KOLHAPUR INSTITUTE
OF TECHNOLOGY'S
COLLEGE OF
ENGINEERING
(AUTONOMOUS),
KOLHAPUR

# Structure for

# B.Tech in

# Civil and Environmental Engineering

## (To be Implemented w.e.f. Academic Year 2022-23)

**Department of Civil and Environmental Engineering**

**Kolhapur Institute of Technology's**
**College of Engineering (Autonomous), Kolhapur,**
**Maharashtra, INDIA**

Received 08/09/2022

Dept. of Civil & Environmental Engg.

08/09/2022

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College of Engineering (Autonomous)
Kolhapur

KOLHAPUR INSTITUTE OF TECHNOLOGY'S
COLLEGE OF ENGINEERING
(AUTONOMOUS),
KOLHAPUR

**Draft Syllabus for**

# T. Y. B. Tech in
# Civil and Environmental Engineering

**(To be implemented from the Academic Year 2022-23)**

## Department of Civil and Environmental Engineering

**Kolhapur Institute of Technology's**
**College of Engineering (Autonomous), Kolhapur,**
**Maharashtra, INDIA**

**Kolhapur Institute of Technology's**
**College of Engineering (Autonomous), Kolhapur**
**DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING**

## VISION AND MISSION OF INSTITUTE

**VISION:**

- To be the Centre of Excellence in technical education and preferred choice of Faculty, Students, Industry and Society.

**MISSION:**

- To empower the faculty, staff and aspiring Engineers with essential technical knowledge and skills.
- To develop competence towards serving the ever changing needs of industry and society.
- To inculcate social and ethical values amongst the Students and Employees.
- To strengthen collaborative Research and Consulting Environment with industry and other institutions.

## VISION AND MISSION OF DEPARTMENT

**VISION**

- To develop as a center of excellence in Civil and Environmental Engineering Education.

**MISSION**

- To impart essential technical knowledge, skills and Environmental ethics.
- To develop professional capabilities to meet changing societal and industrial needs.
- To build up base for Research and Consultancy activities.

## PROGRAM EDUCATION OBJECTIVES (PEOs)

**PEO 1:** Solve Civil and Environmental Engineering problems and pursue higher studies using solid foundation in mathematics, science and technology.

**PEO2:** Design, execute and operate various Civil and Environmental Systems in related fields through participative education.

**PEO3:** Develop skills to communicate effectively and work in a team in multidisciplinary areas.

**PEO4:** Respond to the challenges of issues of Civil and Environmental Engineering through research and development.

## PROGRAM OUTCOMES (POs)

Civil and Environmental Engineering Graduates will be able to:

1. Apply the knowledge of mathematics, Science and Engineering fundamentals for solution of problems of Civil and Environmental Engineering.
2. Identify, formulate, review research literature and analyze Civil and Environmental Engineering problems using fundamentals of mathematics, sciences and engineering.
3. Develop solutions for Civil and Environmental Engineering problems and design system components and processes to meet the specified needs with appropriate consideration for the public health and safety.
4. Make use of their knowledge to interpret the data by experimental analysis to provide valid conclusions.
5. Select and apply various engineering and IT tools and models to solve Civil and Environmental Engineering problems.
6. Assess societal, health, safety and legal issues by applying Civil and Environmental Engineering knowledge.
7. Assess the impact of Civil and Environmental Engineering solutions in Societal and Environmental context for Sustainable Development.
8. Practice ethical principles to fulfill responsibilities as Civil and Environmental Engineer**.**
9. Function effectively as an individual, and as member or leader in multidisciplinary areas.
10. Discuss effectively issues of Civil and Environmental Engineering and solutions through written and oral presentations to engineering communities and society.
11. Demonstrate knowledge and understanding of the engineering and management principles to manage Civil and Environmental Engineering projects.
12. Practice the need of lifelong learning through updating technical knowledge in the context of technological change.

## PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Identify and analyze the pollution related problems generated due to urbanization and industrialization.
2. Interpret the data using various tools and techniques to provide effective and applicable solutions.

**Kolhapur Institute of Technology's**
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**DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING**

## MAPPING OF PROGRAM OUTCOMES TO PROGRAM EDUCATION OBJECTIVES

| PEO | PO | | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** |
| **PEO 1** | 3 | 1 | 2 | | | 1 | | 1 | | | 1 | 2 | 1 | 3 |
| **PEO 2** | 2 | 1 | 3 | 2 | 1 | 2 | 1 | 1 | | | | | 2 | 3 |
| **PEO 3** | | | | | | | | | 2 | 3 | 2 | | | 2 |
| **PEO 4** | 2 | 3 | 2 | | | | 2 | | | | | 2 | 1 | 3 |

**Kolhapur Institute of Technology's**
**College of Engineering (Autonomous), Kolhapur**
Teaching and Evaluation scheme for

## Second Year B. Tech. Program in Civil and Environmental Engineering Semester-III

| Course Code | Course Name | Curriculum Component | Hours/Week | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Credits | Component | Marks | | |
| | | | | | | | | Max | Min for passing | |
| UCEE0301 | Applied Mathematics | BS | 3 | 1 | - | **4** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0302 | Surveying | PC | 3 | - | - | **3** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0303 | Fluid Mechanics | PC | 3 | - | - | **3** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0304 | Solid Mechanics | PC | 4 | - | - | **4** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0305 | Building Materials and Concrete Technology | PC | 3 | - | - | **3** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0361 | Audit Course I: Environmental Studies | BS | 2 | - | - | - | ESE | 100 | 40 | 40 |
| UCEE0331 | Surveying Laboratory | PC | - | - | 2 | **1** | ISE | 50 | 20 | |
| | | | | | | | ESE(OE) | 50 | 20 | |
| UCEE0332 | Fluid Mechanics Laboratory | PC | - | - | 2 | **1** | ISE | 25 | 10 | |
| | | | | | | | ESE(OE) | 25 | 10 | |
| UCEE0333 | Strength of Materials Laboratory | PC | - | - | 2 | **1** | ISE | 50 | 20 | |
| UCEE0334 | Concrete Technology Laboratory | PC | - | - | 2 | **1** | ISE | 25 | 10 | |
| | | | | | | | ESE(OE) | 25 | 10 | |
| UCEE0335 | Building Drawing Laboratory | PC | - | - | 2 | **1** | ISE | 50 | 20 | |
| | | | **18** | **1** | **10** | **22** | **500 + 300 = 800 + Audit Course** | | | |

**Total Credits - 22, Total Contact hours – 29**

**Kolhapur Institute of Technology's**
**College of Engineering (Autonomous), Kolhapur**
Teaching and Evaluation scheme for

## Second Year B. Tech. Program in Civil and Environmental Engineering Semester - IV

| Course Code | Course Name | Curriculum Component | Hours/Week | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Credits | Component | Marks | | |
| | | | | | | | | Max | Min for passing | |
| UCEE0401 | Environmental Chemistry and Microbiology | BS | 3 | - | - | **3** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0402 | Hydrology and Water Resources Engineering | PC | 3 | - | - | **3** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0403 | Structural Analysis | PC | 3 | - | - | **3** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE* | 50 | 20 | |
| UCEE0404 | Hydraulics | PC | 3 | - | - | **3** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE04** | Professional Elective I | PE | 3 | 1 | - | **4** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0462 | Audit Course II: Surveying and Geospatial Technology | PC | 2 | - | - | - | ESE | 100 | 40 | 40 |
| UCEE0431 | Environmental Chemistry and Microbiology Laboratory | BS | - | - | 2 | **1** | ISE | 25 | 10 | |
| | | | | | | | ESE (OE) | 25 | 10 | |
| UCEE0432 | Building Planning and Design Laboratory | PC | - | - | 4 | **2** | ISE | 50 | 20 | |
| | | | | | | | ESE (OE) | 50 | 20 | |
| UCEE0433 | Open Channel Hydraulics Laboratory | PC | - | - | 2 | **1** | ISE | 25 | 10 | |
| | | | | | | | ESE (OE) | 25 | 10 | |
| UCEE0434 | Spreadsheets Laboratory | PC | - | - | 2 | **1** | ISE | 50 | 20 | |
| UCEE0435 | Geospatial Laboratory | PC | - | - | 2 | **1** | ISE | 50 | 20 | |
| | | | **17** | **1** | **12** | **22** | **500 + 300 = 800 + Audit Course** | | | |

**Total Credits - 22, Total Contact hours – 30**

| **Professional Elective – I** | |
|---|---|
| UCEE0421 | Ecology and Environmental Sanitation |
| UCEE0422 | Green Buildings |
| UCEE0423 | Construction Practices |

**Kolhapur Institute of Technology's**
**College of Engineering (Autonomous), Kolhapur**
Teaching and Evaluation scheme for

## Third Year B. Tech. Program in Civil and Environmental Engineering Semester - V

| Course Code | Course Name | Curriculum Component | Hrs/Week | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Credits | Component | Marks | | |
| | | | | | | | | Max | Min for passing | |
| UCEE0501 | Water Supply Engineering | PC | 3 | - | - | **3** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0502 | Highway and Traffic Engineering | PC | 3 | - | - | **3** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0503 | Solid and Hazardous Waste Management | PC | 3 | - | - | **3** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0504 | Geotechnical Engineering | PC | 3 | 1 | - | **4** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE05** | Professional Elective II | PE | 3 | 1 | - | **4** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0563 | Audit Course III: Engineering Management and Economics | HS | 2 | - | - | - | ESE | 100 | 40 | 40 |
| UCEE0531 | Water Treatment Laboratory | PC | - | - | 2 | **1** | ISE | 50 | 20 | |
| | | | | | | | ESE (OE) | 50 | 20 | |
| UCEE0532 | Transportation Engineering Laboratory | PC | - | - | 2 | **1** | ISE | 25 | 10 | |
| | | | | | | | ESE (OE) | 25 | 10 | |
| UCEE0533 | Geotechnical Engineering Laboratory | PC | - | - | 2 | **1** | ISE | 25 | 10 | |
| | | | | | | | ESE (OE) | 25 | 10 | |
| UCEE0534 | Solid Waste Analysis Laboratory | PC | - | - | 2 | **1** | ISE | 50 | 20 | |
| UCEE0541 | Mini Project | MC | - | - | 2 | **1** | ISE | 50 | 20 | |
| | | | **17** | **2** | **10** | **22** | **500 + 300 = 800 + Audit Course** | | | |

**Total Credits - 22, Total Contact hours – 29**

| **Professional Elective – II** | |
|---|---|
| UCEE0521 | Renewable Energy Resources |
| UCEE0522 | Irrigation and Hydraulic Structures |
| UCEE0523 | Noise Pollution and Control |
| UCEE0524 | Design of Steel Structures |

**Kolhapur Institute of Technology's**
**College of Engineering (Autonomous), Kolhapur**
Teaching and Evaluation scheme for

## Third Year B. Tech. Program in Civil and Environmental Engineering Semester - VI

| Course Code | Course Name | Curriculum Component | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Credits | Components | Marks | | |
| | | | | | | | | Max | Min for passing | |
| UCEE0601 | Wastewater Engineering | PC | 3 | - | - | **3** | ISE-I | 10 | | 40 |
| | | | | | | | ISE-II | 10 | | |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0602 | Air Pollution and Control | PC | 3 | - | - | **3** | ISE-I | 10 | | 40 |
| | | | | | | | ISE-II | 10 | | |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0603 | Design of Concrete Structures | PC | 4 | - | - | **4** | ISE-I | 10 | | 40 |
| | | | | | | | ISE-II | 10 | | |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE06** | Professional Elective III | PE | 3 | 1 | - | **4** | ISE-I | 10 | | 40 |
| | | | | | | | ISE-II | 10 | | |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ESE | 50 | 20 | |
| UOEL06** | Open Elective I | OE | 3 | - | - | **3** | ISE-I | 10 | | 40 |
| | | | | | | | ISE-II | 10 | | |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0664 | Audit Course IV: Transportation Infrastructure | PC | 2 | - | - | **-** | ESE | 100 | 40 | 40 |
| UCEE0631 | Wastewater Engineering Laboratory | PC | - | - | 2 | **1** | ISE | 50 | 20 | |
| | | | | | | | ESE (OE) | 50 | 20 | |
| UCEE0632 | Air Pollution and Control Laboratory | PC | - | - | 2 | **1** | ISE | 25 | 10 | |
| | | | | | | | ESE (OE) | 25 | 10 | |
| UCEE0633 | Design of Concrete Structures Laboratory | PC | - | - | 2 | **1** | ISE | 50 | 20 | |
| UCEE0634 | Design and Drawing of Environmental Systems | PC | - | - | 4 | **2** | ISE | 50 | 20 | |
| | | | | | | | ESE (OE) | 50 | 20 | |
| | | | **18** | **1** | **10** | **22** | **500 + 300 = 800 + Audit Course** | | | |

**Total Credits - 22, Total Contact hours – 29**

| **Professional Elective – III** | | **Open Elective I** | |
|---|---|---|---|
| UCEE0621 | Environmental Geotechnology | UOEL0631 | Environmental Laws and Policies |
| UCEE0622 | Optimization Techniques | UOEL0632 | Occupational Safety and Health |
| UCEE0623 | Operation and Maintenance of Environmental Facilities | UOEL0633 | Water Conservation and Management |

**Kolhapur Institute of Technology's**
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Teaching and Evaluation scheme for

## Final Year B. Tech. Program in Civil and Environmental Engineering Semester-VII

| Course Code | Course Name | Curriculum Component | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Credits | Components | Marks | | |
| | | | | | | | | Max | Min for passing | |
| UCEE0701 | Environment, Health and Safety | PC | 3 | - | - | **3** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0702 | Advanced Water and Wastewater Treatment | PC | 3 | 1 | - | **4** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0703 | Quantity Surveying and Valuation | PC | 3 | - | - | **3** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE * | 50 | 20 | |
| UCEE0704 | Environmental Impact Assessment and Environmental Legislation | PC | 3 | - | - | **3** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UOEL07** | Open Elective II | OE | 3 | - | - | **3** | ISE I | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| UCEE0765 | Audit Course V: Foundation Engineering | PC | 2 | - | - | - | ESE | 100 | 40 | 40 |
| UCEE0731 | Treatability Studies Laboratory | PC | - | - | 2 | **1** | ISE | 50 | 20 | |
| | | | | | | | ESE (OE) | 50 | 20 | |
| UCEE0732 | Quantity Surveying and Valuation Laboratory | PC | - | - | 2 | **1** | ISE | 50 | 20 | |
| | | | | | | | ESE (OE) | 50 | 20 | |
| UCEE0741 | Seminar | MC | - | - | 2 | **1** | ISE | 50 | 20 | |
| UCEE0751 | Project Phase I | MC | - | - | 2 | **1** | ISE | 50 | 20 | |
| | | | **17** | **1** | **08** | **20** | **500 + 300 = 800 + Audit Course** | | | |

**Total Credits – 20, Total Contact hours – 26**

| Sr. No. | Open Elective II |
|---|---|
| UOEL0731 | Disaster Management and Risk Analysis |
| UOEL0732 | Waste Management |

**Kolhapur Institute of Technology's**
**College of Engineering (Autonomous), Kolhapur**
Teaching and Evaluation scheme for

## Final Year B. Tech. Program in Civil and Environmental Engineering Semester-VIII

| Course Code | Course Name | Curriculum Component | Teaching Scheme | | | | Evaluation Scheme | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Credits | Components | Marks | |
| | | | | | | | | Max | Min for passing |
| UCEE0852 | Internship and Project Phase II | MC | - | - | 12 | **6** | ISE I | 75 | 30 |
| | | | | | | | ISE II | 75 | 30 |
| | | | | | | | ESE (OE) | 150 | 60 |
| UCEE08** | Professional Elective IV | PE | 3 | - | - | **3** | ISE-I | 10 | 20 |
| | | | | | | | ISE-II | 10 | |
| | | | | | | | MSE | 30 | |
| | | | | | | | ESE | 50 | 20 |
| UCEE08** | Professional Elective V | PE | 3 | - | - | **3** | ISE-I | 10 | 20 |
| | | | | | | | ISE-II | 10 | |
| | | | | | | | MSE | 30 | |
| | | | | | | | ESE | 50 | 20 |
| | | | **6** | **-** | **12** | **12** | **300 + 100 + 100 = 500** | | |

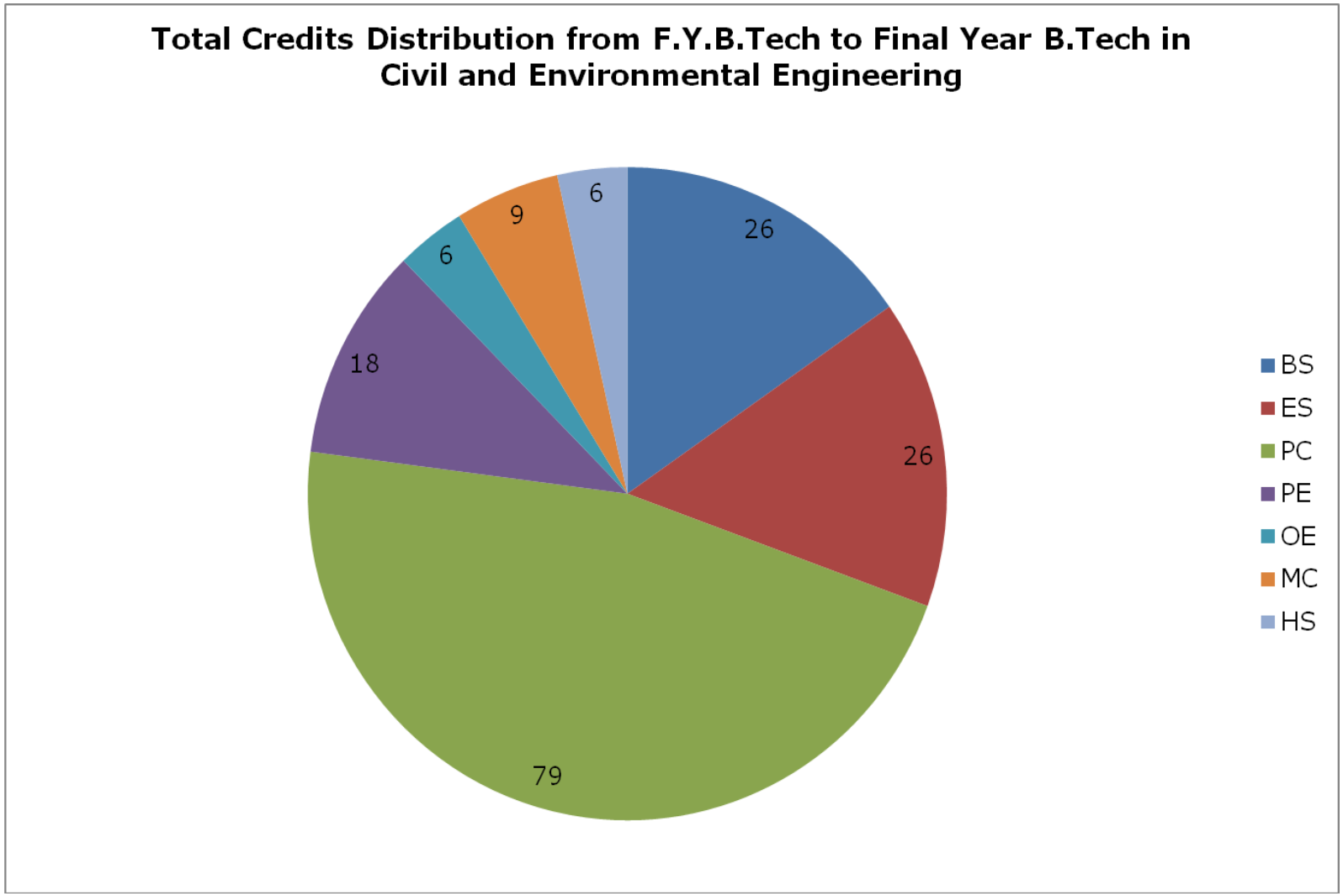
**Total Credits - 12, Total Contact hours – 18**

