| **PO9** | Ethics | 2 | 2 | 3 | 2 | 2 |
| **PO10** | Environment and Sustainability | 1 | 1 | 1 | 1 | 1 |
| **PO11** | Project Management and Finance | 1 | 1 | 2 | 2 | 2 |
| **PO12** | Life Long Learning | 3 | 3 | 3 | 3 | 3 |
| **PSO1** | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 |
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 3 | 3 | 3 | 3 | 3 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | 3 | 3 | 3 | 3 |

**CE7811** **PROJECT WORK** **L T P C**
**0 0 20 10**

**OBJECTIVE:**

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

**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**

**COURSE OUTCOMES:**

- On Completion of the project works students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

| | |
|---|---|
| **CO1** | Identify civil engineering problems reviewing available literature. |
| **CO2** | Identify appropriate techniques to analyze complex civil engineering problems. |
| **CO3** | Apply engineering and management principles through efficient handling of Project have a clear idea of his/her area of work and they are in a position to carry out the work in a systematic way. |

**CO –PO Mapping –PROJECT WORK**

| **PO/PSO** | | **Course Outcome** | | | **Overall Correlation of Cos to POs** |
|---|---|---|---|---|---|
| | | **CO1** | **CO2** | **CO3** | |
| **PO1** | Knowledge of Engineering Sciences | 3 | 3 | 2 | 3 |
| **PO2** | Problem analysis | 1 | 3 | 2 | 2 |
| **PO3** | Design/development of solutions | 1 | 1 | 2 | 1 |
| **PO4** | Investigation | 3 | 3 | | 3 |
| **PO5** | Modern Tool Usage | | | | |
| **PO6** | Individual and Teamwork | 3 | 3 | 2 | 3 |
| **PO7** | Communication | 2 | | 2 | 2 |
| **PO8** | Engineer and Society | 2 | | 2 | 2 |
| **PO9** | Ethics | 2 | | 2 | 2 |
| **PO10** | Environment and Sustainability | 1 | 1 | 1 | 1 |
| **PO11** | Project Management and Finance | 1 | 1 | 1 | 1 |
| **PO12** | Life Long Learning | 3 | 3 | 3 | 3 |
| **PSO1** | Knowledge of Civil Engineering discipline | 3 | 3 | 1 | 3 |

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| | | | | | |
|---|---|---|---|---|---|
| **PSO2** | Critical analysis of Civil Engineering problems and innovation | 3 | 3 | 1 | 3 |
| **PSO3** | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 3 | 1 | 3 |

**AI7071 INTEGRATED WATER RESOURCES MANAGEMENT L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To introduce the students to the interdisciplinary analysis of water and design of intervention strategies.
- To develop knowledge base on capacity building on IWRM.

**UNIT I IWRM FRAMEWORK 9**

Definition – meanings –objectives- evolution of IWRM- IWRM relevance in water resources management – Importance of paradigm shift in India: processes and prospective outcomes.

**UNIT II CONTEXTUALIZING IWRM 9**

IWRM in Global and Regional water partnership - MDG goals - UN formulations-Institutional Transformation- bureaucratic reforms and inclusive development.

**UNIT III EMERGING ISSUES IN WATER MANAGEMENT 9**

IWRM and Irrigation – Domestic - Drinking water Management in the context of Climate change-Flood –Drought – Pollution – Water poverty-sanitation and health-Conceptual problems and policy issues.

**UNIT IV IWRM AND WATER RESOURCES DEVELOPMENT IN INDIA 9**

Rural Development-Ecological sustainability- Watershed Development and conservation-Ecosystem Regeneration – waste water reuse-Sustainable livelihood and food security-Links between water –health- and poverty.

**UNIT V ASPECTS OF INTEGRAL DEVELOPMENT 9**

Capacity building - Solutions for effective Water Management. Case studies on conceptual framework of IWRM – IWRM and regional and global partnership – Emerging issues – IWRM and water resources development

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | At the completion of the course, the student will be able to apply appropriate management techniques different components of water resources under IWRM framework. |
| **CO2** | Select the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies. |
| **CO3** | Discuss the linkages between water-health; develop a HIA framework. |
| **CO4** | Analyse how the virtual water concept pave way to alternate policy options. |

**TEXTBOOKS:**


1. Mollinga .P. etal " Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006
2. Sithamparanathan, Rangasamy, A., and Arunachalam, N., "Ecosystem Principles and Sustainable Agriculture", Scir Publisher, Chennai, 1999.

**REFERENCES:**


1. Cech Thomas V., Principles of Water Resources: History, Development, Management and Policy. John Wiley and Sons Inc., New York. 2003.
2. Murthy, J.V.S., "Watershed Management in India", Wiley Eastern Ltd., New York, 1995.
3. Dalte, S.J.C., "Soil Conservation and Land Management", International Book Distribution, India, 1986.


**CO –PO Mapping – INTEGRATED WATER RESOURCES MANAGEMENT**

| POs/PSOs | | Course Outcome | | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 2 | 2 | 2 | 2 | 2 |
| PO2 | Problem analysis | 1 | 3 | 2 | 2 | 2 | 2 |
| PO3 | Design / development of solutions | | 2 | 2 | 2 | 2 | 2 |
| PO4 | Investigation | 1 | 2 | | | 1 | 1 |
| PO5 | Modern Tool Usage | 1 | 1 | 2 | 1 | 1 | 1 |
| PO6 | Individual and Team work | | 2 | 2 | | | 2 |
| PO7 | Communication | | 2 | 2 | | | 2 |
| PO8 | Engineer and Society | 2 | 2 | 3 | 2 | 3 | 3 |
| PO9 | Ethics | | 2 | 3 | 2 | 2 | 2 |
| PO10 | Environment and Sustainability | 3 | 3 | 3 | 3 | 3 | 3 |
| PO11 | Project Management and Finance | 1 | 1 | 1 | | 1 | 1 |
| PO12 | Life Long Learning | | 2 | 2 | 2 | 2 | 2 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 2 | 2 | 2 | 2 | 2 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 2 | 2 | 2 | 2 | 2 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | 2 | 2 | 2 | 2 | 2 |

**AI7072 PARTICIPATORY WATER RESOURCES MANAGEMENT L T P C**
**3 0 0 3**

**OBJECTIVE :**

- To gain an insight on local and global perceptions and approaches on participatory water resource management

**UNIT I FUNDAMENTALS: SOCIOLOGY AND PARTICIPATORY APPROACH 6**

Sociology – Basic concepts – Perspectives- Social Stratification – Irrigation as a Socio technical Process - Participatory concepts– Objectives of participatory approach - WUA

**UNIT II UNDERSTANDING FARMERS PARTICIPATION 10**

Farmers participation –need and benefits – Comparisons of cost and benefit -Sustained system performance - Kinds of participation – Context of participation, factors in the environment – WUA - Constraints in organizing FA – Role of Community Organiser – Case Studies.

**UNIT III ISSUES IN WATER MANAGEMENT 9**

Multiple use of water – Issues in Inter-sectoral Water Allocation - domestic, irrigation, industrial sectors - modernization techniques – Rehabilitation – Command Area Development - Water delivery systems – Participatory Governance.

**UNIT IV PARTICIPATORY WATER CONSERVATION 10**

Global Challenges -Social – Economic – Environmental - Solutions –Political - Water Marketing – Water Rights -Consumer education – Success Stories Case Studies

**UNIT V PARTICIPATORY WATERSHED DEVELOPMENT 10**

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:**

| | |
|---|---|
| **CO1** | The students shall gain knowledge on the various processes involved in participatory water resource management. |
| **CO2** | The students shall be aware of the issues related to water conservation. |
| **CO3** | Capture to fundamental concepts and terms which are to be applied and understood all through the study. |
| **CO4** | Gain an overarching understanding of recommendation for improved irrigation management with a vision to transform the existing governance and policies with the novel approach of sustainability. |
| **CO5** | Articulate as how reforms can help build up institutional and irrigation agencies with the support obtained from the existing farm network in irrigation Management |

**TEXTBOOKS:**


1. Sivasubramaniyan, K. Water Management, SIMRES Publication, Chennai, 2011.
2. 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.
3. Tideman, E.M., "Watershed Management", Omega Scientific Publishers, New Delhi, 1996.


**REFERENCE:**


1. Chambers Robert, Managing canal irrigation, Cambridge University Press, 1989


**CO-PO mapping- PARTICIPATORY WATER RESOURCES MANAGEMENT**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 1 | 2 | 2 | 2 | 1 | 2 |
| PO2 | Problem analysis | | | 2 | | | 2 |
| PO3 | Design / development of solutions | | | | 3 | 3 | 3 |
| PO4 | Investigation | | | | 2 | 2 | 2 |
| PO5 | Modern Tool Usage | | | 1 | 1 | 1 | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PO6 | Individual and Team work | | | 2 | 1 | 2 | 2 |
| PO7 | Communication | | | 3 | 2 | 2 | 2 |
| PO8 | Engineer and Society | | 3 | 3 | 3 | 1 | 3 |
| PO9 | Ethics | | | 1 | 2 | 2 | 2 |
| PO10 | Environment and Sustainability | | | | | 1 | 1 |
| PO11 | Project Management and Finance | | | | | 1 | 1 |
| PO12 | Life Long Learning | 2 | 3 | 2 | 3 | 3 | 3 |
| PSO1 | Knowledge of Civil Engineering discipline | | | 3 | 3 | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | | | 1 | 1 | | 1 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | | | 3 | 3 | 2 | 3 |

**AI7451 HYDROLOGY AND WATER RESOURCES ENGINEERING L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To introduce the student to the concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources**.**

**UNIT I PRECIPITATION AND ABSTRACTIONS 10**

Hydrological cycle- Meteorological measurements – Requirements, types and forms of precipitation-Rain gauges-Spatial analysis of rainfall data using Thiessen and Isohyetal methods-Interception- Evaporation. Horton's equation, pan evaporation measurements and evaporation suppression- Infiltration-Horton's equation-double ring infiltrometer, infiltration indices.

**UNIT II RUNOFF 8**

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Runoff estimation using empirical - Strange's table and SCS methods – Stage discharge relationships-flow measurements- Hydrograph – Unit Hydrograph – IUH

**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 RESERVOIRS 8**

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve

**UNIT V GROUNDWATER AND MANAGEMENT 10**

Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | The students gain the knowledge needed on hydrologic cycle, hydrometeorology and formation of precipitation. |
| **CO2** | The students are able to apply the various methods of field measurements and empirical formulae for estimating the various losses of precipitation, stream flow, flood and flood routing. |
| **CO3** | The students will know the basics of groundwater and hydraulics of subsurface flows |
| **CO4** | Describe the importance of spatial analysis of rainfall and design water storage reservoirs |
| **CO5** | Apply the concepts of groundwater for water resources management |

**TEXTBOOKS:**

1. Subramanya .K. Engineering Hydrology- Tata McGraw Hill, 2013.
2. Jayarami Reddy .P. Hydrology, Tata McGraw Hill, 2008.

**REFERENCES:**

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, 2010.
3. Raghunath .H.M., Hydrology, Wiley Eastern Ltd., 2004

**CO – PO HYDROLOGY AND WATER RESOURCES ENGINEERING**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 2 | 3 | 3 | 3 | 2 | 3 |
| PO2 | Problem analysis | 2 | 2 | 3 | 3 | 3 | 3 |
| PO3 | Design / development of solutions | 2 | 3 | 2 | 3 | 3 | 3 |
| PO4 | Investigation | 2 | 3 | 3 | 3 | 2 | 3 |
| PO5 | Modern Tool Usage | 2 | 3 | 2 | 3 | 3 | 3 |
| PO6 | Individual and Team work | 1 | 2 | 2 | 3 | 2 | 2 |
| PO7 | Communication | 2 | | 2 | | | 2 |
| PO8 | Engineer and Society | 2 | 3 | 2 | 3 | 3 | 3 |
| PO9 | Ethics | | | | | 2 | 2 |
| PO10 | Environment and Sustainability | | 2 | 2 | 2 | 3 | 2 |
| PO11 | Project Management and Finance | | 2 | 3 | 2 | 3 | 3 |
| PO12 | Life Long Learning | 2 | 2 | 2 | 3 | 3 | 2 |
| PSO1 | Knowledge of Civil Engineering Discipline | 2 | 2 | 1 | 3 | 2 | 2 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 3 | 2 | 3 | 2 | 2 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering issues | 2 | 2 | 3 | 3 | 3 | 3 |

**CE7001** **ADVANCED SURVEYING** **L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To understand the working of Total Station equipment and solve the surveying problems.

**UNIT I FUNDAMENTALS OF TOTAL STATION AND ELECTROMAGNETIC WAVES 9**

Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying. Classification - applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies- Refractive index (RI) - factors affecting RI-Computation of group for light and near infrared waves at standard and ambient conditions-Computation of RI for microwaves at ambient condition - Reference refractive index- Real time application of first velocity correction. Measurement of atmospheric parameters- Mean refractive index- Second velocity correction -Total atmospheric correction- Use of temperature - pressure transducers.

**UNIT II ELECTRO OPTICAL AND MICRO WAVE SYSTEM 9**

Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system. Care and maintenance of Total Station instruments – Traversing and Trilateration-COGO functions, offsets and stake out-land survey applications.

**UNIT III AERIAL SURVEYING 9**

Introduction – Terrestrial photogrammetry – Field work, Terrestrial stereophotogrammetry – Aerial photogrammetry – Equipment and procedure for aerial surveys – Overlaps – scale of photographs – Vertical and tilted photographs – Distortions in aerial photographs – stereoscopiv vision – photo interpretation – features of photographic images – Parallax – Parallax measurement – Plotting and its methods – Plotting machines – Applications and advantages.

**UNIT IV SATELLITE SYSTEM AND GPS DATA PROCESSING 9**

Historical perspective and development - satellite orbital motion – Kepler‘s Law - Perturbing forces - Geodetic satellite - Doppler effect - Positioning concept –GNSS, IRNSS and GAGAN - GPS segments - satellite constellation – GPS signal structure - Orbit determination - Anti Spoofing, Selective Availability - Task of control segment - GPS receivers. GPS observables - code and carrier phase observation - linear combination and derived observables - concept of parameter estimation –data downloading: RINEX Format – Differential data processing – software modules - solutions of cycle slips, ambiguities, Concepts of rapid, static methods with GPS - semi Kinematic and pure Kinematic methods -satellite geometry & accuracy measures - applications- long baseline processing- softwares available in the market.

**UNIT V MISCELLANEOUS 9**

Reconnaissance – Route surveys for highways, railways and waterways – Hydrographic survey- Tides – MSL – Sounding methods – Three point problem – River surveys – Measurement of current and discharge – Mine surveying Equipment – Weisbach triangle – Tunnel alignment and setting out – Transfer of azimuth – Gyro Theodolite – Shafts and audits - Cadastral survey- Legal – Real – Tax cadastre – Land record system – Settlement procedure – deformation studies.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | know the astronomical surveying |
| **CO2** | do the photogrammetric surveying and interpretation |
| **CO3** | solve the field problems with Total station |
| **CO4** | know the GPS surveying and the data processing |
| **CO5** | understand the route surveys and tunnel alignments |

**TEXTBOOKS:**

1. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, McGraw Hill 2001.
2. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004.
3. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3rd Edition, 2004.
4. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1993

**REFERENCES :**

1. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1993.
2. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer - Verlag, Berlin, 2003.
3. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3rd Edition, 2004.
4. Seeber G, Satellite Geodesy, Walter De Gruyter, Berlin, 1998

| PO/PSO | | Course Outcome | | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 3 | 3 | 2 | 3 |
| PO2 | Problem analysis | 3 | 3 | 3 | 2 | 3 | 3 |
| PO3 | Design / development of solutions | 2 | 3 | 3 | 3 | 2 | 3 |
| PO4 | Investigation | 2 | 3 | 3 | 2 | 3 | 3 |
| PO5 | Modern Tool Usage | 2 | 3 | 3 | 3 | 3 | 3 |
| PO6 | Individual and Team work | 2 | 2 | 3 | 2 | 2 | 2 |
| PO7 | Communication | 1 | 1 | 1 | 2 | 1 | 1 |
| PO8 | Engineer and Society | 1 | 3 | 3 | 3 | 2 | 2 |
| PO9 | Ethics | 1 | 1 | 1 | 1 | 1 | 1 |
| PO10 | Environment and Sustainability | | | | | 2 | 1 |
| PO11 | Project Management and Finance | | 1 | | | 1 | 1 |
| PO12 | Life Long Learning | | 2 | 2 | 2 | | 2 |
| PSO1 | Knowledge of Civil Engineering Discipline | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 3 | 3 | 3 | 2 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering issues | 1 | 3 | 3 | 3 | 2 | 3 |

**CE7002 AIR POLLUTION AND CONTROL ENGINEERING L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.

**UNIT I INTRODUCTION**
**7**

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**
**6**

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 11**

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 11**

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**
**10**

Sources types and control of indoor air pollutants, sick building syndrome types – Radon Pollution and its control- Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | an understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management |
| **CO2** | ability to identify, formulate and solve air and noise pollution problems |
| **CO3** | ability to design stacks and particulate air pollution control devices to meet applicable standards |
| **CO4** | Understand the source of indoor air pollution, effects and control methods as well as to identify the source of noise ,and select suitable method for measuring and control of noise pollution |
| **CO5** | select appropriate method for control of gaseous pollutant by due consideration of sources of emission |

**TEXTBOOKS:**


1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, Air Pollution Control Engineering, Tokyo, 2004.
2. Noel de Nevers, Air Pollution Control Engineering, Mc Graw Hill, New York, 1995.
3. Anjaneyulu. Y, “Air Pollution and Control Technologies", Allied Publishers (P) Ltd., India 2002.


