**SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY**
**An Autonomous Institution, Affiliated to Anna University**
**Coimbatore - 641 008**

## DEPARTMENT OF CIVIL ENGINEERING


# CURRICULUM AND SYLLABI

# BE CIVIL ENGINEERING

# REGULATION 2020

**SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY**

An Autonomous Institution affiliated to Anna University, Chennai

Accredited by NAAC with 'A' Grade

Kuniamuthur, Coimbatore - 641 008

## DEPARTMENT OF CIVIL ENGINEERING

# BE CIVIL ENGINEERING

# CURRICULUM AND SYLLABI

# REGULATION 2020

# CHOICE BASED CREDIT SYSTEM

**SRI KRISHNA COLLEGE OF ENGNEERING AND TECHNOLOGY**

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Kuniamuthur, Coimbatore - 641 008

## VISION AND MISSION OF THE DEPARTMENT

### Our Vision

To be a center of excellence in Civil Engineering Education through full-fledged learning experience along with research.

### Our Mission

**To accomplish our vision, we are committed to**

- Provide high quality technical education for Undergraduate, Post Graduate and Doctoral Programmes in Civil Engineering.
- Create excellent infrastructural facility and state-of-the-art Laboratories.
- Encourage faculty and students to carry out socially relevant research through collaboration with industry.
- Inculcate ethics and ensure commitment to the society with leadership qualities.

**Program Outcomes (POs):-**

At the time of their graduation students of Civil Engineering Program should be in possession of the following Program Outcomes

PO 1. **Engineering knowledge:** Apply the knowledge of mathematics, science and engineering fundamentals for the solution of complex Civil Engineering problems.

PO 2. **Problem analysis:** Identify, formulate and analyse complex Civil Engineering problems reaching substantiated conclusions using first principles of mathematics and engineering sciences.

PO 3. **Design/development of solutions:** Design solutions for complex Civil Engineering problems and design system components with appropriate consideration for public health & safety, cultural, societal and environmental considerations.

PO 4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis & interpretation of data and synthesis of the information to provide valid conclusions.

PO 5. **Modern tool usage:** Create, select & apply appropriate techniques, resources,

modern engineering and IT tools, including prediction and modeling to complex Civil Engineering activities, with an understanding of the limitations.

PO 6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal & cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

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

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

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

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

**Program Educational Objectives (PEOs):-**

The following Program Educational Objectives are designed based on the department mission

| | | |
|---|---|---|
| PEO 1 | **Employability Skills** | Graduates will emerge as competitive professionals in collaboration with renowned builders and set a benchmark in the field of construction. |
| PEO 2 | **Technical Competencies** | Graduates will adapt to the latest technological development and continue to be a competitive Civil Engineer / Entrepreneur. |
| PEO 3 | **Critical Analysis and Design Tools** | Graduates will apply logical reasoning and analytical thinking to analyze, interpret, solve multifaceted problems in the field of Civil Engineering and identify advanced tools to satisfy the demands of the society. |

**Mapping of POs to PEOs**

| Program Educational Objectives | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| **PEO 1** | **3** | **2** | **3** | 2 | **2** | **3** | **2** | **2** | **3** | **3** | **3** | **2** |
| **PEO 2** | **3** | **3** | **2** | **2** | **3** | **2** | **2** | **2** | **2** | **2** | **2** | **3** |
| **PEO 3** | **3** | **3** | **3** | **2** | 3 | **3** | **2** | **2** | **2** | **3** | **2** | **3** |

| | | | | | |
|---|---|---|---|---|---|
| **1** | Reasonably agreed | **2** | Moderately agreed | **3** | Strongly agreed |

**Program Specific Outcomes (PSOs):-**

At the end of the Program, Graduate shall have

| | | |
|---|---|---|
| PSO 1 | **Analytical Knowledge and Practical Skills** | The ability to analyse, design and interpret by applying the concepts of mathematics and physical sciences in the core areas of Civil Engineering. |
| PSO 2 | **Civil Engineer and Sustainability** | The propensity to excel in portfolio of waste management, sanitation, housing and construction management for the sustainable environment. |
| PSO 3 | **Environment and Social Commitment** | The ability to acquire and update knowledge continuously and offer engineering solutions to meet the environmental and societal needs. |

**B.E. CIVIL ENGINEERING**
**REGULATION 2020**
**CHOICE BASED CREDIT SYSTEM**
**I – VIII SEMESTER CURRICULUM AND SYLLABI**

| **SEMESTER I** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **SL. No.** | **Course Code** | **Course** | **L/T/P** | **Contact hrs./wk.** | **C** | **Ext./Int.** | **Cat.** |
| **THEORY** | | | | | | | |
| 1. | 20CE101 | Introduction to Civil Engineering | 3/0/0 | 3 | 3 | 50 /50 | ESC |
| **THEORY CUM PRACTICAL** | | | | | | | |
| 2. | 20MA101 | Engineering Mathematics I | 2/1/2 | 5 | 4 | 40/60 | BSC |
| 3. | 20CH101 | Engineering Chemistry | 3/0/3 | 6 | 4.5 | 40/60 | BSC |
| 4. | 20CS111 | Problem Solving Using C Programming | 3/0/2 | 5 | 4 | 40/60 | ESC |
| 5 | 20EN101 | Technical Communication Skills | 2/0/2 | 4 | 3 | 40/60 | HSMC |
| **PRACTICAL** | | | | | | | |
| 6 | 20ME111 | Engineering Graphics | 1/0/3 | 4 | 2.5 | 40/60 | ESC |
| **MANDATORY COURSE** | | | | | | | |
| 7. | 20MC101 | Mandatory Course I | 3 WEEKS | | 0 | 0/100 | MC |
| | | **Total** | **14/1/12** | **27** | **21** | **700** | |

| **SEMESTER II** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **SL. No.** | **Course Code** | **Course** | **L/T/P** | **Contact hrs./wk.** | **C** | **Ext./Int.** | **Cat.** |
| **THEORY CUM PRACTICAL** | | | | | | | |
| 1. | 20CE201 | Architectural Planning and Building Drawing | 3/0/2 | 5 | 4 | 40/60 | ESC |
| 2. | 20MA201 | Engineering Mathematics II | 2/1/2 | 5 | 4 | 40/60 | BSC |
| 3. | 20PH201 | Applied Physics | 3/0/3 | 6 | 4.5 | 40/60 | BSC |
| 4. | 20EE111 | Basics of Electrical and Electronics Engineering | 3/0/2 | 5 | 4 | 40/60 | ESC |
| **PRACTICAL** | | | | | | | |
| 5. | 20CS211 | Python for Engineers Laboratory | 1/0/3 | 4 | 2.5 | 40/60 | ESC |
| 6. | 20ME103 | Engineering Practices Laboratory | 0/0/3 | 3 | 1.5 | 40/60 | ESC |
| **MANDATORY COURSE** | | | | | | | |
| 7. | 20MC102 | Mandatory Course II | 2/0/0 | 2 | 0 | 0/100 | MC |
| | | **Total** | **14/1/15** | **30** | **20.5** | **700** | |

| SEMESTER III | | | | | | | |
|---|---|---|---|---|---|---|---|
| **SL. No.** | **Course Code** | **Course** | **L/T/P** | **Contact hrs./wk.** | **C** | **Ext./Int.** | **Cat.** |
| **THEORY** | | | | | | | |
| 1. | 20ME201 | Engineering Mechanics | 3/1/0 | 4 | 4 | 50 /50 | ESC |
| 2. | 20GE201 | Universal Human Values | 3/0/0 | 3 | 3 | 50/50 | HSMC |
| **THEORY CUM PRACTICAL** | | | | | | | |
| 3. | 20MA301 | Engineering Mathematics III | 2/1/2 | 5 | 4 | 40/60 | BSC |
| 4. | 20CE301 | Construction Materials and Techniques | 3/0/2 | 5 | 4 | 40/60 | PCC |
| 5. | 20CE302 | Fluid Mechanics and Hydraulic Machinery | 3/0/2 | 5 | 4 | 40/60 | PCC |
| 6. | 20CE303 | Surveying and Geomatics | 3/0/2 | 5 | 4 | 40/60 | PCC |
| **MANDATORY COURSE** | | | | | | | |
| 7. | 20MC104 | Mandatory Course III | 2/0/0 | 2 | 0 | 0/100 | MC |
| | | **Total** | **19/2/8** | **29** | **23** | **700** | |

| SEMESTER IV | | | | | | | |
|---|---|---|---|---|---|---|---|
| **SL. No.** | **Course Code** | **Course** | **L/T/P** | **Contact hrs./wk.** | **C** | **Ext./Int.** | **Cat.** |
| **THEORY** | | | | | | | |
| 1. | 20CE401 | Solid Mechanics | 3/0/0 | 3 | 3 | 50/50 | PCC |
| **THEORY CUM PRACTICAL** | | | | | | | |
| 2. | 20MA401 | Probability and Numerical Methods | 2/1/2 | 5 | 4 | 40/60 | BSC |
| 3. | 20CE402 | Engineering Geology and Concrete Technology | 3/0/2 | 5 | 4 | 40/60 | PCC |
| 4. | 20CE403 | Environmental Engineering | 3/0/2 | 5 | 4 | 40/60 | PCC |
| 5. | 20CE404 | Geotechnical Engineering | 3/0/2 | 5 | 4 | 40/60 | PCC |
| 6. | 20CE405 | Transportation Engineering | 3/0/2 | 5 | 4 | 40/60 | PCC |
| **MANDATORY COURSE** | | | | | | | |
| 7. | 20MC103 | Mandatory Course IV | 2/0/0 | 2 | - | 0/100 | MC |
| | | **Total** | **19/1/10** | **30** | **23** | **700** | |

| SEMESTER V | | | | | | | |
|---|---|---|---|---|---|---|---|
| **SL. No.** | **Course Code** | **Course** | **L/T/P** | **Contact hrs./wk.** | **C** | **Ext./Int.** | **Cat.** |
| **THEORY** | | | | | | | |
| 1. | 20xxxxx | Open Elective I | 3/0/0 | 3 | 3 | 50/50 | OEC |
| 2. | 20CE0xx | Emerging Elective I | 3/0/0 | 3 | 3 | 50/50 | EEC |
| 3. | 20CE9xx | Professional Elective I | 3/0/0 | 3 | 3 | 50/50 | PEC |
| **THEORY CUM PRACTICAL** | | | | | | | |
| 3. | 20CE501 | Construction Planning and Management | 3/0/3 | 6 | 4.5 | 40/60 | HSMC |
| 5. | 20CE502 | Design of Reinforced Concrete Structures | 3/0/3 | 6 | 4.5 | 40/60 | PCC |
| 6. | 20CE503 | Mechanics of Materials | 3/0/3 | 6 | 4.5 | 40/60 | PCC |
| **MANDATORY COURSE** | | | | | | | |
| 7. | 20MC105 | Mandatory Course V | 2/0/0 | 2 | - | 0/100 | MC |
| | | **Total** | **20/0/9** | **29** | **22.5** | **700** | |

| SEMESTER VI | | | | | | | |
|---|---|---|---|---|---|---|---|
| **SL. No.** | **Course Code** | **Course** | **L/T/P** | **Contact hrs./wk.** | **C** | **Ext./Int.** | **Cat.** |
| **THEORY** | | | | | | | |
| 1. | 20xxxxx | Open Elective II | 3/0/0 | 3 | 3 | 50/50 | OEC |
| 2. | 20CE0xx | Emerging Elective II | 3/0/0 | 3 | 3 | 50/50 | EEC |
| 3. | 20CE9xx | Professional Elective II | 3/0/0 | 3 | 3 | 50/50 | PEC |
| **THEORY CUM PRACTICAL** | | | | | | | |
| 4. | 20CE601 | Construction Cost Estimation and Valuation | 3/0/3 | 6 | 4.5 | 40/60 | PCC |
| 5. | 20CE602 | Design of Steel Structures | 3/0/3 | 6 | 4.5 | 40/60 | PCC |
| 6. | 20CE603 | Structural Analysis | 3/0/2 | 5 | 4 | 40/60 | PCC |
| **EMPLOYABILITY ENHANCEMENT SKILLS** | | | | | | | |
| 7. | 20EES01 | Employability Enhancement Skills (Summer Internship / Summer Training - 4 weeks) | | | 2 | 40/60 | EES |
| | | **Total** | **18/0/8** | **26** | **24** | **700** | |

| SEMESTER VII | | | | | | | |
|---|---|---|---|---|---|---|---|
| **SL. No.** | **Course Code** | **Course** | **L/T/P** | **Contact hrs./wk.** | **C** | **Ext./Int.** | **Cat.** |
| **THEORY** | | | | | | | |
| 1. | 20CE0xx | Emerging Elective III | 3/0/0 | 3 | 3 | 50/50 | EEC |
| 2. | 20CE0xx | Emerging Elective IV | 3/0/0 | 3 | 3 | 50/50 | EEC |
| 3. | 20CE9xx | Professional Elective III | 3/0/0 | 3 | 3 | 50/50 | PEC |
| 4. | 20CE9xx | Professional Elective IV | 3/0/0 | 3 | 3 | 50/50 | PEC |
| 5. | 20CE9xx | Professional Elective V | 3/0/0 | 3 | 3 | 50/50 | PEC |
| 6. | 20CE9xx | Professional Elective VI | 3/0/0 | 3 | 3 | 50/50 | PEC |
| **PROJECT WORK** | | | | | | | |
| 6. | 20CE701 | Design Comprehensive Project | 0/0/2 | 2 | 1 | 40/60 | PROJ |
| | | **Total** | **18/0/2** | **20** | **19** | **700** | |

| SEMESTER VIII | | | | | | | |
|---|---|---|---|---|---|---|---|
| **SL. No.** | **Course Code** | **Course** | **L/T/P** | **Contact hrs./wk.** | **C** | **Ext./Int.** | **Cat.** |
| **PROJECT WORK** | | | | | | | |
| 1. | 20CE801 | Project Work | 0/0/24 | 24 | 12 | 40/60 | PROJ |
| | | **Total** | **0/0/24** | **24** | **12** | **100** | |

**COURSES DISTRIBUTION - SPECIALIZATION**

| SL. No. | Stream | Courses | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | |
| **1.** | **Structural Engineering** | - | - | - | 1 | 2+2 | 1+2 | 0+6 | - | 4+10 |
| **2.** | **Environmental and Water Resource Engineering** | - | - | 1 | 1 | 0+2 | 0+2 | 0+6 | - | 2+10 |
| **3.** | **Construction Engineering and Management** | - | 1 | 1 | - | 1+2 | 2+2 | 0+6 | - | 5+10 |
| **4.** | **Geotechnical and Transportation Engineering** | - | - | 1 | 2 | 0+2 | 0+2 | 0+6 | - | 3+10 |
| **5.** | **Basic Civil Engineering Courses** | 2 | 1 | 1 | 1 | - | - | - | - | 5 |
| **6.** | **Science and Humanities** | 4 | 4 | 2 | 1 | - | - | - | - | 11 |
| **7.** | **Open Elective / Mandatory Courses** | 1 | 1 | 1 | 1 | 2 | 1 | - | - | 7 |
| **8.** | **Project / Internship** | - | - | - | - | - | 1 | 1 | 1 | 3 |
| | **Total** | **7** | **7** | **7** | **7** | **5+2** | **5+2** | **1+6** | **1** | **40+10** |

## COURSES DISTRIBUTION - SUMMARY

| SL. No. | Stream | Courses/Semester | | | | | | | | Total | % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | | |
| 1. | Theory | 1 | - | 2 | 1 | 3 | 3 | 6 | - | 16 | 32 |
| 2. | Practical | 1 | 2 | - | - | - | - | - | - | 3 | 6 |
| 3. | Theory cum Practical | 4 | 4 | 4 | 5 | 3 | 3 | - | - | 23 | 46 |
| 4. | Project Work / EES | - | - | - | - | - | 1 | 1 | 1 | 3 | 6 |
| 5. | Mandatory Course | 1 | 1 | 1 | 1 | 1 | - | - | - | 5 | 10 |
| **Total** | | **7** | **7** | **7** | **7** | **7** | **7** | **7** | **1** | **50** | **100** |

## SCHEME OF CREDIT DISTRIBUTION – SUMMARY

| SL. No. | Stream | Credits/Semester | | | | | | | | C | % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | | |
| 1. | Humanities & Social Sciences Including Management (HSMC) | 3 | - | 3 | - | 4.5 | | - | - | 10.5 | 6.4 |
| 2. | Basic Sciences (BSC) | 8.5 | 8.5 | 4 | 4 | - | - | - | - | 25 | 15.1 |
| 3. | Engg. Sciences (ESC) | 9.5 | 12 | 4 | - | - | - | - | - | 25.5 | 15.5 |
| 4. | Professional Core (PCC) | - | - | 12 | 19 | 9 | 13 | - | - | 53 | 32.1 |
| 5. | Professional Electives (PEC) | - | - | - | - | 3 | 3 | 12 | - | 18 | 10.9 |
| 6. | Open Electives (OEC) / Emerging Elective Courses (EEC) | - | - | - | - | 6 | 6 | 6 | - | 18 | 10.9 |
| 7. | Project Work (PROJ) / (EES) | - | - | - | - | - | 2 | 1 | 12 | 15 | 9.1 |
| 8. | Mandatory Course (MC) | Non-credit | | | | | | | | 0 | 0 |
| **Total** | | **21** | **20.5** | **23** | **23** | **22.5** | **24** | **19** | **12** | **165** | **100** |

**STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAMME**

| SL. No. | Course Work - Subject Area | AICTE Suggested Breakdown of Credits | SKCET Credits |
|---|---|---|---|
| 1. | Humanities and Social Sciences including Management courses | **12*** | 10.5 |
| 2. | Basic Science courses | **25*** | 25 |
| 3. | Engineering Science courses including Workshop, Drawing, Basics of Electrical / Mechanical / Computer etc. | **24*** | 25.5 |
| 4. | Professional core courses | **48*** | 53 |
| 5. | Professional Electives courses relevant to the chosen specialization / branch | **18*** | 18 |
| 6. | Open Subjects - Electives from other technical and / or emerging subjects | **18*** | 18 |
| 7. | Project Work, Seminar and / or Internship in Industry or elsewhere. | **15*** | 15 |
| 8. | Mandatory Courses | **Non-credit** | **Non-credit** |
| Total | | **160*** | 165 |
| **Minor Variations is allowed as per need of the respective disciplines* | | | |

**HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT (10.5 Credits)**

| SL. No. | Course Code | Course Title | L/T/P | Contact hrs./Wk. | C | Cat. |
|---|---|---|---|---|---|---|
| 1. | 20EN101 | Technical Communication skills | 2/0/2 | 4 | 3 | HSMC |
| 2. | 20GE201 | Universal Human Values | 3/00 | 3 | 3 | HSMC |
| 3 | 20CE602 | Construction Engineering and Management | 3/0/3 | 6 | 4.5 | HSMC |

**BASIC SCIENCE COURSES (25 Credits)**

| SL. No. | Course Code | Course Title | L/T/P | Contact hrs./Wk. | C | Cat. |
|---|---|---|---|---|---|---|
| 1. | 20MA101 | Engineering Mathematics I | 2/1/2 | 5 | 4 | BSC |
| 2. | 20CH101 | Engineering Chemistry | 3/0/3 | 6 | 4.5 | BSC |
| 3. | 20MA201 | Engineering Mathematics II | 2/1/2 | 5 | 4 | BSC |
| 4. | 20PH201 | Applied Physics | 3/0/3 | 6 | 4.5 | BSC |
| 5. | 20MA301 | Engineering Mathematics III | 2/1/2 | 5 | 4 | BSC |
| 6. | 20MA401 | Probability and Numerical Methods | 2/1/2 | 5 | 4 | BSC |

**ENGINEERING SCIENCE COURSES (25.5 Credits)**

| SL. No. | Course Code | Course Title | L/T/P | Contact hrs./Wk. | C | Cat. |
|---|---|---|---|---|---|---|
| 1. | 20CE101 | Introduction to Civil Engineering | 3/0/0 | 3 | 3 | ESC |
| 2. | 20CS111 | Problem Solving using C Programming | 3/0/2 | 5 | 4 | ESC |
| | 20ME111 | Engineering Graphics | 1/0/3 | 4 | 2.5 | ESC |
| 3. | 20EE111 | Basics of Electrical and Electronics Engineering | 3/0/2 | 5 | 4 | ESC |
| 4. | 20CS211 | Python for Engineers Laboratory | 1/0/3 | 4 | 2.5 | ESC |
| 5. | 20ME103 | Engineering Practices Laboratory | 0/0/3 | 3 | 1.5 | ESC |
| 6. | 20ME101 | Engineering Mechanics | 3/1/0 | 4 | 4 | ESC |
| 7. | 20CE201 | Architectural Planning and Building Drawing | 3/0/2 | 5 | 4 | ESC |