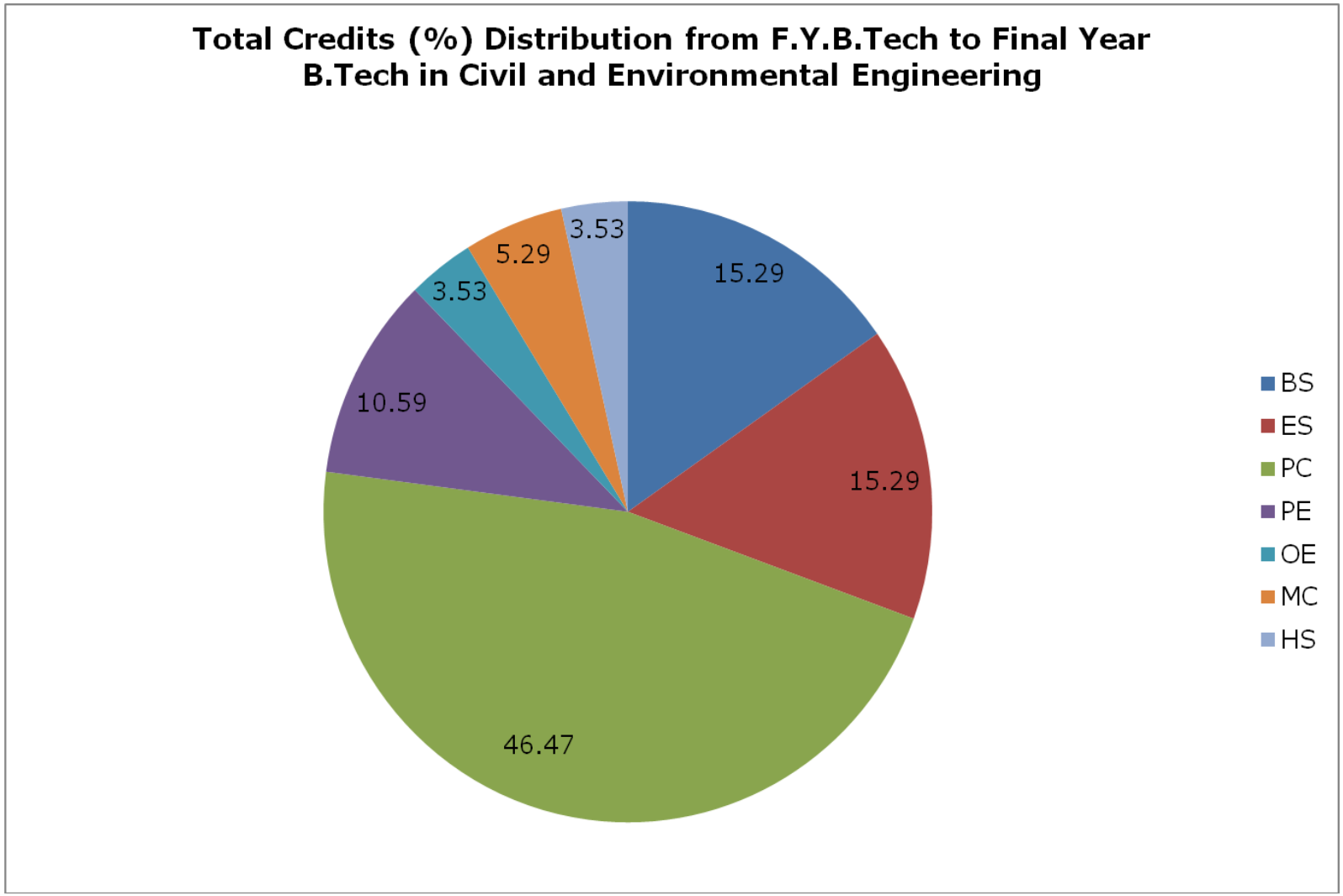
| **Professional Elective – IV** | | **Professional Elective – V** | |
|---|---|---|---|
| UCEE0821 | Industrial Wastewater Treatment | UCEE0824 | Environmental Management System |
| UCEE0822 | Project Management | UCEE0825 | Advanced Construction Technology |
| UCEE0823 | Urban Infrastructure and Smart Cities | UCEE0826 | Environmental Sustainability |

**Kolhapur Institute of Technology's**
**College of Engineering (Autonomous), Kolhapur**
**B. Tech. Program in Civil and Environmental Engineering**

## Total Credits Distribution from F.Y.B.Tech to Final Year B.Tech in Civil and Environmental Engineering

| Component | F.Y.B.Tech | | S.Y.B.Tech | | T.Y.B.Tech | | Final Year B.Tech | | Total | % age |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sem I | Sem II | Sem III | Sem IV | Sem V | Sem VI | Sem VII | Sem VIII | | |
| Basic Sciences (BS) | 9 | 9 | 4 | 4 | - | - | - | - | 26 | 15.29 |
| Engineering Sciences (ES) | 13 | 13 | - | - | - | - | - | - | 26 | 15.29 |
| Program Core (PC) | - | - | 18 | 14 | 17 | 15 | 15 | - | 79 | 46.47 |
| Professional Elective (PE) | - | - | - | 4 | 4 | 4 | - | 6 | 18 | 10.59 |
| Open Elective (OE) | - | - | - | - | - | 3 | 3 | - | 6 | 3.53 |
| Mandatory Course (MC) | - | - | - | - | 1 | - | 2 | 6 | 9 | 5.29 |
| Humanities (HS) | 3 | 3 | - | - | - | - | - | - | 6 | 3.53 |
| **Total** | **25** | **25** | **22** | **22** | **22** | **22** | **20** | **12** | **170** | **100** |


Total Credits Distribution from F.Y.B.Tech to Final Year B.Tech in Civil and Environmental Engineering
26
26
79
18
6
9
6
BS
ES
PC
PE
OE
MC
HS


Total Credits (%) Distribution from F.Y.B.Tech to Final Year B.Tech in Civil and Environmental Engineering
15.29
15.29
46.47
10.59
3.53
5.29
3.53
BS
ES
PC
PE
OE
MC
HS

# SYLLABUS

# T. Y. B. Tech

# Civil and Environmental Engineering

# SEMESTER - V

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Water Supply Engineering<br>**Course Code:** UCEE0501 | **L** | **T** | **P** | **Credits** |
|---|---|---|---|---|
| | **3** | **-** | **-** | **3** |

**Course Pre-Requisite:**

Students shall have knowledge of:

- Environmental chemistry and microbiology
- Hydraulics and water resource engineering

**Course Description:**

This course teaches the fundamentals and design concepts of water supply systems and water treatment plants, as well as the processes involved with their operation. Topics covered include water supply systems, water quality issues, and water treatment processes and systems. After completing this course students will be able to design water collection systems and water treatment plants.

**Course Learning Objectives:**

During this course students will

1. Know sources and characteristic of raw water, quantity and quality of water for drinking purpose.
2. Understand concepts of collection and conveyance of water from source.
3. Acquire an understanding of the fundamental concepts and detailed technical knowledge of the technologies required for water treatment.

**Course Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | **Bloom's Descriptor** |
|---|---|---|
| CO1 | Explain the significance of characteristics of water for drinking purpose and drinking water quality standards. | Cognitive (Understanding) L 2 |
| CO2 | Outline the requirements of raw water abstraction and supply of treated water. | Cognitive (Understanding) L 2 |
| CO3 | Explain the mechanism of different treatment processes in water treatment. | Cognitive (Evaluating) L 5 |
| CO4 | Design the raw water abstraction, transport and conventional treatment units. | Cognitive (Creating) L 6 |

**CO-PO Mapping:**

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

| **CO** | **PSO1** | **PSO2** |
|---|---|---|
| **CO1** | | |
| **CO2** | | |
| **CO3** | | |
| **CO4** | | 2 |

**Assessments:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE-1 | 10 |
| MSE | 30 |
| ISE-2 | 10 |
| ESE | 50 |

- **ISE-1 and ISE-2:** Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions etc. (For each ISE two different tools are to be used).
- **MSE:** Assessment is based on 50% of course content (Normally first three Units)

- **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Unit 1 :**<br>Quantity of water, population forecasting, rate of consumption for various purposes, factors affecting consumption, fluctuation in demand, quality of water - surface water, ground water, drinking water quality standards (IS10500), physical; chemical and bacteriological characteristics of water. | **6 Hrs.** |
| **Unit 2 :**<br>Intake works-types, design of rising main, location and design of jack well and pump house, economic size of rising main, objectives and necessity of treatment, study of flow sheet for different sources of water. | **6 Hrs.** |
| **Unit 3 :**<br>Aeration, two film theory of gas transfer, types of aerators, theory of coagulation and flocculation, rapid mix and slow mix units, design of flash mixer, design of mechanical flocculator, types of settling, design of sedimentation tank. | **8 Hrs.** |
| **Unit 4 :**<br>Filtration process, classification of filters, design of rapid sand filter, introduction to multimedia filters and pressure filters, Mechanism of Disinfection, Physical & chemical disinfectants, factors affecting disinfection, Characteristics of good disinfectant, chlorination- types, break point chlorination, introduction to UV and ozone disinfection. | **8 Hrs.** |
| **Unit 5:**<br>Water softening: Lime soda process, recarbonation, ion exchange process, Removal of colour, taste and odour, iron and manganese, fluoridation and defluoridation. | **6 Hrs.** |
| **Unit 6:**<br>House connection from mains, different valves, meters and hydrants, storage reservoirs, balancing reservoir, detection and prevention of leaks in the distribution systems, maintenance of distribution systems, design of water distribution network. | **6 Hrs.** |

**Textbooks:**

1. Mark J. Hammer & Mark J. Hammer Jr., Water and Waste Water Technology, Prentice Hall of India Pvt. Ltd., 1998, New Delhi.
2. Water Supply & Sanitary Engineering by by Birdie G. S., Birdie J. S., Dhanpatrai Publishing Company.

**References:**


1. Manual of Water Supply and Treatment (3rd ed)- Ministry of Urban Development, New Delhi, 1991.Water Quality and Treatment Handbook -American Water Works Association, McGraw-Hill Pub. 1999.
2. Fair, Geyer & Okun, Water & Waste Water Engineering, John Wiley, 1966, New York.
3. Ernest W. Steel & Terence J. Mc Ghee, Water Supply & Sewage, McGraw Hill, 1990, New York.
4. Physico Chemical Processes for Water Quality Control – Walter J. Weber Jr. Wiley
5. Water Supply Engineering by by Dr. B. C. Punmia, Er. Ashok Kr. Jain, Dr.Arun Kumar Jain

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Highway and Traffic Engineering.<br>**Course Code:** UCEE0502 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | **3** | **-** | **-** | **3** |

**Course Pre-Requisite:**

Students shall have the knowledge of:

- Engineering Mathematics
- Basic Civil Engineering
- Surveying
- Building Materials and Concrete Technology

**Course Description:**

This course will help the students to understand design of Horizontal and Vertical Curves. Types and function of pavement design, stresses in highway pavement, Joints in Pavement. Also this course will helps student to analyze traffic patterns and understand the importance of different traffic management systems.

**Course Learning Objectives:**

1. To provides a basic knowledge on Urbanization and its trend. Necessity, scope and principles of town planning
2. To design various geometrical parameters for road construction.
3. To expose to the various aspects of planning and designing of transportation system.
4. To identify the input parameters required for design of a bridge structures.

**Course Outcomes:**

| **COs** | **After the completion of the course the students will be able to** | **Bloom's Cognitive Descriptor** |
|---|---|---|
| CO.1 | Recall about the history of highway development, classification of roads Highway Construction. | Cognitive (knowledge) L1 |
| CO.2 | Design features such as Super-elevation, Sight distance section of road in Cutting and filling. | Cognitive (knowledge) L1 |
| CO.3 | Understand importance of traffic management systems. | Cognitive (Understanding) L2 |
| CO.4 | Design drainage systems for road infrastructure. | Cognitive (Applying) L3 |

**CO-PO Mapping:**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO.1 | | | 1 | | | 1 | | 1 | | | | |
| CO.2 | 3 | 2 | 1 | | | | | | | | | |
| CO.3 | | | | 1 | 2 | 1 | | | | | 1 | |
| CO.4 | 2 | 2 | | | | 1 | | | | | | |

| **COs** | **PSO1** | **PSO2** |
|---|---|---|
| CO.1 | | |
| CO.2 | | |
| CO.3 | 1 | 1 |
| CO.4 | | |

**Assessments:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

- **ISE-1 and ISE-2:** Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions etc. (For each ISE two different tools are to be used).
- **MSE:** Assessment is based on 50% of course content (Normally first three Units)

| | |
|---|---|
| • **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE. | |
| **Course Contents:** | |
| **Unit :1 Highway Planning**<br>Highway Planning-Classification of roads, brief history of road development in India, present status of roads in India. NHAI, NHDP, PMGSY, MSRDC as per IRC. | **05 Hrs.** |
| **Unit :2 Geometric design of Highways**<br>Geometric design of Highways-Terrain classification, design speed, vehicular characteristics, highway cross-section elements<br>Sight distance: introduction to sight distance, reaction time, analysis of safe sight distance, analysis of overtaking sight distance, intersection sight distance.<br>Design of horizontal alignment: horizontal curves, design of super elevation and its provision, radius at horizontal curves, widening of pavements at horizontal curves, analysis of transition curves.<br>Design of vertical alignment: different types of gradients, grade compensation on curves, analysis of vertical curves, summit curves, valley curves | **08 Hrs.** |
| **Unit :3 Pavement materials**<br>Stone aggregates: desirable properties, tests, requirements of aggregates for different types of pavements as per IRC.<br>Bituminous materials: types, tests on bitumen, desirable properties as per IRC, selection of grade of bitumen. Bituminous mix design: principle, methods, modified binders.<br>Sustainable Materials: - Application of sustainable materials in road construction, Examples, It's advantages and disadvantages. | **07 Hrs.** |
| **Unit :4 Highway Drainage**<br>Highway Drainage: Significance and requirements, Surface drainage system and Design Examples, subsurface drainage system, design of filter materials, Types of cross drainage Structures, their choice and location. | **07 Hrs.** |
| **Unit :5 Traffic engineering**<br>Traffic engineering- Introduction, Traffic scenario in India, traffic characteristics: Vehicular characteristics and user characteristics, importance of traffic characteristics. Traffic Studies:- Importance, Volume study, Speed study, Spot speed study, Accident study etc. | **07 Hrs.** |
| **Unit :6 Intelligent Transport System**<br>Intelligent Transport System: Necessity, importance, basic Principle, components, terms used.<br>Advanced transport management systems, Service in ITS, Critical issues, Application in Indian Context. | **06 Hrs.** |
| **Textbooks:**<br>1. L R Kadiyali ― Highway Engineering, Khanna Publishers, New Delhi. Town and country Planning- N.K. Gandhi<br>2. Khanna and Justo - Highway Engineering, Nemchand and Bros., Roorkee. | |
| **References:**<br>1. Khanna and CEG Justo, ―Highway Engineering, Nemchand Bros, Roorkee.<br>2. S.K. Sharma, Highway Engineering<br>3. Partha Chakraborty and Animesh das, Principles of Transportation Engineering, Prentice Hall,<br>4. IRC code. | |

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Solid and Hazardous Waste Management<br>**Course Code:** UCEE0503 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | **3** | **-** | **-** | **3** |

**Course Pre-Requisite:**
Environmental Chemistry

**Course Description:**

Problems associated with solid waste management (SWM) in today's society are very complicate because of the quantity and varied nature of wastes. As a result, if SWM is to achieve a skillful approach, the fundamentals aspects need to be identified. Thus, there is need to study the activities from the generation to the disposal point. The six functional elements (generation, handing and separations, storage and processing at source, collection, the transformation of wastes, transfer and transport, and final disposal) for the engineering comparison and treatment need to be understood in detail. The understanding of the functional element is important because it helps in evaluating the impacts of projected changes and technological developments. Solid waste management is an essential part of every society, but it is also one of the most neglected one. Detailed understanding of the subject is required to tackle the current solid waste management problems effectively. This course attempts to teach various steps involved in solid waste management.

**Course Learning Objectives:**

1. To explain functional elements of SWM, generation rate and characteristics of solid waste.
2. To elaborate appropriate treatment and disposal option for solid waste.
3. To explain sources, characteristics, treatment and disposal options of hazardous waste.
4. To know the environmental legislations for SWM, Hazardous waste management etc.