**REFERENCES:**


1. David H.F. Liu, Bela G. Liptak „Air Pollution", Lweis Publishers, 2000.
2. Arthur C.Stern, „Air Pollution (Vol.I – Vol.VIII)", Academic Press, 2006.
3. Wayne T.Davis, „Air Pollution Engineering Manual", John Wiley & Sons, Inc.,2000.


**CO – PO Mapping - AIR POLLUTION AND CONTROL ENGINEERING**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of CO s to POs |
|---|---|---|---|---|---|---|---|
| | | CO 1 | CO 2 | CO 3 | CO 4 | CO 5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | | | 3 | 3 | 3 |
| PO2 | Problem analysis | 2 | | | 3 | | 3 |
| PO3 | Design / development of solutions | | | 3 | | 3 | 3 |
| PO4 | Investigation | 3 | | | | 3 | 3 |
| PO5 | Modern Tool Usage | 1 | 1 | | | | 1 |
| PO6 | Individual and Team work | 2 | | | | 2 | 2 |
| PO7 | Communication | | 2 | | 3 | | 3 |
| PO8 | Engineer and Society | 3 | | | | | 3 |
| PO9 | Ethics | | | | 3 | | 3 |
| PO10 | Environment and Sustainability | 3 | | | 3 | 3 | 3 |
| PO11 | Project Management and Finance | 2 | | | | | 2 |
| PO12 | Life Long Learning | 3 | | | | | 3 |
| PSO 1 | Knowledge of Civil Engineering discipline | | | | 3 | 3 | 3 |
| PSO 2 | Critical analysis of Civil Engineering problems and innovation | | | | 3 | | 3 |
| PSO 3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | | | | 3 | 3 | 3 |

**CE7003 COASTAL ENGINEERING L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To provide an overview of the analysis and design procedures used in the field of coastal engineering
- To enable students to determine the characteristics of waves, coastal structures and shore protection and modeling in coastal engineering

**UNIT I INTRODUCTION TO COASTAL ENGINEERING 9**

Introduction - Wind and waves – Sea and Swell - Introduction to small amplitude wave theory – use of wave tables- Mechanics of water waves – Linear (Airy) wave theory – Wave measurement. .

**UNIT II WAVE PROPERTIES AND ANALYSIS 9**

Introduction to non-linear waves and their properties – Waves in shallow waters – Wave Refraction, Diffraction and Shoaling – Hindcasting of waves - Short term wave analysis – wave spectra and its utilities - Long term wave analysis- Statistical analysis of grouped wave data.

**UNIT III TYPES AND WAVE TRANSFORMATION 9**

Tide analysis and prediction, storm surge, seiches and seasonal fluctuations - Long term water level fluctuations – Wave shoaling; wave refraction; wave breaking; wave diffraction

**UNIT IV COASTAL STRUCTURES AND SHORE PROTECTION 9**

Risk analysis – design wave – Break waters – Shore protection – groins, seal walls, offshore breakwaters, artificial nourishment

**UNIT V MODELING IN COASTAL ENGINEERING 9**

Physical modeling in Coastal Engineering – Limitations and advantages – Role of physical modeling in coastal engineering – Numerical modeling – Modeling aspects – limitations

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Calculate the wave transformations |
| **CO2** | Appreciate the multi-faceted nature of coastal problems and the techniques of coastal engineering analysis, modeling and design of coastal structures and shore protection. |
| **CO3** | Distinguish between linear and non-linear wave theories. Solve problems on wave transformations. Apply probability theory for wave analysis. |
| **CO4** | Model and design shore defense structures and describe the problems from reliability and risk perspective. |
| **CO5** | Compare and contrast physical and mathematical coastal models and critique the advantages and disadvantages between them. |

**TEXTBOOKS:**


1. Kamphuis, J.W., Introduction to coastal engineering and management, 2000
2. Dean, R.G. and Dalrymple, R.A., Water wave mechanics for Engineers and Scientists, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1994.
3. Mani, J. S. Coastal Hydrodynamics. PHI Learning Pvt. Ltd., 2012.


**REFERENCES:**


1. Ippen, A.T., Estuary and Coastline Hydrodynamics, McGraw-Hill Book Company, Inc., New York, 1978.
2. Sorenson, R.M., Basic Coastal Engineering, A Wiley-Interscience Publication, NewYork, 1978.
3. Coastal Engineering Manual, Vol. I-VI, Coastal Engineering Research Centre, Dept. of the Army, US Army Corps of Engineers, Washington DC, 2006.


**CO-PO Mapping – COASTAL ENGINEERING**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 3 | 3 | 3 | 3 |
| PO2 | Problem analysis | | 2 | 3 | 3 | 3 | 3 |
| PO3 | Design / development of solutions | | | 2 | 3 | 3 | 3 |
| PO4 | Investigation | | | | | 3 | 3 |
| PO5 | Modern Tool Usage | | | 2 | 3 | 3 | 3 |
| PO6 | Individual and Team work | | 3 | 2 | 3 | 3 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PO7 | Communication | 2 | | | | | 2 |
| PO8 | Engineer and Society | | 3 | 2 | 3 | 3 | 3 |
| PO9 | Ethics | | | | | | |
| PO10 | Environment and Sustainability | | | 2 | 3 | 3 | 3 |
| PO11 | Project Management and Finance | | | | | | |
| PO12 | Life Long Learning | 3 | 2 | 2 | 3 | 3 | 3 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 2 | 3 | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 1 | 3 | 3 | 3 | 3 | 3 |
| PSO3 | Conceptualization and evaluation of Engineering solutions to Civil engineering issues | 1 | 1 | 2 | 2 | 3 | 2 |

**CE7004 COMPUTER AIDED DESIGN OF STRUCTURES L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To understand the design and analysis of structures using softwares and to optimize the structural components.

**UNIT I INTRODUCTION 9**

Fundamental reason for implementing CAD - Software requirements – Hardware components in CAD system – Design process - Applications and benefits.

**UNIT II COMPUTER GRAPHICS 9**

Graphic Software – Graphic primitives - Transformations - 2 Dimensional and 3 Dimensional transformations – Concatenation - Wire frame modeling - Solid modeling - Graphic standards - Drafting packages – Auto CAD.

**UNIT III STRUCTURAL ANALYSIS 9**

Principles of structural analysis - Fundamentals of finite element analysis - Concepts of finite elements – Stiffness matrix formulation – Variational Method – Weighted residual method – Problems – Conditions of convergence of functions – Analysis packages and applications.

**UNIT IV DESIGN AND OPTIMIZATION 9**

Principles of design of steel and RC structures - Beams and Columns - Applications to simple design problems - Optimization techniques - Algorithms - Linear programming.

**UNIT V EXPERT SYSTEMS 9**

Introduction to artificial intelligence - Knowledge based expert systems – Applications of KBES- Rules and decision tables - Inference mechanisms - simple applications

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Understand the concepts of Computer-Aided Design, Software requirements and Hardware components in CAD system. |
| **CO2** | Acquire the knowledge in Computer Graphics and Computer aided drafting using Auto CAD software. |
| **CO3** | Understand the fundamentals of finite element analysis and be able use software for modeling, analysis and design of structures. |
| **CO4** | Understand the concepts of Optimization techniques and its practical applications to structural engineering. |
| **CO5** | Acquire the knowledge in Artificial Intelligence and Knowledge based expert systems. |

**TEXTBOOKS:**


1. Groover M.P. and Zimmers E.W.Jr., CAD / CAM, Computer Aided Design and Manufacturing, Prentice Hall of India Ltd, New Delhi, 2008.
2. Krishnamoorthy.C.S., Rajeev,S, Rajaraman, A and Computer Aided Design: Software and Analytical Tools, Narosa Publishing House, New Delhi,2012.


**REFERENCE:**


1. Harrison H.B., Structural Analysis and Design, Part I and II Pergamon Press, Oxford, 1990.


| PO/PSO | | Course Outcome | | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 3 | 3 | 3 | 3 |
| PO2 | Problem analysis | 2 | 2 | 3 | 2 | 2 | 2 |
| PO3 | Design / development of solutions | 3 | 3 | 3 | 2 | 2 | 3 |
| PO4 | Investigation | 2 | 2 | 3 | 2 | 2 | 2 |
| PO5 | Modern Tool Usage | 3 | 3 | 3 | 3 | 3 | 3 |
| PO6 | Individual and Team work | 2 | 2 | 2 | 2 | 2 | 2 |
| PO7 | Communication | - | 1 | - | 2 | 1 | 1 |
| PO8 | Engineer and Society | 2 | 2 | 3 | 2 | 2 | 2 |
| PO9 | Ethics | - | - | - | 2 | - | 2 |
| PO10 | Environment and Sustainability | - | - | - | 2 | - | 2 |
| PO11 | Project Management and Finance | - | - | - | - | - | - |
| PO12 | Life Long Learning | 3 | 3 | 3 | 3 | 3 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PSO1 | Knowledge of Civil Engineering discipline | 1 | 1 | 3 | 3 | 3 | 2 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 1 | 2 | 3 | 3 | 2 | 2 |
| PSO3 | Conceptualization and evaluation of Engineering solutions to Civil engineering issues | 2 | 2 | 3 | 3 | 3 | 3 |

**CE7005 DESIGN OF PLATE AND SHELL STRUCTURES L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To learn the design of plate and shell and spatial structures

**UNIT I THIN PLATES WITH SMALL DEFLECTION 10**

Laterally loaded thin plates - Governing differential equation, various boundary conditions.

**UNIT II RECTANGULAR PLATES 10**

Simply supported rectangular plates - Navier solution and Levy's method – Loading.

**UNIT III ANALYSIS OF THIN SHELLS 5**

Shells of revolution – Spherical dome, Conical shell and ellipsoid of revolution – Shells of translation – Cylindrical shell and Hyperbolic parabolid - Classification of shells - Types of shells - Structural action.

**UNIT IV DESIGN OF SHELLS 10**

Spherical dome, Conical shell and Cylindrical shell.

**UNIT V SPACE FRAMES 10**

Space Frames – Configuration – Node connector- Types – General principles of design philosophy – Behaviour.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | The students will have indepth knowledge in the analysis and design of plates, shells and space frame structures |
| **CO2** | Analyze thin plates using Navier's method and Levy's method. |
| **CO3** | Analyze circular plates under axis - symmetric deflection. |
| **CO4** | Classify different types of shells and study their behavior. |
| **CO5** | Analyze space frame. |

**TEXTBOOKS:**


1. P.C.Varghese, Design of Reinforced Concrete Shells and Folded Plates, PHI Learning Private Limited, New Delhi, 2010.
2. R.Szilard, Theory and Analysis of Plates, Prentice Hall Inc., 1995.

3. N.Subramanian, Principles of Space Structures, Wheeler Publishing Co. 1999.

**REFERENCES:**

1. Billington D.P. Thin Shell Concrete Structures, McGraw Hill,1995.
2. Chatterjee B.K. Theory and design of Concrete Shells, Oxford and IBH Publishing Co., New Delhi 1998.

**CO – PO Mapping - DESIGN OF PLATE AND SHELL STRUCTURES**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of CO s to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 3 | 2 | 2 | 3 |
| PO2 | Problem analysis | 2 | 2 | 2 | 2 | 2 | 2 |
| PO3 | Design / development of solutions | 3 | 3 | 3 | 3 | 3 | 3 |
| PO4 | Investigation | - | - | - | - | - | - |
| PO5 | Modern Tool Usage | - | - | - | - | - | - |
| PO6 | Individual and Team work | 2 | 1 | 1 | 1 | 1 | 1 |
| PO7 | Communication | - | - | - | - | - | - |
| PO8 | Engineer and Society | - | - | - | - | - | - |
| PO9 | Ethics | 1 | 1 | 1 | 1 | 1 | 1 |
| PO10 | Environment and Sustainability | 1 | 1 | 1 | 1 | 1 | 1 |
| PO11 | Project Management and Finance | - | - | - | - | - | - |
| PO12 | Life Long Learning | 1 | 1 | 1 | 1 | 1 | 1 |
| PSO1 | Knowledge of Civil Engineering discipline | - | 1 | 1 | - | - | 1 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | - | 1 | - | 1 | 2 | 1 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | - | 1 | 2 | - | 2 | 2 |

**CE7006 DESIGN OF PRESTRESSED CONCRETE STRUCTURES L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To understand the behaviour and performance of prestressed concrete structures. Compare the behaviour of prestressed concrete members with that of the normal reinforced concrete structures. Understand the performance of composite members. Finally to learn the design of prestressed concrete structures.

**UNIT I INTRODUCTION 9**

Historical developments – Basic principles of prestressing – Classification and types – Advantages over ordinary reinforced concrete – Materials – High strength concrete and high tensile steel – Methods of prestressing – Freyssinet, Magnel, Lee-McCall and Gifford Udall anchorage systems – Analysis of sections of stresses by stress concept, strength concept and load balancing concept – Losses of prestress in post -tensioned and pre-tensioned members.

**UNIT II DESIGN FOR FLEXURE AND SHEAR 9**

Basic assumptions for calculating flexural stresses – Permissible stresses in steel and concrete as per I.S.1343 Code – Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for strength limit based on I.S. 1343 Code – Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on I.S. 1343 Code.

**UNIT III DEFLECTION AND DESIGN OF ANCHORAGE ZONE 9**

Factors influencing deflections – Short term deflections of uncracked members – Prediction of long term deflections due to creep and shrinkage – Check for serviceability limit state of deflection. Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and I.S. 1343 code – design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.

**UNIT IV COMPOSITE BEAMS AND CONTINUOUS BEAMS 9**

Analysis and design of composite beams - Shrinkage strain and its importance – Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design.

**UNIT V MISCELANEOUS STRUCTURES 9**

Design of tension and compression members – Design of sleepers, Tanks, pipes and poles – Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Student will have knowledge on methods of prestressing and able to design various prestressed concrete structural elements. |
| **CO2** | Design a prestressed concrete beam accounting for losses |
| **CO3** | Design for flexure and shear. |
| **CO4** | Design the anchorage zone for post tensioned members and deflection in beams. |
| **CO5** | Design water tanks, pipes and poles. |

**TEXTBOOKS:**


1. Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, fifth edition, 2012.
2. Pandit.G.S. and Gupta.S.P., Prestressed Concrete, CBS Publishers and Distributers Pvt. Ltd., Second edition , 2014.


**REFERENCES:**


1. Lin T.Y. and Ned.H.Burns, Design of prestressed Concrete Structures, John Wiley and Sons, 1982.
2. Rajagopalan.N, Prestressed Concrete, Narosa Publishing House, 2002.
3. Arthur H.Nilson, Design of Prestressed Concrete, John Wiley and Sons, 1987.
4. Dayaratnam.P., Prestressed Concrete Structures, Fourth Edition, Oxford and IBH, 1987.
5. Sinha.N.C. and Roy.S.K., Fundamentals of Prestressed Concrete, S.Chand and Co. Ltd., 2011.


**CO – PO Mapping - DESIGN OF PRESTRESSED CONCRETE STRUCTURES**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of CO s to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 3 | 2 | 2 | 3 |
| PO2 | Problem analysis | 2 | 2 | 2 | 2 | 2 | 2 |
| PO3 | Design / development of | 3 | 3 | 3 | 3 | 3 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | solutions | | | | | | |
| PO4 | Investigation | - | - | - | - | - | - |
| PO5 | Modern Tool Usage | - | - | - | - | - | - |
| PO6 | Individual and Team work | 2 | 1 | 1 | 1 | 1 | 1 |
| PO7 | Communication | - | - | - | - | - | - |
| PO8 | Engineer and Society | - | - | - | - | - | - |
| PO9 | Ethics | 1 | 1 | 1 | 1 | 1 | 1 |
| PO10 | Environment and Sustainability | 1 | 1 | 1 | 1 | 1 | 1 |
| PO11 | Project Management and Finance | - | - | - | - | - | - |
| PO12 | Life Long Learning | 1 | 1 | 1 | 1 | 1 | 1 |
| PSO1 | Knowledge of Civil Engineering discipline | - | 1 | 1 | - | - | 1 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | - | 1 | - | 1 | 2 | 1 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | - | 1 | 2 | - | 2 | 2 |

**CE7007 DIGITAL CADASTRE L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To introduce the students to the cadastral survey Methods and its applications in generation of Land information system. Cadastral surveys are those classes of land surveys which are executed for the purpose of systematically recording the land rights, producing register of land holdings or an inventory of land areas, land use and determine land tax.