**PROFESSIONAL CORE COURSES (53 Credits)**

| SL. No. | Course Code | Course Title | L/T/P | Contact hrs./Wk. | C | Cat. |
|---|---|---|---|---|---|---|
| 1. | 20CE301 | Construction Materials and Techniques | 3/0/2 | 5 | 4 | PCC |
| 2. | 20CE302 | Fluid Mechanics and Hydraulic Machinery | 3/0/2 | 5 | 4 | PCC |
| 3. | 20CE303 | Surveying and Geomatics | 3/0/2 | 5 | 4 | PCC |
| 4. | 20CE401 | Solid Mechanics | 2/1/0 | 3 | 3 | PCC |
| 5. | 20CE402 | Engineering Geology and Concrete Technology | 3/0/2 | 5 | 4 | PCC |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6. | 20CE403 | Environmental Engineering | 3/0/2 | 5 | 4 | PCC |
| 7. | 20CE404 | Geotechnical Engineering | 3/0/2 | 5 | 4 | PCC |
| 8. | 20CE405 | Transportation Engineering | 3/0/2 | 5 | 4 | PCC |
| 9. | 20CE502 | Design of Reinforced Concrete Structures | 3/0/3 | 6 | 4.5 | PCC |
| 10. | 20CE503 | Mechanics of Materials | 2/1/3 | 6 | 4.5 | PCC |
| 11. | 20CE601 | Construction Cost Estimation and Valuation | 3/0/3 | 6 | 4.5 | PCC |
| 12. | 20CE602 | Design of Steel Structures | 3/0/3 | 6 | 4.5 | PCC |
| 13. | 20CE603 | Structural Analysis | 2/1/2 | 5 | 4 | PCC |

**PROFESSIONAL ELECTIVE COURSES (18 Credits)**

| SL. No. | Course Code | Course Title | L/T/P | Contact hrs./Wk. | C | Cat. |
|---|---|---|---|---|---|---|
| **Elective Stream I: Structural and Foundation Engineering** | | | | | | |
| 1. | 20CE901 | Damage Detection and Rehabilitation of Concrete Structures | 3/0/0 | 3 | 3 | PEC |
| 2. | 20CE902 | Design of Substructures | 3/0/0 | 3 | 3 | PEC |
| 3. | 20CE903 | Disaster Resistant Design of Structures | 3/0/0 | 3 | 3 | PEC |
| 4. | 20CE904 | Green Building Technology | 3/0/0 | 3 | 3 | PEC |
| 5. | 20CE905 | Ground Improvement and Land Reclamation Methods | 3/0/0 | 3 | 3 | PEC |
| 6. | 20CE906 | Prefabricated Structures | 3/0/0 | 3 | 3 | PEC |
| 7. | 20CE907 | Prestressed Concrete Structures | 3/0/0 | 3 | 3 | PEC |
| 8. | 20CE908 | Tall Structures | 3/0/0 | 3 | 3 | PEC |
| 9. | 20CE909 | Valuation of Civil Engineering Structures | 3/0/0 | 3 | 3 | PEC |
| **Elective Stream II: Environmental and Water Resource Engineering** | | | | | | |
| 1. | 20CE910 | Air and Noise Pollution | 3/0/0 | 3 | 3 | PEC |
| 2. | 20CE911 | Ecological and Biological Principles and Process | 3/0/0 | 3 | 3 | PEC |
| 3. | 20CE912 | Environmental Hazard, Risk Assessment and Management | 3/0/0 | 3 | 3 | PEC |
| 4. | 20CE913 | GIS for Environmental Engineering | 3/0/0 | 3 | 3 | PEC |
| 5. | 20CE914 | Industrial Waste Treatment and Disposal | 3/0/0 | 3 | 3 | PEC |
| 6. | 20CE915 | Irrigation Engineering | 3/0/0 | 3 | 3 | PEC |
| 7. | 20CE916 | Occupational Hazards and Industrial Safety | 3/0/0 | 3 | 3 | PEC |
| 8. | 20CE917 | Renewable and Sustainable Energy | 3/0/0 | 3 | 3 | PEC |
| 9. | 20CE918 | Surface Water Hydrology | 3/0/0 | 3 | 3 | PEC |
| **Elective Stream III: Infrastructural Engineering and Management** | | | | | | |
| 1. | 20CE919 | Airport, Docks and Harbors | 3/0/0 | 3 | 3 | PEC |
| 2. | 20CE920 | Construction Methods and Equipment Management | 3/0/0 | 3 | 3 | PEC |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3. | 20CE921 | Disaster Management Planning and Mitigation | 3/0/0 | 3 | 3 | PEC |
| 4. | 20CE922 | Infrastructure Asset Management and Financing | 3/0/0 | 3 | 3 | PEC |
| 5. | 20CE923 | Pavement construction and management | 3/0/0 | 3 | 3 | PEC |
| 6. | 20CE924 | Project Safety Management | 3/0/0 | 3 | 3 | PEC |
| 7. | 20CE925 | Sustainable and Eco-friendly Building Materials | 3/0/0 | 3 | 3 | PEC |
| 8. | 20CE926 | Traffic Engineering and Management | 3/0/0 | 3 | 3 | PEC |
| 9. | 20CE927 | Transport and Environment | 3/0/0 | 3 | 3 | PEC |

**EMERGING ELECTIVE COURSES (12 Credits)**

| SL. No. | Course Code | Course Title | L/T/P | Contact hrs./Wk. | C | Cat. |
|---|---|---|---|---|---|---|
| 1. | 20CE007 | Building Services and Management | 3/0/0 | 3 | 3 | EEC |
| 2. | 20CE008 | Clean Energy Production | 3/0/0 | 3 | 3 | EEC |
| 3. | 20CE009 | Financing and Costing Management for Civil Engineers | 3/0/0 | 3 | 3 | EEC |
| 4. | 20CE010 | Instrumentation and Sensor Technologies for Civil Engineering Applications | 3/0/0 | 3 | 3 | EEC |
| 5. | 20CE011 | Lean startup Management | 3/0/0 | 3 | 3 | EEC |
| 6. | 20CE012 | Metro Systems and Engineering | 3/0/0 | 3 | 3 | EEC |
| 7. | 20CE013 | Pre-Engineered Industrial Structures | 3/0/0 | 3 | 3 | EEC |
| 8. | 20CE014 | Risk and Reliability Analysis of Civil Infrastructure Systems | 3/0/0 | 3 | 3 | EEC |
| 9. | 20CE015 | Rural water supply development and Onsite Sanitation Systems | 3/0/0 | 3 | 3 | EEC |
| 10. | 20CE016 | Contaminated site assessment and Remediation | 3/0/0 | 3 | 3 | EEC |
| 11. | 20CE017 | Smart City Planning and Development | 3/0/0 | 3 | 3 | EEC |
| 12 | 20CE018 | Smart Materials and Structures | 3/0/0 | 3 | 3 | EEC |

**OPEN ELECTIVE COURSES (6 Credits) [Offered to Other Branches]**

| SL. No. | Course Code | Course Title | L/T/P | Contact hrs./Wk. | C | Cat. |
|---|---|---|---|---|---|---|
| 1. | 20CE001 | Disaster Management | 3/0/0 | 3 | 3 | OEC |
| 2. | 20CE002 | Engineering Risk and Uncertainty | 3/0/0 | 3 | 3 | OEC |
| 3. | 20CE003 | Environmental Impact Assessment and Life Cycle Analysis | 3/0/0 | 3 | 3 | OEC |
| 4. | 20CE004 | Geographical Information System | 3/0/0 | 3 | 3 | OEC |
| 5. | 20CE005 | Industrial Pollution control and Prevention Techniques | 3/0/0 | 3 | 3 | OEC |
| 6. | 20CE006 | Sustainability and Infrastructure | 3/0/0 | 3 | 3 | OEC |

**PROJECT WORK (13 Credits)**

| SL. No. | Course Code | Course Title | L/T/P | Contact hrs./Wk. | C | Cat. |
|---|---|---|---|---|---|---|
| 1. | 20CE701 | Design Comprehensive Project | 0/0/2 | 2 | 1 | PROJ |
| 2. | 20CE801 | Project Work | 0/0/24 | 24 | 12 | PROJ |

**EMPLOYABILITY ENHANCEMENT SKILLS (2 Credits)**

| SL. No. | Course Code | Course Title | Duration | C | Cat. |
|---|---|---|---|---|---|
| 1. | 20EES01 | Employability Enhancement Skills (Summer Internship / Summer Training) | 4 WEEKS | 2 | EES |

**MANDATORY COURSES (Non-credit)**

| SL. No. | Course Code | Course Title | L/T/P | Contact hrs./Wk. | C | Cat. |
|---|---|---|---|---|---|---|
| 1. | 20MC101 | Induction Programme | 3 WEEKS | | 0 | MC |
| 2. | 20MC102 | Environmental Sciences | 2/0/0 | 2 | 0 | MC |
| 3. | 20MC103 | Soft Skills | 2/0/0 | 2 | 0 | MC |
| 4. | 20MC104 | Management Organizational Behaviour | 2/0/0 | 2 | 0 | MC |
| 5. | 20MC105 | General Aptitude | 2/0/0 | 2 | 0 | MC |

**SEMESTER WISE CREDIT DISTRIBUTION: -**

| Semester | I | II | III | IV | V | VI | VII | VIII | Total |
|---|---|---|---|---|---|---|---|---|---|
| Credits | 21 | 20.5 | 23 | 23 | 22.5 | 24 | 19 | 12 | 165 |

**Total Credits: 165**

**L** : Lecture **T** : Tutorial

**P** : Practical **C** : Credit

**HSMC** : Humanities and Social Sciences including Management

**Cat.** : Category **MC** : Mandatory Course

**BSC** : Basic Science Courses **ESC** : Engineering Science Courses

**OEC** : Open Elective Courses **EEC** : Emerging Elective Courses

**EES** : Employability Enhancement Skills **PROJ** : Project Work

**PCC** : Professional Core Courses **PEC** : Professional Elective Courses

**SEMESTER 1**

| 20CE101 | INTRODUCTION TO CIVIL ENGINEERING | 3/0/0/3 |
|---|---|---|
| **Nature of Course** | Theory | |
| **Prerequisites** | Nil | |

**Course Objectives:**

| | |
|---|---|
| 1 | To give an understanding to the students of the vast breadth and numerous areas of engagement available in the overall field of Civil Engineering |
| 2 | To motivate the student to pursue a career in one of the many areas of Civil Engineering with deep interest and keenness |
| 3 | To give basic knowledge about the applications and qualities standards of building materials |
| 4 | To expose the students to the various avenues available for doing creative and innovative work in this field by showcasing the many monuments and inspiring projects of public utility |

**Course Outcomes:**
**Upon completion of the course, students shall have the ability to**

| | | |
|---|---|---|
| C101.1 | Discuss the scope of civil engineering and importance of civil engineering structures. | [U] |
| C101.2 | Apply the various building materials in appropriate requirements. | [AP] |
| C101.3 | Discuss the various building components and their functions | [U] |
| C101.4 | Classify the types of masonry and types of flooring | [U] |
| C101.5 | Illustrate the traditional and latest technologies in environmental engineering | [U] |
| C101.6 | Discuss the fundamental principles in transportation engineering | [UP] |

**Course Contents:**

**Module 1: Civil Engineering Structures and Materials** **15 Hrs.**

Scope of Civil Engineering - Functions of a Civil Engineer - Relevance of Civil Engineering in the overall infrastructural development of the country – Definition, types and classification of structures: buildings, bridges, dams, roads, railways, runways, tunnels, towers, chimneys, retaining walls, water tanks, cooling towers and silos - Fundamentals of Town Planning and Smart cities – Definition, types, applications and qualities standards of building materials: Stones, M-sand, bricks, blocks, cement, concrete, structural steel, high tensile steel bar, chemicals, timber, plywood, aluminum, GI sheet, PVC, UPVC, CPVC, recycling of construction & demolition wastes.

**Module 2: Building Components and Construction** **15 Hrs**

Definition, types and classification of buildings - Selection of site - Components of a building and their types and functions: foundation, basement, wall, column, RC members, Pre-stress concrete members, beams, slab, floor, roof, staircase, lintel, truss & damp proof course - Fixing of room dimensions as per NBC - Importance of analysis and design - Highlighting typical available software systems - Setting out of a building - Construction sequences of building – Types of Stone masonry: Ashlar and rubble – Types of Brick masonry bonds –- Types and constructions of flooring - Definition: Maintenances, Repairs & Rehabilitation - Basics of corrosion phenomena.

**Module 3: Infrastructure Engineering** **15 Hrs**

Basic fundamentals and broad outline for the following topics:

Multi-purpose reservoir projects – Water treatment plant - Water supply systems - Irrigation systems – Rain water harvesting - Effluent treatment systems - Hydro power projects - Solid waste management. Building Energy Efficiency - Cross sectional elements in national highway – Water bound macadam road – flexible and rigid pavement – Intelligent Transport Systems - Permanent way and functions of its elements - Metro rail project - Ports & Harbors and other marine structures – Site selection for airport project–structural elements in airport.

**Total Hours : 45 Hrs.**

**Text Books:**

| | |
|---|---|
| 1 | Bhavikatti.S.S., "Basic Civil Engineering", New Age International Publishers, 2018. |
| 2 | Mau S. T. and Sami Maalouf "Introduction to Civil Engineering: A Student's Guide to Academic and Professional Success" Cognella academic publishing, 2014 |
| 3 | Punmia B.C. Ashok kumar jain and Arun kumar jain, "Building constructions" Laxmi Publicaions (P) LTD, 2016 |
| 4 | Valdengrave Okumu, "An Introduction to Civil Engineering" Createspace Independent Publishers, 2014. |
| 5 | Anurag Kandya "Elements Of Civil Engineering" Charotar Publishing House Pvt. Limited, 2015 |

**Suggested Readings:**

| | |
|---|---|
| 1 | Anil Kumar P.P., "Introduction to Smart Cities" Pearson Education, 2019 |
| 2 | Patil, B.S.(1974), Legal Aspects of Building and Engineering Contract |
| 3 | Purushothama Raj P "Building Construction Materials and Techniques" Pearson Education India, 2017 |
| 4 | The National Building Code, Bureau of Indian Standards, 2017. |
| 5 | Wadhera "Intellectual Property Rights", Universal Law Publishing Co, 2004. |

**Web References:**

| | |
|---|---|
| 1 | Construction Contracts, http://www.jnormanstark.com/contract.htm |
| 2 | Internet and Business Handbook, Chap 4, Contracts law, http://www.laderapress.com/laderapress/contractslaw1.html |
| 3 | Contract & Agreements , http://www.tco.ac.ir/law/English/agreements/General/Contract %20Law/C.htm |
| 4 | Contracts, http://206.127.69.152/jgretch/crj/211/ch7.ppt |
| 5 | Business & Personal Law. Chapter 7. "How Contracts Arise", http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt |
| 6 | Types of Contracts, http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt |
| 7 | IV. Types Of Contracts And Important Provisions, http://www.worldbank.org/html/opr/consult/guidetxt/types.html |
| 8 | Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02), http://www.sandia.gov/policy/14g.pdf |
| 9 | www.ieindia.org |
| 10 | https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture-notes/ |
| 11 | http://nptel.ac.in/courses/113106032/4%20-%20Crystal%20structure.pdf |
| 12 | https://www.kluniversity.in/physics/pdfs/crypdf.pdf |

**Tentative Assessment Methods & Levels (based on Revised Bloom's Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom's Level | Assessment Component | Marks |
|---|---|---|---|
| C101.1 & C101.3 | Understand | Online Quiz | 5 |

| | | | |
|---|---|---|---|
| C101.2 | Apply | Group assignment | 5 |
| C101.4 & C101.5 | Understand | Group assignment | 5 |
| C101.6 | Understand | Announced test | 5 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom's Level | Continuous Assessment | | | End Semester Examination (50 marks) |
|---|---|---|---|---|
| | CIA – I [10 Marks] | CIA – II [10 Marks] | CIA – III [10 Marks] | |
| Remember | - | - | - | - |
| Understand | 50 | 60 | 60 | 60 |
| Apply | 50 | 40 | 40 | 40 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

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

| | | | | | |
|---|---|---|---|---|---|
| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |

| 20MA101 | ENGINEERING MATHEMATICS I<br>(COMMON TO MECH,MCT,CIVIL,ECE,EEE,CSE,IT,AIDS) | 2/1/2/4 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Problem analytical |
| **Pre requisites** | Concept of Differentiation and matrices |

**Course Objectives:**

| | |
|---|---|
| 1 | To develop the skill to use matrix algebra techniques that is needed by engineers for practical applications. |
| 2 | To know about system of linear equations and its solution set and how to write down the coefficient matrix and augmented matrix of a linear system |
| 3 | To familiarize with functions of several variables applicable in many branches of engineering. |
| 4 | To find the solution of ordinary differential equations as most of the engineering problems are characterized in this form. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C101.1 | Recall the concepts of matrices, ordinary and partial derivatives. | [R] |
| C101.2 | Express square matrix in the diagonal form. | [U] |
| C101.3 | Solve systems of linear equations numerically and to find inverse matrices. | [AP] |
| C101.4 | Apply numerical techniques effectively to analyse and visualize data to solve basic engineering-related problems. | [AP] |
| C101.5 | Find the extreme values of the given functions to solve the engineering problems. | [AP] |
| C101.6 | Find the solution of second and higher order differential equations connected with electric circuits and simple harmonic motion. | [AP] |

**Course Contents: Theory**

**Module 1: Matrices** **14 Hrs**

Definition – Types of matrices – Characteristic equation – Eigenvalues and eigenvectors of a real matrices and their properties (statement only) – Cayley-Hamilton theorem (statement only) – Verification and application to find inverse and powers of real matrices – Orthogonal transformation of a real symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by Orthogonal transformation.

**Module 2: Solution of Equations and Eigenvalue Problems** **16 Hrs**

Newton-Raphson method – Fixed point iteration method – Gauss-Elimination method – Gauss-Jordan method – Iterative methods of Gauss-Jacobi and Gauss-Seidel – Matrix Inversion by Gauss-Jordan method – Eigenvalue of a matrix by Power method and Jacobi method.

**Module 3: Calculus** **18 Hrs**

Concepts of limits and continuity – Functions of several variables – Total derivatives – Differentiation of implicit functions – Jacobians – Taylor series expansion – Maxima and Minima – Method of Lagrangian multipliers – Ordinary differential equations – Higher order linear differential equations with constant coefficients –Euler Cauchy's equations – Applications of ODE: Solving electrical circuits and simple harmonic motion.