**Course Outcomes:**

| **COs** | **After the completion of the course the students will be able to** | **Bloom's Cognitive Descriptor** |
|---|---|---|
| CO.1 | Identify sources and types of municipal solid waste and hazardous waste. | Cognitive (Remembering) L1 |
| CO.2 | Explain characteristics of municipal solid waste and hazardous waste. | Cognitive (Understanding) L2 |
| CO.3 | Discuss various environmental legislations for safe disposal of solid and hazardous waste. | Cognitive (Understanding) L2 |
| CO.4 | Choose proper waste handling, separation, storage, processing and disposal methods for municipal solid waste and hazardous waste. | Cognitive (Applying) L3 |

**CO-PO Mapping:**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO.1 | - | - | - | - | - | - | 3 | - | 3 | 2 | - | 2 |
| CO.2 | - | - | - | 3 | - | - | - | - | - | - | - | - |
| CO.3 | - | - | - | 2 | - | 2 | - | - | - | - | - | - |
| CO.4 | - | - | - | - | - | 3 | - | - | 2 | 2 | - | 2 |

| **COs** | **PSO1** | **PSO2** |
|---|---|---|
| CO.1 | 2 | - |
| CO.2 | - | 2 |
| CO.3 | 2 | - |
| CO.4 | - | 2 |

**Assessments:**

| Assessment | Weightage (Marks) |
|---|---|
| ISE-1 | 10 |
| MSE | 30 |
| ISE-2 | 10 |
| ESE | 50 |

- **ISE-1 and ISE-2:** Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions etc. (For each ISE two different tools are to be used).
- **MSE:** Assessment is based on 50% of course content (Normally first three Units)
- **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Unit 1:**<br>**Evolution of Solid Waste Management:** Types and classification of wastes, Industrial waste, Municipal solid waste, Waste sources and generation rates, Traditional methods of waste collection and disposal, factors influencing waste generation and health hazards. | **06 Hrs.** |
| **Unit 2:**<br>**Sources/Types and Characteristics of Solid Waste:** Waste composition, Waste collection, Characterization of wastes, Waste processing: Size and volume reduction, Waste minimization, waste hierarchy and waste audit. | **06 Hrs.** |
| **Unit 3:**<br>**Waste Handling, Separation, storage, and Processing:** Handling, separation and storage at source, processing at source, primary collection, types of collection system, need and types of transfer station, transport means and methods, material recovery facilities (MRF), recycling and recovery of plastic. | **08 Hrs.** |
| **Unit 4:**<br>**Disposal of solid waste: a) Biological treatment:** Composting, Vermicomposting, Biogas production from solid waste.<br>**b) Thermal Treatment:** Incineration/ Combustion Flue gas characteristics and treatment, Solid residue generation, characterization and treatment.<br>**c) Sanitary Landfilling**: Site selection and types of landfill, leachate collection and treatment, landfill gas collection and treatment, | **06 Hrs.** |
| **Unit 5:**<br>**Hazardous waste:** Definition, sources, classification, collection and segregation.<br>Hazardous waste characterization, treatment and disposal.<br>Management of Radioactive waste, Bio-medical waste, and E-waste. | **08 Hrs.** |
| **Unit 6:**<br>**ISWM and legislation:** Integrated solid waste management (ISWM), Introduction to Circular Economy, Solid waste management rules 2016, Hazardous and other waste (management and transboundary movement) rules 2016, E- waste management rules 2016, Plastic waste management rules 2016, Bio-Medical Waste (Management and Handling) Rules,2016. | **06 Hrs.** |

**Textbooks:**

1. Solid Waste Management – Dr. A. D. Bhide
2. Hazardous Waste Management - Charles Wentz

**References:**

1. Integrated solid waste management - Tchobanoglous
2. Handbook and Solid Waste Disposal – George Tchobanoglous and Frank Kreith
3. Solid and Hazardous waste management- M. N. Rao
4. Solid and Hazardous waste management- S. Bhatia
5. CPHEEO Manual on Solid Waste Vol. I,II

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Geotechnical Engineering<br>**Course Code:** UCEE0504 | **L** | **T** | **P** | **Credits** |
|---|---|---|---|---|
| | **3** | **1** | **-** | **4** |

**Course Pre-Requisite:**

Students shall have knowledge of:

- Algebra and Engineering Mathematics
- Engineering Physics and Chemistry
- Engineering Mechanics
- Fluid Mechanics

**Course Description:**

The course imparts fundamental knowledge of geotechnical properties and their significance in Civil and Environmental Engineering. The subject covers; interpretation of index and engineering properties, their field relevance as well as estimation of stresses, development of earth pressure, analysis of stability of earth work. The basics and concepts of foundation designand settlement analysis are also dealt.

**Course Learning Objectives:**

1. To study various soil properties and its methods of determination.
2. To understand applications of soil properties in Civil and Environmental Engineering
3. To study parameters of soil for strength and stability.
4. To understand concepts of earth retaining structures.

**Course Outcomes:**

| **CO** | **After the completion of the course the will be able to** | **Bloom's Taxonomy** |
|---|---|---|
| | | **Cognitive Domain** |
| **CO1** | Explain soil properties and methods for its determination | Understanding L2 |
| **CO2** | Utilize soil properties for predicting soil performance. | Applying L3 |
| **CO3** | Analyze shear strength, earth pressure and slope stability. | Analyzing L4 |
| **CO4** | Evaluate suitability of earth retaining Structures. | Evaluating L5 |

**CO-PO Mapping:**

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

| **CO** | **PSO1** | **PSO2** |
|---|---|---|
| **CO1** | | - |
| **CO2** | | - |
| **CO3** | | 2 |
| **CO4** | | 2 |

**Assessments:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE-1 | 10 |
| MSE | 30 |
| ISE-2 | 10 |
| ESE | 50 |

- **ISE-1 and ISE-2:** Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions etc. (For each ISE two different tools are to be used).
- **MSE:** Assessment is based on 50% of course content (Normally first three Units)
- **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE.

| Course Contents: | |
|---|---|
| **Unit 1: Properties of Soil:**<br>Introduction to Geo-technology and its application areas, Formation of soil, Soil as three phase system, Weight- Volume relationships, Index and Engineering properties of soil, Determination of index properties and its significance, Soil classification and Soil structure. | **8 Hrs.** |
| **Unit 2: Soil hydraulics:**<br>Modes of occurrence of water in soil, Darcy's law and its validity, Coefficient of permeability and its determination methods, Factors affecting permeability, Permeability of layered soils. Seepage analysis: Quick sand condition, Uplift pressure, exit gradient, failure due to piping, Flow net - properties andapplications, Concept of effective, neutral and total stress in soil mass. | **6 Hrs.** |
| **Unit 3: Compaction and Consolidation:**<br>Compaction**:** Theory, Methods of compaction, Standard Proctor test and Modified Proctor test as per IS – 2720. Field compaction equipment's and methods, Field control of compaction, Factors affecting compaction.<br>Consolidation**:** Consolidation process - Spring analogy, e- log P curve, Terzaghi's theory of one dimensional consolidation, Lab consolidation test, Determination of coefficient of consolidation, Type of settlement, rate and time of settlement. | **6 Hrs.** |
| **Unit 4: Shear Strength and its measurement:**<br>Concept of shear, Principal plane and stresses, Mohr - Coulomb's theory and failureenvelope of types of soil, Total stress approach and effective stress approach,<br>Types of shear test – Direct (box) shear test, Triaxial compression test, Unconfined Compression test. Drainage conditions: Unconsolidated–Untrained(U-U), Consolidated –Un-drained (C-U) and Consolidated –Drained (C-D) | **7 Hrs.** |
| **Unit 5: Earth Pressure:**<br>Concept, earth pressure at rest, active and passive condition, Rankine's and Coulomb's theory of earth pressure, Estimation of earth pressure in differentconditions.<br>**Concept of slope stability:** Slope classification, slope failure modes, Infinite, Finite slope and analysis of stability, Taylor's stability number, slopeprotection measures. | **7 Hrs.** |
| **Unit 6: Earth Retaining Structures:**<br>Gravity Retaining Walls, Sheet Pile Walls, Cantilever Walls, Anchored Earth Structures, Embankment Slopes, Soil Nail Wall, Gabion Structure, Reinforcement Techniques | **6 Hrs.** |
| **TEXT BOOKS:**<br>1. Text book of soil mechanics in theory and practice‖ by Dr. Alam Singh (Asian Publishing House, Bombay)<br>2. Soil mechanics and Foundation engineering‖ by V. N. S. Murthy. (U. B. S. Publishers and distributors New Delhi | |
| **REFERENCE BOOKS:**<br>1 Soil mechanics and Foundation engineering‖ by B. S. Punmia. (A Saurabh and Company Pvt. Ltd., Madras)<br>2 Geotechnical Engineering‖ by P. Purushottam Raj. (Tata Mcgraw Hill Company Ltd. New Delhi)<br>3 Soil mechanics‖ by Terzaghi and Peak. (John Willey and Sons, New- York)<br>4 Soil Testing by T.W. Lambe. (Willey Eastern Ltd., New Delhi)<br>5 Geotechnical Engineering by Venkatramiah | |

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Professional Elective-II: Renewable Energy Resources<br>**Course Code.:** UCEE0521 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | **3** | **1** | **-** | **4** |

**Course Pre-Requisite:**

Students shall have the knowledge of:

- Engineering Physics and Chemistry

**Course Description:**

The course emphasizes on studying energy demand, energy crisis, types and potential of renewable energy sources, concepts and technology to harness, its applications and limitations

**Course Learning Objectives:**

1. To study energy needs, demand and various renewable alternatives.
2. To understand potential of renewable energy resources.
3. To study technologies to harness the energy.
4. To understand management of energy resources.

**Course Outcomes:**

| **COs** | **After the completion of the course the students will be able to** | **Bloom's Cognitive Descriptor** |
|---|---|---|
| CO.1 | Compare conventional and renewable energy resources | Cognitive (Understanding) L2 |
| CO.2 | Identify scope and potential of renewable energy. | Cognitive (Understanding) L2 |
| CO.3 | Select suitable renewable energy resource | Cognitive (Applying) L3 |
| CO.4 | Utilize energy management principles and strategies. | Cognitive (Applying) L3 |

**CO-PO Mapping:**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO.1 | 1 | 1 | | | | | | | | | | |
| CO.2 | 1 | 2 | | | | | 1 | | | | | |
| CO.3 | 2 | | 2 | | | | 2 | | | | | |
| CO.4 | 2 | | 2 | | | | 1 | | | | | |

| **COs** | **PSO1** | **PSO2** |
|---|---|---|
| CO.1 | 1 | |
| CO.2 | 2 | |
| CO.3 | | |
| CO.4 | | |

**Assessments:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE-1 | 10 |
| MSE | 30 |
| ISE-2 | 10 |
| ESE | 50 |

- **ISE-1 and ISE-2:** Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions etc. (For each ISE two different tools are to be used).
- **MSE:** Assessment is based on 50% of course content (Normally first three Units)

| | |
|---|---|
| • **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE. | |
| **Course Contents:** | |
| **Unit 1:**<br>**Introduction:** Types and Forms of Energy, Energy chains, Energy demand, Energy crisis Causes. Classification of energy sources, Global and Indian energy scenario, Impact of present Energy practices and rise in usage on Environment, Renewable energy resources, types and potential, Merits and obstacles in Renewable Energy. | **06 Hrs.** |
| **Unit 2:**<br>**Solar Energy:** Introduction, utilization methods, merits and demerits of solar energy utilization, potential of solar energy, solar radiation data for India, solar thermal collectors, concentrators and reflectors, collector efficiency, applications of solar energy, solar cooker, solar water heating, solar dryer, solar distillation, solar photovoltaic systems, solar pond. | **07 Hrs.** |
| **Unit 3:**<br>**Hydro Energy:** Introduction, India's Hydro reserves, merits and limitations, low head , medium head, high head schemes, hydro turbines, economics.<br>**Geothermal Energy:** Introduction, types of geothermal resources, potential of geothermal resources in India and world, Environmental problems in utilization of geothermal resources. | **07 Hrs.** |
| **Unit 4:**<br>**Wind Energy:** Introduction, potential and scope, classification and types of wind machines, application of wind energy, merits and limitations of wind energy. Site selection for wind farm, wind map of India, wind energy station in India<br>**Tidal Energy:** Tides, tidal range, tidal power, suitably sites and prospects. Types of tidal power plants, single basin, modulated single basin and double basin schemes, main equipments, energy storage. | **07 Hrs.** |
| **Unit 5:**<br>**Ocean thermal energy conversion:** Introduction, principle of OTEC, open cycle and closed cycle OTEC schemes, potential and prospects in India<br>**Wave Energy:** Introduction, power of wave, wave data collection, wave machines(wave energy converters), forces on wave machines and associated structures, merits and demerits of wave energy | **06 Hrs.** |
| **Unit 6:**<br>**Biomass Energy Resources:** Biomass energy, biomass energy from cultivated crops and from waste organic matter, biomass conversion processes, incineration and thermo chemical, biochemical conversion of biomass, energy from plants / projects.<br>**Energy Management and planning:** Energy management principles, Energy and pollution trade off, objectives of energy management, energy strategy and energy planning, Energy audit. | **07 Hrs.** |
| **Textbooks:**<br>1. Environmental studies: Benny Joseph<br>2. Environmental Biology: K. C. Agarwal<br>3. Environmental Encyclopedia: Cunningham, W. P. Cooper, T. H. Hepworth (Jaico Pub.)<br>4. Energy and Ecology : David M.Gates (Sinaur Associates) | |
| **Reference Books:**<br>1. Non Conventional Energy Sources: G.D.Rai<br>2. Power Technologies: Stephenson<br>3. Energy Technology: S.Rao and B.B.Parulekar | |

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Professional Elective-II: Irrigation and Hydraulic Structures<br>**Course Code:** UCEE0522 | **L** | **T** | **P** | **Credits** |
|---|---|---|---|---|
| | **3** | **1** | **-** | **4** |

**Course Pre-Requisite:**

Students shall have knowledge of:

- Water Resources Engineering
- Fluid Mechanics

**Course Description:**

This course emphasizes on the various Hydraulic Structures used in Irrigation and allied sector. Different Hydraulic Structures like Dams, Spillways, Diversion Headworks, Canals and components of Hydroelectric System are covered in this course. It encompasses the necessity, components and requirements of these Hydraulic Structures.

**Course Learning Objectives:**

During this course students will

1. Know necessity and importance of various Hydraulic Structures.
2. Understand the components, types and requirements of the Hydraulic Structures.
3. Acquire knowledge about the theories related to design of the different Hydraulic Structures.

**Course Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | **Bloom's Descriptor** |
|---|---|---|
| CO1 | Illustrate the requirements of reservoirs. | Cognitive (Understanding) L 2 |
| CO2 | Summarize the different types and components of dams, spillways and hydroelectric system. | Cognitive (Understanding) L 2 |
| CO3 | Explain the requirements and working of diversion headworks, canals and river training works. | Cognitive (Understanding) L 2 |
| CO4 | Analyze the theories and design criteria for water retaining structures and its components. | Cognitive (Analyzing) L 4 |

**CO-PO Mapping:**

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

| **CO** | **PSO1** | **PSO2** |
|---|---|---|
| **CO1** | | |
| **CO2** | | |
| **CO3** | | |
| **CO4** | | |

**Assessments:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE-1 | 10 |
| MSE | 30 |
| ISE-2 | 10 |
| ESE | 50 |

- **ISE-1 and ISE-2:** Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions etc. (For each ISE two different tools are to be used).
- **MSE:** Assessment is based on 50% of course content (Normally first three Units)
- **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE.

| **Course Contents:** | |
|---|---|
| **Unit 1 Introduction:**<br>Water retaining structures, Classification of reservoirs, Investigations for reservoir planning, Site selection for reservoirs, Zones of storage in a reservoir, Reservoir capacity from mass inflow curve, Reservoir sedimentation, Calculation of life of reservoir. | **6 Hrs.** |
| **Unit 2 Dams:**<br>Classification of dams, Gravity dams, Forces acting on a gravity dam, Elemental and practical profile of a gravity dam, Limiting height of a gravity dam, Design of gravity dams and stability analysis, Galleries and joints.<br>Earthen dams - Types, Criteria for safe design of earthen dams, Details of section of Earthen dam, Phreatic lines in earthen dam, Seepage analysis and control measures, Stability Analysis | **8 Hrs.** |
| **Unit 3 Spillways and Diversion Headworks:**<br>Need of spillways, Components of spillways , Types of spillways, Spillway crest gates, Diversion Headworks, Component parts of diversion headworks, Location of head works, Khosla's Theory, Bligh's Creep Theory. | **6 Hrs.** |
| **Unit 4 Canals:**<br>Need of canals, Losses in canals, Lining of canals, Types of lining, Design of lined canals, Canal outlets, Canal regulation works - necessity and location, Development of falls, Classification of falls, Cross drainage works, Types and selection criteria. | **8 Hrs.** |
| **Unit 5 Water Power Engineering:**<br>Necessity of water power, Types of water power development, Principle components of hydro-electric system, Introduction to Power Plant Structure, Penstock, Hydraulic Transients, Surge Tanks. | **7 Hrs.** |
| **Unit 6 River Engineering:**<br>River Engineering, Classification of rivers, Meandering of rivers, Causes and controls for meandering, River training works: classification and types, Interlinking of rivers | **5 Hrs.** |
| **Textbooks:**<br>1. Punmia, Irrigation and water power engineering_, 1986. Standard Publications, New Delhi.<br>2. S.K.Garg, Irrigation Engg.<br>3. P.N.Modi. Irrigation and water power engineering<br>4. R. K. Sharma, T. K. Sharma, A Textbook of Water Power Engineering<br>5. SatyanarayanMurty, Water resources Engg_, New age international private Ltd. | |
| **References:**<br>1. Justinn, Creager and Hinds, Engg.ForDams.Vol.I, II, III<br>2. Varshney, Design of hydraulic structures<br>3. U.S.B.R., Oxford and IBH Publ.Co. Design of small dams<br>4. Varshney, Design of hydraulic structures<br>5. Leliavsky, Design of hydraulic structures. | |

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Professional Elective-II: Noise Pollution and Control<br>**Course Code:** UCEE0523 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | **3** | **1** | **-** | **4** |

**Course Pre-Requisite:**
Knowledge of engineering mathematics and physics

**Course Description:**
This course is intended to make students aware about the sources of noise, measurement. Various effects, health monitoring with respect to noise, legal provisions as well as various engineering measures for control of noise.