**UNIT I INTRODUCTION 9**

History of cadastral survey - Types of survey - Tax - Real Property – Legal cadastre -Graphical and Numerical Cadastre, Legal Characteristics of Records, Torrens System.

**UNIT II METHODS OF SURVEYING 9**

Cadastral Survey Methods - Steps in survey of a village - Instruments used for cadastral survey & mapping - Orthogonal, Polar survey methods - Boundary survey - Rectangulation - Calculation of area of Land- GPS and Total Station in Cadastral survey.

**UNIT III MAINTENANCE AND MEASUREMENTS 9**

Cadastral survey maintenance - Resurveys - Measurement of sub-division - Measurement of obstructed lines - Survey of urban areas - Control requirement for Urban survey use of Satellite Imagery in boundary fixing.

**UNIT IV PHOTOGRAMMETRIC METHODS 9**

Photogrammetry for cadastral surveying and mapping - Orthophoto map – Quality control measures - Organisation of cadastral offices – international scenario.

**UNIT V MAPPING PROCEDURES AND LIS 9**

Cadastral map reproduction - Map projection for cadastral maps – Conventional symbols - map - reproduction processes - Automated cadastral map, Management of Digital Cadastral. Creation of Land Information System. Integrating LIS –Land administration.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Gain knowledge about cadastre survey. |
| **CO2** | Understand the methods of cadastral survey. |
| **CO3** | Get the knowledge about photogrammetric methods. |
| **CO4** | Understand Land Record System and computational procedure for modernization of the same. |
| **CO5** | The students will be in position to understand the Government procedure in Land Record Management. |

**TEXTBOOKS:**


1. Paul. R Wolf., Bon A. DeWitt, Elements of Photogrammetry with Application in GIS McGraw Hill International Book Co., 4th Edition, 2014
2. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.


**REFERENCES:**


1. Karl Kraus, Photogrammetry: Geometry from Images and Laser Scans, Walter de Gruyter GmbH & Co. 2nd Edition, 2007.
2. E. M. Mikhail, J. S. Bethel, J. C. McGlone, Introduction to Modern Photogrammetry, Wiley Publisher, 2001.
3. James, M. Anderson and Edward N. Mikhail, Introduction to Surveying, McGraw Hill Book Co, 1985.


| PO/PSO | | Course Outcome | | | | | Overall Correlation of CO s to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 1 | 1 | 3 | 1 | 1 | 1 |
| PO2 | Problem analysis | 1 | 3 | 1 | 1 | 3 | 1 |
| PO3 | Design / development of solutions | 3 | 1 | 1 | 3 | 1 | 1 |
| PO4 | Investigation | 1 | 1 | 1 | 1 | 1 | 1 |
| PO5 | Modern Tool Usage | 3 | 3 | 1 | 3 | 3 | 3 |
| PO6 | Individual and Team work | 1 | 1 | 3 | 3 | 1 | 1 |
| PO7 | Communication | 3 | 3 | - | - | - | 3 |
| PO8 | Engineer and Society | - | - | - | - | - | - |
| PO9 | Ethics | - | - | - | - | - | - |
| PO10 | Environment and Sustainability | - | - | - | - | - | - |
| PO11 | Project Management and Finance | 3 | 3 | 1 | 2 | 1 | 3 |
| PO12 | Life Long Learning | 3 | 3 | 3 | 2 | 2 | 3 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 1 | 3 | 2 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 3 | 3 | 2 | 2 | 2 | 2 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | 2 | 3 | 3 | 3 | 3 |

**CE7008 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To impart the knowledge and skills to identify, assess and mitigate the environmental and social impacts of developmental projects

**UNIT I INTRODUCTION**
**9**

Impacts of Development on Environment – Rio Principles of Sustainable Development- Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types – EIA in project cycle –EIA Notification and Legal Framework–Stakeholders and their Role in EIA– Selection & Registration Criteria for EIA Consultants – Screening and Scoping in EIA – Drafting of Terms of Reference

**UNIT II ENVIRONMENTAL ASSESSMENT**
**9**

Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise and energy, flora and fauna - Matrices – Networks – Checklist Methods - Mathematical models for Impact prediction – Analysis of alternatives

**UNIT III ENVIRONMENTAL MANAGEMENT PLAN 9**

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna – Environmental Monitoring Plan – EIA Report Preparation – Review of EIA Reports – Environmental Clearance – Post Project Audit

**UNIT IV SOCIO ECONOMIC ASSESSMENT 9**

Baseline monitoring of Socio economic environment – Identification of Project Affected Personal – Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts – Cost benefit Analysis- Public Consultation

**UNIT V CASE STUDIES**
**9**

EIA case studies pertaining to Infrastructure Projects – Real Estate Development - Roads and Bridges – Mass Rapid Transport Systems - Ports and Harbor – Airports - Dams and Irrigation projects - Power plants – Wastewater Treatment Plants- Waste Processing and Disposal facilities – Mining Projects.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | carry out scoping and screening of developmental projects for environmental and social assessments |
| **CO2** | explain different methodologies for environmental impact prediction and assessment |
| **CO3** | plan environmental impact assessments and environmental management plans |
| **CO4** | evaluate environmental impact assessment reports |
| **CO5** | asses socioeconomic investigation of the environment in a project |

**TEXTBOOKS:**


1. Canter, R.L (1995). Environmental impact Assessment, 2nd Edition, McGraw Hill Inc., New Delhi.
2. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu. (1997). Environmental Impact Assessment for Developing Countries in Asia. Volume 1 – Overview, Asian Development Bank
3. Peter Morris, Riki Therivel (2009)," Methods of Environmental Impact Assessment",

Routledge Publishers

**REFERENCES:**


1. Becker H. A., Frank Vanclay (2003), The International handbook of social impact assessment: conceptual and methodological advances, Edward Elgar Publishing
2. Barry Sadler and Mary McCabe (2002), "Environmental Impact Assessment Training Resource Manual", United Nations Environment Programme.
3. Judith Petts, Handbook of Environmental Impact Assessment Vol. I and II, Blackwell Science, New York, 1998.
4. Ministry of Environment and Forests (2010), EIA Notification and Sectoral Guides, Government of India, New Delhi.


**CO – PO Mapping - ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of CO s to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 2 | 3 | 3 | 2 | 1 | 3 |
| PO2 | Problem analysis | 1 | 2 | | 2 | | 2 |
| PO3 | Design / development of solutions | | | 3 | 2 | | 3 |
| PO4 | Investigation | | 2 | 3 | 3 | | 3 |
| PO5 | Modern Tool Usage | | 3 | | | 2 | 3 |
| PO6 | Individual and Team work | | | | | 2 | 2 |
| PO7 | Communication | 2 | | | | | 2 |
| PO8 | Engineer and Society | 2 | | | | | 2 |
| PO9 | Ethics | 3 | | 2 | | | 3 |
| PO10 | Environment and Sustainability | 2 | | 2 | 1 | | 2 |
| PO11 | Project Management and Finance | | | 3 | 2 | 1 | 3 |
| PO12 | Life Long Learning | 2 | | | | 2 | 2 |
| PSO1 | Knowledge of Civil Engineering discipline | | | 3 | | 2 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | | | 3 | | | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | | 3 | 3 | | | 3 |

**CE7009 GEO-ENVIRONMENTAL ENGINEERING L T P C**
**3 0 0 3**

**OBJECTIVE:**

- The student acquires the knowledge on the Geotechnical engineering problems associated with soil contamination, safe disposal of waste and remediate the contaminated soils by different techniques thereby protecting environment.

Attested

**UNIT I GENERATION OF WASTES AND CONSQUENCES OF SOIL POLLUTION 8**

Introduction to Geo environmental engineering – Environmental cycle – Sources, production and classification of waste – Causes of soil pollution – Factors governing soil pollution interaction clay minerals - Failures of foundation due to waste movement.

**UNIT II SITE SELECTION AND SAFE DISPOSAL OF WASTE 10**

Safe disposal of waste – Site selection for landfills – Characterization of land fill sites and waste – Risk assessment – Stability of landfills – Current practice of waste disposal – Monitoring facilities – Passive containment system – Application of geosynthetics in solid waste management – Rigid or flexible liners.

**UNIT III TRANSPORT OF CONTAMINANTS 8**

Contaminant transport in sub surface – Advection, Diffusion, Dispersion – Governing equations – Contaminant transformation – Sorption – Biodegradation – Ion exchange – Precipitation – Hydrological consideration in land fill design – Ground water pollution.

**UNIT IV WASTE STABILIZATION 10**

Stabilization - Solidification of wastes – Micro and macro encapsulation – Absorption, Adsorption, Precipitation – Detoxification – Mechanism of stabilization – Organic and inorganic stabilization – Utilization of solid waste for soil improvement.

**UNIT V REMEDIATION OF CONTAMINATED SOILS 9**

Exsitu and insitu remediation-Solidification, bio-remediation, incineration, soil washing, electro kinetics, soil heating, vetrification, bio-venting.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Students are able to assess the contamination in the soil and to select suitable remediation methods based on contamination. |
| **CO2** | Also they are able to prepare the suitable disposal system for particular waste. |
| **CO3** | Students aware of soil stabilization by utilizing solid waste. |
| **CO4** | Students are assess the contamination in the soil and to select suitable remediation methods based on contamination. |
| **CO5** | Students prepare the suitable disposal system for particular waste. |

**TEXTBOOKS:**


1. Hari D. Sharma and Krishna R. Reddy, “Geo-Environmental Engineering” –John Wiley and Sons, INC, USA, 2004.
2. Daniel B.E., “Geotechnical Practice for waste disposal”, Chapman & Hall, London 1993.
3. Manoj Datta,” Waste Disposal in Engineered landfills”, Narosa Publishing House, 1997.
4. Manoj Datta, B.P. Parida, B.K. Guha, “Industrial Solid Waste Management and Landfilling Practice”, Narosa Publishing House, 1999.


**REFERENCES:**


1. Westlake, K, “Landfill Waste pollution and Control”, Albion Publishing Ltd., England, 1995.
2. Wentz, C.A., “Hazardous Waste Management”, McGraw Hill, Singapore, 1989
3. Proceedings of the International symposium on “Environmental Geotechnology” (Vol.I and II). Environmental Publishing Company, 1986 and 1989.
4. Ott, W.R., “Environmental indices, Theory and Practice”, Ann Arbor, 1978.
5. Fried, J.J., “Ground Water Pollution”, Elsevier, 1975.
6. ASTM Special Tech. Publication 874, Hydraulic Barrier in Soil and Rock, 1985.
7. Lagrega, M.D., Buckinham, P.L. and Evans, J.C., “Hazardous Waste Management” McGraw Hill Inc. Singapore, 1994.


Attested

**CO – PO Mapping – GEO-ENVIRONMENTAL ENGINEERING**



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| PO/PSO | | Course Outcome | | | | | Overall Correlation of CO s to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 2 | 3 | 3 | 2 | 3 | 3 |
| PO2 | Problem analysis | 1 | 1 | 2 | 1 | 1 | 1 |
| PO3 | Design / development of solutions | 2 | 3 | 2 | 3 | 3 | 3 |
| PO4 | Investigation | 1 | 3 | 3 | 3 | 2 | 3 |
| PO5 | Modern Tool Usage | 1 | 2 | 2 | 3 | 3 | 2 |
| PO6 | Individual and Team work | 1 | 1 | 1 | 1 | 1 | 1 |
| PO7 | Communication | 1 | 1 | 1 | 1 | 1 | 1 |
| PO8 | Engineer and Society | 3 | 3 | 3 | 3 | 3 | 3 |
| PO9 | Ethics | 1 | 3 | 3 | 3 | 3 | 3 |
| PO10 | Environment and Sustainability | 3 | 3 | 3 | 3 | 3 | 3 |
| PO11 | Project Management and Finance | 2 | 1 | 1 | 1 | 1 | 1 |
| PO12 | Life Long Learning | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 2 | 2 | 2 | 2 | 2 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 3 | 2 | 2 | 2 | 3 | 2 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | 3 | 3 | 3 | 2 | 3 |

**CE7010 GEOGRAPHIC INFORMATION SYSTEM L T P C**
**3 0 0 3**

**OBJECTIVES :**

- To introduce the fundamentals and components of Geographic Information System
- To provide details of spatial data structures and input, management and output processes.

**UNIT I FUNDAMENTALS OF GIS 9**

Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software - Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements.

**UNIT II SPATIAL DATA MODELS 9**

Database Structures – Relational, Object Oriented – Entities – ER diagram - data models - conceptual, logical and physical models - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models- TIN and GRID data models.

**UNIT III DATA INPUT AND TOPOLOGY 9**

Scanner - Raster Data Input – Raster Data File Formats – Georeferencing – Vector Data Input –Digitiser – Datum Projection and reprojection -Coordinate Transformation – Topology -

Adjacency, connectivity and containment – Topological Consistency – Non topological file formats - Attribute Data linking – Linking External Databases – GPS Data Integration

**UNIT IV DATA QUALITY AND STANDARDS 9**

Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage – Metadata – GIS Standards –Interoperability - OGC - Spatial Data Infrastructure

**UNIT V DATA MANAGEMENT AND OUTPUT 9**

Import/Export – Data Management functions- Raster to Vector and Vector to Raster Conversion - Data Output - Map Compilation – Chart/Graphs – Multimedia – Enterprise Vs. Desktop GIS-distributed GIS.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | This course equips the student to have basic knowledge about the GIS its structure, quality and standards. |
| **CO2** | Appreciate various spatial data models and their advantages |
| **CO3** | Produce a error free GIS database for civil engineering applications |
| **CO4** | Apply various spatial analysis tools for deriving GIS based outcome |
| **CO5** | Present the spatial information along with quality assessment for applications |

**TEXT BOOKS:**

1. Kang - Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition, 2011.
2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, "An Introduction Geographical Information Systems, Pearson Education, 2nd Edition,2007.

**REFERENCE:**

1. C.P. Lo Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers, 2006

**CO – PO Mapping –GEOGRAPHIC INFORMATION SYSTEM**

| | | CO1 | CO2 | CO3 | CO4 | CO5 | Overall |
|---|---|---|---|---|---|---|---|
| PO1 | Knowledge of Engineering Sciences | 2 | 2 | | | | 2 |
| PO2 | Problem analysis | | | | 3 | 3 | 3 |
| PO3 | Design / development of solutions | | | 1 | | 1 | 1 |
| PO4 | Investigation | | | | | | |
| PO5 | Modern Tool Usage | | | | 3 | 3 | 3 |
| PO6 | Individual and Team work | | 1 | | | | 1 |
| PO7 | Communication | | | | | 2 | 2 |
| PO8 | Engineer and Society | | | | | 2 | 2 |
| PO9 | Ethics | | | | | 1 | 1 |
| PO10 | Environment and Sustainability | 2 | | | | 1 | 2 |
| PO11 | Project Management and Finance | | | 1 | 1 | | 1 |
| PO12 | Life Long Learning | | | | | | |
| PSO1 | Knowledge of Civil Engineering discipline | | | | | 1 | 1 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | | | 2 | | 2 | 2 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil | | | | 2 | 2 | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Engineering Issues | | | | | | |

**CE7011 GEOINFORMATICS APPLICATIONS FOR CIVIL ENGINEERS L T P C**
**3 0 0 3**

**OBJECTIVE**:

- To solve the Civil Engineering problems with the help of Geoinformatics technique.

**UNIT I LAND RESOURCE MANAGEMENT 6**

Total Station and GPS Surveys – Topographic and Bathymetric Surveys – Cadastral Information – Soil and Land Use Surveys - Land Information System (LIS) – Real Estate Information System

**UNIT II STRUCTURAL STUDIES 6**

Deformation studies of deflection - Dam deformation - structural movement - Pavement yield - shifting sand-bank and shoreline – Landslide Risk Analysis

**UNIT III SOIL CONSERVATION AND MANAGEMENT 9**

Soil survey interpretation and mapping - impact of agricultural and industrial activity on soil properties - soil erosion - factors influencing soil erosion - soil contamination using Hyper spectral Remote Sensing - mining pollution- EMR responses with contaminated soil - modeling soil characteristics using satellite data - soil degradation assessment using Remote Sensing and GIS - Land reclamation studies

**UNIT IV URBAN AND TRANSPORTATION MANAGEMENT 12**

Monitoring Urban Growth through Remote Sensing - Geo-demographic Analysis – Property Market Analysis Urban Renewal - traffic analysis - accident analysis - site suitability analysis for transport infrastructure –transportation databases: creation and maintenance - Vehicle routing – Highway maintenance system – Intelligent Transportation System

**UNIT V WATER RESOURCES PLANNING AND MANAGEMENT 12**

Location of storage/diversion works – capacity curve generation – sediment yield - modelling of catchments – Delineation of watershed - Watershed modelling for sustainable development - Rainfall – Runoff modelling –LiDAR Mapping for Urban area –Water quality mapping and monitoring – Flood Risk Zoning - Flood damage assessment – Flood Modelling - Assessment of droughts and mitigation

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | The student shall be capable of solving Civil Engineering problems with Geoinformatics technology. |
| **CO2** | Gain knowledge on spatial data and Geographic Information System |
| **CO3** | Impart the required skills for analyzing the spatial data useful modelling the real world problems |
| **CO4** | Impart the required skills for analyzing the spatial data useful modelling transportation networks and resource transport. |
| **CO5** | Gain knowledge on the applicability of Geoinfomatics technology on diverse Civil Engineering Problems |

**TEXTBOOKS:**


1. Basudeb Bhatta, 'Remote Sensing and GIS', Second edition, Oxford University Press 2011.
2. C.P.Lo.Albert K.W.Yeung, Concepts and Techniques of Geographic Information Systems, Second edition, PHI Learning Private Limited, Delhi, 2014.