**Laboratory Course Content:**

| S. No | List of Experiments | CO Mapping | BT |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | Entering row vector, column vector, accessing blocks of elements in MATLAB. | C101.1 | [U] |
| 2 | Entering matrices, to locate matrix elements and Correcting any entry through indexing in MATLAB. | C101.1 | [U] |
| 3 | First and second derivative of single variable functions using MATLAB. | C101.1 | [AP] |
| 4 | Eigenvalues and eigenvectors of a matrix using MATLAB. | C101.2 | [AP] |
| 5 | Sum, product, transpose, inverse, determinant and rank of a matrices using MATLAB. | C101.3 | [AP] |
| 6 | System of linear equations in MATLAB using Gaussian elimination. | C101.3 | [AP] |
| 7 | System of linear equations in MATLAB using matrix inverse method. | C101.3 | [AP] |
| 8 | System of linear equations in MATLAB using linsolve. | C101.4 | [AP] |
| 9 | Maxima and Minima of a function using MATLAB. | C101.5 | [AP] |
| 10 | Higher Order Equations of constant coefficients using MATLAB. | C101.6 | [AP] |
| | | **Total Hours:(48+12)** | **60 Hrs.** |

| | |
|---|---|
| **Text Books:** | |
| 1 | G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14th Edition,Pearson, Reprint,2018 |
| 2 | Kreyszig. E, "Advanced Engineering Mathematics" Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2018. |
| 3 | Grewal. B.S, "Higher Engineering Mathematics", 43rd edition, Khanna Publications, Delhi, 2018. |
| **Suggested Readings:** | |
| 1 | Veerarajan. T, "Engineering Mathematics I", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018. |
| 2 | Glyn James, —Advanced Modern Engineering Mathematics, Pearson Education, 4th edition, 2012. |
| 3 | N.P.Bali and Dr.ManishGoyal,"A Text book of Engineering Mathematics" 9th edition, Laxmi publications ltd, 2014. |
| **Web References:** | |
| 1 | http://www.nptel.ac.in/courses/111105035 |
| 2 | http://www.nptel.ac.in/courses/122104017 |
| 3 | http://nptel.ac.in/courses/122102009 |
| 4 | http://nptel.ac.in/courses/111107063 |
| **Online Resources:** | |
| 1 | https://www.coursera.org/learn/linearalgebra2 |
| 2 | https://www.coursera.org/learn/differentiation-calculus |
| 3 | https://www.coursera.org/learn/single-variable-calculus |
| 4 | https://alison.com/courses/Algebra-Functions-Expressions-and-Equations |
| **Tentative Assessment Methods & Levels (based on Blooms' Taxonomy)** | |
| **Summative assessment based on Continuous and End Semester Examination** | |

| Bloom's Level | Continuous Assessment | | | | End Semester Examination (Theory) [40 marks] |
|---|---|---|---|---|---|
| | Theory | | | Practical& Project | |
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA-III [10 marks] | Rubric based CIA [30 Marks] | |
| Remember | 20 | 20 | 20 | 20 | 20 |
| Understand | 30 | 30 | 30 | 30 | 30 |
| Apply | 50 | 50 | 50 | 50 | 50 |
| Analyse | - | - | - | - | - |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

**Course Articulation Matrix**

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

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|

| 20CH101 | ENGINEERING CHEMISTRY<br>(Common to all I Year B.E. / B.Tech) | 3 /0 /3 /4.5 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory skill based |
| **Pre requisites** | NIL |

**Course Objectives:**

| | |
|---|---|
| 1 | To make the students conversant with water treatment, boiler feed water techniques. |
| 2 | To learn the effect of corrosion in materials and the methods for prevention of corrosion. |
| 3 | To understand the principles and applications of electrochemistry and to learn electroanalytical methods. |
| 4 | To understand the basic concepts, synthesis, and applications of nanomaterials. |
| 5 | To explore the synthesis and properties of important engineering plastics, energy sources and drug molecules. |
| 6 | To understand the concepts of photophysical and photochemical processes in spectroscopy. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C101.1 | Recall the requirements of water treatment procedures and boiler feed water for industries. | [R] |
| C101.2 | Apply the various corrosion control techniques in real time industrial environments. | [AP] |
| C101.3 | Understand the principle and working of reference electrodes and conductivity meters as an analyzer. | [U] |
| C101.4 | Understand the basic concepts and applications of Nanochemistry. | [U] |
| C101.5 | Use the knowledge of polymers, various energy sources and storage devices in engineering field. | [AP] |
| C101.6 | Understand the principle and working of certain analytical techniques, and synthesis of some common drug molecules. | [U] |

**Course Contents: Theory**

**Module 1: Water chemistry and Corrosion** **20 Hrs.**

Water treatment-characteristics of water-hardness-types and estimation by EDTA method with numerical problems. Boiler feed water–requirements-disadvantages of hard water. Domestic water treatment-disinfection methods (chlorination, Ozonation, UV treatment)-demineralization process–desalination-reverse osmosis. Corrosion-types–mechanism of dry and wet corrosion-galvanic corrosion-differential aeration corrosion-protective coatings-electroplating of gold-electroless plating of nickel.

**Module 2: Electrochemistry and Energy sources** **20 Hrs.**

Electrochemical cells-electrolytic cell-reversible and irreversible cells - Free energy and emf, cell potentials, Nernst equation and applications. Oxidation and reduction potentials-standard hydrogen electrode, saturated calomel electrode, glass electrode - pH measurement. Nanochemistry - Basics-Comparison of molecules, nanomaterials and bulk materials; Types – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: Electrochemical deposition and electro spinning. Applications of

nanomaterials in science and technology. Energy Sources - Fuel cells ($H_2$-$O_2$). Storage Devices-Batteries - Alkaline-Lead acid, Nickel cadmium and Lithium-ion batteries.

**Module 3: Polymer chemistry, Spectroscopic techniques and Synthesis of drug molecules 20 Hrs.**

Introduction-monomers and polymers-classification of polymers-Polymerization-types. Mechanism of addition polymerization (free radical mechanism). Plastics-classification-preparation, properties and uses of Nylon 6,6, Nylon 6, PVC, Bakelite and PET. Moulding methods- moulding of plastics for Car parts, bottle caps (Injection moulding), Pipes, Hoses (Extrusion moulding), Mobile Phone Cases, Battery Trays (Compression moulding) and PET bottles (Blow moulding). Spectroscopy-Beer Lambert's law, principle, instrumentation, and applications of Electronic spectroscopy (UV-visible), Vibrational and rotational spectroscopy (IR) and Flame emission spectroscopy (FES). Synthesis of a commonly used drug molecule-Asprin, p-nitroaniline from acetanilide.

**Field work:**

Industrial visit- Water treatment plant / Sewage treatment plant / Reverse osmosis plant

**Laboratory course contents:**

| S. No | List of Experiments | CO Mapping | BT |
|---|---|---|---|
| 1 | Estimation of hardness of water by EDTA method | C101.1 | [E] |
| 2 | Estimation of alkalinity of water sample | C101.1 | [E] |
| 3 | Determination of chloride content in bleaching powder | C101.1 | [E] |
| 4 | Estimation of dissolved oxygen in water | C101.2 | [E] |
| 5 | Potentiometry- determination of redox potentials and emf's | C101.2 | [E] |
| 6 | Corrosion rate of mild steel in acid medium | C101.2 | [E] |
| 7 | Electroplating of nickel over copper | C101.2 | [E] |
| 8 | Conductometric titration-mixture of acids vs NaOH | C101.3 | [E] |
| 9 | Determination of strength of strong acid by pH metry | C101.3 | [E] |
| 10 | Synthesis of Nylon 66 | C101.5 | [E] |
| 11 | Spectrophotometry-Estimation of iron in water | C101.6 | [E] |
| 12 | Separation of mixture of amino acids by thin layer chromatography | C101.6 | [E] |
| | **Total Hours: (60 + 15)** | | **75 Hrs.** |

| **Understanding the concepts by simple Demonstrations/Experiments:** | |
|---|---|
| 1 | To observe the hardness of given water sample by soap solution test |
| 2 | To view the colour of the different medium of given water sample using litmus paper test |
| 3 | To detect the chlorine content in tap water using simple chemical method |
| 4 | To know the presence of dissolved oxygen in given water sample using glucose by redox principle |
| 5 | To illustrate the rate of corrosion in steel nails using acid medium |

| **Text Books:** | |
|---|---|
| 1 | Dara S.S, Umare S.S, "Engineering Chemistry", First revised Edition by S. Chand & Company Ltd., New Delhi 2015. |

| | |
|---|---|
| 2 | Jain P. C. & Monica Jain., "Engineering Chemistry", 16th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015. |
| 3 | Fundamentals of Molecular Spectroscopy, 4th Edition by C. N. Banwell Publishing McGraw-Hill Book Company (P) Ltd, England, 1994. |
| 4 | Physical Chemistry, 11th Edition by P. W. Atkins Publishing Oxford University Press (P) Ltd, United Kingdom, 2018. |
| 5 | Nanochemistry, 2nd Edition by K. Klabunde, G. Sergeev Springer Publisher, 2013. |
| 6 | N.Krishna Murthy, Vallinayagam D.,"Engineering Chemistry" 3rd Edition by PHI Learning Pvt Ltd.,2014 |
| 7 | Sunita Rattan, A Text Book of Engineering Chemistry, Student Edition by SK Kataria Publishers, 2013. |
| 8 | R.V.Gadag, A.Nithyananda Shetty "Engineering Chemistry" 3rd Edition PHI Learning Pvt Ltd., 2014. |
| **Suggested Readings:** | |
| 1 | Shikha Agarwal., "Engineering Chemistry and Applications", Cambridge University press, 2016. |
| 2 | Liliya.,Bazylak.I.,Gennady.E.,Zaikov.,Haghvi.A.K.,"Polymers and Polymeric Composites" CRC Press,2014. |
| 3 | Lefrou.,Christine.,Fabry.,Pierre.,Poignet.,Jean-claude.,"Electrochemistry - The Basics, with examples" 2012 ., Springer. |
| 4 | Zaki Ahmad, Digby Macdonald, "Principles of Corrosion Engineering and Corrosion Control", Elsevier Science, 2nd Edition 2012. |
| 5 | Perez, Nestor,"Electrochemistry and Corrosion Science", Springer, 2016. |
| 6 | Introduction to Nano: basics to Nanoscience and Nanotechnology, by Sengupta, Amretashis, Sarkar, Chandan Kumar, Springer Publisher, 2015. |
| 7 | Ghazi A.Karim. "Fuels, Energy and the Environment", CRC Press, Taylor and Francis group, 2012. |
| **Web References:** | |
| 1 | http://www.analyticalinstruments.in/home/index.html |
| 2 | www.springer.com › Home › Chemistry › Electrochemistry |
| 3 | https://www.kth.se/.../electrochem/welcome-to-the-division-of-applied-electrochemistry |
| 4 | www.edx.org/ |
| 5 | https://www.ntnu.edu/studies/courses |
| 6 | www.corrosionsource.com/ |
| **Online Resources:** | |
| 1 | nptel.ac.in/courses/105104102/hardness.htm |
| 2 | https://ocw.mit.edu/courses/chemistry |
| 3 | nptel.ac.in/courses/105106112/1_introduction/5_corrosion.pdf |
| 4 | https://alison.com - Spectroscopic technique, Colorimetry |
| 5 | https://ocw.mit.edu/courses/chemistry |
| 6 | nptel.ac.in/courses/113108051 |

**Tentative Assessment Methods & Levels (based on Revised Bloom's Taxonomy**

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom's | Continuous Assessment | | End Semester |
|---|---|---|---|
| | Theory | Practical | |

| Level | CIA-1 [10 marks] | CIA-2 [10 marks] | CIA-3 [10 marks] | Rubric based CIA [30 Marks] | Examination (Theory) [40 marks] |
|---|---|---|---|---|---|
| Remember | 30 | 30 | 30 | 10 | 20 |
| Understand | 60 | 50 | 40 | 20 | 50 |
| Apply | 10 | 20 | 30 | 40 | 30 |
| Analyse | - | - | - | 30 | - |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

**Course Articulation Matrix**

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

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|

| 20CS111 | PROBLEM SOLVING USING C PROGRAMMING | 3/0/2/4 |
|---|---|---|
| **Nature of Course** | Theory Programming | |
| **Pre requisites** | Nil | |

**Course Objectives:**

| | |
|---|---|
| 1. | To understand problem solving using structured programming language |
| 2. | To gain knowledge about the control structures in C. |
| 3. | To develop logics and write C programs using arrays |
| 4. | To gain familiarity in inbuilt functions, structures and unions in C. |
| 5. | Apply concept and techniques for implementation in respective domain |

**Course Outcomes**

Upon completion of the course, students shall have ability to

| | | |
|---|---|---|
| C111.1 | Apply problem solving techniques to solve real world problems | [AP] |
| C111.2 | Understand C fundamental constructs and control structures | [U] |
| C111.3 | Use the concept of pointers and arrays in designing programs | [AP] |
| C111.4 | Design C programs using the concepts of strings and functions | [C] |
| C111.5 | Develop programs using structures and Unions in C | [AP] |
| C111.6 | Apply the suitable programming concept for the given computational problem | [AP] |

**Course Contents: Theory**

**Module 1: Problem Solving Techniques and C Fundamentals 15 Hrs.**
Problem Solving Techniques: Algorithm, Pseudo-code and Flowchart. Creative Thinking and Problem solving skills in everyday life. Understanding Compiler and interpreter. Program Development LifeCycle. C Fundamentals: Structure of C program, Character Set – Identifiers and Keywords – Data Types – Constants - Variables and Arrays – Declarations - Operators and Expressions –Precedence of operators and associativity. Data input and output - Preparing and running a Complete C Program

**Module 2: Control Structures, Arrays, Strings 15 Hrs.**
Control Structures: Branching: if-else- Looping – while - do while – for - Nested control structures –switch – break – continue – comma - goto. Arrays - Defining an array - Processing an array - Multi dimensional arrays - Strings: Defining a string - Null character - initialization of strings – reading and writing a string - processing the string

**Module 3: Pointers, Functions, Structures and Unions: 15 Hrs.**
Pointers: fundamentals – Pointer Declaration & Usage – Dynamic Memory Allocation. Functions: Defining a Function – Accessing a function – Function Prototype Functions - Pointer to Function - Functions Returning Pointers. - Pointers and Strings - Passing arguments to a function – Recursion. Structures and Unions: The Type Definition (type def) – Enumerated types – Structure - Type Definition – Initialization – Accessing Structures - Unions.

| | |
|---|---|
| **Total Hours** | **45 Hrs** |

**Laboratory course contents:**

| S. No | List of Experiments | CO Mapping | BT |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1. | Formulate simple algorithm and flowchart using Raptor Tool for simple and complex problem | C111.1 | [AP} |
| 2. | Program to process data types, format input and output and to evaluate an expression | C111.2 | [AP] |
| 3. | Program using decision making statements | C111.2 | [AP] |
| 4. | Program using looping statements | C111.2 | [AP] |
| 5. | Program using single and two dimensional arrays | C111.3 | [AP] |
| 6. | Program with Strings | C111.4 | [AP] |
| 7. | Program using Pointers. | C111.3 | [AP] |
| 8. | Program using Recursion | C111.5 | [AP] |
| 9. | Program using structures | C111.5 | [AP] |
| 10. | Branch specific application program | C111.6 | [AP] |
| | | **Total Hours (45+30)** | **75 Hrs** |

| **Text Books:** | |
|---|---|
| 1. | Sprankle M,"Problem Solving and Programming Concepts", 9th Edition, Pearson Education, New Delhi, 2013 |
| 2. | Yashavant Kanetkar, "Let Us C", 16th Edition, BPB Publication, 2017. |
| 3. | Byron, S. Gottfreid, "Programming with C", McGraw Hill, Schaum's outlines, 4th Edition, 2018. |
| 4. | Reema Thareja Computer Fundamentals and Programming in C, 2nd edition, OXFORD publications, 2016 |
| 5. | Brian W. Kernighan, Dennis Ritchie, " The C Programming Language", 2nd Edition Pearson Publicaitons, 2015 |
| **Suggested Readings:** | |
| 1. | Yashavant Kanetkar, "101 Challenges in C Programming" Edition, BPB Publication, 2017 |
| 2. | Herbert Schildt, "The Complete Reference C", 4th Edition , McGraw Hill , 2015 |
| 3. | Venugopal K R and Sudeep R.Prasad , "Mastering C", 2nd Edition, McGraw Hill, 2017 |
| 4. | Jeri.R Hanly, and Elliot B Koffman, "Problem solving and programming Design in C", 8th Edition, Pearson 2016 |
| **Web References:** | |
| 1. | http://raptor.martincarlisle.com/ |
| **Online Resources:** | |
| 1. | https://nptel.ac.in/courses/106/104/106104128/ |
| 2. | https://nptel.ac.in/courses/106/105/106105171/ |
| 3. | https://www.coursera.org/specializations/c-programming |

| **Tentative Assessment Methods & Levels (based on Revised Bloom's Taxonomy** | | | |
|---|---|---|---|
| **Summative assessment based on Continuous and End Semester Examination** | | | |
| **Revised Bloom's** | **Continuous Assessment** | | **End Semester Examination** |
| | **Theory** | **Practical** | |

| Level | CIA-1 [10 marks] | CIA-2 [10 marks] | CIA-3 [10 marks] | Rubric based CIA [30 Marks] | (Theory) [40 marks] |
|---|---|---|---|---|---|
| Remember | 30 | 30 | 20 | 20 | 20 |
| Understand | 70 | 50 | 30 | 20 | 40 |
| Apply | - | 20 | 50 | 60 | 40 |
| Analyse | - | - | - | - | - |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

**Course Articulation Matrix**

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

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|

| 20EN101 | TECHNICAL COMMUNICATION SKILLS (MECH/MCT/IT/CIVIL/CSE) | 2/0/2/3 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory Skill Based |
| **Pre requisites** | Basics of English Language |

**Course Objectives:**

| | |
|---|---|
| 1 | To enhance learners' LSRW skills. |
| 2 | To develop effective communication skills |
| 3 | To facilitate learners to acquire effective technical writing skills |
| 4 | To prepare learners for placement and competitive exams |
| 5 | To facilitate effective language skills for academic purposes and real-life situations. |

**Course Outcomes:**

**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C101.1 | Recall language skills for technical communication. | [U] |
| C101.2 | Apply communication skills in corporate environment. | [AP] |
| C101.3 | Understand and communicate effectively in personal and professional situation. | [AP] |
| C101.4 | Understand and analyse a variety of reading strategies to foster comprehension and to construct meaningful and relevant connections to the text. | [U] |
| C101.5 | Apply technical writing skills to write letters, emails and prepare technical documents. | [AP] |
| C101.6 | Apply language skills with ease in academic and real-life situations. | [AP] |

**Course Contents: Theory**

**Module 1: Listening and Speaking** **17 Hrs.**

Introduction to Effective Communication- Basics of English Language - Importance of LSRW Skills - Self Introduction - Introducing Others - **Listening** to Short Conversations or Monologues - Listening to Speeches / Talks - Listening and Responding -- Longer Listening Tasks -Recognise Functions **Speaking**- Speaking about Giving Directions / Instruction - Talk about Preferences-Agree and Disagree - Giving Opinions - Speaking Practices by Giving Examples, Reasons and Additional Information- Short Talk on Business Topics- Non Verbal Communication- Presentation using Digital Tools- Effectiveness of Narration- Leadership, Conflict and Persuasion.

**Module 2: Reading** **13 Hrs.**

Reading Short Texts - Skimming and Scanning - Comparing Facts and Figures - Reading and Understanding Specific Information in a Text - Cloze Reading - Identifying Reasons and Consequences Through Reading Practices - Comprehension - Collocations.

**Module 3: Grammar and Writing** **15 Hrs.**

Parts of Speech- Tenses – Subject Verb Agreement - Sentence Structures - Connectives - Modal Verbs - Question Formation - If Conditionals- Active and Passive - Impersonal Passive Voice - Vocabulary Building - Business Vocabulary -- Synonyms, Antonyms – British and American Words - One Word Substitution- Identifying Common Errors.

Writing Formal Letters (Accepting and Declining Invitations) - Writing Business Letters (Calling for Quotation, Seeking Clarification, Placing an Order and Complaint Letter) - Email

Writing – Memo - Circular - Agenda and Minutes of the Meeting - Job Application Letter - Resume Writing - Paragraph Writing – Proof Reading and Editing--Technical Instructions and Recommendations- Jumbled Sentences - Technical Definitions - Report Phrases - Report Writing - Technical Proposal - Transcoding (Bar Chart, Flow Chart).