**Course Learning Objectives:**

1. Study the sources and effects of noise
2. Learn measurement and propagation of noise
3. Study the various techniques for control of noise in community and industries
4. Understand the legal provisions for control of noise.

**Course Outcomes:**

| **COs** | **After the completion of the course the students will be able to** | **Bloom's Cognitive Descriptor** |
|---|---|---|
| CO.1 | Explain propagation and various effects of noise | Cognitive (Understanding) L2 |
| CO.2 | Develop various indices for noise based on noise monitoring data | Cognitive (Applying) L3 |
| CO.3 | Select various control measures for noise in industries and community | Cognitive (Applying) L3 |
| CO.4 | Compare the measured noise levels to legal compliance | Cognitive (Analyzing) L4 |

**CO-PO Mapping:**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO.1 | 1 | 1 | | | | | | | | | | |
| CO.2 | 2 | 2 | | | 1 | | | | | | | |
| CO.3 | 1 | 1 | | | 1 | | 1 | | | | | |
| CO.4 | | | | 2 | | 3 | | | | | | |

| **COs** | **PSO1** | **PSO2** |
|---|---|---|
| CO.1 | 1 | |
| CO.2 | | 2 |
| CO.3 | 2 | 2 |
| CO.4 | 2 | 2 |

**Assessments:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE-1 | 10 |
| MSE | 30 |
| ISE-2 | 10 |
| ESE | 50 |

- **ISE-1 and ISE-2:** Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions etc. (For each ISE two different tools are to be used).
- **MSE:** Assessment is based on 50% of course content (Normally first three Units)
- **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE.

| Course Contents: | |
|---|---|
| **Unit 1: Sound Transmission and measurement**<br>Sound- characteristics, Sound transmission and Characteristics of sound wave, Measurement of sound with respect to sound pressure, Sound power and sound intensity, Units of measurement, Sound Level Meter, Factors influencing sound transmission in outdoor atmosphere | **7 Hrs.** |
| **Unit 2: Sources and effects of Noise**<br>Definition of noise, Sound Vs. Noise, Sources of noise and classification, Infrasonic and ultrasonic sound, Threshold of hearing, Threshold of pain, Anatomy of human ear and mechanism of hearing, Effects of noise - effects on human health, auditory effects, physiological and psychological effects, effects on animals, effects on wild life, effects on plants, effects on structures | **7 Hrs** |
| **Unit 3: Community noise**<br>Sources and characteristics of community noise, nuisance of noise in India, Common noise levels, Measurement of community noise, Equivalent noise, Average Day and Night noise, Noise Pollution Levels, Noise Percentile | **6 Hrs** |
| **Unit 4: Industrial noise**<br>Types, sources and characteristics of industrial noise, Noise levels generated in various industrial operations, Measurement of industrial noise, OSHA exposure standards, Exposure measurement, Use of Dose meter, Health Monitoring, Procedure of Audiometric testing, Interpretation of Noise Induced Hearing Loss from audiogram | **7 Hrs.** |
| **Unit 5: Control of noise**<br>Engineering control of noise, noise reduction at source, acoustical absorbing devices, Enclosure, barrier, Various types of mufflers, Reduction at receiving end, Active Noise Reduction, Administrative control of noise, Personal Protective Equipments for noise, Strategy for control of noise, Control of community noise, Frequency analyzer and octave band analysis, Noise mapping and its applications. | **7 Hrs** |
| **Unit 6: Legal Provision for Control of noise**<br>Legal provisions for control of noise under Noise Pollution (Regulation and Control) Rules, 2000 and its amendments, Local Bye-laws regarding noise pollution control, Case studies in India and abroad | **6 Hrs.** |
| **Textbooks:**<br>1. Noise Pollution and Control Strategy by S.P. Singhal, Narosa Publishing House, 2005<br>2. Noise Pollution – S.K.Agrawal- APH Publishing carporation, New Delhi. 2009 | |
| **References:**<br>1. Handbook of Environmental management and technology by Gwendolyn Holmes, Ben Ramnasiue Singh and Louis Theodore (A Wiley – Enter science publication)<br>2. Standard Hand book of Environmental Engineering by Robert A. Corbett (McGraw Hill Inc.)<br>3. Industrial Pollution by N. Irving Sax (Van Nostrand Reinhold Company)<br>4. Environmental issues and programme by I. Mohan (Ashish publishing house)<br>5. Environmental Engineering by G.N.Pandey and G.C. Carney ( Tata McGraw Hill)<br>6. Some thought on Environmental and law by C.S. Mehta (RBSA Publisher)<br>7. IS code for practice for noise reduction in industrial buildings IS: 3483, 1965<br>8. Soil and Noise pollution: Dr B.K.Sharma and Dr. H.Kaur, Goel Publishing House, Krishana Prakashan mandir, Meerut | |

| **Class:** T.Y.B.Tech. Civil and Environmental Engineering | **L** | **T** | **P** | **Credits** |
|---|---|---|---|---|
| **Title of the Course:** Professional Elective-II: Design of Steel Structures<br>**Course Code:** UCEE0524 | **3** | **1** | **-** | **4** |

**Course Pre-Requisite:**

Students shall have knowledge of:

- Algebra and Engineering Mathematics
- Engineering Mechanics
- Solid Mechanics
- Structural Analysis

**Course Description:**

A Civil-Environmental Engineer needs to understand the design of various structural members such as beams, columns, treatment plants, and storage tanks as well as apply checks for safety and serviceability. Number of problems on design of different steel member gives idea about designing process. This course acts as a prerequisite for the advanced design of steel structures.

**Course Learning Objectives:**

1. To study concepts and design philosophies of Design of steel structures
2. To understand analysis and design of members of steel structure
3. To know various checks of steel structures for the safety and stability
4. To impart basic knowledge about the design of various steel structures.

**Course Outcomes:**

| **CO** | **After the completion of the course the students will be able to** | **Bloom's Taxonomy** | |
|---|---|---|---|
| | | **Descriptor** | **Level** |
| **CO1** | Identify the various loads on various steel members with reference to IS Code | Cognitive | Understanding L2 |
| **CO2** | Analyse the connections of various structural members in steel structure. | Cognitive | Analyzing L4 |
| **CO3** | Assess the strength of various steel sections as per IS Code. | Cognitive | Evaluate L5 |
| **CO4** | Design specific structural element /component of steel structure subjected to specific force. | Cognitive | Creating L6 |

**CO-PO Mapping:**

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

| **CO** | **PSO1** | **PSO2** |
|---|---|---|
| **CO1** | - | - |
| **CO2** | - | 2 |
| **CO3** | - | 2 |
| **CO4** | - | 2 |

**Assessments:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE-1 | 10 |
| MSE | 30 |
| ISE-2 | 10 |
| ESE | 50 |

- **ISE-1 and ISE-2:** Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions etc. (For each ISE two different tools are to be used).
- **MSE:** Assessment is based on 50% of course content (Normally first three Units)
- **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE

| **Course Contents:** | |
|---|---|
| **Unit: 1**<br>**Introduction to steel structures:**<br>Types of steel structures, Advantages and disadvantages of steel structures, Design Philosophies, elastic and plastic properties of sections, shape factor, grades of structural steel, various rolled steel sections, Types of loads and load combinations, partial safety factors for load and materials. stress distribution under tension, compression, bending and shear<br>Types of bolts and welds, analysis and Design of axially and eccentrically loaded bolted and welded connections (subjected to bending and torsion). | **06 Hrs** |
| **Unit: 2**<br>**Tension Members:** Types of sections for tension members, IS code- IS800: 2007 provisions, Gross and Net area, modes of failures Analysis and Design of axially loaded tension members, shear lag effect and design. | **07 Hrs** |
| **Unit: 3**<br>**Compression Members as Struts:**<br>Types of sections for compression members, IS code- IS800: 2007 provisions, section classifications, effective length, slenderness ratio, Design of axially loaded compression members simple sections, single angle and double angle strut, built-up sections, design of lacings and battens. | **07 Hrs** |
| **Unit 4:**<br>**Columns:** IS code- IS800: 2007 provisions, Design of columns subjected to axial and eccentric loading, design of lacing, battening system, column splices.<br>**Column Bases**: IS code- IS800: 2007 provisions, Design of slab bases and gusseted base subjected to axial and eccentric load and design of concrete pedestal (dimensions only). | **07 Hrs.** |
| **Unit 5:**<br>**Beams:** Flexural members –Types of sections, effective length, design of laterally restrained and unrestrained beams, rolled sections, built-up beams/compound beams,<br>IS code- IS800: 2007 provisions, Design for strength and serviceability, web buckling, web crippling, curtailment of flange plates. | **07 Hrs** |
| **Unit 6:**<br>**Gantry girder:** Forces acting on gantry girder, commonly used sections, IS code- IS800: 2007 provisions, design of gantry girder and connection. | **6 Hrs.** |
| **Recommended Textbooks:**<br>1. Design of Steel Structures, by Dr. N. Subramanian, Oxford University Press, New Delhi.<br>2. Limit State Design of Steel Structures: V. L. Shah and Veena Gore, Stuctures Publication, Pune.<br>3. Limit State Design of Steel Structures: S.K. Duggal, Tata Mc-Graw Hill India Publishing House<br>4. Design of Steel Structures: K.S. Sairam, Pearson<br>5. Design of steel structure by Limit State Method as per IS: 800- 2007: Bhavikatti S. S., I K<br>6. International Publishing House, New Delhi<br>7. Limit state design in structural steel: Dr. M. R. Shiyekar, PHI publications. | |
| **References Books:**<br>1. IS: 800 – 2007, IS: 875 (part I, II and III), SP6 (1) and SP 6 (6), IS: 816, IS: 808.<br>2. LRFD Steel Design: William T. Segui, PWS Publishing<br>3. Design of Steel Structures: Edwin H. Gaylord, Charles N. Gaylord James, Stallmeyer, Mc-Graw-Hill<br>4. Design of Steel Structures: Mac. Ginely T.<br>5. Design of Steel Structures: Dayaratnam, Wheeler Publications, New Delhi.<br>6. Design of Steel Structures: Punmia, A. K. Jain and Arun Kumar Jain, Laxmi Publication<br>7. Design of Steel Structures: Kazimi S. M. and Jindal R. S., Prentice Hall India. | |
| **Note:**<br>1. Use of IS: 800-2007, IS: 875 (All parts) and steel table is permitted for theory examinations.<br>2. The Design shall be as per IS: 800 – 2007 by limit state method. | |

| **Class:** T. Y. B. Tech Environmental Engineering<br>**Title of the Course:** Audit Course III: Engineering Management and Economics<br>**Course Code :** UCEE0563 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | **2** | **-** | **-** | **-** |

**Course Pre-Requisite:** Students must have knowledge of

- Basic Civil Engineering
- Engineering Mathematics
- Environmental Studies

**Course Description:**

Students will learn basic principles of management, including their components. Understands the importance of scheduling along with their practical applications. Will able to identify critical activities from various activities also it will enhance the skill of students in material management and decision making. They will able to analyze the economic viability of the project using various techniques. This course introduces students basic Legislation associated with project activity and its importance.

**Course Learning Objectives:**

1. To explain managerial and leadership roles in engineering projects.
2. To discuss the fundamentals of material management and importance of engineering economics in projects.
3. To discuss fundamentals of project planning and decision making.
4. To elaborate the factors affecting legal aspects of engineering projects.

**Course Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | **Bloom's Descriptor** |
|---|---|---|
| **CO1** | Select the managerial and leadership responsibilities in engineering projects. | Cognitive (Remembering) L1 |
| **CO2** | Identify the economic viability of engineering projects and apply principles for managing materials at engineering projects. | Cognitive (Applying) L3 |
| **CO3** | Solve the problems related to project planning and decision making in engineering projects. | Cognitive (Applying) L3 |
| **CO4** | To solve problems in project through Performance Evaluation and Review Technique. | Cognitive (Applying) L3 |

**CO-PO Mapping:**

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

| **CO** | **PSO1** | **PSO2** |
|---|---|---|
| **CO1** | | |
| **CO2** | | |
| **CO3** | | 2 |
| **CO4** | | 2 |

**Assessments:**

| Assessment | Weightage (Marks) |
|---|---|
| ESE | 100 |

- **ESE:** Assessment is based on 100% course content.

**Course Contents:**

| | |
|---|---|
| **Unit 1: Basics of Management**<br>Principles of Management (by Henry Fayol).<br>Functions of Management: a) Planning – Nature, Process and Importance of Planning, b) Organizing – Types, Organization Charts, Site Layout, c) Staffing – Introduction, d) Directing, Co-Ordination, Communication, Motivation and Controlling. e) Decision Tree (Concept Only),<br>Supply chain management, 7 QC Tools for Quality Improvement, Root cause analysis. | **8 Hrs.** |
| **Unit 2: Engineering Economics**<br>– (a) Introduction, Importance, Time Value of Money, Equivalence, Tangible and Intangible Factors,<br>b) Economic Comparisons- Present Worth Method, Equivalent Annual Cost Method, Rate of Return, Payback Method. | **6 Hrs.** |
| **Unit 3: Project Management (CPM)**<br>Introduction, steps in Project Management – Work Break Down Structure. Project Planning - Bar Chart, Mile Stone Chart, Development, Critical Path Method (CPM): Introduction, Time Estimates, Floats, Critical Path. Crashing of Network. | **7 Hrs.** |
| **Unit 4: Project Management (PERT)**<br>Performance Evaluation and Review Techniques (PERT) - Concept of Probability, Normal and Beta Distribution, Time Estimates and Calculations of Project Duration, Slack, Probability of Project Completion, Precedence Network concept. | **7 Hrs.** |

**Textbooks:**

1. Engineering Management – Stoner
2. Principles of Management – Davar
3. A Text book of Management – A.S.Deshpande

**References:**

1. Operation Research – S. H. Deshpande
2. Operation Research – Wagner Wikey Easter Ltd., new Delhi

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Water Treatment Laboratory<br>**Course Code:** UCEE0531 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | --- | --- | **2** | **1** |

**Course Pre-Requisite:**

Students shall have the knowledge of:

- Water Quality Parameters

**Course Description:**

The course explores the knowledge and principles of determination of different water quality parameters. It also enables to understand the relationships between different parameters and its effect in water treatment and water quality.

**Course Learning Objectives:**

1. To understand the knowledge and principles of determination of different water quality parameters
2. To understand the basics of water treatment processes

**Course Outcomes:**

| **COs** | **After the completion of the course the students will be able to** | **Bloom's Cognitive Descriptor** |
|---|---|---|
| CO1 | Interpret the quality of water after treatment. | Cognitive (Understanding) L2 |
| CO2 | Demonstrate the treatment process of water. | Psychomotor (Set) L2 |

**CO-PO Mapping:**

| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | 2 | | | 2 | | | | | |
| CO2 | | | | 2 | | | | | | | 2 | |

| **CO** | **PSO1** | **PSO2** |
|---|---|---|
| **CO1** | 2 | |
| **CO2** | 2 | |

**Assessments:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE | 50 |
| ESE (OE) | 50 |

- **ISE:** Based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.
- **ESE (OE):** Assessment is based on oral examination.

**Course Contents:**

| | |
|---|---|
| **Experiment No. 1: Aeration**<br><br>**Learning Outcome:** To determine the effect of aeration. | **2 Hours** |
| **Experiment No. 2: Plain Sedimentation**<br><br>**Learning Outcome:** To determine the effect of detention time on performance of settling. | **2 Hours** |
| **Experiment No. 3: Coagulation and Flocculation**<br><br>**Learning Outcome:** To determine the optimum dose of coagulant for given water. | **2 Hours** |
| **Experiment No. 4: Filtration**<br><br>**Learning Outcome:** To determine the removal of turbidity from water after filtration. | **2 Hours** |

| | |
|---|---|
| **Experiment No. 5: Head Loss in Filter**<br><br>**Learning Outcome:** To determine the Head Loss in Filter. | **2 Hours** |
| **Experiment No. 6: Hardness Removal**<br><br>**Learning Outcome:** To determine the removal of Hardness by various processes. | **2 Hours** |
| **Experiment No. 7: Break Point Chlorination**<br><br>**Learning Outcome:** To determine Break Point Chlorine dose for given water sample. | **2 Hours** |
| **Experiment No. 8: UV Radiation**<br><br>**Learning Outcome:** To determine performance of UV radiation process. | **2 Hours** |
| **Textbooks:**<br>1. Chemistry for Environmental Engineering and Science by Sawyer, McCarty and Parkin | |
| **References:**<br>1. Standard Methods for examination of Water and Wastewater<br>2. Manual of Water Supply and Treatment (3rd ed)- Ministry of Urban Development, New Delhi, 1991. | |

| **Class:** T.Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Transportation Engineering Laboratory<br>**Course Code:** UCEE0532 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | --- | --- | **2** | **1** |

**Course Pre-Requisite:**

Students shall have the knowledge of:

- Engineering Mathematics
- Basic Civil Engineering
- Building Materials and Concrete Technology

**Course Description:**

The course helps to develop laboratory skills as well as enhances methodical abilities by performing experiments relating to transportation engineering. Experiments will help the students to understand types of Bituminous materials and selection of grade of bituminous and aggregates, for different types of pavement.

**Course Learning Objectives:**

1. To introduce the students to laboratory methods for performing experiment in Transportation engineering
2. To provide clear understanding on conducting various types of different test on aggregates and bituminous materials.
3. To highlight importance of IRC requirements Tor elate laboratory results to field conditions.

**Course Outcomes:**

| **COs** | **After the completion of the course the students will be able to** | **Bloom's Cognitive Descriptor** |
|---|---|---|
| CO1 | Compare the properties of aggregate, sand, bitumen to IRC recommendations. | Cognitive (Understanding) L2 |
| CO2 | Interpret traffic volume and speed data. | Cognitive (Understanding) L2 |

**CO-PO Mapping:**

| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | 2 | 2 | | | | | | | | |
| CO2 | 1 | | | 1 | | | | | | | | |

| **COs** | **PSO1** | **PSO2** |
|---|---|---|
| CO1 | | 1 |
| CO2 | | 1 |

**Assessment:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE | 25 |
| ESE(OE) | 25 |

- **ISE:** Based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.
- **ESE(OE):** Assessment is based on practical oral examination.