Attested

**REFERENCES**:



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1. Andrew N. Rencz, Manual of Remote Sensing: Remote Sensing for Natural Resource Management and Environmental Monitoring, John Wiley & Sons Inc, April 2004
2. Rashed, Tarek; Jürgens, Carsten (Eds.), Remote Sensing of Urban and Suburban Areas, Springer, 1st Edition. 2010.
3. Harvey J. Miller, Shih-Lung Shaw, Geographic Information Systems for Transportation – Principles and Applications, Oxford University Press, 2001.
4. Gert A. Schulitz Edwin T. Engman, Remote Sensing in hydrology and Water Management, Springer - verlag Berlin Heidelberg Germany - 2000.

**CO-PO Mapping - GEOINFORMATICS APPLICATIONS FOR CIVIL ENGINEERS**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | | | | 2 | | 2 |
| PO2 | Problem Analysis | 1 | | 2 | 2 | 3 | 2 |
| PO3 | Design / development of Solutions | | 2 | 2 | 3 | 3 | 3 |
| PO4 | Investigation | | | 3 | 3 | 3 | 3 |
| PO5 | Modern tool usage | | 2 | | 3 | 2 | 3 |
| PO6 | Individual and Team work | 1 | 2 | 2 | 2 | 3 | 2 |
| PO7 | Communication | | | 3 | 3 | 3 | |
| PO8 | Engineer and Society | | | | | 2 | 2 |
| PO9 | Ethics | | | | 3 | 3 | 3 |
| PO10 | Environment and Sustainability | | | | 3 | 3 | 3 |
| PO11 | Project Management and Finance | 2 | 2 | | | 3 | 2 |
| PO12 | Life Long Learning | | | 3 | 3 | | 3 |
| PSO1 | Knowledge of Civil Engineering discipline | | | | 3 | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | | | | 3 | 3 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | | | | | 3 | 3 |

**CE7012 GROUND IMPROVEMENT TECHNIQUES L T P C**
**3 0 0 3**

**OBJECTIVE:**

- Students will be exposed to various problems associated with soil deposits and methods to evaluate them. The different techniques will be taught to them to improve the characteristics of difficult soils as well as design techniques required to implement various ground improvement methods.

**UNIT I PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES 8**

Role of ground improvement in foundation engineering – Methods of ground improvement –

Geotechnical problems in alluvial, lateritic and black cotton soils – Selection of suitable ground improvement techniques based on soil conditions.

**UNIT II DEWATERING 10**

Dewatering Techniques - Well points – Vacuum and electroosmotic methods – Seepage analysis for two dimensional flow for fully and partially penetrated slots in homogeneous deposits – Design for simple cases.

**UNIT III INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS 10**

Insitu densification of cohesionless soils - Dynamic compaction - Vibroflotation, Sand compaction piles and deep compaction. Consolidation of cohesionless soils - Preloading with sand drains, and fabric drains, Stabilization of soft clay ground using stone columns and Lime piles-Installation techniques – Simple design - Relative merits of above methods and their limitations.

**UNIT IV EARTH REINFORCEMENT 9**

Concept of reinforcement – Types of reinforcement material – Reinforced earth wall – Mechanism – Simple design - Applications of reinforced earth; Functions of Geotextiles in filtration, drainage, separation, road works and containment applications.

**UNIT V GROUTING TECHNIQUES 8**

Types of grouts – Grouting equipments and machinery – Injection methods – Grout monitoring – Stabilization with cement, lime and chemicals – Stabilization of expansive soil.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- On completion of the course, the student is expected to

| | |
|---|---|
| CO1 | identify various problems associated with soil deposits, formulate and methods to evaluate them. |
| CO2 | demonstrate an ability to design a dewatering system, component or process as per needs and specifications. |
| CO3 | understand the concept involved for insitu treatment of cohesive and cohesionless soils and ability required to design an appropriate techniques to implement ground improvement methods. |
| CO4 | understand of soil reinforcement and its uses in various engineering structure. Also, graduate will demonstrate an ability to design reinforced earth retaining structure. |
| CO5 | demonstrate an ability to design retaining walls, its component or process as per the needs and specifications. |

**TEXTBOOKS:**


1. Purushothama Raj. P, “Ground Improvement Techniques”, Firewall Media, 2005.
2. Koerner, R.M. “Construction and Geotechnical Methods in Foundation Engineering”, McGraw Hill, 1994.


**REFERENCES:**


1. Moseley, M.P., “Ground Improvement Blockie Academic and Professional”, Chapman and Hall, Glasgow, 2004.
2. Moseley, M.P and Kirsch. K., ‘Ground Improvement mediation”, Sponress, Taylor and Francis Group, London, 2004.
3. Jones C.J.F.P. “Earth Reinforcement and Soil Structure”, Thomas Telford Publising, 1996.
4. Winterkorn, H.F. and Fang, H.Y. “Foundation Engineering Hand Book”. Van Nostrand Reinhold, 1994.

5. Das, B.M., “Principles of Foundation Engineering” (seventh edition), Cengage learning, 2010.
6. Coduto, D.P., “Geotechnical Engineering – Principles and Practices”, Prentice Hall of India Pvt.Ltd. New Delhi, 2011.
7. Koerner, R.M., “Designing with Geosynthetics” (Fourth Edition), Prentice Hall, Jersey, 2012.
8. IS Code 9759 : 1981 (Reaffirmed 1998) “Guidelines for Dewatering During Construction”, Bureau of Indian Standards, New Delhi.
9. IS Code 15284 (Part 1): 2003 “Design and Construction for Ground Improvement – Guidelines” (Stone Column), Bureau of Indian Standards, New Delhi.

**CO – PO Mapping – GROUND IMPROVEMENT TECHNIQUES**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of CO s to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 2 | 3 | 3 | 3 |
| PO2 | Problem analysis | 3 | 3 | 3 | 2 | 3 | 3 |
| PO3 | Design / development of solutions | 2 | 2 | 3 | 3 | 2 | 2 |
| PO4 | Investigation | 3 | 2 | 2 | 3 | 2 | 3 |
| PO5 | Modern Tool Usage | 2 | 2 | 3 | 3 | 3 | 3 |
| PO6 | Individual and Team work | 2 | 2 | 1 | 1 | 1 | 1 |
| PO7 | Communication | 2 | 2 | 2 | 1 | 1 | 2 |
| PO8 | Engineer and Society | 3 | 3 | 3 | 3 | 3 | 3 |
| PO9 | Ethics | 1 | 1 | 1 | 1 | 1 | 1 |
| PO10 | Environment and Sustainability | 2 | 2 | 3 | 2 | 2 | 2 |
| PO11 | Project Management and Finance | 2 | 2 | 2 | 3 | 2 | 2 |
| PO12 | Life Long Learning | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO1 | Knowledge of Civil Engineering discipline | 2 | 2 | 3 | 3 | 2 | 2 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 1 | 3 | 3 | 2 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil engineering issues | 1 | 2 | 3 | 2 | 3 | 3 |

**CE7013 GROUNDWATER ENGINEERING L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To introduce the student to the principles of Groundwater governing equations and characteristics of different aquifers
- To understand the techniques of development and management of groundwater.

**UNIT I HYDROGEOLOGICAL PARAMETERS 9**

Introduction – Water bearing Properties of Rock – Type of aquifers - Aquifer properties – permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation – Ground water table fluctuation and its interpretations – Groundwater development and Potential in India – GEC norms.

**UNIT II WELL HYDRAULICS 9**

Objectives of Groundwater hydraulics – Darcy's Law - Groundwater equation – Flow net Theory – steady state flow - Dupuit Forchheimer assumption - Unsteady state flow - Theis method - Jacob method -Slug tests - Image well theory – Partial penetrations of wells.

**UNIT III GROUNDWATER MANAGEMENT 9**

Need for Management Model – Database for groundwater management – BIG DATA, Data Mining–groundwater balance study – Introduction to Mathematical model – Flow and Transport– Conjunctive use – Collector well and Infiltration gallery.

**UNIT IV GROUNDWATER QUALITY 9**

Ground water chemistry – Origin- Point Source, Non Point Source, movement and quality - Water quality standards – Health and aesthetic aspects of water quality - Saline intrusion – Environmental concern and Regulatory requirements

**UNIT V GROUNDWATER CONSERVATION 9**

Artificial recharge techniques – Remediation of Saline intrusion– Ground water management studies – Protection zone delineation, Contamination source inventory, remediation schemes: Physical, Chemical, Biological- Ground water Pollution and legislation.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Students will be able to understand aquifer properties and its dynamics after the completion of the course. It gives an exposure towards well design and practical problems of groundwater aquifers. |
| **CO2** | Students will be able to understand the importance of artificial recharge and groundwater quality concepts. |
| **CO3** | understand the concept involved for insitu treatment of cohesive and cohesionless soils and ability required to design an appropriate techniques to implement ground improvement methods. |
| **CO4** | understand of soil reinforcement and its uses in various engineering structure. Also, graduate will demonstrate an ability to design reinforced earth retaining structure. |
| **CO5** | demonstrate an ability to design retaining walls, its component or process as per the needs and specifications. |

**TEXTBOOKS:**


1. Raghunath H.M., Ground Water Hydrology, New Age International (P) Limited, New Delhi, 2010.
2. Todd D.K., Ground Water Hydrology, John Wiley and Sons, New York, 2000.


**REFERENCES:**


1. Fitts R Charles. Groundwater Science. Elsevier, Academic Press, 2002.
2. Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998.


**CO – PO MAPPING- GROUNDWATER ENGINEERING**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering | 3 | 3 | 2 | 2 | 2 | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Sciences | | | | | | |
| PO2 | Problem analysis | 3 | 3 | 2 | 2 | 2 | 2 |
| PO3 | Design / development of solutions | 3 | 3 | 3 | 2 | 2 | 3 |
| PO4 | Investigation | | | | | 3 | 3 |
| PO5 | Modern Tool Usage | 1 | 2 | 3 | 3 | 3 | 3 |
| PO6 | Individual and Team work | 1 | 2 | 2 | 3 | 3 | 3 |
| PO7 | Communication | 2 | 2 | 2 | 2 | 2 | 2 |
| PO8 | Engineer and Society | 3 | 3 | 2 | 3 | 3 | 3 |
| PO9 | Ethics | | | | | 3 | 3 |
| PO10 | Environment and Sustainability | | | 3 | 3 | 3 | 3 |
| PO11 | Project Management and Finance | 1 | 2 | 3 | 2 | 2 | 2 |
| PO12 | Life Long Learning | 2 | 2 | 2 | 3 | 3 | 2 |
| PSO1 | Knowledge of Civil Engineering Discipline | 2 | 2 | 3 | 3 | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 3 | 3 | 3 | 3 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering issues | 2 | 2 | 3 | 3 | 3 | 3 |

**CE7014 INDUSTRIAL STRUCTURES L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To learn the layout, functional aspects and design of steel and R.C structures used in industries.

**UNIT I PLANNING 9**

Classification of industries and industrial structures – General requirements of various industries – Planning and layout of buildings and components.

**UNIT II FUNCTIONAL REQUIREMENTS 9**

Lighting – Ventilation - Acoustics – Fire safety – Guidelines from factories act.

**UNIT III DESIGN OF STEEL STRUCTURES 9**

Industrial roofs – Crane girders – pre-engineered and Mills buildings – Bunkers and Silos – pipe/cable racks- Chimney.

**UNIT IV DESIGN OF R.C. STRUCTURES 9**

Corbels, Brackets and Nibs - Silos and bunkers –Chimney - Principles of folded plates and shell roofs

**UNIT V PREFABRICATION 9**

Principles of prefabrication – Prestressed precast roof trusses - Construction of roof and floor slabs - Wall panels- storage/transportation/handling in yard/site and erection –joints in precast structures.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | At the end of this course the student shall be able to design some of the structures used in industries. |
| **CO2** | Analyze and Design steel industrial structures |
| **CO3** | Explain the concepts of Prefabrication |
| **CO4** | Analyze and Design R.C. industrial structures |
| **CO5** | Describe the functional requirements of structures. |

**TEXTBOOKS:**


1. Ramamrutham.S., Design of Reinforced Concrete Structures, Dhanpat Rai Publishing Company, 2007.
2. Varghese.P.C., Advanced Reinforced Concrete Design, PHI, Eastern Economy Editions, Second Edition, 2005.
3. Bhavikatti.S.S., Design of Steel Structures, J.K. International Publishing House Pvt. Ltd., 2009.
4. Ramachandra and Virendra Gehlot , Design of steel structures -2, Scientific Publishers 2012.


**REFERENCES:**


1. Henn W. Buildings for Industry, Vol.I and II, London Hill Books, 1995
2. Handbook on Functional Requirements of Industrial buildings, SP32–1986, Bureau of Indian Standards, 1990.
3. Course Notes on Modern Developments in the Design and Construction of Industrial Structures, Structural Engineering Research Centre, Madras, 1982.
4. Koncz, J., Manual of Precast Construction Vol. I and II, Bauverlay GMBH,1971.


**CO – PO Mapping – INDUSTRIAL STRUCTURES**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of CO s to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 3 | 2 | 2 | 3 |
| PO2 | Problem analysis | 2 | 2 | 2 | 2 | 2 | 2 |
| PO3 | Design / development of solutions | 3 | 3 | 3 | 3 | 3 | 3 |
| PO4 | Investigation | - | - | - | - | - | - |
| PO5 | Modern Tool Usage | - | - | - | - | - | - |
| PO6 | Individual and Team work | 2 | 1 | 1 | 1 | 1 | 1 |
| PO7 | Communication | - | - | - | - | - | - |
| PO8 | Engineer and Society | - | - | - | - | - | - |
| PO9 | Ethics | 1 | 1 | 1 | 1 | 1 | 1 |
| PO10 | Environment and Sustainability | 1 | 1 | 1 | 1 | 1 | 1 |
| PO11 | Project Management and Finance | - | - | - | - | - | - |
| PO12 | Life Long Learning | 2 | 1 | 2 | 2 | 1 | 2 |
| PSO1 | Knowledge of Civil Engineering discipline | - | 1 | 1 | - | - | 1 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | - | 1 | - | 2 | 2 | 2 |
| PSO3 | Conceptualization and evaluation of engineering | - | 1 | 2 | - | 2 | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | solutions to Civil Engineering Issues | | | | | | |

**CE7015 INDUSTRIAL WASTEWATER ENGINEERING L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To provide knowledge on sources and characteristics of Industrial Wastewaters, Techniques and approaches for minimizing the generation of wastewaters at the source and application of physico-chemical, biological and advanced treatment methods for recovery, reuse and disposal of wastewaters in Indian Industries.

**UNIT I INTRODUCTION**
**8**

Industrial scenario in India – Uses of water by Industry – sources, generation rates and characteristics of Industrial wastewaters – Toxicity of Industrial Effluents and Bioassay Tests – Environmental Impacts of Industrial Wastewaters – Regulatory requirements for Industrial wastewaters.

**UNIT II INDUSTRIAL POLLUTION PREVENTION 5**

Prevention Vs Control of Industrial Pollution – Benefits and Barriers – Waste Minimization Strategies – Evaluation of Pollution Prevention Options – Cost benefit analysis – Pay back period.

**UNIT III TREATMENT OF INDUSTRIAL WASTEWATERS**
**13**

Physico–Chemical Treatment Processes – Equalisation, Neutralisation, Oil Seperation, Flotation – Precipitation, Aerobic and Anaerobic Biological Treatment Processes – Sequencing batch reactors, membrane bioreactors, Advanced oxidation and Tertiary Treatment processes for removal of dissolved organics and inorganics- Ozonation, photocatalysis, Evaporation and membrane Technologies.

**UNIT IV WASTEWATER REUSE AND RESIDUAL MANAGEMENT 9**

Individual and Common Effluent Treatment Plants –Zero Effluent Discharge Systems and Management of RO Rejects, Quality requirements for wastewater reuse – Industrial reuse, Disposal on water and land – Residuals of Industrial Wastewater treatment – Quantification and Characteristics of Sludge – Thickening, Digestion, Conditioning, Dewatering and Disposal of Sludge – Solidification – Incineration – Secured Landfills.