**Laboratory course contents:**

| S.No. | List of Experiments | CO Mapping | BT |
|---|---|---|---|
| 1 | Listening Comprehension | C101.1 | [E] |
| 2 | Pronunciation, Intonation, Stress and Rhythm | C101.3 | [E] |
| 3 | Situational Dialogues | C101.6 | [E] |
| 4 | Formal Presentation | C101.2 | [E] |
| 5 | Group Discussion | C101.2 | [E] |
| 6 | Interview Skills- Online and Offline | C101.6 | [E] |
| | **Total Hours: (45+15)** | | **60 Hrs.** |

**Text Books:**

| | |
|---|---|
| 1 | Practical English Usage. Michael Swan. OUP. 1995. |
| 2 | Remedial English Grammar. F.T. Wood. Macmillan.2007 |
| 3 | On Writing Well. William Zinsser. Harper Resource Book. 2001 |
| 4 | Dr Sumanth S, English for Engineers, Vijay Nicole Imprints Private Limited 2015. |

**Suggested Readings:**

| | |
|---|---|
| 1 | Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006. |
| 2 | Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011. |
| 3 | Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press |

**Web References:**

| | |
|---|---|
| 1 | http://www.academiccourses.com/Courses/English/Business-English |
| 2 | https://**steptest**.in |

**Online Resources:**

| | |
|---|---|
| 1 | https://www.coursera.org/specializations/business-english |
| 2 | http://www.academiccourses.com/Courses/English/Business-English |
| 3 | https://scoop.eduncle.com/one-word-substitution-list |

**Assessment Methods & Levels (based on Blooms' Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| Bloom's Level | Continuous Assessment | | | | End Semester Examination (Theory) [40 marks] |
|---|---|---|---|---|---|
| | Theory | | | Practical | |
| | CIA-I [10 marks] | CIA-II [10 marks] | Term End Examination [10 marks] | Rubric based CIA [30 Marks] | |
| Remember | 20 | 20 | 20 | 20 | 20 |
| Understand | 40 | 40 | 40 | 40 | 40 |
| Apply | 40 | 40 | 40 | 40 | 40 |
| Analyse | - | - | - | - | - |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

| Course Articulation Matrix | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| **1** | | | | | | | 3 | | 2 | | | 2 | | | |
| **2** | | | | | | | 3 | | 2 | | | 2 | | | |
| **3** | | | | | | | 3 | | 2 | | | 2 | | | |
| **4** | | | | | | 3 | 3 | | 2 | | | 2 | | | |
| **5** | | | | | | | 3 | | 2 | | | | | | |
| **6** | | | | | | | 3 | | 2 | | | 2 | | | |
| **Avg** | | | | | | 3 | 3 | | 2 | | | 2 | | | |
| 1 | Reasonably agreed | | | | 2 | Moderately agreed | | | | | 3 | Strongly agreed | | | |

| 20ME111 | ENGINEERING GRAPHICS | 1/0/3/2.5 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Practical application |
| **Pre Requisites** | Basic Drawing and Computer Knowledge |

**Course Objectives:**

| | |
|---|---|
| 1 | To know the method to construct the conic curves used in engineering applications. |
| 2 | To develop an understanding of Isometric to orthographic views and vice versa. |
| 3 | To learn the basic projection of straight lines and plane surfaces. |
| 4 | To develop the imagination of solids inclined to one reference plane. |
| 5 | To know the development of surfaces used in various fields. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C111.1 | Understand the basic concepts of Engineering Graphics. | [U] |
| C111.2 | Sketch isometric, orthographic projections and projection of lines and planes | [AP] |
| C111.3 | Develop lateral surfaces of solids including prisms and pyramids | [AP] |
| C111.4 | Construct projections of lines, planes, solids and isometric views using modelling software. | [A] |

**Course Contents: Theory**

Conic curves and special curves – Isometric projections, Isometric to orthographic projection-Orthographic to Isometric projection-Projection of lines and plane surfaces-Projection of solids-Development of surfaces-Introduction to perspective projection.

**Laboratory course contents:**

| S. No | List of Experiments | CO Mapping | BT |
|---|---|---|---|
| 1 | Introduction to drafting software. | C111.1 | [U] |
| 2 | Construction of conic curves (Ellipse, Parabola and Hyperbola) | C111.1 | [U] |
| 3 | Construction of special curves (Cycloid and Involutes) | C111.1 | [U] |
| 4 | Isometric to orthographic projections – manual sketches | C111.2 | [AP] |
| 5 | Isometric to orthographic projections – software sketches | C111.4 | [A] |
| 6 | Projection of lines - inclined to HP, VP and Both HP & VP | C111.4 | [A] |
| 7 | Projection of plane surfaces (Hexagon, Pentagon and circle) – inclined to any one of the principle planes | C111.4 | [A] |
| 8 | Projection of solids (Prism and Pyramid) – inclined to HP | C111.3 | [AP] |
| 9 | Projection of solids (Cone and Cylinder) – inclined to VP | C111.3 | [AP] |
| 10 | Development of surfaces (Prism, Pyramid, Cone and Cylinder) | C111.4 | [A] |
| 11 | Introduction to perspective projection | C111.2 | [U] |
| | | **Total Hours:** | **45 Hrs.** |

**Suggested Readings:**


| | |
|---|---|
| 1 | Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2014. |
| 2 | K. V. Natarajan, “A Text Book of Engineering Graphics", Dhanalakshmi Publishers, 2018. |
| 3 | Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2011. |
| 4 | Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International |

| | |
|---|---|
| | (P) Limited, 2013. |
| **Web References:** | |
| 1 | http://nptel.ac.in/courses/112102101/ |
| 2 | www.solidworks.com |

| **Tentative Assessment Methods & Levels (based on Bloom's Taxonomy)** | | |
|---|---|---|
| **Summative assessment based on Continuous and End Semester Examination** | | |
| **Bloom's Level** | **Rubric based Continuous Assessment [60 marks]** | **End Semester Examination [40 marks]** |
| Remember | 30 | 30 |
| Understand | 30 | 30 |
| Apply | 20 | 20 |
| Analyze | 20 | 20 |
| Evaluate | 0 | 0 |
| Create | 0 | 0 |

**Course Articulation Matrix**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | 2 | 2 | | | | 2 | 2 | 3 | | 2 | 2 | 2 | | |
| **2** | 2 | 2 | 2 | | | | 2 | 2 | 3 | | 2 | 2 | 2 | | |
| **3** | 2 | 2 | 2 | | | | 2 | 2 | 3 | | 2 | 2 | 2 | | |
| **4** | 2 | 2 | 2 | | | | 2 | 2 | 3 | | 2 | 2 | 2 | | |
| **Avg** | 2 | 2 | 2 | | | | 2 | 2 | 3 | | 2 | 2 | 2 | | |

| | | | | | |
|---|---|---|---|---|---|
| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |

**SEMESTER 2**

| 20CE201 | ARCHITECTURAL PLANNING AND BUILDING DRAWING | 3/0/3/4.5 |
|---|---|---|
| **Nature of Course** | Theory Application | |
| **Pre-requisites** | Nil | |

**Course Objectives:**

| | |
|---|---|
| 1. | To introduce the various facets of architecture and planning for a holistic understanding of the disciplines. |
| 2. | To understand the elements and principles of architecture. |
| 3. | To understand the design approach of various building types with specific reference to site and climate. |
| 4. | To understand the building rules, Bye laws and Building Information Modelling (BIM ). |

**Course Outcomes: Theory**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C201.1 | Apply the components and elements of an architectural design. | [AP] |
| C201.2 | Relate spatial relationship and spatial organization principles. | [AP] |
| C201.3 | Incorporate principles of architecture and circulation in the design. | [AP] |
| C201.4 | Perform climate responsive designs and its various components – passive design strategy. | [AP] |
| C201.5 | Design in terms with building Bye laws, National Building Code and their significance . | [AP] |
| C201.6 | Discuss the Building Information Modelling concepts and its significance. | [AP] |

**Course Contents: Theory**

**Module 1: Introduction and Elements of Architecture** **15 Hrs**

Definitions of Architecture – architecture as a discipline – context for architecture as satisfying human needs: functional, aesthetic and psychological- outline of components and aspects of architectural form. Building typologies: Residential, institutional, commercial and Industrial types – Anthropometry and space standards- Functional relationships - Understanding fundamental elements such as point, line, plane, form and space, shape, pattern, light, color, surface and texture. Understanding perceptual effects of geometric forms such as sphere, cube, pyramid, cylinder and cone. Understanding perceptual effects of configuration of architectural spaces – Spatial relationship and its types, Spatial organization and its types – built form and open space relationships.

**Module 2: Principles of Architecture and Climate responsive design** **15 Hrs**

Understanding fundamental principles such as proportion, scale, balance, symmetry/asymmetry, rhythm, axis, hierarchy, datum, unity, harmony, dominance, and climax. Movement with reference to the architectural form and space – relationship between architectural form and circulation – Types of circulation. Site analysis and climate responsive design **-** Site Surveys - Site analysis of natural, cultural and aesthetic factors – topography, hydrology, soils, vegetation, macro/micro climate, surface drainage, accessibility, size and shape, infrastructures available - Site level planning and organization of open, semi-open and built spaces. Man, Climate and Shelter - Factors that determine

climate – Characteristics of climate types – Design for various climate types – Passive and active energy controls - Simple passive design considerations.

**Module 3: Building Bye laws & Building Information Modelling** **15 Hrs**

Building Rules and Bye-laws - Overview to National Building Code (NBC) -Overview to Development Control Regulation (DCR) - Guidelines -Floor Space Index (FSI)- Floor Area Ratio (FAR)- Setbacks-Open space reservation (OSR) - Industries - Fire safety regulations-Building services-Building Approval Process -Plan Requirements- Real estate regulatory authority (RERA)- Building Information Modelling –Concepts -Advantages - Drawing based process vs BIM process- 3D Simulations- 4D Scheduling- 5D Costing- 6D Sustainability-7D Facility and Asset Management- Design Coordination - BIM softwares - Case studies.

| | **Total Hours** | **45 Hrs** |
|---|---|---|

**Course Outcomes: Lab Component**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C201.1 | Design a single storied residential space for a given client set and draft its sectional and elevation views. | [AN] |
| C201.2 | Design a hospital building with all amenities and draft its sectional and elevational views. | [AN] |
| C201.3 | Design a school building with all amenities and draft its sectional and elevational views. | [AN] |
| C201.4 | Design a factory building with North Light roof truss & G+1 commercial building and draft its sectional and elevational views. | [AN] |
| C201.5 | Render a 3D model of residential building, school and hospital building using Revit software Package. | [AN] |
| C201.6 | Understand the 4D (Scheduling) , 5D (Costing), Clash detection and Automation in BIM. | [U] |

**Laboratory course contents:**

| **S.No.** | **List of Exercises** | **CO Mapping** | **RBT** |
|---|---|---|---|
| 1. | Planning and drafting the plan, section & elevation of a single storied residential building. | C201.1 | [AN] |
| 2. | Planning and drafting the section, elevation of a G+1 hospital building | C201.2 | [AN] |
| 3. | Planning, drafting the section and elevation of a school building | C201.3 | [AN] |
| 4. | Planning and drafting the section, elevation of a factory building with north Light Roof truss | C201.4 | [AN] |
| 5. | Planning and drafting the section elevation of a G+1 commercial complex building. | C201.4 | [AN] |
| 6 | Hands on Overview to Building Information Modelling (BIM) | C201.6 | [U] |
| 7. | Hands-on 3D Modeling of a single storied residential building. (Autodesk Revit Architecture). | C201.5 | [AN] |
| 8. | Hands-on 3D Modeling of a factory building with north Light Roof truss (Autodesk Revit Architecture). | C201.5 | [AN] |

| | | | |
|---|---|---|---|
| 9. | Hands-on 3D Modeling of a school building (Autodesk Revit Architecture) | C201.5 | [AN] |
| 10. | Hands-on Overview to 4D (BIM)- Simulation of a residential building. | C201.6 | [U] |
| 11. | Hands-on Overview to 5D (BIM) - cost estimating of a residential building. | C201.6 | [U] |
| 12. | Hands-on Overview to Clash detection (Navisworks) and Visual Programming environment for automation (Dynamo Studio) | C201.6 | [U] |

| | |
|---|---|
| **Text Books :** | |
| 1. | Simon Unwin, "Analysing Architecture", Routledge; 4th edition, 2014 |
| 2. | Koenigsberger O.H. et.al.,, "Manual of Tropical Housing and Building" – Part I - Climate design, Orient Longman, Madras, India, 2010. |
| 3. | Kale C.M, Patki S.Y. "Building Drawing with an Integrated to Built Environment" Mc-Graw Hill Education, fifth reprint edition 2013. |
| **Suggested Readings** | |
| 1. | Julius Panero, Martin Zelnik, "Human Dimension and Interior Space: A Source Book of Design Reference Standards", 2012. |
| 2. | Arvind Krishnan, Nick Baker, Simos Yannas and Szokolay.S.V., "Climate Responsive Architecture"., A Design Hand Book for Energy Efficient Building, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017 |
| 3. | Ricard Hyde, "Climate Responsive Design: A Study of Buildings in Moderate and Hot Humid Climates" Taylor & Francis; 1 edition, 2015 |
| 4. | National Building Code of India, SP7 (Group 1) Bureau of Indian Standards, New Delhi, 2016. |
| **Web References:** | |
| 1. | http://www.civilengineeringx.com/building-design-and-construction-handbook |
| 2. | https://www.thebalancesmb.com/designing-climate-responsive-architecture-3157812 |
| **Online Resources:** | |
| 1. | http://char.txa.cornell.edu/language/principl/principl.htm |
| 2. | https://www.open.edu.au/sitecore/content/Alchemy/Home/degrees/master-of-urban-and-regional-planning-curtin-university-cur-urp-mas |

**Tentative Assessment Methods and Levels (based on Revised Bloom's Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom's Level | Continuous Assessment | | | | End Semester Examination (Theory) [40 Marks] |
|---|---|---|---|---|---|
| | Theory | | | Practical | |
| | CIA-I [10 Marks] | CIA-II [10 Marks) | CIA-III [10 Marks] | Rubric based CIA [30 Marks] | |
| Remember | 20 | 20 | 10 | - | 10 |
| Understand | 30 | 20 | 20 | 30 | 20 |
| Apply | 50 | 60 | 70 | 70 | 70 |
| Analyse | - | - | - | - | - |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

| Course Articulation Matrix – Theory | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| **1** | 3 | 2 | 1 | | | | | | | 1 | | 1 | 2 | 2 | 1 |
| **2** | 3 | 2 | 1 | | | | | | | 1 | | 1 | 2 | 2 | 1 |
| **3** | 3 | 2 | 1 | | | | | | | 1 | | 1 | 2 | 2 | 1 |
| **4** | 3 | 2 | 1 | | | | 3 | | | 1 | | 1 | 2 | 2 | 1 |
| **5** | 3 | 2 | 1 | | | | | | | 1 | | 1 | 2 | 2 | 1 |
| **6** | 3 | 2 | 1 | | | | | | | 1 | | 1 | 2 | 2 | 1 |
| **Avg** | 3 | 2 | 1 | | | | 3 | | | 1 | | 1 | 2 | 2 | 1 |
| **Course Articulation Matrix – Laboratory** | | | | | | | | | | | | | | | |
| **1** | 3 | 2 | 1 | | 3 | | 2 | 3 | 3 | 2 | | 1 | 2 | 2 | 1 |
| **2** | 3 | 2 | 1 | | 3 | | 2 | 3 | 3 | 2 | | 1 | 2 | 2 | 1 |
| **3** | 3 | 2 | 1 | | 3 | | 2 | 3 | 3 | 2 | | 1 | 2 | 2 | 1 |
| **4** | 3 | 2 | 1 | | 3 | | 2 | 3 | 3 | 2 | | 1 | 2 | 2 | 1 |
| **5** | 3 | 2 | 1 | | 3 | | 2 | 3 | 3 | 2 | | 1 | 2 | 2 | 1 |
| **6** | 3 | 2 | 1 | | 3 | | 2 | 3 | 3 | 2 | | 1 | 2 | 2 | 1 |
| **Avg** | 3 | 2 | 1 | | 3 | | 2 | 3 | 3 | 2 | | 1 | 2 | 2 | 1 |

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|

| 20MA201 | ENGINEERING MATHEMATICS II<br>(COMMON TO MECH,MCT,CIVIL,ECE,EEE,CSE,IT,AIDS) | 2/1/2/4 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Problem analytical |
| **Pre requisites** | Concepts of Differentiation and Integration. |

**Course Objectives:**

| | |
|---|---|
| 1 | To gain knowledge in integrals, which are needed in engineering applications. |
| 2 | To develop logical thinking and analytical skills in evaluating multiple integrals. |
| 3 | To acquaint with the concepts of vector calculus needed for problems in all engineering disciplines. |
| 4 | To impart the knowledge of Laplace transform, to find solutions of initial value problems for linear ordinary differential equations. |

**Course Outcomes:**

**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C201.1 | Determine the area and volume by applying the techniques of double and triple integrals. | [R] |
| C201.2 | Finding the values of integrals through different numerical methods. | [U] |
| C201.3 | Differentiate and integrate a vector-valued functions to solve real world applications. | [AP] |
| C201.4 | Calculate grad, div, curl and use Gauss, Stokes and Greens theorem to simplify the calculations of integrals. | [AP] |
| C201.5 | Apply Laplace transform techniques in system modelling, digital signal processing, process control, solving boundary value problems. | [AP] |
| C201.6 | Apply Laplace transform methods for solving linear differential equations. | [AP] |

**Course Contents: Theory**

**Module 1: INTEGRAL CALCULUS** **18 Hrs.**

Definite integrals: Evaluation of definite integrals using Bernoulli's formula –Multiple Integrals: Double integration in Cartesian coordinates – Area as double integral –Change of order of Integration – Triple integration in Cartesian co-ordinates –Volume as triple integral – Beta and Gamma functions – Relation between Beta and Gamma Functions – Evaluation of Integrals using Beta and Gamma Functions – Numerical integration: Trapezoidal rule and Simpson's rule for single and double integrals.

**Module 2: VECTOR CALCULUS** **14 Hrs.**

Vector differential operator – Gradient of a scalar point function - Directional derivatives – Divergence and Curl of a vector point function – Irrotational and solenoidal vector fields – Simple problems – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (theorems statements only) – Simple applications involving cubes and rectangular parallelepipeds.

**Module 3: LAPLACE TRANSFORM** **16 Hrs.**

Convergence of Laplace transform – Transform of some standard functions – Unit step function – Unit Impulse function – Properties – Initial and final value theorem – Inverse Laplace transform – Partial fraction method – Convolution theorem – Application of Laplace transform for solving second order ordinary differential equation.

| Laboratory course contents: | | | |
|---|---|---|---|
| **S.No.** | **List of Exercises** | **CO Mapping** | **RBT** |
| 1 | Double integrals evaluation in cartesian coordinates using MATLAB. | C201.1 | [AP] |
| 2 | Triple integral calculations using MATLAB in cartesian and cylindrical coordinates. | C201.1 | [AP] |
| 3 | Double integral evaluation in MATLAB by Trapezoidal rule. | C201.2 | [AP] |
| 4 | Evaluation of gradient, curl and divergence in MATLAB. | C201.3 | [AP] |
| 5 | Line integral over a vector field using MATLAB | C201.3 | [AP] |
| 6 | Applying Green's theorem to solve integrals in MATLAB. | C201.4 | [AP] |
| 7 | Relation between Laplace transform of function and its derivative using MATLAB. | C201.5 | [AP] |
| 8 | Laplace transform of Dirac delta and Heaviside functions in MATLAB. | C201.5 | [AP] |
| 9 | Solving Differential Equations in MATLAB using Laplace Transform. | C201.5 | [AP] |
| 10 | Inverse Laplace Transform of symbolic expressions using MATLAB. | C201.6 | [AP] |
| | | **Total Hours:(48+12)** | **60 Hrs.** |
| **Text Books:** | | | |
| 1 | G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14th Edition, Pearson, Reprint,2018. | | |
| 2 | Kreyszig. E, "Advanced Engineering Mathematics" Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2018. | | |
| 3 | Grewal. B.S, "Higher Engineering Mathematics", 43rd edition, Khanna Publications, Delhi, 2014. | | |
| **Suggested Readings:** | | | |
| 1 | Veerarajan. T, "Engineering Mathematics II",Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018. | | |
| 2 | Glyn James, —Advanced Modern Engineering Mathematics, Pearson Education, 4th edition, 2012. | | |
| 3 | N.P.Bali and Dr.Manish Goyal,"A Text book of Engineering Mathematics" 9th edition, Laxmi publications ltd, 2014. | | |
| **Web References:** | | | |
| 1 | http://nptel.ac.in/video.php?subjectId=122107037 | | |
| 2 | http://nptel.ac.in/courses/122107036/ | | |
| 3 | http://nptel.ac.in/video.php?subjectId=117102060 | | |
| **Online Resources:** | | | |
| 1 | https://www.coursera.org/learn/pre-calculus | | |
| 2 | https://www.coursera.org/learn/linearalgebra1 | | |
| 3 | https://alison.com/courses/Advanced-Mathematics-1 | | |
| 4 | https://www.edx.org/course/algebra-lineal-mexicox-acf-0903-1x. | | |
| **Assessment Methods & Levels (based on Blooms' Taxonomy)** | | | |

| Summative assessment based on Continuous and End Semester Examination | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bloom's Level** | **Continuous Assessment** | | | | | | | | | | | | | | | **End Semester Examination (Theory) [40 marks]** |
| | **Theory** | | | | | | | | | | **Practical& Project** | | | | | |
| | **CIA-I [10 marks]** | | **CIA-II [10 marks]** | | | **CIA-III [10 marks]** | | | | | **Rubric based CIA [30 Marks]** | | | | | |
| Remember | 20 | | 20 | | | 20 | | | | | 20 | | | | | 20 |
| Understand | 30 | | 30 | | | 30 | | | | | 30 | | | | | 30 |
| Apply | 50 | | 50 | | | 50 | | | | | 50 | | | | | 50 |
| Analyse | - | | - | | | - | | | | | - | | | | | - |
| Evaluate | - | | - | | | - | | | | | - | | | | | - |
| Create | - | | - | | | - | | | | | - | | | | | - |

| Course Articulation Matrix | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| **1** | 2 | 2 | 2 | 1 | 2 | 1 | | | | | | | 1 | | |
| **2** | 2 | 2 | 2 | 2 | 2 | 2 | | | | | | | 2 | | |
| **3** | 3 | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 | | |
| **4** | 3 | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 | | |
| **5** | 3 | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 | | |
| **6** | 3 | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 | | |
| **Avg** | 2 | 2 | 2 | 2 | 2 | 2 | | | | | | | 2 | | |
| 1 | Reasonably agreed | | | | 2 | Moderately agreed | | | | | 3 | Strongly agreed | | | |

| 20PH201 | APPLIED PHYSICS<br>(Common to Mech. MCT and Civil) | 3/0/3/4.5 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory skill based |
| **Prerequisites** | Nil |

**Course Objectives:**

| | |
|---|---|
| 1 | To learn the basic concepts of physics needed for all branches of engineering |
| 2 | To enable the students to understand the basics of properties of matter, harmonic oscillator, quantum mechanics and crystallography. |
| 3 | To familiarize the principles of various instrument and laser. |

**Course Outcomes: Theory**
**Upon completion of the course, students shall have the ability to**

| | | |
|---|---|---|
| C201.1 | Describe the bending behavior beams, analyze the expression for young's modulus and working of torsional pendulum. | [U] |
| C201.2 | Identify the various parameters that are measurable in different instruments. | [U] |
| C201.3 | Discuss the physical characteristics of oscillation and the basic principle of laser. | [U] |
| C201.4 | Understand the central concepts and principles in quantum mechanics, such as the Schrödinger equation, the wave function and its statistical interpretation. | [U] |
| C201.5 | Estimate the Atomic packing and acquire the basic knowledge about Crystal Lattice, Unit cell, Crystal defects and classify the solids based on band theory. | [AP] |
| C201.6 | Apply the gained knowledge to solve the problems related to their field of study. | [AP] |

**Course Contents: Theory**

**Module 1: Properties of Matter and Instrumentations: 15 Hrs.**

**Properties of matter:** elasticity – Plasticity – Types of stress and strain – Hooke's law, stress-strain diagram - Poisson's ratio – Types of moduli of elasticity, relation between three moduli of elasticity –Factors affecting elasticity – Bending moment of a body: neutral surface and neutral plane, derivation of expression for bending moment of a beam with circular and rectangular cross section, cantilever, I- beam – Derivation of expression for Young's modulus – Torsion of cylinder: expression for couple per unit twist of a solid cylinder (derivation), torsional pendulum, expression for period of oscillation.