**Course Contents:**

| | |
|---|---|
| **Experiment No.1:** Aggregate Impact Value Experiment<br><br>**Learning Outcome:** Determine the Impact value of aggregate and understand its practical significance. | **2 Hours** |
| **Experiment No.2:** Los Angles Abrasion Test Experiment<br><br>**Learning Outcome:** Determination of Abrasion value of aggregates for road construction. | **2 Hours** |

| | |
|---|---|
| **Experiment No.3:** Crushing test of aggregate Experiment<br><br>**Learning Outcome:** Determination of Crushing strength of aggregates | **2 Hours** |
| **Experiment No. 4:** Bitumen Penetration Experiment<br><br>**Learning Outcome:** Determination of penetration value of bitumen | **2 Hours** |
| **Experiment No.5:** Softening Point Experiment.<br><br>**Learning Outcome:** Determination of Softening Point of bitumen | **2 Hours** |
| **Experiment No.6:** Flash Point and Fire Point Test Experiment.<br><br>**Learning Outcome:** Determination of Flash Point and Fire Point of bitumen | **2 Hours** |
| **Experiment No.7:** Ductility test Experiment.<br><br>**Learning Outcome:** To Determine ductility of bitumen. | **2 Hours** |
| **Experiment No.8:** Viscosity of bitumen Experiment<br><br>**Learning Outcome:** To Determine Viscosity of bitumen | **2 Hours** |
| **Experiment No.9:** Traffic Volume Study<br><br>**Learning Outcome:** To conduct a traffic volume study and to determine different volume statistics for a particular road section. | **2 Hours** |
| **Experiment No.10:** Spot Speed Studies<br><br>**Learning Outcome:** To conduct a spot speed study, develop a cumulative frequency speed distribution curve and calculate various statistical measures. | **2 Hours** |

**TEXTBOOKS and REFERENCE BOOKS**


1. L R Kadiyali**—** Highway Engineering, Khanna Publishers, New Delhi. Town and country Planning-N.K. Gandhi
2. Khanna and Justo - Highway Engineering, Nemchandand Bros., Roorkee.
3. S.K. Sharma, Highway Engineering
4. Partha Chakraborty and Animesh das, Principles of Transportation Engineering, Prentice Hall,
5. IRC code.

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Geotechnical Engineering Laboratory<br>**Course Code:** UCEE0533 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | --- | --- | **2** | **1** |

**Course Pre-Requisite:**

Students shall have the knowledge of:

- Algebra and Engineering Mathematics
- Engineering Physics and Chemistry
- Engineering Mechanics
- Fluid Mechanics

**Course Description:**

The course helps to develop laboratory skills as well as enhances analytical abilities by performing experiments pertaining to Geotechnical Engineering. The laboratory performance and work; helps to use theoretical concepts in practice, refer standard procedures and IS codes, measure parameters, make interpretations/ judgments and draw valid conclusions by using geotechnical engineering knowledge.

**Course Learning Objectives:**

1. To introduce the students to laboratory methods for performing experiment in Geotechnical Engineering.
2. To interpret observations/readings and draw conclusions.
3. To relate laboratory results to field conditions.

**Course Outcomes:**

| **COs** | **After the completion of the course the students will be able to** | **Bloom's Cognitive Descriptor** |
|---|---|---|
| CO1 | Explain laboratory methods to determine Index and Engineering properties of soil. | Cognitive (Understanding) L2 |
| CO2 | Examine soil for its suitability as construction material. | Cognitive (Analyzing) L4 |

**CO-PO Mapping:**

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

| **COs** | **PSO1** | **PSO2** |
|---|---|---|
| CO1 | - | 1 |
| CO2 | - | 1 |

**Assessments :**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE | 25 |
| ESE (OE) | 25 |

- **ISE:** Based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.
- **ESE (OE):** Assessment is based on practical oral examination.

**Course Contents:**

| | |
|---|---|
| **Experiment No. 1:** Specific gravity determination<br><br>**Learning Outcome:** Interpretation of specific gravity value of given soil and using it forclassification of soil. | **2 Hours** |

| | |
|---|---|
| **Experiment No. 2:** Water content determination<br><br>**Learning Outcome:** Determination of natural moisture content and evaluating status of soil. | **2 Hours** |
| **Experiment No. 3:** Grain size analysis<br><br>**Learning Outcome:** Determination of gradation of soil and its classification | **2 Hours** |
| **Experiment No. 4:** Consistency Limits of soil<br><br>**Learning Outcome:** Values of consistency limits help to comment on field behavior of soil and its classification. | **2 Hours** |
| **Experiment No. 5:** Field density determination.<br><br>**Learning Outcome:**<br>Field density values help to estimate soil performance and strength. | **2 Hours** |
| **Experiment No. 6:** Standard proctor compaction test.<br><br>**Learning Outcome:** Important parameter for earth work design and construction are determined for field compaction. | **2 Hours** |
| **Experiment No. 7:** To Determine Coefficient of Permeability.<br><br>**Learning Outcome:** To Determine Coefficient of Permeability of The Given Soil Sample By Permeability Test. | **4 Hours** |

**TEXT BOOKS and REFERENCE BOOKS**


1. Text book of soil mechanics in theory and practice‖ by Dr. Alam Singh (Asian Publishing House, Bombay)
2. Soil mechanics and Foundation engineering‖ by V.N.S.Murthy.(U.B.S. Publishers and distributors, Delhi
3. Soil mechanics and Foundation engineering‖ by B. S. Punmia. (A Saurabh and Company P.Ltd., Madras)
4. Geotechnical Engineering‖ by P. Purushottam Raj. (Tata Mcgraw Hill Company Ltd. NewDelhi)
5. Soil mechanics‖ by Terzaghi and Peak. (John Willey and Sons, New- York)
6. Soil Testing by T.W. Lambe. (Willey Eastern Ltd., New Delhi)
7. Geotechnical Engineering by Venkatramiah

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Solid Waste Analysis Laboratory<br>**Course Code:** UCEE0534 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | --- | --- | **2** | **1** |

**Course Pre-Requisite:**
Environmental Chemistry and Microbiology

**Course Description:**
The course explores knowledge of solid waste composition, characterization and standard procedures available for evaluation of different components. The course imparts the experimental skills in identifying various important characteristics of solid waste.

**Course Learning Objectives:**

1. To carry out the composition and characterization study of solid waste.
2. To carry out the proximate analysis of solid waste.

**Course Outcomes:**

| **COs** | **After the completion of the course the students will be able to** | **Bloom's Cognitive Descriptor** |
|---|---|---|
| CO.1 | Demonstrate composition and characterization of solid waste. | Cognitive (Applying) L3 |
| CO.2 | Determine proximate analysis of solid waste. | Cognitive (Understanding) L2 |

**CO-PO Mapping:**

| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | 2 | 3 | 2 | 2 | | | | | | 2 |
| CO2 | | | | 3 | 2 | | 3 | | | | | 2 |

| **COs** | **PSO1** | **PSO2** |
|---|---|---|
| CO1 | 3 | 2 |
| CO2 | 3 | 2 |

**Assessments:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE | 50 |

- **ISE:** Based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

**Course Contents:**

| | |
|---|---|
| **Experiment No. 1:** Study of Composition of solid waste by Coning and Quartering method<br><br>**Learning Outcome:** To identify the composition by weight of solid waste. | **2 Hours** |
| **Experiment No. 2:** Study of bulk density of solid waste<br><br>**Learning Outcome:** To calculate density of solid waste. | **2 Hours** |
| **Experiment No. 3:** Determination of moisture content.<br><br>**Learning Outcome:** To analyze the moisture content of solid waste. | **2 Hours** |
| **Experiment No. 4:** Determination of particle size distribution.<br><br>**Learning Outcome:** To examine the particle size distribution | **2 Hours** |
| **Experiment No. 5:** Determination of calorific value.<br><br>**Learning Outcome:** To estimate energy content of solid waste. | **2 Hours** |

| | |
|---|---|
| **Experiment No. 6:** Determination of proximate analysis<br><br>**Learning Outcome:** To identify moisture loss, volatile matter, ash and fixed carbon in solid waste. | **2 Hours** |
| **Experiment No. 7:** Determination of Ultimate analysis<br><br>**Learning Outcome:** To identify Carbon, Hydrogen, Oxygen, Nitrogen and Sulphur in solid waste. | **2 Hours** |
| **Textbooks:**<br>Solid Waste Management – Dr. A. D.Bhide | |
| **References:**<br>1. Integrated Solid Waste Management by Tchobanoglous/Theisen/Vigil; Publisher: McGraw Hill<br>2. CPHEEO Manual on solid Waste Management part I, II. | |

| **Class:** T.Y.B.Tech Civil and Environmental Engineering<br>**Title of the Course:** Mini Project Laboratory<br>**Course Code:** UCEE0541 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | **-** | **-** | **2** | **1** |

**Course Pre-Requisite:**

Students shall have the knowledge of:

- Basic Sciences
- Engineering Sciences
- Mathematics
- Program Core Courses

**Course Description:**

The mini project is designed to help students to develop practical ability and knowledge about practical tools/ techniques in order to solve real life problems related to the industry, academic institutions and research. The course Mini Project is one that involves practical work for understanding and solving problems in the field of Civil and Environmental Engineering. It provides the opportunity for students to demonstrate the application of their fundamental, analytical and research skills, and to apply their knowledge to complex and real world problems.

**Course Learning Objectives:**

1. To acquire knowledge to conduct research
2. Develop experimental set-up to solve problem, do testing and validation of the results

**Course Outcomes:**

| **COs** | **After the completion of the course the students will be able to** | **Bloom's Cognitive Descriptor** |
|---|---|---|
| CO1 | Undertake research work using theoretical studies, experimentations and computer simulations. | Psychomotor (Readiness to Act) L2 |
| CO2 | Establish findings for describing the work undertaken, results and conclusions within the specified time frame. | Psychomotor (Ability to Perform) L5 |

**CO-PO Mapping:**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO.1 | | | | 2 | 2 | | | | 2 | | | |
| CO.2 | | | | | 2 | | 1 | | 2 | | 1 | |

| **COs** | **PSO1** | **PSO2** |
|---|---|---|
| CO.1 | 2 | 1 |
| CO.2 | 1 | 2 |

**Assessments:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE | 50 |

**ISE:** Assessment is based on the efforts by the students for formulating problem, developing design solution, testing and validation of the solution and presentation

**Course Contents:**

Students are expected to carry out independent research work on the selected topic. It is expected that the students formulate the research problem, development/ fabrication of experimental set-up (if any) and testing and analysis of results thus obtained. The students are required to submit the report of mini project work and present their findings during the oral presentations.

# SYLLABUS

# T. Y. B. Tech

# Civil and Environmental Engineering

# SEMESTER - VI

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Wastewater Engineering<br>**Course Code.:** UCEE0601 | **L** | **T** | **P** | **Credits** |
|---|---|---|---|---|
| | **3** | **-** | **-** | **3** |

**Course Pre-Requisite:**

Students shall have knowledge of:

- Environmental Chemistry and Microbiology
- Hydraulics and Water Supply Engineering

**Course Description:**

The course reviews collection and conventional treatment of municipal wastewater. Students design sewers and sewage pumping station. Students learn primary and secondary/biological treatment principles and processes. Management of sludge and disinfection of municipal effluents are also covered. This course prepares students for advanced wastewater treatment processes, including industrial wastewater, in further treatment courses.

**Course Objectives:**

During this course student will be provided

1. To deliver knowledge of sources and flowrates of wastewater and Characteristic of Municipal waste water.
2. To impart necessary skill for the design and operation of wastewater treatment plants.
3. To introduce new developments in the field of wastewater treatment.
4. To prepare students for higher studies and research in the field of wastewater treatment technology.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | **Bloom's Descriptor** |
|---|---|---|
| **CO1** | **Explain** characteristics of domestic wastewater | Cognitive (Understanding) L2 |
| **CO2** | **Explain** domestic wastewater treatment technologies | Cognitive (Understanding) L2 |
| **CO3** | **Apply** the knowledge of wastewater treatment technologies to solve / analyse problems in wastewater treatment | Cognitive (Applying) L3 |
| **CO4** | **Design** domestic wastewater treatment units. | Cognitive (Creating) L6 |

**CO-PO Mapping:**

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

| **CO** | **PSO1** | **PSO2** |
|---|---|---|
| **CO1** | 2 | |
| **CO2** | 2 | |
| **CO3** | | 2 |
| **CO4** | | 2 |

**Assessments:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE-1 | 10 |
| MSE | 30 |
| ISE-2 | 10 |
| ESE | 50 |

- **ISE-1 and ISE-2:** Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions/STP visit report etc. (For each ISE two different tools are to be used).
- **MSE:** Assessment is based on 50% of course content (Normally first three Units)
- **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Unit No. 1 Components, quantity and characteristics of wastewater:**<br>Components of Wastewater Flows, Wastewater Sources &Flow rate, Variations in Flow rates & Strength, sampling and significance of wastewater analysis, physical, chemical and biological characteristics of domestic wastewater,<br>Sewer appurtenances, Sewage Pumping, Location, Capacity, Pumping Station Design | **6 Hrs.** |
| **Unit No. 2 Primary Treatment of Wastewater**<br>Physical Unit Operations- Screening, Grit Removal, Oil & Grease Removal, Primary Sedimentation, Equalization Tank. | **5 Hrs.** |
| **Unit No. 3 Secondary Treatment of Wastewater**<br>Fundamentals of Biological Treatment, Microbial Metabolism, Bacterial Growth, Suspended & Attached Growth Processes, Activated Sludge Process & its Modifications, Trickling Filters, Secondary Clarification, Aerated Lagoons | **9 Hrs.** |
| **Unit No. 4Anaerobic Treatment of Wastewater**<br>Anaerobic Suspended & Attached Growth Processes, Factors affecting Anaerobic Processes, Anaerobic Lagoons, UASB, Septic Tank, Introduction to fecal sludge management, Anaerobic Baffled Reactor, Waste Stabilization Ponds | **7 Hrs.** |
| **Unit No. 5 Sludge Treatment**<br>Solid Sources, Characteristics & Quantities, Sludge Pumping, Introduction to mass balance approach, Treatment-Thickening, Stabilization, Design of Sludge Digester, Conditioning, Dewatering, Drying, Ultimate Disposal of Sludge Solids | **6 Hrs.** |
| **Unit No. 6 Decentralized wastewater treatment and Disposal of Wastewater**<br>Concept of decentralized wastewater treatment systems,<br>Need of Disinfection, Introduction to tertiary treatment,<br>Self-Purification of water bodies, DO Sag Curve, Streeter Phelp's Model, Stream Classification, Effluent Standards for Discharge into Surface Water & on Land | **7 Hrs.** |

**Textbooks:**

1. Modi, P. N., "Wastewater Engineering," Standard Book House, 1st edition, 2001.
2. Manual on sewerage and sewage Treatment- Ministry of Urban Development, New Delhi (CPHEEO)

**References:**

1. Metcalf and Eddy, Waste Water Engg. Treatment and Disposal, Tata McGraw Hill (2nd Edition)
2. Peavey, H. S. Rowe, D.R., and Tchobanoglous, Environmental Engineering, McGraw-Hill Book Company.
3. Hammer M.J. Water and Waste water Technology, Prentice-Hall of India P.Ltd.

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Air Pollution and Control<br>**Course Code:** UCEE0602 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | **3** | **-** | **-** | **3** |

**Course Pre-Requisite:** knowledge of engineering mathematics, physics and Environmental chemistry

**Course Description:** It introduces the sources of air pollution, physical and chemical behavior of pollutants, the effects of air pollutants on human beings and environment and dispersion in the atmosphere. Also, it covers legislation and regulation; control technologies and future trends toward preventing air pollution.