**UNIT V CASE STUDIES**
**10**

Industrial manufacturing process description, Wastewater characteristics , Pollution Prevention Options and Treatment Flow sheets for selected Industries – Tanneries- Textiles- Pulp and Paper – Metal finishing – Sugar and Distilleries.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | an insight into the pollution from major industries including the sources and characteristics of pollutants |
| **CO2** | ability to plan minimization of industrial wastes |
| **CO3** | ability to design facilities for the processing and reclamation of industrial waste water |
| **CO4** | Plan and develop sludge management scheme for sludge generated from industries |
| **CO5** | conduct research to develop effective management systems for industrial wastewater that are technically sound, economically feasible and socially acceptable |

Attested

**TEXTBOOKS:**

1. S.C.Bhatia, Handbook of Industrial Pollution and Control, Volume I & II, CBS Publishers, New Delhi, 2003.
2. Mahajan, S.P.Pollution Control in Process Industries, Tata McGraw Hill Publishing Co., New Delhi, 1991.

**REFERENCES:**

1. Eckenfelder, W.W., „Industrial Water Pollution Control", Mc-Graw Hill, 2000.
2. Nelson Leonard Nemerow, "Industrial waste treatment – contemporary practice and vision for the future", Elsevier, Singapore, 2007.
3. Frank Woodard, „ Industrial waste treatment Handbook", Butterworth Heinemann, NewDelhi,2001.
4. World Bank Group, „ Pollution Prevention and Abatement Handbook – Towards Cleaner Production", World Bank and UNEP, Washington D.C., 1998
5. Paul L. Bishop, „ Pollution Prevention:- Fundamentals and Practice", Mc-Graw Hill International, Boston,2000.
6. Wang L.K., Yung-Tse Hung, Howard H.Lo and Constantine Yapijakis, „Handbook of Industrial and Hazardous Wastes Treatment", Marcel Dekker, Inc., USA, 2004.

**CE7016 INTRODUCTION TO SOIL DYNAMICS AND MACHINE FOUNDATIONS L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To impart knowledge in theory of different vibrations, and principles of design of vibration measuring instruments.
- To familiarize propagation of different wave types in 1D and 3D for finite and infinite mediums.
- To impart knowledge on determination of dynamic properties of soil and design of different machine foundations and remediation for influence of vibration.

**UNIT I THEORY OF VIBRATION 9**

Introduction – Nature dynamic loads – Vibrations of single degree freedom system – Free vibrations of spring – mass systems – Forced vibrations – Viscous damping - Transmissibility – Principles of vibration measuring instruments – Effect of Transient and Pulsating loads

**UNIT II WAVE PROPAGATION 9**

Elastic waves in rods of infinite length – Longitudinal and Torsional – Effect of end conditions – Longitudinal and torsional vibrations of rods of finite length – Wave Propagation in infinite, homogeneous isotropic and elastic medium - Wave propagation in elastic half space – Typical values of compres wave and shear wave velocity – Wave propagation due to Machine foundation – Surface wave – Typical values – Particle movements and velocity.

**UNIT III DYNAMIC PROPERTIES OF SOILS 9**

Dynamic stress – Strain characteristics – Principles of measuring dynamic properties – Laboratory Techniques – Field tests – Factors affecting dynamic properties – Typical values – Dynamic bearing capacity – Dynamic earth pressure.

**UNIT IV FOUNDATION FOR DIFFERENT TYPES OF MACHINES 9**

Types of machines and foundation – General requirements – Modes of vibration of a rigid foundation – Method of analysis – Linear elastic weightless spring method – Elastic half space method – Analog Method – Design of block foundation – Special consideration for rotary, Impact type of machines – Codal Provisions.

**UNIT V INFLUENCE OF VIBRATION AND REMEDIATION 9**

Mechanism of Liquefaction – Influencing factors – Evaluation of Liquefaction potential based on SPT-Force Isolation – Motion Isolation – Use of spring and damping materials – Vibration control

of existing machine foundation – Screening of vibration – Open trenches – Pile Barriers – Salient construction aspects of machine Foundations.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Graduates will show the basic understanding of theory of different vibrations and design of vibration measuring instruments |
| **CO2** | Graduates will understand the basic concepts of wave propagation in 1D and 3D for different end conditions. |
| **CO3** | Graduates will demonstrate the procedure of determination of dynamic properties of soil and evaluate the dynamic bearing capacity and earth pressure. |
| **CO4** | Graduates will design different types of machine foundation based on different methods of analysis as per codal provisions |
| **CO5** | Graduates will select and design different remediation techniques for screening the vibration and vibration induced damages. |

**TEXT BOOKS:**


1. Swamisaran, "Soil Dynamics and Machine Foundations", Galgotia Publications Pvt.Ltd. (Second Edition) 2006, (Reprint 2010), New Delhi-110002
2. Kameswara Rao., "Dynamics Soil Tests and Applications", Wheeler Publishing, New Delhi, 2003.
3. P. Srinivasulu, and C.V. Vaidyanathan, "Handbook of Machine Foundations", Tata McGraw-Hill, 2007


**REFERENCES:**


1. Kamaswara Rao., "Vibration Analysis and Foundation Dynamics", Wheeler Publishing, New Delhi, 1998.
2. IS Code of Practice for Design and Construction of Machine Foundations, McGrew Hill, 1996.
3. Moore, P.J., "Analysis and Design of Foundation for Vibration", Oxford and IBH, 2005
4. Steven L. Kramer, "Geotechnical Earthquake Engineering", Prentice Hall, 1996.
5. IS Code 5249: 1992 (Reaffirmed 2006) "Determination of Dynamic Properties of Soil - Method of Test" Bureau of Indian Standards, New Delhi.
6. IS Code 2974: (Part 1) 1982 (Reaffirmed 2008) "Code of Practice for Design and Construction of Machine Foundations - Foundation for Reciprocating Type Machines" Bureau of Indian Standards, New Delhi.
7. IS Code 2974: (Part 2) 1980 (Reaffirmed 2008) "Code of Practice for Design and Construction of Machine Foundations - Foundations for Impact Type Machines (Hammer Foundations)" Bureau of Indian Standards, New Delhi.
8. IS Code 2974: (Part 3) 1992 (Reaffirmed 2006) "Code of Practice for Design and Construction of Machine Foundations - Foundations for Rotary Type Machines (Medium and High Frequency)" Bureau of Indian Standards, New Delhi.


**CO – PO Mapping – INTRODUCTION TO SOIL DYNAMICS AND MACHINE FOUNDATIONS**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of CO s to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 3 | 3 | 3 | 3 |
| PO2 | Problem analysis | 3 | 3 | 3 | 3 | 3 | 3 |
| PO3 | Design / development of solutions | 3 | 3 | 3 | 3 | 3 | 3 |
| PO4 | Investigation | 2 | 2 | 2 | 2 | 2 | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PO5 | Modern Tool Usage | 2 | 2 | 2 | 2 | 2 | 2 |
| PO6 | Individual and Team work | 2 | 2 | 2 | 2 | 2 | 2 |
| PO7 | Communication | 1 | 1 | 1 | 1 | 1 | 1 |
| PO8 | Engineer and Society | 3 | 3 | 3 | 3 | 3 | 3 |
| PO9 | Ethics | 3 | 3 | 3 | 3 | 3 | 3 |
| PO10 | Environment and Sustainability | 3 | 3 | 3 | 3 | 2 | 3 |
| PO11 | Project Management and Finance | 2 | 2 | 2 | 2 | 2 | 2 |
| PO12 | Life Long Learning | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 2 | 2 | 2 | 2 | 2 |
| PSO3 | Conceptualization and evaluation of Engineering solutions to Civil engineering issues | 3 | 3 | 3 | 3 | 3 | 3 |

**CE7017 MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To acquire the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

**UNIT I 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, causes of deterioration.

**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, Sustained elevated temperature, Corrosion - - 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, Self compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.

**UNIT IV TECHNIQUES FOR REPAIR AND PROTECTION METHODS 9**

Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.

**UNIT V REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES 9**

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage, earthquake. demolition techniques - Engineered demolition methods - Case studies.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Students have the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures. |
| **CO2** | Know about High Performance concrete |
| **CO3** | Know the failures of the structures and demolition techniques |
| **CO4** | Understand the materials and techniques needed for repairs. |

**TEXT BOOKS:**


1. Shetty.M.S. Concrete Technology - Theory and Practice, S.Chand and Company, 2008.
2. B.Vidivelli, Rehabilitation of Concrete Structures Standard Publishes Distribution.1st edition 2009.
3. P.C.Varghese, Maintenance Repair and Rehabilitation & Minor works of building, Prentice Hall India Pvt Ltd 2014.
4. R. Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth-Heinemann,Elsevier,New Delhi 2012


**REFERENCES:**


1. Dov Kominetzky.M.S., - Design and Construction Failures, Galgotia Publications Pvt.Ltd., 2001
2. Ravishankar.K., Krishnamoorthy.T.S, Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures, Allied Publishers, 2004.
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 – 2002


**CO – PO Mapping - MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of CO s to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 3 | 2 | 2 | 3 |
| PO2 | Problem analysis | 2 | 2 | 2 | 2 | 2 | 2 |
| PO3 | Design / development of solutions | 3 | 3 | 3 | 3 | 3 | 3 |
| PO4 | Investigation | - | - | - | - | - | - |
| PO5 | Modern Tool Usage | - | - | - | - | - | - |
| PO6 | Individual and Team work | 2 | 1 | 1 | 1 | 1 | 1 |
| PO7 | Communication | - | - | - | - | - | - |
| PO8 | Engineer and Society | - | - | - | - | - | - |
| PO9 | Ethics | 1 | 1 | 1 | 1 | 1 | 1 |
| PO10 | Environment and Sustainability | 1 | 1 | 1 | 1 | 1 | 1 |
| PO11 | Project Management and Finance | - | - | - | - | - | - |
| PO12 | Life Long Learning | 1 | 1 | 1 | 1 | 1 | 1 |
| PSO1 | Knowledge of Civil Engineering discipline | - | 1 | 1 | - | - | 1 |
| PSO2 | Critical analysis of Civil Engineering problems and | - | 1 | - | 1 | 2 | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | innovation | | | | | | |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | - | 1 | 2 | - | 2 | 2 |

**CE7018 MUNICIPAL SOLID WASTE MANAGEMENT L T P C**
**3 0 0 3**

**OBJECTIVE:**

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

**UNIT I SOURCES AND CHARACTERISTICS**
**8**

Sources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization; Effects of improper disposal of solid wastes-Public health and environmental effects. Elements of solid waste management –Social and Financial aspects – Municipal solid waste (M&H) rules – integrated management-Public awareness; Role of NGO"s- Public Private participation.

**UNIT II ON-SITE STORAGE AND PROCESSING**
**8**

On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – waste segregation and storage – case studies under Indian conditions – source reduction of waste – Reduction, Reuse and Recycling.

**UNIT III COLLECTION AND TRANSFER 8**

Methods of Residential and commercial waste collection – Collection vehicles – Manpower – Collection routes – Analysis of collection systems; Transfer stations – Selection of location, operation & maintenance; options under Indian conditions – Field problems- solving.

**UNIT IV OFF-SITE PROCESSING 12**

Objectives of waste processing – Physical Processing techniques and Equipments; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.



**UNIT V DISPOSAL**
**9**

Land disposal of solid waste; Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor – Dumpsite Rehabilitation

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | an understanding of the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management |
| **CO2** | ability to plan waste minimisation and design systems for storage, collection, transport, processing and disposal of municipal solid waste |
| **CO3** | explains the segregation of solid waste and the onsite storage methods |
| **CO4** | select appropriate methods for processing and disposal of solid and |

| | |
|---|---|
| | hazardous wastes, taking into account the impact of the solutions in a sustainability context |
| **CO5** | knowledge about selection of appropriate disposal methods and its handling in an efficient manner |

**TEXTBOOKS:**


1. George Tchobanoglous and FrankKreith(2002).Handbook of Solid waste Management, McGraw Hill, New York.
2. William A. Worrell, P. Aarne Vesilind, Solid Waste Engineering, Cengage Learning, 2012.


**REFERENCES:**


1. CPHEEO, "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi, 2014.
2 Bhide A.D. and Sundaresan, B.B. Solid Waste Management Collection, Processing and Disposal, 2001, ISBN 81-7525-282-0


**CO – PO Mapping - MUNICIPAL SOLID WASTE MANAGEMENT**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of CO s to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 2 | 2 | | | 2 | 2 |
| PO2 | Problem analysis | 2 | | 3 | | | 2 |
| PO3 | Design / development of solutions | 2 | | | 3 | 2 | 2 |
| PO4 | Investigation | | 1 | | | 2 | 2 |
| PO5 | Modern Tool Usage | | | | 2 | | 2 |
| PO6 | Individual and Team work | | 2 | | | 3 | 3 |
| PO7 | Communication | | 3 | | | | 3 |
| PO8 | Engineer and Society | | 2 | | | | 2 |
| PO9 | Ethics | 2 | | | | | 2 |
| PO10 | Environment and Sustainability | 3 | 3 | | | 3 | 3 |
| PO11 | Project Management and Finance | 2 | | 3 | 2 | | 2 |
| PO12 | Life Long Learning | 2 | | | 2 | | 2 |
| PSO1 | Knowledge of Civil Engineering discipline | | 3 | | | | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | | | 2 | | | 2 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | | 3 | | 3 | 3 |

**CE7019** **PAVEMENT ENGINEERING** **L T P C**
**3 0 0 3**

**OBJECTIVE:**

- Student gains knowledge on various IRC guidelines for designing rigid and flexible pavements. Further, the student will be in a position to assess quality and serviceability conditions of roads.

**UNIT I TYPE OF PAVEMENT AND STRESS DISTRIBUTIONON LAYERED SYSTEM** **8**

Introduction – Pavement as layered structure – Pavement types rigid and flexible. Resilient modulus - Stress and deflections in pavements under repeated loading.

**UNIT II DESIGN OF FLEXIBLE PAVEMENTS** **10**

Flexible pavement design 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 PERFORMANCE EVALUATION AND MAINTENANCE** **10**

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** **8**

Stabilisation with special reference to highway pavements – Choice of stabilizers – Testing and field control - Stabilisation for rural roads in India – Use of Geosynthetics in roads.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Students are able to design different new pavements and rehabilitate the existing roads using recent technology. |
| **CO2** | Apply the knowledge of science and engineering fundamentals in designing flexible pavement. by adopting various design standard |
| **CO3** | Apply the standards adopted in designing rigid pavement. |
| **CO4** | Address the problem statement in construction of pavement and to impart knowledge in stabilization techniques. |
| **CO5** | select appropriate methods for construction and evaluation of Pavements |

**TEXTBOOKS:**


1. Khanna, S.K. and Justo C.E.G.and Veeraragavan, A, “Highway Engineering”, New Chand and Brothers, Revised 10th Edition, 2014.
2. Kadiyali, L.R., “Principles and Practice of Highway Engineering”, Khanna tech.Publications, New Delhi, 2005.


**REFERENCES:**


1. Yoder, R.J. and Witchak M.W. “Principles of Pavement Design”, John Wiley 2000.
2. Guidelines for the Design of Flexible Pavements,IRC-37–2001,The Indian roads Congress,

New Delhi.

3. Guideline for the Design of Rigid Pavements for Highways, IRC 58-1998, The Indian Road Congress, New Delhi.

**CO – PO Mapping – PAVEMENT ENGINEERING**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | | | | | | |
| PO2 | Problem analysis | | | 3 | 3 | 2 | 3 |
| PO3 | Design / development of solutions | | 3 | 3 | 2 | 1 | 3 |
| PO4 | Investigation | | | 2 | 2 | 1 | 2 |
| PO5 | Modern Tool Usage | | 2 | 3 | 2 | 2 | 2 |
| PO6 | Individual and Team work | 2 | 2 | | | | 2 |
| PO7 | Communication | | | | | 1 | 1 |
| PO8 | Engineer and Society | 3 | | | 3 | 3 | 3 |
| PO9 | Ethics | | | 3 | 3 | 3 | 3 |
| PO10 | Environment and Sustainability | 1 | 1 | 2 | 3 | 1 | 2 |
| PO11 | Project Management and Finance | | | 2 | 3 | 3 | 3 |
| PO12 | Life Long Learning | | 2 | 3 | 3 | 3 | 3 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 2 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 3 | 3 | 3 | 1 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | | 1 | 1 | 2 | 2 | 2 |



**CE7020 POWER PLANT STRUCTURES L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To study the layout, functional aspects and principles involved in the selection of different types of Power Plant Structures.

**UNIT I FUNDAMENTALS OF POWER PLANTS 9**

Introduction – Classification of Power Plants – Principles of Power Plant – Lay out of Power Plant Building – Selection of type of generation – Resources for power generation – Machine foundation.