**Instrumentations:** dial gauge – Piezo electric strain gauge – Load cell: pneumatic load cell and hydraulic load cell – Pirani gauge – Optical microscope: Scanning electron microscope (SEM), transmission electron microscope (TEM) – Types of errors: gross error, systematic error and random error.

**Module 2: Harmonic Oscillations and Laser 15 Hrs.**

**Harmonic oscillations:** periodic motion – Simple harmonic motion: characteristics of simple harmonic motion – Simple spring-mass system – Resonance – Damped harmonic oscillator, energy decay in a damped harmonic oscillator.

**Laser:** characteristics of laser – Principle of spontaneous emission and stimulated emission – Einstein's theory of matter radiation interaction and A and B coefficients (derivation) –

Population inversion – Pumping – Different types of lasers: Neodymium laser, $CO_2$ and semiconductor laser (heterojunction) – Thermal effect – Qualitative industrial applications of lasers: welding, drilling and cutting.

**Module 3: Quantum Mechanics and Crystallography: 15 Hrs.**

**Quantum mechanics:** Planck's quantum theory (derivation) – Matter waves, de-Broglie wavelength – Heisenberg's uncertainty principle – Schrödinger's wave equation: time independent and time dependent – Physical significances of wave function – Particle in a one dimensional potential box.

**Crystallography:** crystal system – lattice – Bravais lattice, calculation of atomic packing factor for simple cubic, body centered cubic, face centered cubic and hexagonal close packed lattice – Miller indices – Crystal imperfections: point, line burger vector – Basic concepts of band theory and classification of materials into conductor, semiconductor and insulator

**45 Hours**

**Laboratory course contents**

| S.No. | List of Exercises | CO Mapping | RBT |
|---|---|---|---|
| 1 | Young's modulus of the material - Non-Uniform bending method. | C201.1 | [U] |
| 2. | Moment of Inertia of disc and rigidity modulus of a wire – Torsional pendulum. | C201.1 | [U] |
| 3. | Projectile motion – Simulation lab. | C201.2 | [U] |
| 4 | Frequency of transverse and longitudinal wave modes – Melde's experiment. | C201.3 | [U] |
| 5 | Simple harmonic motion- Simulation lab. | C201.3 | [U] |
| 6 | Determination of laser and optical fiber parameters. | C201.3 | [U] |
| 7 | Determination of Planck's Constant. | C201.4 | [U] |
| 8 | Determination of Stefan's Constant. | C201.4 | [U] |
| 9 | Determination of lattice constant of cubic crystal structure. | C201.5 | [U] |
| 10 | Determination of banFd gap of semiconductor. | C201.5 | [U] |
| **Life Skills Experiments** | | | |
| 1 | How does a fuel (gas/liquid) pump nozzle shut off? | C201.6 | [U] |
| 2 | How does a circuit breaker work? | C201.6 | [U] |
| 3 | How to Check Earthing at Home? | C201.6 | [U] |
| | | **Total Hours:** | **75 Hrs.** |

**Text Books:**

| | |
|---|---|
| 1 | David Halliday, Robert Resnick, Jearl Walker "Fundamentals of Physics" Wileyplus.2018 |
| 2 | Rajendran, V "Engineering Physics" Mc Graw Hill Publications ltd, New Delhi, 2016. |

**Suggested Readings:**

| | |
|---|---|
| 1 | Avadhanulu M.N., Kshirshagar P.G., Arun Murthy TVS "A Text Book of Engineering Physics"S. Chand& Co Ltd, 2018. |
| 2 | Sawhney A.K., Puneet Sawhney "A Course In Mechanical Measurements And Instrumentation & Control" Dhanpat Rai & Co, 2013. |
| 3 | Richard P. Feynman. Robert B. Leighton, Matthew Sands"The Feynman Lectures on Physics Vol. I": The New Millennium Edition.2015 |

**Web References:**

| | |
|---|---|
| 1 | https://faraday.physics.utoronto.ca/IYearLab/Elastic-properties-of-solids-manual.pdf |

| | |
|---|---|
| 2 | https://www.physik.uzh.ch/~matthias/espace-assistant/manuals/en/anleitung_102-tb_e.pdf |
| 3 | https://ir.nctu.edu.tw/bitstream/11536/1680/1/A1995TF11100052.pdf |
| 4 | http://www2.optics.rochester.edu/workgroups/cml/whole-enchilada-SPR05.pdf |
| 5 | https://nptel.ac.in/courses/122/103/122103010/ |
| 6 | https://nptel.ac.in/courses/115/106/115106119/ |
| 7 | https://www.eatm.in/upload/srit__unit_i_laser.pdf |
| 8 | https://nptel.ac.in/courses/115/101/115101107/ |
| 9 | https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture-notes/ |
| 10 | http://nptel.ac.in/courses/113106032/4%20-%20Crystal%20structure.pdf |

**Tentative Assessment Methods & Levels (based on Blooms' Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| Bloom's Level | Continuous Assessment | | | | End Semester Examination (Theory) [40 marks] |
|---|---|---|---|---|---|
| | Theory | | | Practical | |
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA-III [10 marks] | Rubric based CIA [30 Marks] | |
| Remember | 30 | 20 | 30 | 20 | 30 |
| Understand | 60 | 60 | 60 | 40 | 60 |
| Apply | 10 | 20 | 10 | 30 | 10 |
| Analyse | - | - | - | 10 | - |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

**Course Articulation Matrix**

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

| | | | | | |
|---|---|---|---|---|---|
| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |

| 20EE111 | BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING (COMMON TO CSE, MECH, CIVIL AND IT) | 3/0/2/4 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory analytical |
| **Prerequisites** | Nil |

**Course Objectives:**

| | |
|---|---|
| **1** | To equip students with a basic understanding of Electrical circuits |
| **2** | To learn the working principle of transformers |
| **3** | To understand the DC and AC Machine working principles and to have a knowledge on selection of machine for specific types of applications. |
| **4** | To give a comprehensive exposure to electrical installations. |
| **5** | To equip students with an ability to understand basics of analog and digital electronics. |

**Course Outcomes:**

Upon completion of the course, students shall have ability to

| | | |
|---|---|---|
| C111.1 | Analyze the concepts in ac circuit and dc circuits. | [A] |
| C111.2 | Understand the working principle of single phase and three phase transformers. | [U] |
| C111.3 | Understand the working principle of DC and AC machines. | [U] |
| C111.4 | Utilize the basic components for electrical installations. | [AP] |
| C111.5 | Understand the basic concepts of Analog and Digital Electronics. | [U] |

**Course Contents: Theory**

**Module 1: DC Circuits and AC Circuits** **20 Hrs**

DC Circuits-Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage law, analysis of simple circuits with dc excitation, Mesh, Nodal Analysis Superposition, Thevenin Theorem, Maximum power transfer theorem and Norton Theorem. AC Circuits- Representation of sinusoidal waveforms, peak and rms values, Phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Three phase balanced circuits, voltage and current relations in star and delta connections.

**Module 2: Electrical Machines and Installations** **15 Hrs**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections (Qualitative only). Construction and working principle of DC motor. Construction and working principle of Synchronous motor and three phase Induction motor. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption.

**Module 3: Basics of Analog and Digital Electronics** **10 Hrs**

Semiconductor, PN junction diode, Zener diode, rectifier- Half wave, full wave and Bridge rectifier, Introduction to Number system, basic Boolean laws, reduction of Boolean

| | | | |
|---|---|---|---|
| expressions and implementation with logic gates. | | | |
| **Laboratory course contents** | | | |
| **S.No.** | **Lab Exercise** | **CO Mapping** | **BT** |
| 1. | Familiarization of Electrical Elements, Sources, Measuring Devices and Verification of ohm's law | C111.1 | [U] |
| 2. | Estimation of voltage and current by KVL and KCL in Electric Circuits | C111.1 | [AP] |
| 3. | Determination of mesh current and node voltage by Mesh and Nodal Analysis | C111.1 | [AP] |
| 4. | Application of Superposition theorems, thevenin's and maximum power transfer theorem in electrical circuits | C111.1 | [AP] |
| 5. | Measurement of three phase power | C111.2 | [A] |
| 6. | Demonstration of cut-out sections of machines: dc machine (Commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding - slip ring arrangement) and single-phase induction machine | C111.3 | [U] |
| 7. | Load test on dc shunt motor. | C111.3 | [AP] |
| 8. | Demonstration of components of LT Switch Gears | C111.4 | [U] |
| 9. | Construction of bridge rectifier with and without filters | C111.5 | [U] |
| 10. | Verification of logic gates. | C111.5 | [U] |
| | | **Total Hours: 75 Hrs.** | |
| **Text Books:** | | | |
| 1 | Fitzgerald. A.E., Charles KingselyJr, Stephen D.Umans, 'Electric Machinery', Tata McGraw Hill, 6th edition 2015. | | |
| 2 | Vincent. Del. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 2nd edition, 2015. | | |
| 3 | E. Hughes, "Electrical and Electronics Technology", Pearson, 10th edition, 2011 | | |
| 4 | Donald .A. Neamen, Electronic Circuit Analysis and Design, 2nd Edition reprint,Tata Mc GrawHill, 2013. | | |
| 5 | M. Morris Mano, 'Digital Logic and Computer Design', Prentice Hall of India, 6th edition, 2017 | | |
| **Suggested Readings:** | | | |
| 1 | Charles A.Gross, Thaddeus A.Roppel, "Fundamentals of Electrical Engineering", CRC press, 2012. | | |
| 2 | D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 5th edition 2012, | | |
| 3 | Theodore F. Bogart, Jeffery S. Beasley and Guilermo Rico, 'Electronic Devices and Circuits', Pearson Education,6th edition, 2019. | | |
| **Web References:** | | | |
| 1 | http://nptel.ac.in/course.php?disciplineId=108 | | |
| 2 | https://ocw.mit.edu/courses/find-by topic/#cat=engineering&subcat=electricalengineering&spec=electricpower | | |
| 3 | https://nptel.ac.in/video.php?subjectId=117103063 | | |
| 4 | https://onionesquereality.wordpress.com/.../more-video- lectures-iit-open | | |
| 5 | https://nptel.iitg.ernet.in/Elec_Comm_Engg/.../Video-ECE.pdf | | |
| **Online Resources:** | | | |
| **1** | https://www.edx.org/course/electricity-magnetism-part-1-ricex-phys102-1x-1 | | |

| | |
|---|---|
| **2** | https://www.mooc-list.com/course/fundamentals-electrical-engineering-coursera |
| **3** | https://nptel.ac.in/course.php |

**Tentative Assessment Methods & Levels (based on Blooms' Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| **Bloom's Level** | **Continuous Assessment** | | | | **End Semester Examination (Theory) [40 marks]** |
|---|---|---|---|---|---|
| | **Theory** | | | **Rubrics Based Practical Assessment [30 Marks]** | |
| | **CIA-I [10 Marks]** | **CIA-II [10 Marks]** | **Term End Examination [10 Marks]** | | |
| Remember | 50 | 50 | 40 | 40 | 40 |
| Understand | 50 | 50 | 40 | 40 | 40 |
| Apply | | - | 20 | 20 | 20 |
| Analyse | - | - | - | - | - |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

**Course Articulation Matrix**

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

| | | | | | |
|---|---|---|---|---|---|
| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |

| 20CS211 | PYTHON FOR ENGINEERS LABORATORY | 1/0/3/2.5 |
|---|---|---|

| | |
|---|---|
| **Nature of Course:** | Theory Programming |
| **Pre requisites:** | Nil |

**Course Objectives:**

| | |
|---|---|
| 1 | Interpret the use of procedural statements like assignments, conditional statements, loops and function calls. |
| 2 | Infer the supported data structures like lists, dictionaries and tuples in Python. |
| 3 | Improve problem solving skills using strings, and functions |
| 4 | Describe the need for Object-oriented programming concepts in Python.. |

**Course Outcomes: Theory**

**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C211.1 | Structure simple Python programs for solving problems. | [U] |
| C211.2 | Describe the Python language syntax including control statements, loops and functions to write programs for a wide variety problem in mathematics, science, and games. | [U] |
| C211.3 | Examine the core data structures like lists, dictionaries, tuples and sets in Python to store, process and sort the data. | [AP] |
| C211.4 | Interpret the concepts of Object-oriented programming as used in Python using encapsulation, polymorphism and inheritance. | [AP] |
| C211.5 | Identify the external modules for creating and writing data to excel files and inspect the file operations to navigate the file systems. | [AP] |

**Course Contents: Theory**

**Introduction to Python:** **15 Hrs.**

Interpreter And Interactive Mode; Values and Data Types, Variables, Expressions, Statements, Operators, **Conditionals:** Boolean Values and Operators, Conditional (If), Alternative (If-Else), Chained Conditional (If-Elif-Else); **Iteration:** While, For, Break, Continue, Pass **Functions:** Function Definition, parameters and arguments, Recursion. **Strings:** String Slices, String Functions and Methods **Lists:** List Operations, List Slices, List Methods, List Loop **Tuples:** Tuple Assignment and Methods **Dictionaries:** Operations and Methods, Set in Python **Files**: Text Files, Reading and Writing Files, Command Line Arguments.

**Laboratory course contents :** Write Python programs for the following

| S.No. | Lab Experiments | CO Mapping | BT |
|---|---|---|---|
| **1** | Commands in interactive mode | C211.1 | [U] |
| **2** | Programs using operators | C211.2 | [AP] |
| **3** | Programs using I/O Operations | C211.2 | [AP] |
| **4** | Programs using control structures | C211.3 | [AP] |
| **5** | Programs using break, continue and pass statements | C211.3 | [AP] |
| **6** | Programs using loops | C211.4 | [AP] |

| | | | |
|---|---|---|---|
| **7** | Programs using functions | C211.4 | [AP] |
| **8** | Programs using recursive functions | C211.4 | [AP] |
| **9** | Programs using Strings | C211.4 | [AP] |
| **10** | Programs using Lists | C211.4 | [AP] |
| **11** | Programs using Tuples | C211.4 | [AP] |
| **12** | Programs using Dictionary | C211.4 | [AP] |
| **13** | Programs using Sets | C211.5 | [AP] |
| **14** | Programs using Files | C211.5 | [AP] |
| **15** | Programs using Command line arguments | C211.5 | [AP] |
| | | | **Total Hours: 60 Hrs** |

| **Text Books:** | |
|---|---|
| 1 | John V. Guttag., Introduction to computation and programming using python: with applications to understanding data, PHI Publisher, 2016 |
| 2 | Beginning Python: From Novice to Professional, Magnus Lie Hetland. Edition, 2005 |
| 3 | Allen B. Downey, "Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 |
| 4 | Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python" – Revised and updated for Python 3.2, Network Theory Ltd., 2011. |
| **Suggested Readings:** | |
| 1 | Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd.,2016. |
| 2 | Timothy A. Budd, "Exploring Pythonǁ", Mc-Graw Hill Education (India) Private Ltd.,,2015. |
| 3 | John V Guttag, "Introduction to Computation and Programming Using Python'',Revised and expanded Edition, MIT Press , 2013 |
| **Web References:** | |
| 1 | https://www.wileyindia.com/introduction-to-computer-science-using-python.html |
| 2 | https://www.programiz.com/python-programming |
| 3 | https://www.fullstackpython.com/best-python-resources |
| 4 | https://www.tutorialspoint.com/python/ |
| 5 | https://www.geeksforgeeks.org/python-programming-language/ |
| **Online Resources:** | |
| 1 | http://nptel.ac.in/courses/106106145/ |
| 2 | https://www.codecademy.com/learn/learn-python |

| **Assessment Methods & Levels (based on Bloom'sTaxonomy)** | | |
|---|---|---|
| **Summative assessment based on Continuous and End Semester Examination** | | |
| **Bloom's Level** | **Rubric based Continuous Assessment[60 marks] (in %)** | **End Semester Examination [40 marks] (in %)** |
| Remember | - | - |
| Understand | 20 | 20 |

| | | |
|---|---|---|
| Apply | 30 | 30 |
| Analyse | 50 | 50 |
| Evaluate | - | - |
| Create | - | - |

**Course Articulation Matrix**

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

| | | | | | |
|---|---|---|---|---|---|
| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |

| 20ME103 | ENGINEERING PRACTICES LABORATORY | 0/0/3/1.5 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Practical application |
| **Pre Requisites** | Nil |

**Course Objectives:**

| | |
|---|---|
| 1 | To learn the use of basic hand tools and to know the need for safety in work place and to gain hands on experience in Carpentry, Sheet metal, Plumbing, Welding and Foundry. |
| 2 | To learn about basic electrical devices, meters and electronics devices and to gain knowledge about the fundamentals of various electrical and electronic gadgets their working and trouble shooting. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C103.1 | Identify and solve the basic engineering problems at home and in workplace. | [AP] |
| C103.2 | Develop the surfaces and make simple components like tray and funnel. | [C] |
| C103.3 | Make simple metal joints using welding equipment and wooden joints using carpentry tools. | [AP] |
| C103.4 | Prepare pipe connections and sand moulds. | [AP] |
| C103.5 | Understand the fundamentals of hot forging and injection moulding | [U] |
| C103.6 | Examine and troubleshoot electrical and electronic circuits | [A] |

**Course Contents:**

**GROUP A (CIVIL & MECHANICAL)**

Manufacturing Methods –Sheet metal operations - Welding - arc welding, gas welding,Study of TIG & MIG welding. Study of foundry, Demonstration of Smithy and Injection moulding - Carpentry work using power tools - Plumbing components and pipelines

**Laboratory Component:**

| S.No | List of Experiments | CO Mapping | RBT |
|---|---|---|---|
| 1 | Preparation of butt joints and lap joints using arc welding | C103.3 | [AP] |
| 2 | Sheet metal Forming and Bending, Model making – Trays and funnels. | C103.2 | [AP] |
| 3 | Preparation of wooden joints by sawing, planning and cutting. | C103.3 | [AP] |
| 4 | Making basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. | C103.4 | [AP] |
| 5 | Demonstration of foundry operations like mould preparation for solid and split piece pattern. | C103.4 | [U] |
| 6 | Demonstration of Smithy operations | C103.5 | [AP] |
| 7 | Demonstration of assembly of pump / Demonstration of Injection moulding | C103.5 | [AP] |

**GROUP B (ELECTRICAL AND ELECTRONICS ENGINEERING)**

Basic Circuit Elements: Resistor, inductor, capacitor. Introduction to measuring equipments: Moving iron meter, moving coil meter, Wattmeter, Energy meter, CRO, Multi-meter. Digital logic circuits, PCB design, fuse, relay, circuit breaker, wire, Earthing, fan, fluorescent lamp, iron box, mixer grinder, study of FM radio and mobile phone.