**Course Learning Objectives:**

1. Study the current situation with respect to air pollution at national and international levels
2. Learn dispersion of air pollutants and role of meteorological parameters
3. Study the mechanisms and design of control equipment's for air pollutants.
4. Learn the policies and measures for control of air pollution at national and international levels

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | **Bloom's Cognitive level Descriptor** |
|---|---|---|
| **CO1** | Explain the national and global scenario with respect to air pollutions, its causes and impacts | Cognitive (Understanding) L2 |
| **CO2** | Relate the role of meteorological parameters in dispersion of air pollutants | Cognitive (Understanding) L2 |
| **CO3** | Explain various measures, legal standards and policies for control of air pollution. | Cognitive (Understanding) L2 |
| **CO4** | Explain mathematical models and control equipments for identification and solution of problems related to air pollution | Cognitive (Evaluating) L5 |

**CO-PO Mapping:**

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

| **CO** | **PSO1** | **PSO2** |
|---|---|---|
| CO1 | 2 | |
| CO2 | 1 | |
| **CO3** | | 1 |
| **CO4** | | 3 |

**Assessments:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

- **ISE 1 and ISE 2** are based on assignment/declared test/quiz/seminar/Group Discussions etc.
- **MSE:** Assessment is based on 50% of course content (Normally first three Units)
- **ESE:** Assessment is based on 100% course content with60-70% weightage for course content

| | |
|---|---|
| (normally last three Units) covered after MSE. | |
| **Course Contents:** | |
| **Unit 1:--- Introduction to Air pollution**<br>Current scenario of air pollution at national and global scales, Sources and types air pollutants, criteria air pollutants and their effects, Ambient air quality standards | **2 Hrs.** |
| **Unit 2:--- Meteorology and Air Pollution**<br>Structure and composition of atmosphere, Wind circulation, Wind rose diagram, Lapse rates, Stability of atmosphere, Inversion and its types, Plume behavior, Maximum Mixing Depth, Cyclones and anticyclones, Precipitation and its relation to removal of air pollutants | **8 Hrs.** |
| **Unit 3:--- Dispersion of Air Pollutants**<br>Air quality dispersion models, Gaussian dispersion model for point sources and line sources, applications and limitations of Gaussian model, plume rise- causes and significance, Formulas for estimation of Plume Rise, Plume down wash, Stability classes, Box model , Street canyon model, Introduction to AERMOD and other soft wares | **10 Hrs.** |
| **Unit 4:--- Air Quality management**<br>Control of air pollution from stationary and mobile sources, measures for effective control of air pollution in India, , Alternative fuels, Air quality index, National Air Quality Monitoring Program, Legislative measures, International treaties for control and mitigation of air pollution | **6 Hrs**. |
| **Unit 5:--- Control of Particulate Matter**<br>Sources of SPM, Terminal settling velocity, Particulate removal mechanisms, study of working principle and design of Particulate Control Equipments : - Gravity settling chamber, Cyclone separator, Fabric filters, Electrostatic precipitator, Wet collectors, removal efficiency- block flow and mixed flow, | **8 Hrs.** |
| **Unit 6:--- Air Quality management**<br>Control of air pollution from stationary and mobile sources, measures for effective control of air pollution in India, , Alternative fuels, Air quality index, National Air Quality Monitoring Program, Legislative measures, International treaties for control and mitigation of air pollution | **6 Hrs.** |
| **Textbooks:**<br>1. K. Wark, C.F. Warner and W.T. Davis Air Pollution Control: its Origin and Control, Addision-Wesley, (1998).<br>2. Stern A.C., "Air Pollution Vol. I and II", Allied Publishers Limited, 1st Edition, 1994.<br>3. Nevers N., "Air Pollution control Engineering" McGraw-Hill, New York, 2nd edition, 1995 | |
| **References:**<br>1. Martin Crawford, "Air Pollution and Control", Tata McGraw Hill Publication, 1st Edition, 1976.<br>2. Air Pollution and Control Technologies by Anjaneyulu, D", Allied Publishers, Mumbai, 2002<br>3. Environmental Pollution Control Engineering by Rao, C.S., Wiley Eastern Ltd., New Delhi, 1996<br>4. Industrial Air Pollution Control Systems by W.L.Heumann, McGraw-Hill, New York, 1997<br>5. Environmental Engineering by Peavy S.W., Rowe D.R. and Tchobanoglous G, McGraw Hill, New Delhi, 1985<br>6. Environmental Engineering Vol. II by Garg, S.K, Khanna Publishers, New Delhi<br>7. Fundamentals of Air Pollution by Richard W.Boubel, D.L.Fox, D.B.Turnerand A.C.Stern, Reed Elsevier India Pvt. Ltd., New Delhi, | |

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Design of Concrete Structures<br>**Course Code:** UCEE0603 | **L** | **T** | **P** | **Credits** |
|---|---|---|---|---|
| | **4** | - | - | **4** |

**Course Pre-Requisite:**

Students shall have knowledge of:

- Algebra and Engineering Mathematics
- Engineering Mechanics
- Structural Mechanics
- Concrete Technology

**Course Description:**

The course imparts fundamental knowledge on concepts of reinforced concrete, its design philosophies. An Environmental Engineer needs to understand the design of various structural members such as beams, slabs, columns of buildings, treatment plants, and storage tanks as well as apply checks for safety and serviceability. The knowledge of RCC sections is useful in estimating and costing also.

**Course Objectives:**

1. To study concepts and design philosophies of RCC
2. To understand analysis and design of reinforced concrete sections
3. To know various checks for the designs.
4. To learn designs of specific RCC elements/structures.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the students will be able to** | **Bloom's Taxonomy Cognitive Domain** |
|---|---|---|
| **CO1** | Explain design philosophies and stress-strain behavior of Reinforced Cement Concrete sections. | Understanding L2 |
| **CO2** | Apply concepts of design and analyze various RCC section. | Applying L3 |
| **CO3** | Evaluate the design with respect to various stability checks. | Evaluate L5 |
| **CO4** | Design specific structural elements /components of concrete structures | Creating L6 |

**CO-PO Mapping:**

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

| **CO** | **PSO1** | **PSO2** |
|---|---|---|
| **CO1** | - | - |
| **CO2** | - | 2 |
| **CO3** | - | 2 |
| **CO4** | - | 2 |

**Assessments:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE-1 | 10 |
| MSE | 30 |
| ISE-2 | 10 |
| ESE | 50 |

- **ISE 1 and ISE 2** are based on assignment/declared test/quiz/seminar/Group Discussions etc.
- **MSE:** Assessment is based on 50% of course content (Normally first three Units)
- **ESE:** Assessment is based on 100% course content with60-70% weightage for course content (normally last three Units) covered after MSE.

**Course Contents:**

| **Unit : 1:** | |
|---|---|
| Introduction- Stress strain behavior of concrete and steel, Behavior of RCC, Permissible stresses in steel and concrete, Design philosophies, Various limits states, Characteristics strength and Characteristic load, Load factor, Partial safety factors. Analyze forces in structure | **8 Hrs.** |

| | |
|---|---|
| **Unit 2:**<br>Limit state of collapse (flexure): Analysis and Design of Singly and Doubly Reinforced rectangular sections, Singly reinforced Flanged beams. | **9 Hrs.** |
| **Unit 3:**<br>Limit state of collapse (shear and bond): Shear failure, Types of Shear reinforcement, Design of Shear reinforcement, Bond-types, Factors affecting bond Resistance, Check for development length.<br>Limit state of serviceability: Significance of deflection, IS recommendations, Cracking-classification and Types of Cracks, Causes, mechanism and IS recommendations. | **9 Hrs.** |
| **Unit 4:**<br>Design of slabs: One way, Two way with different support conditions as per IS:456, Cantilever slabs. Design of staircases: Design of Simply Supported and Dog legged staircases | **9 Hrs.** |
| **Unit 5:**<br>Analysis and Design of axially and eccentrically (uni-axial) loaded circular, rectangular columns, Interaction diagram, Circular column with helical reinforcement, Design of footings | **8 Hrs.** |
| **Unit 6:**<br>Design of water tank: design criteria , permissible stresses, design of circular water tank resting on ground with flexible and rigid base, design of rectangular water tank resting on ground by approximate method, Design of ESR | **9 Hrs.** |

**Textbooks / Reference books:**


1 IS 456-2000
2. Limit state theory and Design –Karve and Shah, Structures publications, Pune
3. Reinforced Concrete Design – Limit state - A.K. Jain Nem Chand brothers Roorkee
4. Fundamentals of Reinforced Concrete –Sinha and Roy, S. Chand and company Ltd. Ram Nagar, New Delhi
6. Limit State Design of reinforced concrete P.C.Varghese, Prentice Hall, New Delhi
7. Reinforced Concrete Design- B.C. PunmiaLaxmi publications New Delhi
8. Reinforced Concrete Design-M. L. Gambhir-Mcmillan India Ltd. New Delhi
9. Special publications -16-Bureau of Indian standard

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Professional Elective-III: Environmental Geotechnology<br>**Course Code:** UCEE0621 | **L** | **T** | **P** | **Credits** |
|---|---|---|---|---|
| | **3** | **1** | **-** | **4** |

**Course Pre-Requisite:**

Students shall have knowledge of:

- Engineering Physics and Chemistry
- Geotechnical Engineering.
- Solid Waste Treatment

**Course Description:**

The course imparts knowledge of geotechnical aspects relevant to Environmental Engineering. Soil interaction with wastes, landfill compaction, and stability analysis in changing environmental conditions, waste control systems and use of geosynthetics is dealt.

**Course Learning Objectives:**

1. To study geotechnical/geoenvironmental parameters and its relevance.
2. To understand environmental geotechnical problems.
3. To study soil pollution interaction.
4. To understand waste control systems and applications of geosynthetics.

**Course Outcomes:**

| **CO** | **After the completion of the course the will be able to** | **Bloom's Taxonomy Cognitive Domain** |
|---|---|---|
| **CO1** | Explain significant aspects of Environmental Geo-technology. | Understanding L2 |
| **CO2** | Make use of concepts for stability analysis and landfill design | Applying L3 |
| **CO3** | Choose suitable waste control system. | Analyzing L4 |
| **CO4** | Explain site remediation and applications of geo-synthetics. | Evaluating L5 |

**CO-PO Mapping:**

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

| **CO** | **PSO1** | **PSO2** |
|---|---|---|
| **CO1** | | - |
| **CO2** | | - |
| **CO3** | | 2 |
| **CO4** | | 2 |

**Assessments:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE-1 | 10 |
| MSE | 30 |
| ISE-2 | 10 |
| ESE | 50 |

- **ISE-1 and ISE-2:** Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions/STP visit report etc. (For each ISE two different tools are to be used).
- **MSE:** Assessment is based on 50% of course content (Normally first three Units)
- **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE.

| Course Contents: | |
|---|---|
| **Unit 1: Introduction**<br>Introduction and Scope of Environmental Geotechnology, Role of soil in Geoenvironmental applications, Multidisciplinary aspects of Geoenvironmental Engineering, Sources and types of ground contamination, Impact of ground contamination on geoenvironment. | **7 Hrs.** |
| **Unit 2:Soil and Rocks**<br>Problematic soils and rocks, guidelines and care to be exercised for such soils, Environmental geotechnical problems. Pollution effect on soil behavior, environment and public concerns | **6 Hrs.** |
| **Unit 3: Soil Interaction**<br>Environmental cycles and their interaction, Soil mineralogy, Soil-Water-Contaminant interactions and its Implications, Pollution process and soil pollution interaction, Waste Containment System, Landfills, Methods for landfill site selection, Design concepts of landfills. Role of soil in engineered landfill. | **7 Hrs** |
| **Unit 4: Landfill**<br>Disposal of solid and liquid waste in soil, stability of refuse landfill, problems of land fill sites, compaction of landfill, slope stability of landfills, stability of garbage in decomposedstage. | **6 Hrs.** |
| **Unit 5: Waste Control System**<br>Design of waste control systems, their components, structures of control system components. | **5 Hrs** |
| **Unit 6:** Contaminated Site Remediation<br>Contaminated Site Characterization and Risk Assessment, Selection and planning of remediation methods for soil and groundwater, Physico-chemicaland other methods. Types and configurations of Geosynthetics / geotextiles, applications in Env.Engineering and pollution control. | **9 Hrs.** |

**TEXT BOOKS and REFERENCE BOOKS:**


1. Introduction to Environmental Geotechnology by Hsai Pang Fang,CRC press, Boca Raton, New York
2. Geoenvironmental Engineering by Sharma and Reddy.
3. Fundamentals of Soil Behavior Mitchell, J. K and Soga, K, John Wiley and Sons Inc.,2005
4. Geotechnical Practice for Waste Disposal Daniel, D.E, , Chapman, and Hall, 1993.
5. Barrier Systems for Waste Disposal Facilities Rowe, R.K., Quigley, R.M. and Booker, Clay, J.R., E and FN Spon, 1995.
6. Geotechnical and Geoenvironmental Engineering Handbook Rowe, R. K., Kluwer Academic publishers, 2001
7. Geoenvironmental Engineering – Principles and Applications Reddi, L. N. and Inyang, H. F, Marcel Dekker Inc, 2000
8. Waste Containment Systems, Waste Stabilization and Landfills: Design and EvaluationSharma, H.D, and Lewis, S.P, , John Wiley and Sons Inc., 1994
9. Geotechnical Engineering (2002): D.P. Coduto, Pearson Education Asia.


**Term work:**

A) Tutorials based on above units

B) Visit to disposal/contaminated site ( desirable) and report

| **Class:** T. Y. B.Tech Civil and Environmental Engineering<br>**Title of the Course:** Professional Elective-III: Optimization Techniques<br>**Course Code.:** UCEE0622 | **L** | **T** | **P** | **Credits** |
|---|---|---|---|---|
| | **3** | **1** | **-** | **4** |

**Course Pre-Requisite:**

Students must have knowledge about numerical and mathematical rules and its use in solving problems by correlating constants and parameters with each other.

- Use of variables for the formulation of the problem
- Numerical calculations
- Mathematical operators

**Course Description:**

Optimization Techniques course deals with various methods used for determining the optimum solution in engineering and project management field. It covers the methodology of operation research and its applications in different fields. Various optimization techniques covered in the course are Linear Programming Problems, Job Sequencing, Transportation and Assignment Models.

**Course Learning Objectives:**

1. Understand the significance and scope of optimization in Environmental engineering.
2. Study the formulation by correlating parameters of technical, engineering problem in mathematical model.
3. Learn to solve transportation problems, Assignment problems, Job sequencing using modified techniques.
4. Study optimization techniques and genetic algorithm techniques for application in projects of Environmental Engineering to get optimum results.

**Course Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | **Bloom's Descriptor** | **Level** |
|---|---|---|---|
| **CO 1** | Explain significance and concepts of optimization in Civil and Environmental Engineering. | Cognitive | Understanding L2 |
| **CO 2** | Apply optimization techniques for Linear Programming Problems of maximization and minimization of variables. | Cognitive | Apply L4 |
| **CO 3** | Evaluate Transportation Problems, Assignment Problems and Job Sequencing problems. | Cognitive | Evaluate L5 |
| **CO 4** | Adapt appropriate method of optimization for project completion. | Cognitive | Create L6 |

**CO-PO Mapping:**

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

| **COS** | **PSO1** | **PSO2** |
|---|---|---|
| **CO1** | - | - |
| **CO2** | - | - |
| **CO3** | - | 1 |
| **CO4** | 2 | 2 |

**Assessments:**

| Assessment | Weightage (Marks) |
|---|---|
| ISE-1 | 10 |
| MSE | 30 |
| ISE-2 | 10 |
| ESE | 50 |

- **ISE-1 and ISE-2:** Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions etc. (For each ISE two different tools are to be used).
- **MSE:** Assessment is based on 50% of course content (Normally first three Units)
- **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Unit 1: Introduction**:<br>Birth of OR, Methodology, Scope and Limitations, Types of OR models, Applications, Use of computers in OR | **4 Hrs.** |
| **Unit 2: Linear Programming**<br>Introduction to LPP, Formulation, graphical method, Simplex algorithm for maximization and minimization of problems, sensitivity analysis, Two phase method, Big M method, duality theory and its use in economic interpretation and decision making, | **8 Hrs.** |
| **Unit 3: Non-Linear Programming**<br>Non-linear Programming: Unconstrained optimization techniques, Classification of methods, steepest ascent, Newton method, constrained optimization, Separable and quadratic programming.<br>**Dynamic Programming**<br>Dynamic Programming: Multistage decision process, recursive relationships, Principle of optimality, Computational procedure in DP, DP applications, Problem of dimensionality. | **7 Hrs.** |
| **Unit 4: Transportation and Assignment Models**<br>Mathematical structure of model, industrial and business applications.<br>Transportation problems: Use of various methods for solving transportation problems, North- West corner method, Least cost method, Vogel's approximation method, Stepping stone method, degeneracy and its solution.<br>Assignment problems: Solution of various types of problems, Hungarian method Traveling Salesman problem.<br>Sequencing: Sequencing of n jobs and 2 and 3 machines, 2 jobs and m machines. | **7 Hrs.** |
| **Unit 5: Numerical differentiation and Numerical integration**<br>Numerical differentiation and Numerical integration: Numerical solution of ordinary differential equation, Systems of ordinary differential equations, Runge – Kutta Method, Trapezoidal rule, Simpson's rule, Gauss – Siedel method, Jacobian method | **7 Hrs.** |
| **Unit 6: Decision Theory**<br>Introduction, Types of decision, Decision models, Decision making under uncertainty, Decision making under conflict, Decision tree analysis, Decision making under utility<br>**Genetic Algorithm**<br>Introduction to Genetic Algorithm (GA), The structure of a genetic algorithm GA design, Resources, Theoretical approaches to genetic algorithms, GA operators, Statistical mechanics, Model fitting and optimization Neural Networks and Fuzzy Systems: Introduction, Representation of decision variables, Objective function and constraints, Optimization of fuzzy systems. | **7 Hrs.** |

**Textbooks:**

1. Operations Research – Hiraand Gupta.
2. Introduction to O.R., 6/e (with floppy disk) – Hamdy A. Taha, (PHI)

**Reference Books:**


1. Quantitative Techniques in Management, 2/e - N.D. Vora. (TMH)
2. Operations Research – J.K. Sharma. (Mac Millan)
3. Operations Research – S.D. Sharma
4. Optimization in Operation Research – Ronald L. Rardin (Pearson education)
5. Quantitative Techniques in Management, 2/e - N.D. Vora. (TMH)
6. Genetic algorithm – Goldberg

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Professional Elective-III: Operation and Maintenance of Environmental Facilities<br>**Course Code:** UCEE0623 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | **3** | **1** | **-** | **4** |

**Course Pre-Requisite:**

- Students shall have knowledge of Water Supply Engineering.
- Students shall have knowledge of Wastewater Engineering.
- Students shall have knowledge of Air Pollution and Control.

**Course Description:**

Operation and Maintenance of Environmental Facilities deals with the operation of environmental facilities like water supply facilities, water treatment plants, water distribution systems, wastewater treatment plants, wastewater collection systems, air pollution control equipment and their maintenance.

**Course Learning Objectives:**

At the end of **course** students will

1. Know the necessity of maintenance of environmental facilities.
2. Study measures to avoid failures in pipe systems.
3. Understand the criteria of operation and its purpose for water treatment plants, wastewater treatment plants and air pollution control equipments.
4. Learn the importance of planning and scheduling in maintenance activities.