**UNIT II HYDRO ELECTRIC POWER PLANTS 9**

Elements of hydro-electric power plants – Advantages and disadvantages of water power – General and essential elements of Hydro electric Power Plant – Structural requirements – Selection of site for hydro electric plant – Penstocks and surge Tanks in Power Station.

**UNIT III THERMAL POWER PLANTS 9**

Planning, Analysis of thermal power plants – Layout – Ash handling – Dust collection – Induced draught and natural cooling towers – Air/water pollution by thermal power plants.

**UNIT IV NUCLEAR POWER PLANTS 9**

General characteristics of Nuclear Power Plants – Classification of reactors – Pressurized Water Reactor, Boiling Water Reactor, Fusion Power Reactor, Heavy Water Reactor - Selection criteria of materials for different systems – Containment structures – Nuclear power plant safety measures – Safety systems and support systems.

**UNIT V NON CONVENTIONAL POWER PLANTS 9**

Types – Wind power plants – Selection of wind mill – Tidal power plants – Solar thermal power plants – Geothermal power plants – Principles and essential features.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**:

| | |
|---|---|
| **CO1** | The student will be able to understand the operations of different types of power plants. |
| **CO2** | The students will be able to analyse and design various power plant components like surge tanks, cooling towers and containment structures. |
| **CO3** | Analyze and design the layout and components of hydroelectric power plant |
| **CO4** | Develop an understanding of the various non-conventional sources of energy and design the layout and components. |
| **CO5** | Explain the functioning of a nuclear power plant and design its components. |

**TEXTBOOKS :**


1. S.C. Sharma and G.R. Nagpal, Power Plant Engineering, Khanna Publishers,2013
2. Raja A.K, Amit Prakash Srivastava and Manish Dwivedi, Power Plant Engineering, New Age International Publishers, 2006.


**REFERENCES :**


1. Lewis.E.E., Nuclear Power Reactor Safety, Willey Inter Science, 1977.
2. Srinivasasulu.P and Vaidyanathan.C.V., Hand book on Machine Foundations, Tata McGraw Hill Publishing Co. Ltd., 2007.
3. Gilbert Gedeon.P.E., Planning and Design of Hydro Electric Power Plants, CECW-ED Engineer Manual, 1110-2-3001 Manual No.1110-2-3001, 1995.


**CO – PO Mapping - POWER PLANT STRUCTURES**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of CO s to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 3 | 2 | 2 | 3 |
| PO2 | Problem analysis | 2 | 2 | 2 | 2 | 2 | 2 |
| PO3 | Design / development of solutions | 3 | 3 | 3 | 3 | 3 | 3 |
| PO4 | Investigation | - | - | - | - | - | - |
| PO5 | Modern Tool Usage | - | - | - | - | - | - |
| PO6 | Individual and Team work | 2 | 1 | 1 | 1 | 1 | 1 |
| PO7 | Communication | - | - | - | - | - | - |
| PO8 | Engineer and Society | - | - | - | - | - | - |
| PO9 | Ethics | 1 | 1 | 1 | 1 | 1 | 1 |
| PO10 | Environment and | 1 | 1 | 1 | 1 | 1 | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Sustainability | | | | | | |
| PO11 | Project Management and Finance | - | - | - | - | - | - |
| PO12 | Life Long Learning | 1 | 1 | 1 | 1 | 1 | 1 |
| PSO1 | Knowledge of Civil Engineering discipline | - | 1 | 1 | - | - | 1 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | - | 1 | - | 1 | 2 | 1 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | - | 1 | 2 | - | 2 | 2 |

**CE7021 PREFABRICATED STRUCTURES L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To understand the principles of prefabrication, behaviour and design of prefabricated components and structural connections.

**UNIT I INTRODUCTION 10**

Need for prefabrication - Principles - Materials - Modular co-ordination – Standardization – Systems Production – Transportation – Erection Disuniting of Structures.

**UNIT II PREFABRICATED COMPONENTS 10**

Behaviour of structural components – Large panel constructions – Construction of roof, floor slabs and Wall panels – Columns – Shear walls.

**UNIT III DESIGN PRINCIPLES 10**

Design of Structural components – Beam, Column and Corbel - Stress limitations – Handling without cracking, handling with controlled cracking – Design for stripping forces

**UNIT IV JOINTS IN STRUCTURAL MEMBERS 8**

Joints for different structural connections – Beam to Column, Beam to Beam, Column to Column, Column to Foundation, Connections between wall panels, Connections between floor panels - Dimensions and detailing – Design of expansion joints- Jointing Materials.

**UNIT V DESIGN FOR EARTHQUAKES AND CYCLONES 7**

Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones etc. - Importance of avoidance of progressive collapse.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | The student shall be able to design the prefabricated elements and also have the knowledge of the construction methods in using these elements. |
| **CO2** | Understand the principles of modular coordination |
| **CO3** | Know the construction of roof and floor |
| **CO4** | Identify the different types of connections between structural members |
| **CO5** | Understand the concept of progressive collapse |

**TEXTBOOKS:**


1. Koncz T., Manual of Precast Concrete Construction, Vols. I, II and III, Bauverlag, GMBH, 1971.
2. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the Use of Precast Concrete, Netherland Betor Verlag, 1978.

3. Haas. A.M., Precast Concrete Design and Applications,CRC Press,1983.
4. PCI Manual for Structural Design of Architectural Precast Concrete, PCI Publication number MNL-121-77,1977.
5. M.Levitt, “Precast Concrete Material, Manufacture, Properties and Usage” Applied Science Publishers Ltd., 1982.
6. A.S.G. Bruggeling and G.F.Huyghe, Prefabrication with concrete, Netherlands: A.A. Balkema Publishers, 1991.
7. Lasslo Mokk, “Prefabricated Concrete for Industrial and Public Structures Budapest Budapest, Akadémiai Kiadó,publishers, 1964

**REFERENCES:**

1. Building Materials and Components, CBRI, India, 1990.
2. Glover C.W, Structural Precast Concrete, Asia Publishing House, 1965
3. PCI Design Hand Book, 6th Edition, 2004.

**CO – PO Mapping - PREFABRICATED STRUCTURES**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of CO s to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 3 | 2 | 2 | 3 |
| PO2 | Problem analysis | 2 | 2 | 2 | 2 | 2 | 2 |
| PO3 | Design / development of solutions | 3 | 3 | 3 | 3 | 3 | 3 |
| PO4 | Investigation | - | - | - | - | - | - |
| PO5 | Modern Tool Usage | - | - | - | - | - | - |
| PO6 | Individual and Team work | 2 | 1 | 1 | 1 | 1 | 1 |
| PO7 | Communication | - | - | - | - | - | - |
| PO8 | Engineer and Society | - | - | - | - | - | - |
| PO9 | Ethics | 1 | 1 | 1 | 1 | 1 | 1 |
| PO10 | Environment and Sustainability | 1 | 1 | 1 | 1 | 1 | 1 |
| PO11 | Project Management and Finance | - | - | - | - | - | - |
| PO12 | Life Long Learning | 1 | 1 | 1 | 1 | 1 | 1 |
| PSO1 | Knowledge of Civil Engineering discipline | - | 1 | 1 | - | - | 1 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | - | 1 | - | 1 | 2 | 1 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | - | 1 | 2 | - | 2 | 2 |

**CE7022 RAILWAYS, AIRPORTS AND HARBOUR ENGINEERING L T P C**

**3 0 0 3**

**OBJECTIVE:**

- To introduce the students about Railways planning, design, construction and maintenance and planning design principles of airport and harbour

**UNIT I RAILWAY PLANNING AND CONSTRUCTION**
**10**

Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges - Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods--Geometric design of railway, gradient, super elevation, widening of guage on curves- Level Crossings. .

**UNIT II RAILWAY CONSTRUCTION AND MAINTENANCE**
**8**

Earthwork – Stabilization of track on poor soil - Tunneling Methods, drainage and ventilation – Calculation of Materials required for track laying - Construction and maintenance of tracks – Railway Station and yards and passenger amenities

**UNIT III AIRPORT PLANNING**
**7**

Air transport characteristics-airport classification-air port planning: objectives, components, layout characteristics, socio-economic characteristics of the Catchment area, criteria for airport site selection and ICAO stipulations, typical Airport Layouts, Case Studies, parking and Circulation Area

**UNIT IV AIRPORT DESIGN**
**10**

Runway Design: Orientation, Wind Rose Diagram, Problems on basic and Actual Length, Geometric Design, Configuration and Pavement Design Principles – Elements of Taxiway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markings.

**UNIT V HARBOUR ENGINEERING** **10**

Definition of Basic Terms: Harbour, Port, Satellite Port, Docks, Waves and Tides – Planning and Design of Harbours: Requirements, Classification, Location and Design Principles – Harbour Layout and Terminal Facilities – Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage – Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works – Environmental concern of Port Operations – Coastal Regulation Zone, 2011

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Understand the concepts and elements in Planning, Design and construction of Railways. |
| **CO2** | Select appropriate methods for construction and maintenance of Railway tracks and other infrastructures |
| **CO3** | Understand the concepts and elements in Planning and selection of site for Airport. |
| **CO4** | Design the Runway length and evaluate the orientation of runways |
| **CO5** | Understand the terminologies, infrastructures in Harbour Engineering and Coastal regulations. |

**TEXTBOOKS:**


1. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering, Scitech Publications (India), Chennai, 2010
2. Saxena Subhash, C.and Satyapal Arora, ACourse in Railway Engineering, DhanapatRai and Sons, Delhi, 1998
3. Khanna.S.K. Arora.M.G and Jain.S.S, Airport Planning and Design, Nemachand and Bros, Roorkee, 1994


**REFERENCES:**

1. C.Venkatramaiah., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels.,Universities Press (India) Private Limited, Hyderabad, 2015.
2. Mundrey J S, Railway Track Engineering, McGraw Hill Education ( India) Private Ltd, New Delhi, 2013

**CO – PO Mapping - RAILWAYS, AIRPORTS AND HARBOUR ENGINEERING**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of CO s to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | | | 3 | 3 | 3 |
| PO2 | Problem analysis | | | 3 | 3 | 2 | 3 |
| PO3 | Design / development of solutions | | 3 | 3 | | 3 | 3 |
| PO4 | Investigation | | | 2 | 2 | 3 | 2 |
| PO5 | Modern Tool Usage | | 2 | 3 | 2 | | 2 |
| PO6 | Individual and Team work | | 2 | | 2 | | 2 |
| PO7 | Communication | 1 | | | | | 1 |
| PO8 | Engineer and Society | 3 | | | 3 | | 3 |
| PO9 | Ethics | 3 | | 3 | 1 | | 3 |
| PO10 | Environment and Sustainability | | | 2 | 2 | 2 | 2 |
| PO11 | Project Management and Finance | | | 1 | 1 | | 1 |
| PO12 | Life Long Learning | | 2 | 2 | 2 | | 2 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 2 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 3 | 3 | 2 | 2 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | 3 | 2 | 3 | 3 | 3 |



**CE7023 ROCK ENGINEERING L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To impart knowledge on fundamentals of rock mechanics and its application in solving simple problems associated with rock slopes and underground openings. Student gains the knowledge on the mechanics of rock and its applications in underground structures and rock slope stability analysis.

**UNIT I CLASSIFICATION AND INDEX PROPERTIES OF ROCKS 6**

Geological classification – Index properties of rock systems – Classification of rock masses for engineering purpose – Rock Mass Rating and Q System.

**UNIT II ROCK STRENGTH AND FAILURE CRITERIA 12**

Modes of rock failure – Strength of rock – Laboratory measurement of shear, tensile and

compressive strength. Stress - strain behaviour of rock under compression – Mohr -Coulomb failure criteria and empirical criteria

**UNIT III INITIAL STRESSES AND THEIR MEASUREMENTS 10**

Estimation of initial stresses in rocks – influence of joints and their orientation in distribution of stresses – measurements of in-situ stresses – Hydraulic fracturing – Flat jack method – Over coring method

**UNIT IV APPLICATION OF ROCK MECHANICS IN ENGINEERING 10**

Simple engineering application – Underground openings – Rock slopes – Foundations and mining subsidence.

**UNIT V ROCK STABILISATION 7**

Introduction – Rock support and Rock reinforcement – Principles – Support reaction curves – Shotcreting.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Students are capable of classifying the rock. They can understand stares-strain characteristics, failure criteria, and influence of insitu stress in the stability of various structures and also know various technique to improve the insitu strength of rocks. |
| **CO2** | arrive at the behaviour of rock for the given project. |
| **CO3** | design underground excavation, open excavation and sub-structures. |
| **CO4** | design suitable support system under unstable condition. |

**TEXTBOOKS:**


1. Goodman, P.E. “Introduction to Rock Mechanics”, John Wiley and Sons, 1999.
2. Stillborg B., “Professional User Handbook for rock Bolting”, Tran Tech Publications, 1996.
3. Brady, B.H.G. and Brown, E.T., Rock mechanics for underground mining (Third Edition), Kluwer Academic Publishers, Dordrecht, 2006.


**REFERENCES:**


1. Brown, E.T. “Rock Characterisation Testing and Monitoring”. Pergaman Press 1991.
2. Arogyaswamy, R.N.P., Geotechnical Application in Civil Engineering”, Oxford and IBH, 1991.
3. Hook E.and Bray J., Rock slope Engineering, Institute of Mining and Metallurgy”, U.K. 2004.
4. Ramamurthy. T., “Engineering in Rocks for Slopes, Foundation and Tunnels: (Third Edition), PHI Learning Private Limited, New Delhi, 2014.


**CO – PO Mapping – ROCK MECHANICS**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of CO s to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 3 | 3 | 3 | 3 |
| PO2 | Problem analysis | 3 | 3 | 3 | 3 | 3 | 3 |
| PO3 | Design / development of solutions | 2 | 3 | 3 | 3 | 3 | 3 |
| PO4 | Investigation | 3 | 3 | 3 | 2 | 2 | 3 |
| PO5 | Modern Tool Usage | 1 | 2 | 3 | 3 | 3 | 3 |
| PO6 | Individual and Team work | 2 | 1 | 1 | 1 | 1 | 1 |
| PO7 | Communication | 1 | 1 | 1 | 1 | 1 | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PO8 | Engineer and Society | 3 | 3 | 3 | 3 | 3 | 3 |
| PO9 | Ethics | 1 | 1 | 1 | 1 | 2 | 1 |
| PO10 | Environment and Sustainability | 3 | 3 | 3 | 3 | 3 | 3 |
| PO11 | Project Management and Finance | 2 | 1 | 1 | 1 | 1 | 1 |
| PO12 | Life Long Learning | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 2 | 2 | 2 | 2 | 2 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 3 | 2 | 2 | 2 | 3 | 2 |
| PSO3 | Conceptualization and evaluation of Engineering solutions to Civil engineering issues | 2 | 3 | 3 | 3 | 2 | 3 |

**CE7024 STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To understand the behaviour of dynamic loading. Study the effect of earthquake loading on the behaviour of structures. Understand the codal provisions to design the structures as earthquake resistant.

**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' Alemberts Principles – Effect of damping – Free and forced vibration of damped and undamped structures – Response to harmonic forces and periodic forces.

**UNIT II MULTI DEGREE OF FREEDOM SYSTEM 9**

Formulation of equation of motion for multidegree 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 – Seismotectonics – 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 and prestressed Concrete Structures under earthquake loading – Pinching Effect – Bouchinger Effects – 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:**

| | |
|---|---|
| **CO1** | The student will have the knowledge to analyse structures subjected to dynamic loading and to design the structures for seismic loading as per code provisions. |
| **CO2** | Apply the knowledge of science and engineering fundamentals to idealize and formulate the equations of motion for SDOF system. |
| **CO3** | Apply the knowledge of science and engineering fundamentals to idealize and formulate the equations of motion for SDOF system. |
| **CO4** | To identify the various causes and effects of earthquakes on structures due to past earthquakes. |
| **CO5** | To analyze the structures subjected to dynamic loading and to design for seismic loading as per codal provisions. |

**TEXTBOOKS:**


1. Mario Paz, Structural Dynamics – Theory and Computations, Fourth Edition, CBS publishers, 1997.
2. Agarwal.P and Shrikhande.M. Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd. 2007.


**REFERENCES:**


1. Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, McGraw Hill International Edition, 1995.
2. Jai Krishna, Chandrasekaran.A.R., and Brijesh Chandra, Elements of Earthquake Engineering, South Asia Publishers, 1994.
3. Minoru Wakabayashi, Design of Earthquake Resistant Buildings, Mc Graw – Hill Book Company, 1986
4. Humar.J.L, Dynamics of Structures, Prentice Hall Inc., 1990.
5. Anil K Chopra, Dynamics of structures – Theory and applications to Earthquake Engineering, Prentice Hall Inc., 2007.
6. Moorthy.C.V.R., Earthquake Tips, NICEE, IIT Kanpur,2002.