**Laboratory Component:**

| S.No | List of Experiments | CO Mapping | RBT |
|---|---|---|---|
| 1 | Study and identification of electronic components with specification. | C103.6 | [A] |

| | | | |
|---|---|---|---|
| 2 | Testing of CRO and Electronic components using Multimeter. | C103.6 | [A] |
| 3 | Generation and measurement of signals using CRO. | C103.6 | [A] |
| 4 | Familiarisation of digital basic gate IC's. | C103.6 | [A] |
| 5 | Soldering practice-components devices and circuits- using general purpose PCB. | C103.6 | [A] |
| 6 | Demonstration of meters and electrical components. | C103.6 | [A] |
| 7 | Safety precautions with electrical components. | C103.6 | [A] |
| 8 | Residential house wiring. | C103.6 | [A] |
| 9 | Measurement of power and energy. | C103.6 | [A] |
| 10 | Trouble shooting of electrical equipments. | C103.6 | [A] |
| | | **Total Hours:** | **45 Hrs.** |

**Suggested Readings:**

| | |
|---|---|
| 1 | Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2009 (Second Indian Reprint). |
| 2 | Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promotors Pvt Ltd., 2014. |
| 3 | Suyambazhagan S, 'Engineering practices' PHI Learning private limited, New Delhi,2012. |
| 4 | D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. |
| 5 | E. Hughes, "Electrical and Electronics Technology", Pearson, 2010. |

**Web References:**

| | |
|---|---|
| 1 | www.nptel.ac.in |
| 2 | www.sme.org |
| 3 | http://www.allaboutcircuits.com/education/ |

**Tentative Assessment Methods & Levels (based on Bloom's Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| Bloom's Level | Rubric based Continuous Assessment [60 marks] | End Semester Examination [40 marks] |
|---|---|---|
| Remember | 10 | 10 |
| Understand | 10 | 10 |
| Apply | 40 | 40 |
| Analyze | 20 | 20 |
| Evaluate | 10 | 10 |
| Create | 10 | 10 |

**Course Articulation Matrix**

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

| | | | | | |
|---|---|---|---|---|---|
| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |

## SEMESTER 3

| 20ME201 | ENGINEERING MECHANICS<br>(COMMON TO CIVIL AND MECH) | 3/1/0/4 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Concepts and Analytical |
| **Pre Requisites** | Engineering Mathematics and Applied Physics |

**Course Objectives:**

| | |
|---|---|
| 1 | To make the students understand the vector and scalar representation of forces and moments and the static equilibrium of particles and rigid bodies. |
| 2 | To understand the effect of friction on equilibrium, laws of motion, kinematics of motion and their interrelationship. |
| 3 | To make the students understand the sectional properties of surfaces and solids |
| 4 | To make the students to predict of behaviour of particles and rigid bodies under motion. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C201.1 | Define and illustrate the basic concepts of force system | [U] |
| C201.2 | Calculate the resultant force, moment and geometrical properties of 2D, 3D objects | [AP] |
| C201.3 | Determine the sectional properties of surfaces and solids | [AN] |
| C201.4 | Analyse the resistance force of particles and objects for Impending Motion | [AN] |
| C201.5 | Apply the equations of dynamics to determine the unknown quantities of particles in kinetics and kinematics. | [AP] |
| C201.6 | Determine the displacement, velocity and acceleration using equations of kinetics of rigid bodies. | [AP] |

**Course Contents:**

**Module 1: Equilibrium of Particles and Rigid Bodies** **20 Hrs**

Force Systems – Basic concepts, System of Forces, Coplanar Concurrent Forces, Resolution and addition of forces, resultant of several concurrent forces, Forces in space, Particle equilibrium in 2D and 3D. Moment of Forces and its Application; Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems - Equations of equilibrium of rigid bodies in 2D and 3D. Beams and frames - types of supports, loads and reactions.

**Module 2: Centre of Gravity, Moment of Inertia and Friction** **20 Hrs**

Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere.

Friction: Types of friction, Limiting friction, Laws of friction – Static and Dynamic Friction; simple contact friction, ladder friction – wedge friction.

**Module 3: Dynamics of Particles and rigid bodies** **20 Hrs**

Kinematics of Particles: Basic terms, general principles in dynamics; Rectilinear motion; Plane

curvilinear motion (rectangular, path, and polar coordinates); Relative motion.

Kinetics of Particles: Newton's 2nd law (rectangular, path, and polar coordinates). D'Alembert's principle and its applications; Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique). Method of Virtual Work - Work of a Force, Potential Energy, Potential Energy and Equilibrium.

Kinetics of rigid bodies: rigid body translation, rotation and general plane motion.

| | **Total Hours:** | **60 Hrs.** |
|---|---|---|

**Text Books:**

| | |
|---|---|
| 1 | Beer, Johnston, Cornwell, Self, Mazurek and Sanghi, Vector Mechanics for Engineers – Statics and Dynamics, 12th Edition, McGraw Hill Education, New Delhi, 2019. |
| 2 | Dhiman A.K, Dhiman P, Kulshreshtha D.C, Engineering Mechanics-Statics and Dynamics, McGraw Hill Education, 2017 |
| 3 | Kottiswaran N, Engineering Mechanics - Statics and Dynamics, Sri Balaji Publications, 2018. |

**Suggested Readings:**

| | |
|---|---|
| 1 | Rajasekaran S and Sankarasubramanian G, Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., New Delhi, 2009. |
| 2 | Meriam JL, Craige and Bolton, Engineering Mechanics statics and dynamics, John Willey and Son's publication 9th edition, 2018 |
| 3 | Kumar DS, Engineering Mechanics, S.K.Kataria and Sons Publications, 2013. |
| 4 | Irving H. Shames, Engineering Mechanics - Statics and Dynamics, Pearson Education Asia Pvt. Ltd., 2005. |

**Web References:**

| | |
|---|---|
| 1 | http://nptel.ac.in/courses/122104015/ |
| 2 | http://nptel.ac.in/courses/112103109/ |

**Online Resources:**

| | |
|---|---|
| 1 | https://ocw.mit.edu/courses |

**Tentative Assessment Methods & Levels (based on Bloom's Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Bloom's Level | Assessment Component | Marks |
|---|---|---|---|
| C201.1 | Understand | Objective type Quiz | 5 |
| C201.2 | Apply | Assignment | 5 |
| C201.3 & C201.4 | Analyze | Assignment | 5 |
| C201.5 & C201.6 | Apply | Tutorial | 5 |

**Summative assessment based on Continuous and End Semester Examination**

| Bloom's Level | Continuous Assessment | | | End Semester Examination [50 marks] |
|---|---|---|---|---|
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA-III [10 marks] | |
| Remember | 10 | 10 | 10 | 10 |
| Understand | 10 | 10 | 20 | 20 |
| Apply | 50 | 40 | 40 | 40 |
| Analyze | 30 | 40 | 30 | 30 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

| Course Articulation Matrix | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| 1 | 3 | - | 1 | 2 | | | | | | | | | 2 | - | 1 |
| 2 | 3 | 2 | 2 | 3 | | | | | | | | | 3 | 1 | 1 |
| 3 | 3 | 3 | 2 | 3 | | | | | | | | | 3 | - | 1 |
| 4 | 3 | 2 | 2 | 3 | | | | | | | | | 3 | 1 | 1 |
| 5 | 3 | 2 | 2 | 3 | | | | | | | | | 3 | - | 1 |
| 6 | 3 | 2 | 2 | 3 | | | | | | | | | 3 | 1 | 1 |
| **AVG** | **3** | **2.2** | **1.83** | **2.83** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2.83** | **1** | **1** |

| 20GE201 | UNIVERSAL HUMAN VALUES<br>(COMMON TO ALL BRANCHES) | 3/0/0/3 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory Concept |
| **Pre Requisites** | Interpersonal Communication and Value Sciences |

**Course Objectives:**

| | |
|---|---|
| 1 | Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence. |
| 2 | Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence. |
| 3 | Strengthening of self-reflection. |
| 4 | Development of commitment and courage to act. |
| 5 | Helping the students to appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings |
| 6 | Highlighting plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C201.1 | Understand about themselves and their surroundings (family, society, nature). | [U] |
| C201.2 | Understand and take responsibilities in life and handle problems to attain sustainable solutions while keeping human relationships and human nature in mind. | [U] |
| C201.3 | Apply responsibilities towards their commitments (human values, human relationship and human society). | [AP] |
| C201.4 | Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction. | [AP] |
| C201.5 | Analyse ethical and unethical practices, and formulate strategies to actualize a harmonious environment wherever they work. | [AN] |
| C201.6 | Understand the harmony in nature and existence, and work out mutually on fulfilling participation in the nature. | [U] |

**Course Contents:**

**Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education, Understanding Harmony in the Human Being - Harmony in Myself! 15 Hrs**

Purpose and motivation for the course. Self-Exploration–Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Understanding human being as a co-existence of the sentient 'I' and the 'Material Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical Facility. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of

'I' and harmony in 'I'. Understanding the harmony of 'I' with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail- Programs to ensure Sanyam and Health.

**Module 2: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship, Understanding Harmony in the Nature and Existence - Whole existence as Coexistence 15 Hrs**

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and Competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all- pervasive space. Holistic perception of harmony at all levels of existence.

**Module 3: Implications of the above Holistic Understanding of Harmony on Professional Ethics 15 Hrs**

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for the above production systems. Case studies of typical holistic technologies, management models and eco-friendly production systems. Strategy for transition from the present state to Universal Human Order: a. Individual level: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations. Sum up.

| | |
|---|---|
| **Total Hours** | **45 Hrs.** |

| | |
|---|---|
| **Text Books:** | |
| 1 | Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010 |
| 2 | Rajni Setia, Priyanka Sharma, " Human Values", Genius Publication", Jaipur,2019. |
| **Suggested Readings:** | |
| 1 | Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004. |
| 2 | The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi |
| 3 | India Wins Freedom - Maulana Abdul Kalam Azad. |
| **Web References:** | |
| 1 | https://examupdates.in/professional-ethics-and-human-values/ |
| 2 | http://hvpe1.blogspot.com/2016/06/notes-human-values-and-professional.html |
| 3 | https://www.yourmorals.org/schwartz.2006.basic%20human%20values.pdf |
| **Online Resources:** | |
| 1 | https://nptel.ac.in/courses/109/104/109104068/ |

| | |
|---|---|
| 2 | https://medium.com/the-mission/the-12-important-life-skills-i-wish-id-learned-in-school-f4593b49445b |
| 3 | https://www.thebalancecareers.com/life-skills-list-and-examples-4147222 |

**Tentative Assessment Methods & Levels (based on Bloom's Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Bloom's Level | Assessment Component | Marks |
|---|---|---|---|
| C201.1 | Understand | Group Discussion | 5 |
| C201.2 | Understand | Book Review | 5 |
| C201.3 & C201.4 | Apply | Role Play | 5 |
| C201.5 & C201.6 | Apply | Formal Presentation | 5 |

**Summative assessment based on Continuous and End Semester Examination**

| Bloom's Level | Continuous Assessment | | | Term End Assessment [50 marks] |
|---|---|---|---|---|
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA-III [10 marks] | |
| Remember | 20 | 20 | 20 | 20 |
| Understand | 40 | 40 | 40 | 40 |
| Apply | 40 | 40 | 40 | 40 |
| Analyze | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

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

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|

| 20MA301 | ENGINEERING MATHEMATICS III<br>(COMMON TO MECH/MCT/CIVIL/ECE/EEE) | 2/1/2/4 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Problem analytical |
| **Pre requisites** | Concepts of basic differentiation and Integration |

**Course Objectives:**

| | |
|---|---|
| 1 | To understand the different possible forms of Fourier series and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data. |
| 2 | To acquaint the student with transform techniques which are used in variety of engineering fields. |
| 3 | To study the concept of mathematical formulation of certain practical problems in terms of partial differential equations and solving for physical interpretation. |
| 4 | To find the numerical solution for partial differential equations. |

**Course Outcomes: Theory**

**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C301.1 | Recall the basic integration concepts and partial derivatives | [R] |
| C301.2 | Interpret Fourier series solutions to the engineering problems | [U] |
| C301.3 | Apply continuous transforms techniques to evaluate definite integrals | [AP] |
| C301.4 | Apply the Z transform techniques in discrete sequences | [AP] |
| C301.5 | Apply analytical methods to solve the partial differential equations | [AP] |
| C301.6 | Apply numerical methods to solve wave and heat equation with boundary conditions | [AP] |

**Course Contents: Theory**

**Module 1: Fourier Series** **15 Hrs**

Dirichlet's conditions-General Fourier Series-Odd and Even Functions- Half range sine series and cosine series - Parseval's Identity-Harmonic analysis

**Module 2: Fourier Transform and Z Transform** **15 Hrs**

**Fourier Transform:** Complex form of Fourier Transforms – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem and Parseval's Identity (Statement only) – Evaluation of integrals using Parseval's Identity. **Z-Transform**: Convergence of Z transform **-**Z-transform of Standard functions**-**Properties **-** Inverse Z- transform-Convolution theorem(Statement only)-Partial fraction method - Formation of difference equations - Solution of difference equations using Z-transform Techniques.

**Module 3: Partial Differential Equations** **15 Hrs**

Introduction to PDE – Solving PDE by Lagrange's linear equations-Linear homogeneous partial differential equations of second and higher order with constant coefficients-Classifications-Numerical Solution to Partial differential Equation-Elliptic equations- Laplace equation - Liebmann's Iteration Process -Poisson equation -Parabolic Equation (one dimensional heat equation) - Bender-Schmidt's Difference Scheme – Crank-Nicholson's Difference Scheme- Hyperbolic Equation (one dimensional wave equation).

| | |
|---|---|
| **Total Hours:** | **45 Hrs.** |

**Course Outcomes: Laboratory**

| Upon the completion of the course, students shall have ability to | |
|---|---|
| C301.1 | Understand the need for a function or its approximation as an infinite series. |
| C301.2 | Represent discontinuous function which occurs in electrical circuits and signal processing by using Fourier series |
| C301.3 | Demonstrate the use of Fourier transform to connect the time domain and frequency domain |
| C301.4 | Understanding Z- transform and analyzing discrete signals by using Z- transform. |
| C301.5 | To describe homogeneous and higher order partial differential equations using PDE techniques. |
| C301.6 | Understanding of basic concepts in application of partial differential equations in one dimensional heat and wave equations. |

**Course Contents: Laboratory**

| S.No | List of Experiments | CO Mapping | RBT |
|---|---|---|---|
| 1. | To perform symbolic Fourier series calculation of the given full range signals using suitable mathematical software. | C301.1 | [AP] |
| 2. | To perform symbolic Fourier series calculation of the given half range signals using suitable mathematical software. | C301.2 | [AP] |
| 3. | To plot the Fourier transform of time function using suitable mathematical software. | C301.3 | [AP] |
| 4. | To find the Z transform of given expression f(n) using suitable mathematical software. | C301.4 | [AP] |
| 5. | To find the inverse Z transform of given expression f(n) using suitable mathematical software. | C301.4 | [AP] |
| 6. | To find the solution of homogeneous partial differential equation using suitable mathematical software. | C301.5 | [AP] |
| 7. | To find the solution for higher order partial differential equations using suitable mathematical software. | C301.5 | [AP] |
| 8. | To solve initial and boundary value problems for systems of partial differential equations in one spatial variable x and time t using suitable mathematical software. | C301.5 | [AP] |
| 9. | To perform the solution of Laplace equation using suitable mathematical software. | C301.6 | [AP] |
| 10. | To perform the solution of Poisson equation using suitable mathematical software. | C301.6 | [AP] |
| 11. | To solve the one-dimensional heat equation using suitable mathematical software. | C301.6 | [AP] |
| 12. | To solve the one-dimensional wave equation using suitable mathematical software. | C301.6 | [AP] |

**Text Books:**


| | |
|---|---|
| 1 | Erwin E., “Advanced Engineering Mathematics”, John Wiley and Sons (Asia) Limited, Hoboken,2020. |
| 2 | Grewal. B.S, “Higher Engineering Mathematics”, 44th edition, Khanna Publications, Delhi, 2018. |

| | |
|---|---|
| 3 | Jain M.K. Iyengar, K & Jain R.K., Numerical Methods for Scientific and Engineering Computation, New Age International (P) Ltd, Publishers,6th edition, 2016. |
| **Suggested Readings:** | |
| 1 | Veerarajan. T, “Transforms and Partial differential equations”, 3rd edition, Tata McGraw-Hill Publishing Company Ltd., reprint, 2016. |
| 2 | N.P.Bali ,”A Text book of Engineering Mathematics Sem-III/IV” 13th edition, Laxmi Publications ltd, 2017. |
| 3 | Glyn James, ”Advanced Modern Engineering Mathematics”, Pearson Education, 4th edition, 2016. |
| 4 | P. Kandasamy, K. Thilagavathy and K. Gunavathy, “Numerical Methods”,S.Chand Co. Ltd., New Delhi, 2015. |
| 5 | Holly Moore, “MATLAB for Engineers” Fifth Edition – Pearson Publications, 2018. |
| **Web References:** | |
| 1 | https://www.youtube.com/watch?v=jNC0jxb0OxE |
| 2 | https://www.youtube.com/watch?v=iRXXmtcocAQ |
| 3 | https://www.youtube.com/watch?v=OGT59INHz3Y |
| **Online Resources:** | |
| 1 | https://nptel.ac.in/courses/111/106/111106111/ |
| 2 | https://nptel.ac.in/courses/111/107/111107111/ |
| 3 | https://nptel.ac.in/courses/111/107/111107107/ |

**Assessment Methods & Levels (based on Blooms’ Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| Bloom’s Level | Continuous Assessment | | | | End Semester Examination (Theory) [40 marks] |
|---|---|---|---|---|---|
| | Theory | | | Practical& Project | |
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA-III [10 marks] | Rubric based CIA [30 Marks] | |
| Remember | 20 | 20 | 20 | 20 | 20 |
| Understand | 30 | 30 | 30 | 30 | 30 |
| Apply | 50 | 50 | 50 | 50 | 50 |
| Analyse | - | - | - | - | - |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

**Course Articulation Matrix : Theory**

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

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **6** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 1 | - | - |
| **Avg** | **2.5** | **2.5** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **0.6** | **-** | **-** |
| 1 | Reasonably agreed | | | | 2 | Moderately agreed | | | | | | 3 | Strongly agreed | | |

**Course Articulation Matrix : Laboratory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 1 | 1 | - | - | 3 | - | - | - | - | - | - | - | 1 | - | - |
| **2** | 2 | 2 | - | - | 3 | - | - | - | - | - | - | - | 1 | - | - |
| **3** | 3 | 3 | - | - | 3 | - | - | - | - | - | - | - | | - | - |
| **4** | 3 | 3 | - | - | 3 | - | - | - | - | - | - | - | 1 | - | - |
| **5** | 3 | 3 | - | - | 3 | - | - | - | - | - | - | - | | - | - |
| **6** | 3 | 3 | - | - | 3 | - | - | - | - | - | - | - | 1 | - | - |
| **Avg** | **2.5** | **2.5** | **-** | **-** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **0.6** | **-** | **-** |
| 1 | Reasonably agreed | | | | 2 | Moderately agreed | | | | | | 3 | Strongly agreed | | |

| 20CE301 | CONSTRUCTION MATERIALS AND TECHNIQUES | 3/0/2/4 |
|---|---|---|
| **Nature of Course** | Theory and Practical Application | |
| **Pre requisites** | Engineering Chemistry and Applied Physics. | |

**Course Objectives**

| | |
|---|---|
| 1. | To have a clear knowledge of construction materials and their properties. |
| 2. | To know the market forms of speaical and alternate building materials. |
| 3. | To learn various testing methods for assessing the strength and quality of materials. |
| 4. | To be familiar with the several advanced construction techniques and practices. |

**Course Outcomes: Theory**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C301.1 | Explain the properties and applications of various building materials and their appropriate suitability for a given scenario. | [AP] |
| C301.2 | Demonstrate the manufacturing process of buildings materials and role of admixtures in the concrete mixture. | [AP] |
| C301.3 | Illustrate the characteristics and applications of alternate and decorative construction materials used in various construction works. | [AP] |
| C301.4 | Illustrate the characteristics and applications of protective and special materials used in various construction works. | [AP] |
| C301.5 | Identify and describe the significance of modern machineries and technologies for construction activities. | [AP] |
| C301.6 | Select appropriate techniques and tools for construction activities. | [AP] |

**Course Content: Theory**

**Module 1: Construction materials and Admixtures** **15 Hrs.**

Bricks and Blocks: Classifications, Manufacturing, Tests – Steel: Composition, Types, Manufacturing, Properties and Applications – Aggregates: Natural and Artificial aggregates, Recycled aggregates, Grading, Bulking of fine aggregate – Cement: Ingredients, Manufacturing, Types, Grades, Properties, Cement mortar, Hydration of cement – Admixtures: Accelerators, Retarders, Plasticizers, Super plasticizer, Air entraining admixtures.