**Course Outcomes:**

| **COs** | **After the completion of the course the students will be able to** | **Bloom's Cognitive Descriptor** |
|---|---|---|
| CO1 | Explain the types of maintenance, use of diagrams and manuals in operation and maintenance activities. | Cognitive (Understanding) L 2 |
| CO2 | Summarize the necessity of planning and scheduling in operation and maintenance activities. | Cognitive (Understanding) L 2 |
| CO3 | Interpret the operation and maintenance requirements of air pollution control equipments. | Cognitive (Understanding) L 2 |
| CO4 | Identify the appropriate remedies for problems in transmission pipes, water treatment plants and wastewater treatment plants. | Cognitive (Applying) L 3 |

**CO-PO Mapping:**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | 2 | | 2 | |
| CO2 | | 2 | | | | | | | 2 | | 2 | |
| CO3 | | 2 | | | | | | | 2 | | 2 | |
| CO4 | | 2 | | | | | | | 2 | | 2 | |

| **COs** | **PSO1** | **PSO2** |
|---|---|---|
| CO1 | | |
| CO2 | 2 | |
| CO3 | 2 | |
| CO4 | 2 | |

**Assessments:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE-1 | 10 |
| MSE | 30 |
| ISE-2 | 10 |
| ESE | 50 |

- **ISE-1 and ISE-2:** Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions etc. (For each ISE two different tools are to be used).
- **MSE:** Assessment is based on 50% of course content (Normally first three Units)
- **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Unit 1: Introduction**<br>Need of O and M, Types of Maintenance - Corrective and Preventive, Data: Detailed Plans, Drawings, Operation Manuals, Log Books, Computer Usage in O and M. | **04 Hrs.** |
| **Unit 2: Water Intakes**<br>O and M of Water Supply Facilities: Intakes, Pumps, Transmission Pipes, Water Treatment Units Maintenance, Quantity and Quality Monitoring. | **08 Hrs.** |
| **Unit 3: Water Distribution Systems**<br>Water Distribution System: Maintenance of Water Distribution System; Reservoirs, Loss of Carrying Capacity of Pipes, Pipe Breaks and Leakages, O and M of Appurtenances - Pipe Joints, Water Meters, Water Audit, Use of sensors, PLCs in operation. | **08 Hrs.** |
| **Unit 4: Wastewater Facilities**<br>O and M of Wastewater Facilities: Sewerage System and Appurtenances, Inspection Methods, Manual and Television, Cleaning and Rehabilitation, Safety in Sewer Inspection, O and M of Wastewater Treatment Plant- Activated Sludge Process, Trickling Filters, Monitoring and Operational Problems, Corrective Measures, Treatment Plant Performance Monitoring. | **08 Hrs.** |
| **Unit 5: Air Pollution Control Facilities**<br>Air Pollution Control Facilities: Regular Inspection of Devices, Operation and Maintenance of Particulate Matter Control Equipments, Gravity Settlers, Cyclone Separators, Bag Filters, Scrubbers, Electrostatic Precipitator. | **08 Hrs.** |
| **Unit 6: O and M Planning**<br>O and M planning: Organizational Structure, Work Planning, Preparation and Scheduling, Inventory, Cost Estimates, Wastewater Treatment Plant Staff Training | **04 Hrs.** |

**Textbooks:**

1. CPHEEO manual on Water Supply and Treatment
2. CPHEEO manual on Sewerage and Sewage Treatment
3. A manual on Operation and Maintenance of Water Supply Systems by CPHEEO
4. Air Pollution M N Rao, H V N Rao

**References:**

1. Industrial Air Pollution Control Systems – Neumann
2. O and M of Water treatment plant –Charles R Cox
3. Guidelines for Operation and Maintenance of Effluent Treatment Plants by MPCB

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Open Elective-I: Environmental Laws and Policies<br>**Course Code :** UOEL0631 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | **3** | **-** | **-** | **3** |

**Course Pre-Requisite** Students must have knowledge of

- Environmental Studies

**Course Description:**

Students will learn various international environmental policies and compare them with Indian policies. They will also learn various international environmental legislations. They will learn various environmental legislation of Govt. of India. Importance of environmental organizations and their functions. Environmental ethics and its importance role of NGO's.

**Course Learning Objectives:**

1. To explain scope and need of Environment Legislation.
2. To discuss historical prospective and International environmental legislation and conventions.
3. To teach the various Acts in India related to Environment.
4. To elaborate risk associated and importance of economics for environmental components.

**Course Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | **Blooms Cognitive Descriptor** |
|---|---|---|
| **CO1** | Explain need and scope of environmental legislation. | Cognitive (Understanding) L2 |
| **CO2** | Summarize historical prospective and international environmental legislation and conventions. | Cognitive (Understanding) L2 |
| **CO3** | Make use of environmental laws in practical applications. | Cognitive (Applying) L3 |
| **CO4** | Examine the risk associated and importance of economics for environmental components. | Cognitive (Analyzing) L4 |

**CO-PO Mapping:**

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

| **CO** | **PSO1** | **PSO2** |
|---|---|---|
| **CO1** | - | - |
| **CO2** | - | - |
| **CO3** | - | - |
| **CO4** | - | - |

**Assessments:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE I | 10 |
| ISE II | 10 |
| MSE | 30 |
| ESE | 50 |

- **ISE-1 and ISE-2:** Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group

Discussions etc. (For each ISE two different tools are to be used).

- **MSE:** Assessment is based on 50% of course content (Normally first three Units)
- **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Unit 1:**<br>Introduction, Need and Necessity, Basic information, Various five year plans and the provision for environment in these plans, Various environmental policies like National plan for cause of aquatic ecosystem, Sustainable developmental policy, National forest policy, and other policies related to environment. | **7 Hrs.** |
| **Unit 2:**<br>Historical development of various environmental legislations, USEPA 1969, Clean Air Act, Clean Water Act, NEPA, OSHA Standards. | **6 Hrs.** |
| **Unit 3:**<br>Water (Prevention and Control of Pollutants act), 1974 and Rules, Water Cess Act and Rules, Air (Prevention and Control of Pollutants act), 1981 and Rules, Indian Forest Act and Rules, Solid waste Management Rules, 2016 | **7 Hrs.** |
| **Unit 4:**<br>Environmental Protection Act 1986 and Rules, EIA notification and procedure, Rules under EPA. Present status of these rules in India. | **7 Hrs.** |
| **Unit 5:**<br>Functions and powers of ministry of Environment and forest and pollution control Boards in centre and state, Energy Bureau of India, energy audit, Environmental audit, National River action Plan, National Lake action Plan | **6 Hrs** |
| **Unit 6:**<br>Case studies of various landmark judgments in Environmental field, Critical Evaluation of current environmental Risk Policy, Environmental Management plans at centre and state. Environmental Economics, Basic concepts in economics, Green rating of industries. | **7 Hrs.** |

**Textbooks:**

1. Environmental Planning and Management in India – Saxena
2. Introduction to Environmental Law - Shantakumar S.

**References:**


1. All Environmental Legislations, amendments, rules Published by Ministry of Environment and Forest, Govt of India
2. Handbook of Environmental Law, Acts, Guidelines, Compliances and Standards Vol. I, II - Trivedi R.K.
3. International environmental Law – Lakshman
4. Environmental Policies in India – Singh Shekhar

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Open Elective-I: Occupational Health and Safety<br>**Course Code:** UOEL0632 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | **3** | **-** | **-** | **3** |

**Course Pre-Requisite:**
NIL

**Course Description:**
Introduction Concept and Need of Safety, Safety and Industries, Introduction to Risk Assessment and Management, Safety Management Systems, Accidents in Industries, Occupational Health and Industrial Hygiene, Various Preventive Methods for Occupational
Health Problems, Introduction to legal aspects of Safety, Safety in Engineering industries.

**Course Learning Objectives:**

1. To understand concept and need of safety in industries
2. To study various safety management systems, OSHAS 18001 management system.
3. To study cause and impact of accidents.
4. To study accident prevention techniques.
5. To study industrial hygiene and occupational dieses.

**Course Outcomes:**

| **COs** | **After the completion of the course the students will be able to** | **Bloom's Cognitive Descriptor** |
|---|---|---|
| CO.1 | Identify issue related to health and safety in industries. | Cognitive (Remembering) L1 |
| CO.2 | Grasp causes of accidents and correctiveactions for them. | Cognitive (Understanding) L2 |
| CO.3 | Solve problems relatedto industrial hygiene. | Cognitive (Applying) L3 |
| CO.4 | Explain various safety management systems and OSHAS 18001 management systems for industries. | Cognitive (Understanding) L2 |

**CO-PO Mapping:**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO.1 | | | | | | 2 | | | 2 | 2 | | |
| CO.2 | | | | | | 2 | | | 2 | | | |
| CO.3 | | | | | | 3 | | | 2 | | | 2 |
| CO.4 | | | | 2 | | | | | 2 | | | |

| **COs** | **PSO1** | **PSO2** |
|---|---|---|
| CO.1 | - | 2 |
| CO.2 | - | - |
| CO.3 | - | - |
| CO.4 | - | 2 |

**Assessments:**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE-1 | 10 |
| MSE | 30 |
| ISE-2 | 10 |
| ESE | 50 |

- **ISE-1 and ISE-2:** Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions etc. (For each ISE two different tools are to be used).

- **MSE:** Assessment is based on 50% of course content (Normally first three Units)
- **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Unit 1:**<br>Safety - Concept and Need of Safety, Safety and Industries - Definition, Various Hazards in Industries, Safety Department and its Role.<br>History of Safety movement, Evolution of modern safety concept, Purpose and Overview of Audit Systems, Scope and Background, Intended Audience, Period of Applicability, identification of unsafe acts of workers and unsafe conditions | **6 Hrs.** |
| **Unit 2:**<br>Introduction to Risk Assessment and Management, Safety Management Systems, Concept of an Accident, Accidents in Industries, Definition and Various Causes, Cost of Accidents, Accident Prevention Techniques, Accident Statistics, Reportable and Non Reportable Accidents, Principles of Accident Prevention, Theories of Accidents, Accident Investigation and Reporting, Domino sequence, Supervisory role, Role of safety committee, Cost of accident. | **7 Hrs.** |
| **Unit 3:**<br>Safety in Industries-, Safe Design and Layout of Plants and Equipments, Machine Guarding, Safe Storage and Handling of Hazardous chemicals, MSDS, Fire Safety, Good House Keeping. Job Safety Analysis, Safety Checklists, Safety Inspections, ConfinedSpace Entry, Work Permit System, Lock Out- Tag Out System | **7 Hrs.** |
| **Unit 4:**<br>Occupational Health and Industrial Hygiene - Definition, Objectives, Need, Chronic and Acute Effects, Various Limits of Exposure-, LD50, LC50, TLV(TWA), STEL, OSHA Limits etc. Effects of Various Physical, Chemical and Biological Hazards Present in Industries on Human Health. Various Occupational Diseases and Causative Agent, Occupational Diseases in Various Industries,<br>Various Personal and Work Place Monitoring Systems. | **7 Hrs.** |
| **Unit 5:**<br>Various Preventive Methods for Occupational Health Problems, Protection of Workers against Harmful Agents and Conditions, LEVs, PPEs, Ergonomics, Health Monitoring and Medicine. | **6 Hrs.** |
| **Unit 6:**<br>Legal aspects of Safety, Safety in Engineering industries, Chemical industries, Construction industries, On site and Off site Emergency Management Plan, OSHAS 18001 management system and Auditing, Product Safety. | **7 Hrs.** |

**Textbooks:**


1. Occupational Safety and health -by David L. Goetsch, Prentice Hall,Ohio
2. Safety manual - EDEL Engineering consultancy Pvt.Ltd.
3. Hazardous Material and Hazardous Waste management - by Gayle Woodside, John Wiley and sonsInc.
4. Environmental Health and Safety Auditing Handbook - by Lee Harrison, Mac Graw HillInc.
5. Health Hazards of the Human Environment - World Health Organization, Geneva,1972
6. Textbook of Preventive and Social Medicine - by K. Park, BanarsidasBhanotPublishers.
7. Industrial and Occupational Safety, Health and Hygiene - by Dr. A.H.Hommadi
8. Introduction to Industrial Safety - by K.T.Kulkarni


**References:**


1. Occupational Safety and health -by David L. Goetsch, Prentice Hall,Ohio
2. Safety manual - EDEL Engineering consultancy Pvt.Ltd.
3. Hazardous Material and Hazardous Waste management - by Gayle Woodside, John Wiley andsons Inc.

| **Class:** T. Y. B.Tech Civil and Environmental Engineering<br>**Title of the Course:** Open Elective-I: Water Conservation and Management<br>**Course Code :** UOEL0633 | **L** | **T** | **P** | **Credits** |
|---|---|---|---|---|
| | **3** | **-** | **-** | **3** |

**Course Pre-Requisite:**

Students shall have knowledge of:

- Water crises and impact due to mismanagement of water usage
- Importance of water usage
- Concept of sustainability

**Course Description:**

The objective of the course is imparting fundamental knowledge of water crises due to exploitation and overuse natural resources of water. Student will get knowledge of sustainable development with the help of water conservation and management.

**Course Learning Objectives:**

At the end of the course students will be able to:

1. Apply knowledge about concept, necessity and scope of water conservation and Management.
2. Understand general, scientific and engineering approaches regarding proper planning and utilization of water using different technologies.
3. Develop communication skill so as to create awareness about conservation and utilization of natural resources team work, community for sustainable development participation among society.
4. Inculcate professional and multidisciplinary approach for excellence in various projects of civil and environmental engineering.

**Course Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | **Bloom's Cognitive Descriptor** |
|---|---|---|
| **CO1** | Explain significance and necessity of water conservation, Management and sustainable management practices. | Cognitive Understanding Explain L2 |
| **CO2** | Analyze standard watershed model based on standard modeling approaches and classifications. | Cognitive Analyzing Analyze L5 |
| **CO3** | Assess Socio – Economic Aspects of conservation and utilization of natural resources through community participation, water legislation and implementations. | Cognitive Evaluating Assess L4 |
| **CO4** | Develop appropriate technology for water conservation and management with low cost for sustainable development. | Cognitive Developing Develop L6 |

**CO-PO Mapping:**

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

| **CO** | **PSO1** | **PSO2** |
|---|---|---|
| **CO1** | - | - |
| **CO2** | - | - |
| **CO3** | - | 1 |
| **CO4** | - | 2 |

**Assessments:**

| Assessment | Weightage (Marks) |
|---|---|
| ISE-1 | 10 |
| MSE | 30 |
| ISE-2 | 10 |
| ESE | 50 |

- **ISE-1 and ISE-2:** Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions etc. (For each ISE two different tools are to be used).
- **MSE:** Assessment is based on 50% of course content (Normally first three Units)
- **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Unit 1: Introduction to water conservation and management**: Status in India, historical background, Overview of water resources of India, Present status of water availability, Water shortage and scarcity ,Problems of surface and ground water quantity and quality, Surface water Scenario, Ground Water Scenario | **7 Hrs** |
| **Unit 2: Surface water Scenario**: Investigation of surface water, data and analysis, utilization of wasted flows, rainwater harvesting, groundwater potential and harvesting, well construction, integrated water resources management. development in Irrigation Sector, , Low Irrigation Efficiency, Industrial and Other Uses, Declining per capita water availability | **7 Hrs** |
| **Unit 3: Ground Water Scenario**: Ground water states, ground water sources, Types of aquifers, Ground water conservation, soil conservation, soil and soil moisture conservation, conservation measures, rainwater management, Water resources development. | **6 Hrs** |
| **Unit 4: Water quality**: Domestic sector - urban and rural water supply, Water quality issues of surface and groundwater in India, Pathogenic pollution in both sources, Salinity in both sources, Fluoride, Nitrate and Arsenic problems in Groundwater, Oxygen depletion in Surface water, Eutrophication in Surface water, Toxicity in Ground and Surface water, Ecological Health in surface water | **5 Hrs** |
| **Unit 5: Water use management**: Agriculture, sustainable agriculture, dry land agriculture, and selection of water use efficiency, crops, irrigation, water losses, Issues and challenges in the water resources development and management, mitigate Gap between demand and availability, wetland management.<br>Advanced Irrigation techniques, IT tools for water distribution, Development of Modeling Tools, Less water consuming gadgets, Water saving Technologies, Research in desalination and wastewater Treatment, Developing water resistant crop varieties, Policy Research | **8 Hrs** |
| **Unit 6: Watershed concept** – Introduction, Need, characteristics of watershed, proforma for basic data on watershed, watershed management, integrated multidisciplinary approach, administrative aspects. Socio economics, peoples part, awareness, participation, state and integrated approach, pasture and silvipastures, horticulture, tree culture, farm forestry, afforestation, sustainable society, international agencies, future, economic viability.<br>Impact of water shed management: Model watershed, Government watershed, Government projects national projects, World bank projects, ICRISAT, NGOs in water management. | **7 Hrs** |

**Textbooks:**

1. Hydrology and Soil Conservation Engineering - Ghansham Das , Prentice Hall of India

**References:**

1. Watershed management - J.V.S.Murthy.
2. Watershed management in India - J.V.S.Murthy
3. Hydrology and Soil Conservation Engineering - Ghansham Das , Prentice Hall of India
4. Soil and Water Conservation Engineering - R. Suresh, Standard Punlishers Distributors
5. Manual of Soil and Water Conservation Practices - Gurumal Singh, Oxford and IBH Publishing Company

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Audit Course IV: Transportation Infrastructure<br>**Course Code:** UCEE0664 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | **02** | **-** | **-** | **-** |

**Course Pre-Requisite:**

Students shall have the knowledge of:

- Building Materials and Concrete Technology
- Building Drawing
- Transportation Engineering

**Course Description:**

This course is aimed at providing the student's knowledge of railway, bridge airport, docks and harbor, and tunnel engineering. Railway engineering is concerned with designing, constructing, operating, and maintaining railway transport systems and networks. Bridge engineering involves the planning, design, construction, operation, and maintenance of bridges to ensure safe and effective transportation of vehicles, people, and goods. while airport engineering involves the design and construction of facilities for the landing, take off, movement of aircraft on the ground, parking of airplanes, etc.

**Course Learning Objectives:**

1. To provide a basic knowledge of infrastructure engineering.
2. To deal with elements of permanent way and Geometric design of railways.
3. To expose to airport and bridge engineering.
4. To identify the requirements of harbors and the importance of Tunnel Engineering.

**Course Outcomes:**

| **COs** | **After the completion of the course, the students will be able to** | **Bloom's Cognitive Descriptor** |
|---|---|---|
| CO.1 | Define the scope of infrastructure engineering in national and global development | Cognitive (remembering} L1 |
| CO.2 | Explain elements of permanent way and Geometric design of railways | Cognitive (Understanding) L2 |
| CO.3 | Summarize the classification of airport and bridge | Cognitive (Understanding) L2 |
| CO.4 | Illustrate the requirements of harbors and the importance of Tunnel Engineering | Cognitive (Understanding) L2 |

**CO-PO Mapping:**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO.1 | | | 1 | | | 1 | | 1 | | | | |
| CO.2 | 3 | 2 | 1 | | | | | | | | | |
| CO.3 | | | | 1 | 2 | 1 | | | | | 1 | |
| CO.4 | 2 | 2 | | | | 1 | | | | | | |

| **COs** | **PSO1** | **PSO2** |
|---|---|---|
| CO.1 | -- | - |
| CO.2 | -- | - |
| CO.3 | -- | 1 |
| CO.4 | -- | 1 |

**Assessments :**

| Assessment | Weightage (Marks) |
|---|---|
| ESE | 100 |

- **ESE:** Assessment is based on 100% course content.