**CO – PO Mapping –Structural Dynamics and Earthquake Engineering**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | - | - | - | - | 3 |
| PO2 | Problem analysis | - | - | - | 2 | 3 | 2 |
| PO3 | Design / development of solutions | - | - | - | 2 | 3 | 3 |
| PO4 | Investigation | - | - | - | - | 2 | 2 |
| PO5 | Modern Tool Usage | - | - | - | - | 3 | 3 |
| PO6 | Individual and Team work | - | - | - | 2 | 2 | 2 |
| PO7 | Communication | - | - | - | 2 | 2 | 2 |
| PO8 | Engineer and Society | 3 | - | - | 2 | 2 | 2 |
| PO9 | Ethics | - | - | - | - | 1 | 1 |
| PO10 | Environment and Sustainability | - | - | - | - | 1 | 1 |
| PO11 | Project Management and Finance | - | - | - | - | 1 | 1 |
| PO12 | Life Long Learning | - | - | - | - | 1 | 1 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 2 | 3 | 3 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 3 | 3 | 2 | 2 | 2 | 2 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | 2 | 3 | 3 | 3 | 3 |

**CE7025 TALL STRUCTURES L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To understand the design philosophy of tall buildings, the loading and behaviour of structural systems. To enlighten the students on modern techniques available for the analysis of tall buildings.

**UNIT I DESIGN CRITERIA AND MATERIALS 8**

Design Philosophy - Modern concepts – Materials used - High Performance Concrete, Fibre Reinforced Concrete, Light weight concrete, Self Compacting Concrete, Glass, High strength steel.

**UNIT II LOADING 9**

Gravity Loading – Dead load, Live load – Live load reduction techniques, Impact load, Construction load, Sequential loading. Wind Loading – Static and Dynamic Approach, Analytical method, Wind Tunnel Experimental methods. Earthquake Loading – Equivalent lateral Load analysis, Response Spectrum Method, Combination of Loads.

**UNIT III BEHAVIOUR OF STRUCTURAL SYSTEMS 9**

Factors affecting the growth, height and structural form, Behaviour of Braced frames, Rigid Frames, in filled frames, Shear walls, Coupled Shear walls, Wall – Frames, Tubular, Outrigger braced, Hybrid systems.

**UNIT IV ANALYSIS 10**

Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of structures as an integral unit, Analysis for member forces, drift and twist. Computerized 3D analysis, Evaluation of frequency of vibration of structures – Buckling analysis of tall structures

**UNIT V DESIGN PARAMETERS 9**

Design for differential movement, Creep and Shrinkage effects, Temperature Effects and Fire Resistance.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | The student should have an understanding on the behaviour of tall buildings subjected to lateral building. |
| **CO2** | The students should have knowledge about the principles of designing safer tall structures as per the existing codes. |
| **CO3** | Identify various structural systems, their behavior and performance under different loading conditions. |
| **CO4** | Analyze the structures as an integral unit for drift and twist. |
| **CO5** | Design tall structures under different conditions like stability considerations, creep, shrinkage, and temperature and fire resistance. |

**TEXTBOOKS:**

1. Bryan Stafford Smith and Alex Coull, Tall Building Structures, Analysis and Design, John Wiley and Sons, Inc., 1991.
2. Taranath B.S, Structural Analysis and Design of Tall Buildings, McGraw Hill, 1988

**REFERENCES:**

1. Coull, A. and Smith Staford.B, Tall Buildings , Pergamon Press, London, 1997.
2. LinT.Y. and Burry D.Stotes, Structural Concepts and Systems for Architects and Engineers, John Wiley, 1994.
3. Lynn S.Beedle, Advances in Tall Buildings, CBS Publishers and Distributors, Delhi, 1996.
4. Wolfgang Schuler, High Rise Building Structures, John Wiley & Sons, New York, 1977

**CO – PO Mapping – Tall Structures**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | - | 3 | - | - | - | 3 |
| PO2 | Problem analysis | - | 3 | 2 | 3 | 3 | 3 |
| PO3 | Design / development of solutions | - | 2 | 2 | 2 | 3 | 2 |
| PO4 | Investigation | - | - | 1 | - | - | 1 |
| PO5 | Modern Tool Usage | - | 2 | 2 | 3 | 2 | 2 |
| PO6 | Individual and Team work | - | - | - | 2 | 2 | 2 |
| PO7 | Communication | - | - | - | | 2 | 2 |
| PO8 | Engineer and Society | - | 3 | - | 2 | 2 | 2 |
| PO9 | Ethics | - | - | - | - | 1 | 1 |
| PO10 | Environment and Sustainability | 3 | - | - | - | - | 3 |
| PO11 | Project Management and Finance | - | - | - | 1 | 1 | 1 |
| PO12 | Life Long Learning | - | - | - | 1 | 1 | 1 |
| PSO 1 | Knowledge of Civil Engineering discipline | - | 2 | 3 | 3 | 3 | 3 |
| PSO 2 | Critical analysis of Civil Engineering problems and innovation | - | 2 | - | 3 | 2 | 2 |
| PSO 3 | Conceptualization and evaluation of engineering solutions to Civil | 2 | 2 | 3 | 2 | 2 | 2 |

Attested



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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Engineering Issues | | | | | | |

**CE7026 TOTAL STATION AND GPS SURVEYING L T P C**
**3 0 0 3**

**OBJECTIVE :**

- To understand the working of total station equipment and solve the surveying problems.

**UNIT I FUNDAMENTALS OF TOTAL STATION AND GPS 9**

Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying. Basic concepts of GPS - Historical perspective and development - applications - Geoid and Ellipsoid- satellite orbital motion - Keplerian motion – Kepler's Law - Perturbing forces - Geodetic satellite - Doppler effect - Positioning concept – GNSS

**UNIT II ELECTROMAGNETIC WAVES 9**

Classification - applications of Electromagnetic waves, Propagation properties, wavepropagation at lower and higher frequencies- Refractive index (RI) - factors affecting RI- Computation of group for light and near infrared waves at standard and ambient conditions- Computation of RI for microwaves at ambient condition - Reference refractive index- Real time application of first velocity correction. Measurement of atmospheric parameters- Meanrefractive index- Second velocity correction -Total atmospheric correction- Use of temperature
- pressure transducers.

**UNIT III ELECTRO OPTICAL AND MICRO WAVE SYSTEM 9**

Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro- optical and Microwave system. Care and maintenance of Total Station instruments. Modern positioning systems – Traversing and Trilateration.

**UNIT IV SATELLITE SYSTEM 9**

GPS - Different segments - space, control and user segments - satellite configuration - GPS signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - GPS receivers.

**UNIT V GPS DATA PROCESSING 9**

GPS observables - code and carrier phase observation - linear combination and derived observables - concept of parameter estimation – downloading the data - data processing – software modules -solutions of cycle slips, ambiguities, RINEX format. Concepts of rapid, static methods with GPS - semi Kinematic and pure Kinematic methods -basic constellation of satellite geometry & accuracy measures - applications- long baseline processing- use of different softwares available in the market.

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | The student shall acquire through working knowledge of modern surveying equipment such as Total Station and GPS so that they will be able to solve all surveying problem faced by our Country. |
| **CO2** | Learn the basic concepts of GPS |
| **CO3** | Gains knowledge about Total station and GPS data downloading and processing |
| **CO4** | Understand the measuring and working principle of electro optical and Microwave Total station and GPS |
| **CO5** | Provides knowledge about electromagnetic waves and its usage in Total |

Attested



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| | |
|---|---|
| | station and GPS |

**TEXTBOOKS:**

1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 1990.
2. Satheesh Gopi, rasathishkumar, Nmadhu, " Advanced Surveying , Total Station GPS and Remote Sensing " Pearson education , 2007 isbn: 978-81317 00679

**REFERENCES :**

1. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1993.
2. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer - Verlag, Berlin, 2003.
3. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3rd Edition, 2004.
4. Seeber G, Satellite Geodesy, Walter De Gruyter, Berlin, 1998

**CO-PO Mapping - TOTAL STATION AND GPS SURVEYING**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of CO s to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | | 2 | 2 | 3 |
| PO2 | Problem Analysis | | | 3 | | 3 | 3 |
| PO3 | Design / development of Solutions | | | 3 | | 3 | 3 |
| PO4 | Investigations | | | 1 | | 1 | 1 |
| PO5 | Usage of Modern Technology | | | 3 | | 3 | 3 |
| PO6 | Individual and Team work | | | | | | |
| PO7 | Communication | | | | | | |
| PO8 | Engineer and Society | | | 3 | | 3 | 3 |
| PO9 | Ethics | | | 3 | | 3 | 3 |
| PO10 | Environment and Sustainability | | | | | | |
| PO11 | Project Management and Finance | | 2 | | | 2 | 2 |
| PO12 | Life Long Learning | | | 3 | | 3 | 3 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | | | | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | | | | | 3 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | | | | | 3 | 3 |

**CE7027 TRAFFIC ENGINEERING AND MANAGEMENT L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To give an overview of Traffic engineering, various surveys to be conducted, traffic regulation, management and traffic safety.

Attested

**UNIT I TRAFFIC CHARACTERISTICS 10**

Road Characteristics – Classification – Functions and standards – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India

**UNIT II TRAFFIC SURVEYS 7**

Traffic Surveys – Speed, journey time and delay surveys – Vehicle Volume Survey – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – level of service – Concept, application and significance.

**UNIT III TRAFFIC ENGINEERING REGULATION AND CONTROL 8**

Capacity of Rotary intersection and Design – Capacity of signalized intersections – Traffic signals, warrants, type – Design and coordination – Intersection channelisation – Grade separation - Traffic signs and road markings.

**UNIT IV TRAFFIC SAFETY AND ENVIRONMENT 10**

Road accidents – Causes, effect, prevention, and cost – street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, health effects and abatement measures.

**UNIT V TRAFFIC MANAGEMENT 10**

Area Traffic Management System – One way street system, exclusive traffic lanes, tidal flow operation, staggering of work hours and road pricing – Non road pricing options _ Parking charges, Public transport, Subsidies, Vehicle License fees, Road Building, Permit system, Physical Traffic Management Transport System Management (TSM) and Transport Demand Management (TDM)- - Introduction to Intelligent Transportation Systems (ITS)- ITS Applications in Traffic Management.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Students would have gained knowledge on characteristics of traffic elements, traffic survey, traffic regulation and traffic management measures. |
| **CO2** | Apply the knowledge of science and engineering fundamentals in conducting traffic surveys and analyze the problems. |
| **CO3** | Designing various types of control and regulatory measures to meet an efficient traffic network. |
| **CO4** | Understand various traffic management measures in addressing the demand, pricing and ITS applications. |
| **CO5** | Select appropriate methods to ensure the safety of the road users and analyze the environmental issues related to traffic network. |

**TEXTBOOKS:**


1. Kadiyali. L.R. Traffic Engineering and Transport Planning, Khanna Publishers, Delhi,2008.
2. Khanna .K and Justo C.E.G. and Veeraragavan, A Highway Engineering, Nem Chand Bros., Roorkee, Revised 10th Edition, 2014.
3. Salter. R.I and Hounsell N.B, Highway Traffic Analysis and design, Macmillan Press Ltd.1996.
4. Roger P.Roess, William R.Mcshane and Elena S.Prassas, Traffic Engineering-Second Edition, Prentice Hall Publishers,, Upper Saddle River, New Jersey 1998


**REFERENCES:**


1. Partha Chakroborty and Animesh Das Principles of Transportation Engineering, PHI Learning Pvt. Ltd., 2005
2. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
3. C. Jotin Khisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
4. Hobbs. F.D. Traffic Planning and Engineering,University of Brimingham, Peragamon Press

Ltd, 1994.
5. Taylor MAP and Young W, Traffic Analysis – New Technology and New Solutions, Hargreen Publishing Company , 1998.
6. Jason C.Yu Transportation Engineering, Introduction to Planning, Design and Operations, Elseevier, 1992.

**CO-PO - TRAFFIC ENGINEERING AND MANAGEMENT**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | | 2 | | 3 |
| PO2 | Problem analysis | | | 3 | 3 | 2 | 3 |
| PO3 | Design / development of solutions | | 3 | 3 | 2 | 1 | 3 |
| PO4 | Investigation | | 3 | 2 | 2 | 1 | 2 |
| PO5 | Modern Tool Usage | | 2 | 3 | 2 | 2 | 2 |
| PO6 | Individual and Team work | 2 | 2 | | | | 2 |
| PO7 | Communication | | | | | 1 | 1 |
| PO8 | Engineer and Society | 3 | | | 3 | 3 | 3 |
| PO9 | Ethics | | | 3 | 3 | 3 | 3 |
| PO10 | Environment and Sustainability | 1 | 1 | 2 | 3 | 1 | 2 |
| PO11 | Project Management and Finance | | | 2 | 2 | 1 | 2 |
| PO12 | Life Long Learning | | 2 | 3 | 3 | 3 | 3 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 2 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 3 | 3 | 3 | 1 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | | 1 | 1 | 2 | 2 | 2 |

**CE7028 TRANSPORT AND ENVIRONMENT L T P C**
**3 0 0 3**

**OBJECTIVE:**

- The objective of this course is to create an awareness / overview of the impact of Transportation Projects on the environment and society..

**UNIT I INTRODUCTION 8**

Environmental Inventory, Environmental Assessment, Environmental Impact Assessment (EIA), Environmental Impact of Transportation Projects, Need for EIA, EIA Guidelines for Transportation Project, Historical Development.

**UNIT II METHODOLOGIES 8**

Elements of EIA – Screening and Scoping – Methods of Impact Analysis – Applications – Appropriate methodology.

**UNIT III ENVIRONMENTAL IMPACT, PREDICTION AND ASSESSMENT 10**

Prediction and Assessment of Impact of Transportation Project at various stages on water, air, noise, land acquisition and resettlement, Socio economic impact, indigenous people, aesthetics, health and safety, energy studies, IRC guidelines.

**UNIT IV ENVIRONMENTAL MITIGATION AND MANAGEMENT PLAN 10**

Mitigation of the impact on Natural and Man-made Environment, Health, Water, Land, Noise, Air, Public participation, Environmental Management Plan, Energy Conservation, Methods to reduce Global Warming.

**UNIT V EIA CASE STUDIES 9**

EIA Case Studies on Highway, Railway, Airways and Waterways Projects

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Students would have understood the impact of Transportation projects on the environment, Environmental Laws on Transportation Projects and the mitigative measures adopted in the planning stage |
| **CO2** | Reviewing various case studies on environmental impact assessment of transport projects. |
| **CO3** | Select appropriate Mitigation methods and Environmental Management Plan. |
| **CO4** | Stage wise Assessment and Prediction of impact of transportation project |
| **CO5** | Apply various methods of analyzing environmental Impact Analysis |

**TEXTBOOKS:**


1. Canter, L.R., Environmental Impact Assessment, McGraw Hill, New Delhi, 1996.
2. Indian Road Congress (IRC), Environmental Impact of Highway Projects, IRC, Delhi, 1998.
3. P. Meenakshi, Elements of Environmental Science and Engineering, Prentice Hall of India, New Delhi, 2006
4. Thirumurthy A.M., Introduction to Environmental Science and Management, Shroff Publishers, Bombay, 2005


**REFERENCES:**


1. John G.Rau and David, C.Hooten, Environmental Impact Analysis Handbook, McGraw Hill Book Company, 1995
2. James H.Banks, Introduction to Transportation Engineering, McGraw Hill Book Company, 2000
3. World Bank, A Handbook on Roads and Environment, Vol.I and II, Washington DC, 1997
4. Priya Ranjan Trivedi, International Encyclopedia of Ecology and Environment – EIA, Indian Institute of Ecology and Environment, New Delhi, 1998


**CO-PO- TRANSPORT AND ENVIRONMENT**

| PO/PSO | | Course Outcome | | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | | | | 3 |
| PO2 | Problem analysis | | 3 | 3 | 3 | 2 | 3 |
| PO3 | Design / development of solutions | | 3 | 3 | 2 | 1 | 3 |
| PO4 | Investigation | | | 2 | 2 | 1 | 2 |
| PO5 | Modern Tool Usage | | 2 | 3 | 2 | 2 | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PO6 | Individual and Team work | 2 | 2 | | | | 2 |
| PO7 | Communication | | | | | 1 | 1 |
| PO8 | Engineer and Society | 3 | | | 3 | 3 | 3 |
| PO9 | Ethics | | | 3 | 3 | 3 | 3 |
| PO10 | Environment and Sustainability | 1 | 1 | 2 | 3 | 1 | 2 |
| PO11 | Project Management and Finance | | | 2 | 2 | 3 | 2 |
| PO12 | Life Long Learning | 2 | | 2 | 1 | 1 | 2 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 2 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 1 | 2 | 3 | | 2 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | | 2 | 3 | 2 | 3 | 3 |

**CE7029 TRANSPORTATION PLANNING AND SYSTEMS L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To give an exposure on overview of the principles of the bus and rail transportation planning and evaluation of the transportation projects.

**UNIT I STUDY AREA AND SURVEYS 10**

Importance of planning and integrated transport facilities in urban areas – Delineation of study area and zoning – Conducting various surveys – Travel patterns, transport facilities and planning parameters.