**Module 2: Alternate, Decorative, Protective and Special Materials** **15 Hrs.**

Alternate materials: Engineered wood, Bamboo, Sustainable particle boards, Veneer, Foam, Eco-friendly materials - Decorative materials: Panels of laminates, Paints, Varnishes, Distempers, Glass, Ceramics, Plaster, Fabric, Paper - Protective materials: Sealants for joints, Fiber glass reinforced plastic, Carbon fiber, Thermal insulation - Special materials: Composite materials and types, Applications of laminar composites

**Module 3: Construction Machineries and Techniques** **15 Hrs.**

Machineries for: Earthmoving, Dewatering, Concrete mixing, Transporting & placing of materials, Plastering, Prestressing jacks and grouting equipment, Pile driving, Lifting (Cranes, Hoists and other equipment) - Equipment Productivities - Use of Drones for spread out sites - Use of robots for repetitive activities and for modern construction material use and manufacturing of materials, 3D printing. Innovative modern construction tools, accessories

and equipment's. Special construction methods: Scaffolding, Shoring, Underpinning, Piling. Conventional construction methods Vs Mechanized methods and advantages of latter.

| | | |
|---|---|---|
| | **Total Hours:** | **45 Hrs.** |

**Course Outcomes: Laboratory**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C301.1 | Choose the physical inspection methods and analayse the physical characteristics of bricks and blocks | [AN] |
| C301.2 | Assess the strength property of steel using various laboratory methods | [AN] |
| C301.3 | Assess the strength property of metal and steel bar using laboratory methods | [AN] |
| C301.4 | Examine the physical characteristics of cement using various laboratory methods | [AN] |
| C301.5 | Estimate the strength property of cement using various laboratory methods | [AN] |
| C301.6 | Demonstrate the operation of modern building tools | [U] |

**Course Content : Laboratory**

| S.No. | List of Experiments | CO Mapping | RBT |
|---|---|---|---|
| 1 | Determine the general quality of bricks and building blocks (Drop test, Dimension test, Warpage test) | C301.1 | [AN] |
| 2 | Estimate the Water absorption and Efflorescence of bricks and building blocks | C301.1 | [AN] |
| 3 | Assess the compression strength of bricks and building blocks | C301.1 | [AN] |
| 4 | Determination of tensile strength of steel rods | C301.2 | [AN] |
| 5 | Evaluate the double shear strength of steel rods | C301.2 | [AN] |
| 6 | Estimate the torsion strength of steel rods | C301.2 | [AN] |
| 7 | Determine the impact strength of steel bar | C301.3 | [AN] |
| 8 | Determine the hardness of metal specimens | C301.3 | [AN] |
| 9 | Assess the fineness and soundness properties of cement | C301.4 | [AN] |
| 10 | Estimate the consistency and setting time of cement | C301.4 | [AN] |
| 11 | Determination of compression strength of cement | C301.5 | [AN] |
| 12 | 3D Printing in building construction (study experiment) | C301.6 | [U] |

**Text Books:`**


| | |
|---|---|
| 1. | Varghese.P.C, "Building Materials", PHI Learning Pvt. Ltd, New Delhi, 2016. |
| 2. | Sahu G.C, Jayagopal Jena, "Building Materials and Construction", McGraw Hill Education Pvt. Ltd, New Delhi, 2017. |
| 3. | Rangwala.S.C, "Engineering Materials", Charotar Publishing House, New Delhi 2015. |
| 4. | Carlos Balaguer, "Robotics and automation in construction", Springer ed., 2008. |


**Suggested Readings:**

| | |
|---|---|
| 1. | Rajput.R.K, “Engineering Materials”, S. Chand & Company Ltd., 2014. |
| 2. | Duggal.S.K, “Building Materials”, New Age International (P) Ltd., Publishers, 2012 |
| 3. | Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", 9th Edition, McGraw Hill, Singapore, 2018. |
| 4. | Arora S.P and Bindra S.P “Building Construction, Planning Techniques and Method of Construction”, Dhanpat rai and Sons, 2013 |
| **IS Code of Practices:** | |
| 1. | IS 3495 – 2016 (Part I – IV), “Methods of tests on burnt clay building bricks”. |
| 2. | IS 4031 – 2019 (Part 1 – 15), “Methods of physical tests for cement” |
| 3. | IS 4032 – 2019, “Method of chemical analysis of hydraulic cement” |
| 3. | IS 2386 – 1963 (Part 1 – 8), “Methods of Test for Aggregates for Concrete” |
| 4. | IS 1608 – 2018 (Part 1 – 3), “Metallic Materials — Tensile Testing” |
| **Web References:** | |
| 1. | https://aquicore.com/blog/10-new-materials-changing-commercial-construction/ |
| 2. | https://www.nbmcw.com/tech-articles/concrete/3725-new-construction-materials-for-modern-projects.html |
| 3. | http://www.iaacblog.com/programs/robot-assisted-interior/ |
| 4. | https://www.sciencedirect.com/science/article/pii/S2352710219300889 |
| 5. | https://construction-robotics.eu/journal/ |
| 6. | https://wingtra.com/drone-mapping-applications/drones-in-construction-and-infrastructure/ |
| 7. | https://www.thenbs.com/knowledge/drones-in-construction |
| **Online Resources:** | |
| 1. | https://nptel.ac.in/courses/105/106/105106053/ |
| 2. | https://onlinecourses.nptel.ac.in/noc20_ar04/preview |
| 3. | https://alison.com/course/diploma-in-characterization-of-construction-materials |
| 4. | https://www.futurelearn.com/courses/modern-building-design |
| 5. | https://www.youtube.com/watch?v=ZTvNm4QamX8 |
| 6. | https://www.youtube.com/watch?v=fyGW_7eGVfo |

**Tentative Assessment Methods & Levels (based on Revised Bloom’s Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s Level | Continuous Assessment | | | | End Semester Examination (Theory) [40 marks] |
|---|---|---|---|---|---|
| | Theory | | | Practical | |
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA-III [10 marks] | Rubric based CIA [30 marks] | |

| | | | | | |
|---|---|---|---|---|---|
| Remember | 10 | 10 | 10 | - | 10 |
| Understand | 40 | 30 | 30 | - | 35 |
| Apply | 40 | 50 | 50 | 50 | 50 |
| Analyse | 10 | 20 | 20 | 50 | 15 |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

**Course Articulation Matrix : Theory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | - | - | 3 | - | - | - | - | - | - | - | - | 3 | - | - |
| **2** | 3 | - | 3 | - | - | - | - | - | - | - | - | - | - | 1 | - |
| **3** | 2 | 3 | - | - | 2 | 1 | 2 | - | - | - | 1 | - | 3 | 2 | - |
| **4** | 2 | 3 | - | - | 2 | 1 | 2 | - | - | - | 1 | - | 3 | 2 | - |
| **5** | 2 | 2 | 1 | 1 | 3 | - | 1 | 2 | - | - | 2 | - | 1 | 3 | 1 |
| **6** | 2 | - | 1 | 1 | 3 | - | 1 | 2 | - | - | 2 | - | 1 | 3 | 1 |
| **Avg** | **2.3** | **2.7** | **1.7** | **1.7** | **2.5** | **1.0** | **1.5** | **2.0** | **-** | **-** | **1.5** | **-** | **2.2** | **2.2** | **1.0** |

**Course Articulation Matrix : Laboratory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | **1** | **3** | **-** | **3** | **1** | **-** | **-** | **2** | **-** | **-** | **-** | **3** | **2** | **2** | **2** |
| **2** | **2** | **3** | **-** | **-** | **2** | **-** | **-** | **2** | **-** | **-** | **-** | **3** | **2** | **2** | **2** |
| **3** | **2** | **3** | **-** | **-** | **2** | **-** | **-** | **2** | **-** | **-** | **-** | **3** | **2** | **2** | **2** |
| **4** | **2** | **3** | **-** | **-** | **2** | **-** | **-** | **2** | **-** | **-** | **-** | **3** | **2** | **2** | **2** |
| **5** | **2** | **3** | **-** | **-** | **2** | **-** | **-** | **2** | **-** | **-** | **-** | **3** | **2** | **2** | **2** |
| **6** | **2** | **2** | **-** | **-** | **3** | **-** | **-** | **2** | **-** | **-** | **-** | **3** | **2** | **2** | **2** |
| **Avg** | **1.8** | **2.8** | **-** | **3.0** | **2.0** | **-** | **-** | **2.0** | **-** | **-** | **-** | **3.0** | **2.0** | **2.0** | **2.0** |

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|

| 20CE302 | FLUID MECHANICS AND HYDRAULIC MACHINERY | 3/0/2/4 |
|---|---|---|
| **Nature of Course** | Theory Application | |
| **Pre requisites** | Nil | |

**Course Objectives:**

| | |
|---|---|
| 1. | To study the concepts of fluid mechanics |
| 2. | To understand the closed conduit flow in different flow condition and the open channel flow types |
| 3. | To understand the application of Dimensional analysis in similitude and model study. |
| 4. | To study the concepts of hydraulic machines and the basics of Computational Fluid Dynamics for Civil Engineering Problems |

**Course Outcomes : Theory**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C302.1 | Understand the broad principles of fluid statics, kinematics and dynamics | [U] |
| C302.2 | Calculate major and minor losses in flow through pipes | [AN] |
| C302.3 | Apply the knowledge of fluid mechanics in addressing problems in open channels flow. | [AP] |
| C302.4 | Apply the principle of dimensional analysis and model analysis in hydraulic engineering problems | [AP] |
| C302.5 | Design and Study the performance of hydraulic machineries (Pumps & Turbines) | [AN] |
| C302.6 | Apply the basics of Computational Fluid Dynamics in solving pipe flow | [AP] |

**Course Contents : Theory**

**Module I: Fluid Mechanics (Fluid Statics, Kinematics & Dynamics) 15 Hrs.**

Properties of fluids-Fluid Statics-Pascal's Law, Pressure Measurement, Buoyancy and Flotation, Hydrostatic force on plane and curved surface-Fluid Kinematics-Classification of Flow, Continuity equation, Stream and Velocity Function-Fluid Dynamics-Bernoulli's equations, Laminar and Turbulent Flow-Closed Conduit Flow- major and minor losses-Concept of boundary Layer and boundary layer thickness.

**Module II: Applied Hydraulics 15 Hrs.**

Open Channel Flow-Types of Flow, Discharge measurement, Most Economical Section, Gradually Varied Flow, Rapidly Varied Flow- Energy-depth relationships, specific energy, critical flow, hydraulic jump, uniform flow, Energy dissipation-Water surface profile-Dimensional analysis-Rayleigh's method and Buckingham's pi theorem-Hydraulic models – Geometric, kinematic and dynamic similarities - dimensionless numbers – model and prototype relations.

**Module III: Hydraulic Machines and Computational Fluid Dynamics 15 Hrs.**

Turbines-Reaction and Impulse Turbines (Pelton, Francis and Kaplan Turbine)-Hydrodynamic force of jet-Pumps-Centrifugal Pumps, Reciprocating Pumps-working principle Velocity diagram, Work done and Efficiency- Computational Fluid Dynamics-Basic equations of fluid dynamics, Grid generation, Introduction to in-viscid incompressible flow, Boundary layer flow as applicable to C.F.D. Hydro informatics: Concept of hydro informatics –scope of internet and web based modeling in Civil Engineering Problems

**Total Hours: 45 Hrs.**

**Course Outcomes : Laboratory**

| Upon completion of the Laboratory, students shall have ability to | | |
|---|---|---|
| C302.1 | Measure the flow in pipe section using orificemeter and venturimeter | [AP] |
| C302.2 | Measure the discharge in channels using notches and impact of jet | [AP] |
| C302.3 | Determine the major and minor losses in pipes | [AP] |
| C302.4 | Study the performance of different types of pumps | [AP] |
| C302.5 | Study the performance of different types of hydraulic turbines | [AP] |
| C302.6 | Model the pipe flow using CFD | [AP] |

**Course Content: Laboratory**

| S. No | List of Experiments | CO Mapping | RBT |
|---|---|---|---|
| 1. | Flow Measurement in pipe using Venturimeter | C302.1 | [AP] |
| 2. | Flow Measurement in pipe using Orificemeter | C302.1 | [AP] |
| 3. | Flow measurement in open channel using notches. | C302.2 | [AP] |
| 4. | Study of impact of jet on vanes | C302.2 | [AP] |
| 5. | Determination of frictional loss in pipes | C302.3 | [AP] |
| 6. | Determination of minor losses in pipes | C302.3 | [AP] |
| 7. | Performance test on reciprocating pump | C302.4 | [AP] |
| 8. | Performance test on centrifugal & submersible pump | C302.4 | [AP] |
| 9. | Performance test on impulse turbine (Pelton Turbine) | C302.5 | [AP] |
| 10. | Performance test on reaction turbine (Francis Turbine) | C302.5 | [AP] |
| 11. | Performance test on reaction turbine (Kaplan Turbine) | C302.5 | [AP] |
| 12. | Modeling of a pipe flow using CFD software | C302.6 | [AP] |

**Text Books:**


| | |
|---|---|
| 1. | Modi P N and Seth S.M, “Hydraulics & Fluid Mechanics”, Standard book house, New Delhi, 2017. |
| 2. | Bansal R K, “Fluid Mechanics and Hydraulic Machines”, Laxmi Publications, New Delhi, 10th Edition 2018. |
| 3. | Versteeg, H. K.; Malalasekera, W.,” An Introduction to Computational Fluid Dynamics”, Pearson Publishers,2007 |


**Suggested Readings:**


| | |
|---|---|
| 1. | Subramanya K, “Flow in open channels”, Tata McGraw Hill publishing company 4th Edition, 2015. |
| 2. | Som S K, “Introduction to Fluid Mechanics and Fluid Machines", McGraw Hill Education; 3rd edition, 2017 |
| 3. | Yunus Cengel, “Fluid Mechanics in SI Units”, McGraw Hill Education; 3rd edition, 2017 |
| 4. | Madan Mohan Das, Mimi Das Saikia, Bhargab Mohan Das , “Hydraulics and hydraulic machines”, PHI Leaning Pvt Ltd, New Delhi,2013 |


**Web References:**

| | |
|---|---|
| 1. | https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-01-unified-engineering-i-ii-iii-iv-fall-2005-spring-2006/fluid-mechanics/ |
| 2. | https://nptel.ac.in/courses/105/105/105105203/ |
| 3. | https://cfdflowengineering.com/basics-of-cfd-modeling-for-beginners/ |

| | |
|---|---|
| 4. | https://www.simscale.com/blog/2016/03/what-everybody-ought-to-know-about-cfd/ |
| **Online Courses** | |
| 1. | https://nptel.ac.in/courses/112/104/112104118/ |
| 2. | https://www.coursera.org/learn/lectures-on-selected-topics-in-classical-and-fluid-mechanics |
| 3. | https://www.learncax.com/courses/by-software/fundamentals-of-cfd-detail |
| 4. | https://onlinecourses.nptel.ac.in/noc20_ae11/preview |

**Tentative Assessment Methods and Levels (based on Revised Bloom's Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom's Taxonomy | Continuous Assessment | | | | End Semester Examination (Theory) [40 Marks] |
|---|---|---|---|---|---|
| | Theory | | | Practical | |
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA III [10 marks] | Rubric Based CIA [30 Marks] | |
| Remember | - | - | - | 10 | - |
| Understand | 10 | 10 | 10 | 20 | 10 |
| Apply | 50 | 50 | 50 | 30 | 50 |
| Analyse | 40 | 40 | 40 | 40 | 40 |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

**Course Articulation Matrix : Theory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | 1 | | 1 | | | 1 | | | 1 | 1 | 1 | 2 | 2 | 2 |
| **2** | 3 | 3 | 2 | 3 | | | 1 | | | 1 | 1 | 1 | 2 | 2 | 2 |
| **3** | 3 | 2 | 1 | 2 | | | 1 | | | 1 | 1 | 1 | 1 | 1 | 1 |
| **4** | 3 | 2 | 1 | 2 | | | 1 | | | 1 | 1 | 1 | 1 | 2 | 2 |
| **5** | 3 | 3 | 2 | 3 | 2 | | 1 | | | 1 | 1 | 1 | 2 | 2 | 2 |
| **6** | 2 | 2 | 2 | 2 | 3 | | 1 | | | 1 | 1 | 1 | 2 | 2 | 2 |
| **Avg** | **2.7** | **2.2** | **1.6** | **2.2** | **2.5** | | **1.0** | | | **1.0** | **1.0** | **1.0** | **1.7** | **1.8** | **1.8** |

**Course Articulation Matrix : Laboratory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 2 | 2 | 1 | | | | 1 | | | | 2 | 2 | 2 | 2 |
| **2** | 3 | 2 | 2 | 1 | | | | 1 | | | | 2 | 2 | 2 | 2 |
| **3** | 3 | 2 | 2 | 1 | | | | 2 | | | | 2 | 1 | 1 | 1 |
| **4** | 3 | 2 | 2 | 2 | 2 | | | 2 | | | | 2 | 1 | 2 | 2 |
| **5** | 3 | 2 | 2 | 2 | 2 | | | 2 | | | | 1 | 2 | 2 | 2 |
| **6** | 3 | 2 | 2 | 2 | 3 | | | 2 | | | | 1 | 2 | 2 | 2 |
| **Avg** | **3.0** | **2.0** | **2.0** | **1.5** | **2.3** | | | **1.7** | | | | **1.7** | **1.7** | **1.8** | **1.8** |

| | | | | | |
|---|---|---|---|---|---|
| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |

| 20CE303 | SURVEYING AND GEOMATICS | 3/0/2/4 |
|---|---|---|
| **Nature of Course** | Theory Application | |
| **Pre requisites** | Nil | |

**Course Objectives:**

| | |
|---|---|
| 1. | To introduce the principles of various surveying methods and applications to Civil Engineering Projects |
| 2. | To deals with geodetic measurements and control survey methodology and its Adjustments. |
| 3. | To introduce the working principles of modern surveying instruments |
| 4. | To introduce the concepts of software tools in modern surveying methods |

**Theory Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C303.1 | Apply the concepts of basic surveying in the measurement of area, volume and earthwork calculations | [AP] |
| C303.2 | Apply the concepts of setting out of simple and compound curves using linear methods | [AP] |
| C303.3 | Distinguish the advantages of modern surveying over conventional surveying methods | [AP] |
| C303.4 | Analyze the working principle of Total station and its applications in modern surveying | [AN] |
| C303.5 | Measure the depth of water bodies using modern surveying methods | [AN] |
| C303.6 | Classify the concepts of photogrammetry and remote sensing techniques used in modern surveying methods | [AP] |

**Course Contents: Theory**

**Module 1: Classic surveying methods** **15 Hrs.**

Definitions, Classifications – basic principles – methods of ranging – Errors in linear measurements and their corrections - Compass – types – bearing systems and conversions – errors and local attraction – levelling and applications –Methods – Fly, Check and Reciprocal levelling – curvature and refraction– Contouring – characteristics & Interpolating methods – Computations of cross sectional areas and volumes **–** Earthwork calculations - Mass haul diagrams – Curves – Simple, Compound and Reverse curves – Setting out in linear methods.