**Course Contents:**

| | |
|---|---|
| **Unit 1 Introduction**<br>Scope of Infrastructure Engineering in National and Global development, Necessity of mechanization, Provisions made for various infrastructure sectors like Roads and Highways, Railways, Airports, Ports, Housing, Energy and Power sector. Necessity advantages and disadvantages of PPP (Public-Private Partnership.) | **04 Hrs.** |
| **Unit 2 Railway Planning**<br>Elements of the permanent way –Rails, Sleepers, Ballast, rail fixtures, and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails–Route alignment surveys, conventional and modern methods—Soil suitability analysis–Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings. | **05 Hrs.** |
| **Unit 3 Airport Planning**<br>Air transport characteristics, airport classification, airport planning: objectives, components, layout characteristics, socioeconomic characteristics of the catchment area, criteria for airport site selection and typical airport layouts, Runway Design, Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings Pavement and lighting. | **05 Hrs.** |
| **Unit 4: Bridge Engineering**<br>a) Classification of bridges, selection of site, Bridge Hydrology: determination of design discharge, linear waterway, economical span, location of piers and abutments, afflux, scour depth, design problems on above topics.<br>b) Types of bridge foundations, Bridge piers, Abutments, Wing walls, Bearings, Construction and maintenance of bridges-Introduction; Recent trends in bridges. | **05 Hrs.** |
| **Unit 5: Docks and Harbour**<br>a) Docks and Harbour: Definition of Basic Terms, Requirements, Classification, Location and<br>b) Design Principles– Harbour Layout and Terminal Facilities<br>c) Breakwater: type, comparison, design criteria, and methods of construction | **05 Hrs.** |
| **Unit 6: Tunnel Engineering**<br>Introduction, size and shape of the tunnel, tunneling methods in hard rock and soft material, tunnel lining, tunnel lighting, drainage and ventilation. | **04 Hrs.** |

**Textbooks:**


1. Saxena Subhash C and Satyapal Arora, ―A Course in Railway Engineering‖,Dhanpat Rai and Sons,Delhi,
2. Khanna S K,Arora MG and JainSS,―Airport Planning and Design‖, NemchandandBrothers,Roorkee,
3. Bridge Engineering – S.P. Bindra
4. Bindra S.P., Docks and Harbor Engineering, Dhanpat Rai, New Delhi
5. R Shrinivasan, Harbour Dock and Tunnel Engineering
6. S. C. Saxena , Tunnel Engineering


**References:**


7. Transportation Engineering‖, Volume II: Railways, Airports, Docks and Harbours- C Venkatramaiah,
8. Bridges and Railway Engineering – K. F. Antia.

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Wastewater Engineering Laboratory<br>**Course Code:** UCEE0631 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | **---** | **---** | **02** | **1** |

**Course Pre-Requisite:**

Students shall have the knowledge of:

- Environmental Chemistry
- Wastewater treatment

**Course Description:**

The course explores the application of environmental chemistry to measure physical, chemical, and biological parameters of wastewater. The course includes laboratory methods and interpretation of results with regard to environmental engineering applications.

**Course Learning Objectives:**

1. To provide hands-on practice for analyzing the quality of wastewater.
2. To use basic design considerations for sewerage network.

**Course Outcomes:**

| **COs** | **After the completion of the course the students will be able to** | **Bloom's Cognitive Descriptor** |
|---|---|---|
| CO.1 | **Make use of** physical, chemical and biological methods for wastewater quality analysis. | Cognitive (Applying) L3 |
| CO.2 | **Analyze** and apply the experimental results. | Cognitive ( Analyzing) L4 |

**CO-PO Mapping:**

| **CO** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | 2 | | | | | | | | |
| CO2 | | | 3 | | | | | | | | | |

| **COs** | **PSO1** | **PSO2** |
|---|---|---|
| CO1 | 2 | |
| CO2 | | 2 |

**Assessments :**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE | 50 |
| ESE (OE) | 50 |

- **ISE:** Based on practical performed/ results analyzed / designs of treatment unit/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.
- **ESE (OE):** Assessment is based on oral examination.

**Course Contents:**

| | |
|---|---|
| **Experiment No. 1:** Analysis of domestic wastewater for volatile and fixed solids**.**<br><br>**Learning Outcome:** To determine volatile and fixed solids and relation between them from domestic wastewater. | **2 Hrs.** |
| **Experiment No. 2:** Analysis of domestic wastewater for BOD**.**<br><br>**Learning Outcome:** To determine BOD of domestic wastewater. | **2 Hrs.** |
| **Experiment No. 3:** Analysis of domestic wastewater for COD<br><br>**Learning Outcome:** To determine COD of domestic wastewater | **2 Hrs.** |
| **Experiment No. 4:** Analysis of domestic wastewater for Oil and Grease<br><br>**Learning Outcome:** To determine Oil and Grease from domestic wastewater | **2 Hrs.** |

| | |
|---|---|
| **Experiment No. 5:** Determine sludge settleability<br><br>**Learning Outcome:** To determine Sludge Volume Index from aeration tank of activated sludge process | **2 Hrs.** |
| **Experiment No. 6:** Analysis of domestic wastewater for Phosphorous<br><br>**Learning Outcome:** Determination of Orthophosphates from domestic wastewater | **2 Hrs.** |
| **Experiment No. 7:** Analysis of domestic wastewater for Total Kjeldhal Nitrogen**.**<br><br>**Learning Outcome:** To determine Ammonia and organic nitrogen from domestic wastewater. | **2 Hrs.** |
| **Experiment No. 8:** Analysis of sludge<br><br>**Learning Outcome:** Determination of characteristics of sludge such as pH, moisture content, volatile solids | **2 Hrs.** |
| **Experiment No. 9:** Design of sewerage network for a given area<br><br>**Learning Outcome:** To design sewerage network for small residential area | **2 Hrs.** |

**References:**


1. Chemistry for Environmental Engineering and Science, Clair N Sawyer, Perry L. McCarty, Gene F. Parkin
2. Standard Methods for the Examination of Water and Wastewater by American Public Health Association, American Water Works Association, Water Environment Federation (2005)
3. IS 3025: Methods of sampling and test (physical and chemical) for water and wastewater
4. Manual on sewerage and sewage Treatment- Ministry of Urban Development, New Delhi (CPHEEO)

| **Class:** T.Y.B.Tech Civil and Environmental Engineering<br>**Title of the Course:** Air Pollution and Control Laboratory<br>**Course Code:** UCEE0632 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | --- | --- | **2** | **1** |

**Course Pre-Requisite:**

Students shall have the knowledge of:

- Environmental Chemistry

**Course Description:**

During the course, students will be demonstrated with the use of equipment in laboratories and hands-on practice in the field for monitoring of various meteorological parameters as well as Ambient Air quality monitoring and stack gas monitoring

**Course Outcomes:**

| **COs** | **After the completion of the course the students will be able to** | **Bloom's Cognitive Descriptor** |
|---|---|---|
| CO1 | Monitor various meteorological parameters needed for air pollution studies | Psychomotor (Understanding) L2 |
| CO2 | Design and conduct experiments for air quality monitoring | Psychomotor (Design) L5 |

**CO-PO Mapping:**

| **CO** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | 3 | 2 | | | | | | | |
| CO2 | | | | 3 | 2 | 1 | 1 | | | | 2 | |

**Assessments :**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE | 25 |
| ESE (OE) | 25 |

- **ISE:** Based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.
- **ESE (OE):** Assessment is based on oral examination.

**Course Contents:**

| | |
|---|---|
| **Experiment No. 1:** To Measure ambient air temperature<br><br>**Learning Outcome :** Students will be monitor ambient air temperature for study and research purposes. | **2 Hours** |
| **Experiment No.2:** To Measure relative humidity of ambient air<br><br>**Learning Outcome:** Students will be able to monitor relative humidity for study and research purposes. | **2 Hours** |
| **Experiment No.3:** To Measure dew point temperature of ambient air<br><br>**Learning Outcome :**Students will be able to measure dew point temperature for study and research purposes. | **2 Hours** |
| **Experiment No. 4:** To measure wind speed and direction<br><br>**Learning Outcome:** Students will be able to interpret and develop wind rose diagrams for study and research purposes. | **2 Hours** |

| | |
|---|---|
| **Experiment No. 5:** To study the functioning of Automatic weather station<br><br>**Learning Outcome :** Students will be able to monitor various meteorological parameters for study and research purposes. | **2 Hours** |
| **Experiment No. 6:** To study the functioning of Fine Dust Sampler-FDS<br><br>**Learning Outcome :** Students will be able to operate the FDS for ambient air monitoring | **2 Hours** |
| **Experiment No. 7:** To determine the concentration of RSPM( PM10 and PM2.5) in ambient air<br><br>**Learning Outcome :** Students will be able to determine concentration of RSPM sulfur in ambient air<br>for study and research purposes. | **2 Hours** |
| **Experiment No. 8:** To determine the concentration of oxides of sulfur in ambient air<br><br>**Learning Outcome:** Students will be able to determine concentration of oxides of sulfur in ambient air for study and research purposes. | **2 Hours** |
| **Experiment No. 9:** To determine the concentration of oxides of nitrogen in ambient air<br><br>**Learning Outcome:** Students will be able to determine concentration of oxides of nitrogen in ambient air for study and research purposes | **2 Hours** |
| **Experiment No. 10:** To study the sampling procedure of Stack gas Monitoring KIT<br><br>**Learning Outcome:** Students will be able to explain significance and procedure of stack gas monitoring | **2 Hours** |
| **Textbooks:**<br>Chemistry for Environmental Engineering and Science by Sawyer, McCarty and Parkin | |
| **References:**<br>1. Guidelines for Ambient Air Qulaity Monitoring-Central Pollution Control Board, (2003).<br>2. Stack Gas Monitoring Guide lines - Central Pollution Control Board<br>3. Air Pollution Sampling and Analysis (Laboratory Manual)- Dr. Sharad Ghokale, IITGuwahati<br>4. Laboratory Manual for Air Quality Sampling and Analysis, IIT Delhi | |

| **Class:** T. Y. B. Tech Civil and environmental Engineering<br>**Title of the Course:** Design of Concrete Structures Laboratory<br>**Course Code:** UCEE0633 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | --- | --- | **2** | **1** |

**Course Pre-Requisite:**

Students shall have the knowledge of:

- Algebra and Engineering Mathematics
- Engineering Mechanics
- Structural Mechanics
- Construction Technology

**Course Description:**

The course helps to develop as well as enhance mathematical skills and analytical abilities by using various design philosophies to design various structural components as per IS Code 456:2000 provisions. Students design beams, slabs, columns, environmental structures with varying grades of material, Loading as well as spans. Knowledge of structural members helps in costing and valuation also.

**Course Learning Objectives:**

3. To use concepts to design structural members and refer IS Code.
4. To apply checks to verify the designs.
5. To understand concept of design of structures related to Environmental Engineering.

**Course Outcomes:**

| **COs** | **After the completion of the course the students will be able to** | **Bloom's Cognitive Descriptor** |
|---|---|---|
| CO1 | Illustrate design philosophies and concepts of Reinforced Cement Concrete design | Cognitive (Understanding) L2 |
| CO2 | Examine the design solutions related to Environmental Engineering by using various checks. | Cognitive (Analyzing) L4 |

**CO-PO Mapping:**

| **CO** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | 3 | | 2 | | | | | 1 | | |
| CO2 | | | 3 | | 2 | | | | | 1 | | |

| **COs** | **PSO1** | **PSO2** |
|---|---|---|
| CO1 | - | 2 |
| CO2 | - | 2 |

**Assessments :**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE | 50 |

- **ISE:** Based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

**Course Contents:**

| | |
|---|---|
| **Experiment No. 1:** Stress strain behavior of concrete and steel<br><br>**Learning Outcome:** Interpretation of behavior of the materials and estimating their permissible values of stress for design. | **2 Hours** |
| **Experiment No. 2: Use of Limit State method of Collapse for singly reinforced sections** (Limit state of flexure)<br><br>**Learning Outcome:** Design of singly reinforced sections with varying conditions. | **2 Hours** |

| | |
|---|---|
| **Experiment No. 3: Use of Limit State method of Collapse for doubly reinforced sections** (Limit state of flexure)<br><br>**Learning Outcome:** Design of doubly reinforced sections with varying conditions. | **2 Hours** |
| **Experiment No. 4: Use of Limit State method of Collapse for flanged sections** (Limit state of flexure)<br><br>**Learning Outcome:** Design of flanged sections with varying conditions. | **2 Hours** |
| **Experiment No. 5: Use of Limit State method of Collapse for shear and bond** (Limit state of shear and bond)<br><br>**Learning Outcome:** Verification of design by applying checks for shear and bond | **2 Hours** |
| **Experiment No. 6: Use of Limit State method of Collapse for one-way slab** (Limit state of flexure)<br><br>**Learning Outcome:** Design of one way slab | **2 Hours** |
| **Experiment No. 7: Use of Limit State method of Collapse for two way slabs** (Limit state of flexure)<br><br>**Learning Outcome:** Design of two way slab with various support conditions | **2 Hours** |
| **Experiment No. 8: Use of Limit State method of Collapse for cantilever slabs** (Limit state of flexure)<br><br>**Learning Outcome:** Design of cantilever slab | **2 Hours** |
| **Experiment No. 9: Use of Limit State method of Collapse for staircase** (Limit state of flexure)<br><br>**Learning Outcome:** Design of staircase. | **2 Hours** |
| **Experiment No. 10: Use of Limit State method of Collapse for columns** (Limit state of bond)<br><br>**Learning Outcome:** Design of rectangular and circular column | **2 Hours** |
| **Experiment No. 11: Use of Limit State method of Collapse for circular water tanks** (Limit state of bond)<br><br>**Learning Outcome:** Design of circular water tank. | **2 Hours** |
| **Experiment No. 12: Use of Limit State method of Collapse Rectangular water tanks** (Limit state of bond)<br><br>**Learning Outcome:** Design of rectangular water tank. | **2 Hours** |

**Textbooks / Reference books:**


1 IS 456-2000
2. Limit state theory and Design –Karve and Shah, Structures publications, Pune
3. Reinforced Concrete Design – Limit state - A.K. Jain Nem Chand brothers Roorkee
4. Fundamentals of Reinforced Concrete –Sinha and Roy, S. Chand and company Ltd. Ram Nagar, New Delhi
6. Limit State Design of reinforced concrete P.C.Varghese, Prentice Hall, New Delhi
7. Reinforced Concrete Design- B.C. PunmiaLaxmi publications New Delhi
8. Reinforced Concrete Design-M. L. Gambhir-Mcmillan India Ltd. New Delhi
9. Special publications -16-Bureau of Indian standard

| **Class:** T. Y. B. Tech Civil and Environmental Engineering<br>**Title of the Course:** Design and Drawing of Environmental Systems Laboratory<br>**Course Code:** UCEE0634 | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|
| | --- | --- | **04** | **2** |

**Course Pre-Requisite:**

Students shall have the knowledge of:

- Engineering Drawing
- Water Supply Engineering

**Course Description:**

This course includes knowledge of design and drawing of different water and wastewater treatment units. Also it covers design of storage reservoirs and sewerage systems

**Course Objectives:**

1. Understand water and wastewater treatment facilities
2. Learn drawing of water and wastewater treatment units, storage reservoirs and sewerage systems

**Course Learning Outcomes:**

| **COs** | **After the completion of the course the students will be able to** | **Bloom's Cognitive Descriptor** |
|---|---|---|
| CO1 | **Make use of** AutoCAD for drawing of treatment units of water and waste water | Cognitive L-3 |
| CO2 | **Design** and draw treatment units for water and waste water, service reservoir and sewer appurtenances. | Cognitive L-6 |

**CO-PO Mapping:**

| **CO** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 2 | | | | | | | |
| CO2 | 3 | 2 | 2 | | | | | | | | | |

| **COs** | **PSO1** | **PSO2** |
|---|---|---|
| CO1 | | |
| CO2 | 1 | |

**Assessments :**

| **Assessment** | **Weightage (Marks)** |
|---|---|
| ISE | 50 |
| ESE (OE) | 50 |

- **ISE:** Based on practical performed/ drawing sheets/Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc
- **ESE (OE):** Assessment is based on oral examination.

**Course Contents:**

| | |
|---|---|
| **Experiment No. 1:** Flow sheet of conventional water and waste water treatment plant<br>**Learning Outcomes:** To plan and draw treatment flow sheet of water and waste water treatment plant | **2 Hours** |
| **Experiment No. 2:** Cascade Aerator, Hydraulic Mixing Unit (Parshall Plume) and Flash Mixer<br><br>**Learning Outcomes:** To design and draw of Cascade Aerator, Hydraulic Mixing Unit and Flash Mixer | **4 Hours** |

| | |
|---|---|
| **Experiment No. 3:** Clarifier, Clariflocculator<br><br>**Learning Outcomes:** To design and draw Clarifier, Clariflocculator | **2 Hours** |
| **Experiment No. 4:** Rapid Sand Filter<br>**Learning Outcomes:** To design and draw Rapid Sand Filter | **2 Hours** |
| **Experiment No. 5:** Service Reservoir<br><br>**Learning Outcomes:** To design and draw Service Reservoir | **4 Hours** |
| **Experiment No. 6:** Screen chamber and Detritus Pit<br><br>**Learning Outcomes:** To design and draw Screen Chamber and Detritus Pit | **2 Hours** |
| **Experiment No. 7:** Sewer Profile<br><br>**Learning Outcomes:** To design and draw Sewer Profile | **4 Hours** |
| **Experiment No. 8:** Hydraulic flow diagram of conventional water and waste water treatment plant using AutoCAD<br>**Learning Outcomes:** To draw hydraulic flow diagram of conventional water and waste water treatment plant using AutoCAD | **2 Hours** |
| **Experiment No. 9:** Water treatment units (any two) using AutoCAD<br><br>**Learning Outcomes:** To draw water treatment units using AutoCAD | **4 Hours** |

**References:**


1. Manual on Water Supply and Treatment (3rd Ed) – Ministry of Urban Development, New Delhi, 1991.
2. Manual on Sewerage and Sewage Treatment (2nd Ed) – Ministry of Urban Development, New Delhi, 1993.
3. Manual on Sewerage and Sewage Treatment (Final Draft) – Ministry of Urban Development, New Delhi, 2012