**UNIT II MODES 7**

Basics of trip generation – Trip distribution – Trip assignment and modal split models – Validation of the model.

**UNIT III PLAN PREPARATION AND EVALUATION 8**

Preparation of alternative plans – Evaluation techniques – Economic and financial evaluation – Environment Impact Assessment (EIA) – Case Studies.

**UNIT IV BUS TRANSPORTATION 10**

Characteristics and bus transportation in urban areas – Fare policy – Route planning – Planning of terminals – Break even point and its relevance.

**UNIT V RAIL TRANSPORTATION 10**

Characteristics of suburban, IRT and RRT systems – Planning of rail terminals – Fare policy – Unified traffic and transport authority.

**TOTAL: 45**

**PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | The students would have gained knowledge on comprehensive traffic and transport planning for cities with special emphasis on bus and rail system planning. |

| | |
|---|---|
| **CO2** | Knowledge on modelling of trip generation assigning and distribution techniques in transportation system. |
| **CO3** | Planning and evaluating transportation projects through various case studies. |
| **CO4** | Planning of various rail transportation and fare policies adopted. |

**TEXTBOOKS:**


1. Michael J.Bruton, Introduction to Transportation Planning, Hutchinson, London, 1995.
2. Kadiyali. L.R., Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2008.


**REFERENCES:**


1. John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1990.
2. C. Jotin Khisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
3. Juan de Dios Ortúzar and Luis G. Willumsen, Modelling Transport, John Wiley & Sons 2001
4. Chennai Comprehensive Traffic Study, Chennai Metropolitan Development Authority, 2007.


| PO/PSO | | Course Outcome | | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 2 | | 2 | 2 | | 2 |
| PO2 | Problem analysis | | | 3 | 3 | 2 | 3 |
| PO3 | Design / development of solutions | | 3 | 3 | 2 | 1 | 3 |
| PO4 | Investigation | | | 2 | 2 | 1 | 2 |
| PO5 | Modern Tool Usage | | 2 | 3 | 2 | | 2 |
| PO6 | Individual and Team work | 2 | 2 | | | | 2 |
| PO7 | Communication | | | | | 1 | 1 |
| PO8 | Engineer and Society | 3 | | | 3 | 3 | 3 |
| PO9 | Ethics | | | 3 | 3 | 3 | 3 |
| PO10 | Environment and Sustainability | 1 | 1 | 2 | 3 | 1 | 2 |
| PO11 | Project Management and Finance | | | 3 | | 3 | 3 |
| PO12 | Life Long Learning | | 2 | 3 | | 3 | 3 |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 2 | 2 | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 1 | 2 | 3 | 3 | 1 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | | 2 | 1 | 2 | 1 | 2 |

| CE7030 | URBAN PLANNING AND DEVELOPMENT | L T P C<br>3 0 0 3 |
|---|---|---|

**OBJECTIVES:**

- To enable students to have the knowledge on planning process and to introduce to the students about the regulations and laws related to Urban Planning.

**UNIT I BASIC ISSUES 8**

Definition of Human settlement, Urban area, Town, City, Urbanisation, Suburbanisation, Urban sprawl, Peri-urban areas, Central Business District (CBD), Classification of urban areas – Trend of Urbanisation at International, National, Regional and State level.

**UNIT II PLANNING PROCESS 8**

Principles of Planning – Types and Level of Plan, Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Surveys and Questionnaire Design.

**UNIT III DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION 10**

Scope and Content of Regional Plan, Master Plan, Detailed Development Plan, Development Control Rules, Transfer of Development Rights , Special Economic Zones- Development of small town and smart cities-case studies

**UNIT IV PLANNING AND DESIGN OF URBAN DEVELOPMENT PROJECTS 9**

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 URBAN SYSTEM 10**

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:**

| | |
|---|---|
| **CO1** | describe basic issues in urban planning |
| **CO2** | formulate plans for urban and rural development and |
| **CO3** | plan and analyse socio economic aspects of urban and rural planning |
| **CO4** | Understand the norms, legal aspects and stakeholders role in planning an urban area. |

**TEXTBOOKS:**


1. Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi 2002
2. George Chadwick, A Systems view of planning, Pergamon press, Oxford 1978
3. Singh V.B, Revitalised Urban Administration in India, Kalpaz publication, Delhi, 2001
4. Edwin S.Mills and Charles M.Becker, Studies in Urban development, A World Bank publication, 1986


**REFERENCES:**


1. Tamil Nadu Town and Country Planning Act 1971, Government of Tamil Nadu, Chennai
2. Goel S.L., Urban Development and Management, Deep and Deep Publications, New Delhi, 2002
3. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005
4. CMDA, Second Master Plan for Chennai, Chennai 2008

| PO/PSO | | Course Outcome | | | | | Overall Correlation of CO s to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| **PROGRAM OUTCOMES (PO)** | | | | | | | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 3 | | | 3 |
| PO2 | Problem analysis | | 3 | 1 | 1 | | 1 |
| PO3 | Design / development of solutions | | 3 | 2 | 2 | | 2 |
| PO4 | Investigation | | 3 | | 3 | | 3 |
| PO5 | Modern Tool Usage | 2 | 2 | | | | 2 |
| PO6 | Individual and Team work | | | 2 | 2 | | 2 |
| PO7 | Communication | | | | | 1 | 1 |
| PO8 | Engineer and Society | 3 | | 3 | 3 | 3 | 3 |
| PO9 | Ethics | | 3 | | 3 | 3 | 3 |
| PO10 | Environment and Sustainability | 3 | | 2 | | 3 | 3 |
| PO11 | Project Management and Finance | | | | 3 | | 3 |
| PO12 | Life Long Learning | | | 3 | 3 | | 3 |
| **PROGRAM SPECIFIC OUTCOMES (PSO)** | | | | | | | |
| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 2 | | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 3 | | | 2 | 3 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | | 2 | | 3 | 2 | 2 |

**CE7031 WATER RESOURCES SYSTEMS ENGINEERING L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To introduce the student to the concept of Mathematical approaches for managing the water resources system.
- To make the students apply an appropriate system approach to optimally operate a water resource system.

**UNIT I SYSTEM APPROACH 7**

Philosophy of modelling – Goals and Objectives – Basics of system analysis concept – scopes and steps in systems engineering.

**UNIT II PHYSICAL AND SOCIO - ECONOMIC DATA 6**

Collection, evaluation and processing – project appraisal – public involvement, master Comprehensive and integrated planning of water resources project.

**UNIT III LINEAR PROGRAMMING 10**

Operation research - introduction - Problem Formulation-graphical solution- Simplex method – Sensitivity analysis - simple applications

**UNIT IV DYNAMIC PROGRAMMING 11**

Optimality criteria Stage coach problem – Bellman's optimality criteria Problem formulation and Solution - simple applications

**UNIT V SIMULATION 11**

Basic principles – Methodology and Philosophy – Model development – input and outputs – Deterministic simulation - simple applications

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | The students will be exposed to the economical aspects and analysis of water resources systems by which they will get an idea of comprehensive and integrated planning of a water resources project. |
| **CO2** | The students will develop skills in solving problems in operations research through LP, DP and Simulation techniques. |
| **CO3** | Develop the simulation model based on deterministic and stochastic simulation for reservoir operating policy |
| **CO4** | Apply advance optimisation techniques like goal programming, heuristic algorithm in the field of water resources planning and management |
| **CO5** | Explain the concept of dynamic programming and apply in water resource system. |

**TEXTBOOK:**


1. Vedula, S., and Majumdar, P.P. Water Resources Systems – Modeling Techniques and Analysis Tata McGraw Hill, New Delhi, Fifth reprint, 2010.


**REFERENCES:**


1. Hall Warren, A. and John A. Dracup., Water Resources System Engineering, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1998
2. Chadurvedi M.C., Water resource Systems Planning and Management, Tata McGraw Hill inc., New Delhi,1997
3. Taha H.A., Operation Research, McMillan Publication Co., New York, 1995.
4. 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.
5. Goodman Aluvin S., Principles of Water Resources Planning, Prentice-Hall, India 1984.


## CO – PO MAPPING- WATER RESOURCES SYSTEMS ENGINEERING

| PO/PSO | | Course Outcome | | | | | Overall Correlation of COs to POs |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | |
| PO1 | Knowledge of Engineering Sciences | 3 | 3 | 3 | 3 | 3 | 3 |
| PO2 | Problem analysis | | 2 | 3 | 3 | 3 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PO3 | Design / development of solutions | | | 2 | 3 | 3 | 3 |
| PO4 | Investigation | | | | | 3 | 3 |
| PO5 | Modern Tool Usage | | | 2 | 3 | 3 | 3 |
| PO6 | Individual and Team work | | 3 | 2 | 3 | 3 | 3 |
| PO7 | Communication | 2 | | | | | 2 |
| PO8 | Engineer and Society | | 3 | 2 | 3 | 3 | 3 |
| PO9 | Ethics | | | | | 2 | 2 |
| PO10 | Environment and Sustainability | | | | 2 | | 2 |
| PO11 | Project Management and Finance | | 2 | 3 | 2 | 3 | 3 |
| PO12 | Life Long Learning | 3 | 2 | 2 | 3 | 3 | 3 |
| PSO1 | Knowledge of Civil Engineering Discipline | 2 | 2 | 1 | 3 | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 3 | 3 | 3 | 3 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering issues | 2 | 2 | 3 | 3 | 3 | 3 |

**GE7071 DISASTER MANAGEMENT L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

**UNIT I INTRODUCTION TO DISASTERS 9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

**UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

**UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and

Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

**UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

**UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Differentiate the types of disasters, causes and their impact on environment and society |
| **CO2** | Assess vulnerability and various methods of risk reduction measures as well as mitigation. |
| **CO3** | Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management. |

**TEXTBOOKS:**


1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.


**REFERENCES:**


1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.




**GE7074 HUMAN RIGHTS L T P C**
**3 0 0 3**

**OBJECTIVES :**

- To sensitize the Engineering students to various aspects of Human Rights.

**UNIT I 9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

**UNIT II 9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.



**UNIT III 9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

**UNIT IV** **9**

Human Rights in India – Constitutional Provisions / Guarantees.

**UNIT V** **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Engineering students will acquire the basic knowledge of human rights. |

**REFERENCES:**


1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi


**GE7351 ENGINEERING ETHICS AND HUMAN VALUES** **L T P C**
**3 0 0 3**

**OBJECTIVES**

- To emphasise into awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.

**UNIT I HUMAN VALUES** **3**

Morals, Values and Ethics – Integrity – Work Ethic – Honesty – Courage –Empathy – Self-Confidence – Discrimination- Character.

**UNIT II ENGINEERING ETHICS** **9**

Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest –Professional Ideals and Virtues - uses of ethical theories. Valuing Time – Co-operation – Commitment.

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION** **9**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics – Importance of Industrial Standards - a balanced outlook on law – anticorruption- occupational crime -the challenger case study.

**UNIT IV ENGINEER'S RIGHTS AND RESPONSIBILITIES ON SAFETY** **12**

Collegiality and loyalty – Respect for authority – Collective Bargaining – Confidentiality- Conflict of interest – Occupational Crime – Professional Rights – IPR- Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island, Bhopal Gas plant and Chernobyl as case studies.

**UNIT V GLOBAL ISSUES**
**12** **1**

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-Sample code of conduct.

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Students will have the ability to perform with professionalism, understand their rights, legal, ethical issues and their responsibilities as it pertains to engineering profession with engaging in life-long learning with knowledge of contemporary issues. |

**TEXTBOOKS**


1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill, New York 2005.
2. Charles E Harris, Michael S. Pritchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Wadsworth Thomson Learning, United States, 2000 (Indian
3. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.


**REFERENCES**


1. Charles D. Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2004
2. Charles E Harris, Michael S. Pritchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Wadsworth Thomson Learning, United States, 2000
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford Press , 2000
5. R. Subramanian , “Professional Ethics “,Oxford University Press ,Reprint ,2015.


**GI7009 CARTOGRAPHY L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To introduce Cartography as science and technology of Map making.
- The course also introduces its connections with Communication Science, Computer technology and IT.
- To outline the Cartography as a creative art.

**UNIT I MAP – A SPECIAL GRAPHIC COMMUNICATOR 6**

Maps, their functions and use – Definition of Cartography – Types of Maps – other cartographic products – map making steps – surveying and mapping – Role of IT and computers, RS, GIS and GPS– Map Scales and Contents –accuracy and errors- History of Cartography – Mapping organizations in India.

**UNIT II ABSTRATION OF EARTH AND MAP PROJECTION 12**

Concepts of sphere, ellipsoid and geoid - latitudes, longitudes and graticules –map projections – shape, distance, area and direction properties - role of aspect, development surface, secant and light source / view points – perspective and mathematical projections – Indian maps and projections – Map co-ordinate systems – UTM and UPS references – common projections and selections– projections for hemispheres and the world maps.

**UNIT III MAP COMPILATION AND DESIGN 9**

Base map concepts – scanning and digitization – planimetric, topographic and thematic information – sample and census surveys – attribute data tables – Elements of a map - Map Layout principles – Map Design fundamentals – symbols and conventional signs - graded and ungraded symbols - color theory - colours and patterns in symbolization – map lettering

**UNIT IV MAP MAKING 9**

Definition of chropleth , daysimetric and isopleth maps – class interval selection and shading – isopleth maps and interpolation strategies – located symbol maps – flow maps – cadestral and engineering maps – demographic and statistical mapping –sequential maps – map production – map

printing– colours and visualization – map reproduction – printing soft copies and standards.

**UNIT V MAP TRANSFORMATIONS 9**

Map generalization – attribute conversions and transforms – reduction and enlargement - fusions - geometric transformations – bilinear and affine transformations - hardware and software in map making – conversion to multimedia, internet and web objects - mobile maps– cartometry.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Be familiar with appropriate map projection and co-ordinate system for production of maps. |
| **CO2** | Be able compile and design maps for the required purpose. |
| **CO3** | Be familiar with co-ordinate and datum transformations. |

**TEXTBOOKS:**


1. R. W. Anson and F. J. Ormeling, Basic Cartography for students and Technicians. Vol. I, II and III, Elsevier Applied Science Publishers, 3rd Edition, 2004.
2. Arthur, H. Robinson , Joel L. Morrison , Phillip C. Muehrcke, A. Jon Kimerling, Stephen C. Guptill Elements of Cartography, Sixth Edition, John Wiley and Sons, 2009.
3. Gretchen N.Peterson, GIS Cartography : A Guide to effective Map design, second edition, CRC press Taylor & Trancis group, 2014.


**REFERENCES:**


1. John Campbell, introductory Cartography, Wm. C. Brown Publishers, Third Edition, 2004.
2. Menno Jan Kraak & Ferjan Ormeling, Cartography Visualization of Geospatial Data, Second Edition, Pearson Education, 2004
3. Geographic Visualization, Martin Dodge, Marrs Mc derby & Martin Turner. John wiley & srena, west sin sex, England, 2008
4. Thematic Cartography and Geovisualisation 3rd edition by Terry A slocum, Robert B Mc Master, fritz C Kessler, Hugh H Howard, Prentice Hall, 2013.


**GE7072 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT**

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

**OBJECTIVES:**

- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

**UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT 9**

Attested

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**Global Trends Analysis and Product decision -** Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends **- Introduction to Product Development Methodologies and Management -** Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies **-** Product Life Cycle – Product Development Planning and Management.

**UNIT II REQUIREMENTS AND SYSTEM DESIGN 9**

**Requirement Engineering -** Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - **System Design & Modeling -** Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

**UNIT III DESIGN AND TESTING 9**

**Conceptualization -** Industrial Design and User Interface Design - Introduction to Concept generation Techniques – **Challenges in Integration of Engineering Disciplines** - Concept Screening & Evaluation - **Detailed Design -** Component Design and Verification – **Mechanical, Electronics and Software Subsystems** - High Level Design/Low Level Design of S/W Program **-** Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – **Prototyping -** Introduction to Rapid Prototyping and Rapid Manufacturing - **System Integration, Testing, Certification and Documentation**

**UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT 9**

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - **Sustenance -**Maintenance and Repair – Enhancements - **Product EoL -** Obsolescence Management – Configuration Management - EoL Disposal

**UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY 9**

**The Industry -** Engineering Services Industry - Product Development in Industry versus Academia –**The IPD Essentials -** Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

| | |
|---|---|
| **CO1** | Define, formulate and analyze a problem |
| **CO2** | Solve specific problems independently or as part of a team |
| **CO3** | Gain knowledge of the Innovation & Product Development process in the Business Context |
| **CO4** | Work independently as well as in teams |
| **CO5** | Manage |

**TEXTBOOKS:**


1. Book specially prepared by NASSCOM as per the MoU.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.


**REFERENCES:**


1. Hiriyappa B, “Corporate Strategy – Managing the Business”, Author House, 2013.
2. Peter F Drucker, “People and Performance”, Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, “Enterprise Resource Planning – Concepts”, Second Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013


Attested



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