**Module 2: Triangulation & Modern surveying methods** **15 Hrs.**

Theodolite – surveying adjustments – Heights and Distances – Triangulation – instrument and accessories – satellite station – reduction to center – Signals and towers - Total Station Surveying– Electro optical system: Measuring and working principles, sources of errors. Electro optical micro wave system – COGO functions – Field procedure and applications - Comparison between Electro-optical and Microwave system - Care and maintenance of Total Station instruments.

**Module 3: Hydrographic and GPS surveying** **15 Hrs.**

Hydrographic surveying – Tides – MSL – Sounding methods – Determination of depth and position using multi-beam sounder - SURFER 8.0 – Applications – GPS Surveying - segments of GPS – Satellite configuration and signal structure – Hand held and Geodetic receivers – Photogrammetry and remote sensing techniques – Flying height - Geodetic satellite – Doppler effect – Positioning concept – GNSS – IRNSS and GAGAN – Anti spoofing and selective availability.

| | | | |
|---|---|---|---|
| | | **Total Hours:** | **45 Hrs.** |
| **Laboratory Course Outcomes:**<br>**Upon completion of the course, students shall have ability to** | | | |
| C303.1 | Measure the Horizontal & Vertical angles and calculate the area of the given plot | | [AN] |
| C303.2 | Measure the difference in elevation between two inaccessible points | | [AN] |
| C303.3 | Plot the LS & CS view of the road surface using software tools | | [AP] |
| C303.4 | Prepare the contour map of the area using modern tools | | [AP] |
| C303.5 | Plot the curve between two points by various methods | | [AP] |
| C303.6 | Find out the Latitude & Longitude of the point using GPS | | [AP] |
| **Course Contents: Laboratory** | | | |
| **S. No** | **List of Experiments** | **CO Mapping** | **RBT** |
| 1. | Computation of bearings and area by Compass Traversing | C303.1 | [AP] |
| 2. | Measurement of Horizontal angles by Repetition, Reiteration and Vertical angles. | C303.2 | [AP] |
| 3. | Determination of Elevation of an object single plane method.<br>(Base accessible and in- accessible) | C303.2 | [AP] |
| 4. | Determination of difference in elevation using Dumpy Level. | C303.2 | [AP] |
| 5. | Profile levelling – Longitudinal & Cross-sectional plotting using TERRA MODEL/EXCEL | C303.2 | [AP] |
| 6. | Determination of Tachometric Constants. | C303.3 | [AP] |
| 7. | Measurement of height and distance by tangential tachometry. | C303.3 | [AP] |
| 8. | Preparation of Contour map by grid contouring method using SURFER 8.0. | C303.4 | [AP] |
| 9. | Study of total station, measuring horizontal and vertical angles | C303.4 | [AN] |
| 10. | Setting out of simple and Transition curve. | C303.5 | [AP] |
| 11. | Determination of distances and elevation between two inaccessible points using total station. | C303.6 | [AN] |
| 12. | Traversing and area measurement using total station and its latitude and longitude observation using GPS. | C303.6 | [AN] |
| **Text Books:** | | | |
| 1. | Punmia B.C., “Surveying” – “Vols. – I, II & III”, Laxmi publications, New Delhi 2016 | | |
| 2. | N.N. Basak., “Surveying and Levelling”, McGraw Hill Edition, 2017 | | |
| 3. | Anji Reddy M., “Remote Sensing and Geographical Information System”, B.S. Publications, 2012 | | |
| **Suggested Readings:** | | | |
| 1. | Aylmer Johnson, “Plane and Geodetic surveying”, 4th edition, Crc Press, 2014 | | |
| 2. | James M.Anderson and Edward M. Mikhali, “Surveying, Theory and Practice”, 7th Edition, McGraw Hill, 2017 | | |
| 3. | Satheesh Gopi, Rasathishkumar, N.Madhu, “Advanced Surveying, Total Station GPS and Remote sensing” Pearson education, 2017. | | |
| 4. | Arora K.R., “Surveying Vol I & II”, Standard book house, 2019 | | |

| Web References: | |
|---|---|
| 1. | http://www.textofvideo.nptel.iitm.ac.in/105107121/lec3.pdf |
| 2. | https://books.google.co.in/books?id=dF3oDzQ6KZgC&printsec=frontcover&dq=inauthor:%22C+Venkatramaiah%22&hl=en&sa=X&ved=0ahUKEwi3gfG_5eneAhXRdCsKHQZHBh0Q6AEILTAB#v=onepage&q&f=false |
| **Online Resources:** | |
| 1. | http://www.nptel.ac.in/courses/105107122 |
| 2. | http://www.nptel.ac.in/courses/105104101 |

**Tentative Assessment Method & Level (based on Revised Bloom's Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom's Level | Continuous Assessment | | | | End Semester Examination (Theory) [40 Marks] |
|---|---|---|---|---|---|
| | Theory | | | Practical | |
| | CIA – I (10 Marks) | CIA – II (10 Marks) | CIA – III (10 Marks) | Rubric based CIA (30 Marks) | |
| Remember | - | - | - | - | - |
| Understand | 20 | 10 | 10 | 20 | 10 |
| Apply | 40 | 50 | 40 | 20 | 40 |
| Analyze | 40 | 40 | 50 | 60 | 50 |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

**Course Articulation Matrix : Theory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 2 | | | | | | 1 | | | | 2 | 1 | | 1 |
| **2** | 3 | 3 | 3 | 3 | | | | 2 | | | | 3 | 3 | | 2 |
| **3** | 2 | | | | | | | 1 | | | | 1 | | | 1 |
| **4** | 3 | 3 | 2 | 2 | 2 | | | 2 | | | | 3 | 3 | | 2 |
| **5** | 3 | 3 | 3 | 3 | 3 | | | 2 | | | | 3 | 3 | | 2 |
| **6** | 2 | | 2 | | 3 | | | 1 | | | | 3 | 3 | | 2 |
| **Avg.** | **2.7** | **2.8** | **2.5** | **2.7** | **2.7** | | | **1.5** | | | | **2.5** | **2.6** | | **1.7** |

**Course Articulation Matrix : Laboratory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 3 | 1 | | 1 | | | 2 | | | | 3 | 3 | | 2 |
| **2** | 3 | 3 | 1 | | 2 | | | 2 | | | | 3 | 3 | | 2 |
| **3** | 3 | 3 | 2 | | 3 | | | 3 | | | | 3 | 3 | | 2 |
| **4** | 3 | 3 | 2 | 2 | 3 | | | 3 | | | | 3 | 3 | | 3 |
| **5** | 3 | 3 | 3 | 2 | 3 | | | 3 | | | | 3 | 3 | | 3 |
| **6** | 3 | 3 | 3 | 2 | 3 | | | 3 | | | | 3 | 3 | | 2 |
| **Avg.** | **3** | **3** | **2** | **2** | **2.5** | | | **2.6** | | | | **3** | **3** | | **2.3** |

## SEMESTER 4

| 20CE401 | SOLID MECHANICS | 2/1/0/3 |
|---|---|---|
| **Nature of Course** | Problem Analytical | |
| **Pre requisites** | Engineering Mechanics | |

**Course Objectives:**

| | |
|---|---|
| 1. | To apply the fundamental concepts of stress, strain and deformation of solids and thin cylinders |
| 2. | To compute and sketch the bending moment, shear force, stresses and deformations of beams. |
| 3. | To analyse plane trusses using various methods. |
| 4. | To compute the torsion on shafts and springs. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C401.1 | Apply the concept of stress and strain for brittle and ductile materials to compute the stresses and strains. | [AP] |
| C401.2 | Analyse the composite bars, simple applications of strain energy principles and thin cylinders | [AP] |
| C401.3 | Analyse the determinate beams for various load cases and construct bending moment and shear force diagrams. | [AN] |
| C401.4 | Analyse the trusses for various load cases. | [AN] |
| C401.5 | Apply the simple bending concept and various methods to compute the stresses, bending, slope and deformations in determinate beams. | [AN] |
| C401.6 | Compute the bending and torsional deformation on shafts and springs. | [AN] |

**Course Contents:**

**Module 1: Simple Stresses, Strains and Thin cylinders** **15 Hrs.**

Stresses in the Members of a Structure - types of stresses and strain - Hooke's Law - Stress–Strain relationship- True Stress and True Strain - Stress–Strain Behavior of Ductile and Brittle Materials - Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli - Relation between Elastic Constants - Bars of varying section – composite bars – Temperature stresses - Strain Energy - Resilience – Gradual, sudden, impact and shock loadings – simple applications - Thin cylinders - under internal pressure - deformation of thin cylinders.

**Module 2: Analysis of Beams and Trusses** **15 Hrs.**

Determinate structures – internal forces and moment in beams – relationships between loads, shear forces, and bending moments - Shear force and bending moment diagrams – cantilever, simply supported beams – with and without overhangs - Analysis of plane truss - stability and equilibrium of plane frames - analysis of forces in truss members - method of joints - method of sections – method of tension coefficient

**Module 3: Bending, Slope and Deflection of beams, Torsion on shafts** **15 Hrs.**

Theory of simple bending - Determination of bending stresses - Section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Slope and deflection - Relationship between moment, Slope and deflection - Integration Method - Macaulay's Method - Moment-Area Method - Conjugate beam method - Torsion - Bending and Torsional Deformation of a Circular Shaft – power transmitted by shafts –

| | |
|---|---|
| Springs - stresses in helical springs - deflection of springs. | |
| **Total Hours** | **45 Hrs.** |

| | |
|---|---|
| **Text Books:** | |
| 1. | Bansal R.K, “Strength of Materials”, Laxmi Publications Ltd, New Delhi, 2018. |
| 2. | Rajput R K, “A Textbook of Strength of Materials (Mechanics of Solids)”, 7e, S. Chand Publishing, 2018. |
| 3. | Beer, F.P., Johnston Jr., E.R., Dewolf, J.T. and Mazurek, D.F. “Mechanics of Materials”, 8e, McGraw-Hill, 2020. |
| **Suggested Readings:** | |
| 1. | William A. Nash, Strength of Materials, Tata McGraw-Hill Publishing Co. Ltd, New Delhi, 2010 |
| 2. | Gambhir M.L. “Fundamentals of Solid Mechanics”, PHI Learning Private Ltd., New Delhi, 2010. |
| 3. | Rattan S.S, “Strength of Material”, Tata McGraw-Hill Publishing Co. Ltd, New Delhi, 2011 |
| 4 | Timoshenko S., “Strength of Materials – Part 1 and 2” D Van Nostrand Company, Inc. London, 2002 |
| **Web References:** | |
| 1. | http://www.nesoacademy.org/civil-engineering/mechanics of solids |
| 2. | http://web.mit.edu/emech/dontindex-build/ |
| **Online Resources:** | |
| 1. | http://nptel.ac.in/course.php?disciplineId=105 |
| 2. | http://nptel.iitk.ac.in/courses/Webcourse-contents/IIT Delhi/Mechanics%20Of%20Solids/index.htm |

**Tentative Assessment Methods & Levels (based on Revised Bloom’s Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom’s Level | Assessment Component | Marks |
|---|---|---|---|
| C401.1& C401.2 | Analyse | Online Quiz/ class room quiz | 5 |
| C401.3 | Analyse | Assignment | 5 |
| C401.4 | Analyse | Technical Presentation | 5 |
| C401.5 & C401.6 | Analyse | Tutorial | 5 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s Level | Continuous Assessment | | | End Semester Examination [50 marks] |
|---|---|---|---|---|
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA-III [10 marks] | |
| Remember | 10 | 10 | 10 | 10 |
| Understand | 30 | 20 | 10 | 10 |
| Apply | 30 | 30 | 30 | 30 |
| Analyse | 30 | 40 | 50 | 50 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

| CO | PO | PO | PO | PO | PO | PO | PO | PO | PO | PO | PO | PO | PSO | PSO | PSO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | - | 3 |
| **2** | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | - | 3 |
| **3** | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | - | 3 |
| **4** | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | - | 3 |
| **5** | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | - | 3 |
| **6** | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | - | 3 |
| **Avg** | **3** | **2.5** | **2** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | **-** | **3** |

| 20MA401 | PROBABILITY AND NUMERICAL METHODS<br>(COMMON TO MECH/MCT/CIVIL) | 2/1/2/4 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Problem Analytical |
| **Pre requisites** | Concepts of Differentiation and Integration. |

**Course Objectives:**

| | |
|---|---|
| 1. | To define the concept of probability and its features |
| 2. | To have a well – founded knowledge of standard distributions which can be used to describe real life phenomena |
| 3. | To learn the concept of testing hypothesis using statistical analysis |
| 4. | To study the concept of fitting a curve of best fit to the given numerical data and to calculate the deviation of the expected value from the observed value |

**Course Outcomes: Theory**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C401.1 | Recall the concept of probability | [R] |
| C401.2 | Understand to handle situations involving random variables and Standard distributions. | [U] |
| C401.3 | Apply measures of central tendency to Analyze statistical data | [AP] |
| C401.4 | Develop the inferences for engineering problems using testing of hypothesis. | [AP] |
| C401.5 | Apply curve fitting to Fit a polynomial or special function curve for the given data. | [AP] |
| C401.6 | Apply numerical methods to fit the polynomial. | [AP] |

**Course Contents: Theory**

**Module 1: Probability** **15 Hrs**

Sample space, Axioms of Probability-Events-independent events-Conditional probability, Total Probability-Baye's Theorem (Statement only) – Simple Problems. One dimensional Random Variable-Probability mass function-Probability density function-Discrete random variable-Continuous Random Variable-Simple problems. Mathematical Expectations-Moments-Moment generating function-Properties-Standard distributions - Discrete distributions: Binomial – Poisson – Continuous distribution: Normal – Simple Problems.

**Module 2: Statistics** **15 Hrs**

Definition of Statistics-Applications-Data-Collection of Data: Internal and external data, Primary and secondary Data. Descriptive Statistics: Classification and tabulation of univariate data, Measures of central tendency: Mean, Median and Mode. Scatter diagram - correlation (Karl Pearson's)- Rank correlation (Spearman's)- Linear regression. Testing of Hypothesis-Small Samples-Student's t-Test for single mean, difference of mean-F test-Chi square test for goodness of fit and independence of attributes.

**Module 3: Numerical Methods** **15 Hrs**

Curve Fitting-Empirical laws -Linear law - Laws reducible to Linear law- Method of group averages - straight line and parabola -Principle of Least squares -Fitting straight line, parabola and exponential curve - Interpolation - Interpolation with equal intervals –Newton's Forward and Backward difference formula - Interpolation with unequal intervals –Newton's Divided difference formula – Lagrange's interpolation formula.

| | |
|---|---|
| **Total Hours** | **45 Hrs.** |

**Course Outcomes: Laboratory**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C401.1 | Analyze and interpret the distribution function for the given data. | [AP] |
| C401.2 | Perform central tendency measures for the given data | [AP] |
| C401.3 | Create 2D line plot for the given data. | [AP] |
| C401.4 | Test the significance level of hypothesis | [AP] |

| | | |
|---|---|---|
| C401.5 | Estimate the correlation and regression between the given data. | [AP] |
| C401.6 | Fit a polynomial for the given data by various interpolation formulas | [AP] |

**Course Contents: Laboratory**

| S.No | List of Experiments | CO Mapping | RBT |
|---|---|---|---|
| 1. | To fit a binomial distribution for the given data by using R programming. | C401.1 | [AP] |
| 2. | To fit a Poisson distribution for the given data by using R programming. | C401.1 | [AP] |
| 3. | To fit a normal distribution for the given data by using R programming. | C401.1 | [AP] |
| 4. | To find measures of central tendency for the given data by using R programming. | C401.2 | [AP] |
| 5. | To create 2D line plot for the given data by using R programming. | C401.3 | [AP] |
| 6. | Applying F test to test the significance difference between the variance of two samples by using R programming. | C401.4 | [AP] |
| 7. | Applying Chi Square test to test the goodness of fit for the given samples by using R programming. | C401.4 | [AP] |
| 8. | To find the correlation and regression between the given data by using R programming. | C401.5 | [AP] |
| 9. | To find regression between the given data by using R programming. | C401.5 | [AP] |
| 10. | To fit a straight line and parabola for the given data by using MATLAB. | C401.6 | [AP] |
| 11. | To fit a polynomial for the given data and finding the unknown by Lagrange's interpolation formula by using MATLAB. | C401.6 | [AP] |
| 12. | To fit a polynomial for the given data by Newton's forward and backward formula by using MATLAB. | C401.6 | [AP] |

**Text Books:**


| | |
|---|---|
| 1. | Peebles Jr. P.Z., —Probability Random Variables and Random Signal Principles, Tata McGraw-Hill Publishers, Fourth Edition, New Delhi, 2016 |
| 2. | Gupta, S.C., & Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand & sons, 12th edition , 2020 |
| 3. | Grewal B.S., Numerical methods in Engineering and Science. 12th edition, Stylus Publishing, 2018. |


**Suggested Readings:**


| | |
|---|---|
| 1. | Ross, S,"A First Course in Probability, Ninth edition", Pearson Education, Delhi, 2018. |
| 2. | Richard A. Johnson, Irwin Miller, John Freund, Miller & Freund's,"Probability and Statistics for Engineers",Ninth edition,2016. |
| 3. | Steven Chapra, "Applied Numerical Methods with MATLAB for engineers and scientists", 4th edition, 2017. |

| | |
|---|---|
| 4. | Holly Moore, “MATLAB for Engineers” Fifth Edition – Pearson Publications,2018. |
| **Web References:** | |
| 1. | http://nptel.ac.in/courses/111104079/ |
| 2. | http://www.nptelvideos.in/2012/12/probability-random-variables.html |
| 3. | http://freevideolectures.com/Course/2311/Digital-Communication/4 |
| **Online Resources:** | |
| 1. | https://www.coursera.org/learn/probability-intro |
| 2. | https://www.coursera.org/lecture/wharton-introduction-spreadsheets-models/3-1-random-variables-and-probability-distributions-Y3bCF |
| 3. | https://www.codewithc.com/newtons-interpolation-in-matlab/ |

**Tentative Assessment Methods & Levels (based on Revised Bloom’s Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s Level | Continuous Assessment | | | | End Semester Examination (Theory) [40 marks] |
|---|---|---|---|---|---|
| | Theory | | | Practical | |
| | CIA – I [10 Marks] | CIA – II [10 Marks] | CIA – III [10 Marks] | Rubric based CIA [30 Marks] | |
| Remember | 20 | 20 | 20 | 20 | 20 |
| Understand | 30 | 30 | 30 | 30 | 30 |
| Apply | 50 | 50 | 50 | 50 | 50 |
| Analyse | - | - | - | - | - |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

**Course Articulation Matrix : Theory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 1 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | - | - |
| **2** | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 1 | - | - |
| **3** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | | - | - |
| **4** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 1 | - | - |
| **5** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | | - | - |
| **6** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 1 | - | - |
| **Avg** | **2.5** | **2.5** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **0.6** | **-** | **-** |

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|

**Course Articulation Matrix : Laboratory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 1 | 1 | - | - | 3 | - | - | - | - | - | - | - | 1 | - | - |
| **2** | 2 | 2 | - | - | 3 | - | - | - | - | - | - | - | 1 | - | - |
| **3** | 3 | 3 | - | - | 3 | - | - | - | - | - | - | - | | - | - |
| **4** | 3 | 3 | - | - | 3 | - | - | - | - | - | - | - | 1 | - | - |
| **5** | 3 | 3 | - | - | 3 | - | - | - | - | - | - | - | | - | - |
| **6** | 3 | 3 | - | - | 3 | - | - | - | - | - | - | - | 1 | - | - |
| **Avg** | **2.5** | **2.5** | **-** | **-** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **0.6** | **-** | **-** |

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|

| 20CE402 | Engineering Geology and Concrete Technology | 3/0/2/4 |
|---|---|---|
| **Nature of Course** | Theory Application | |
| **Pre-requisites** | Construction Materials and Techniques | |

**Course Objectives:**

| | |
|---|---|
| 1. | To impart knowledge on structure of earth and |
| 2. | To enable the students to understand the concept of mix design. |
| 3. | To impart knowledge on properties and durability of concrete. |
| 4. | To impart knowledge on the special concretes. |

**Course Outcomes: Theory**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C402.1 | Understand about types of rocks, their distribution and uses. | [U] |
| C402.2 | Enumerate the geological structure and seismology | [AN] |
| C402.3 | Apply mix proportion principles to design a concrete mix by using IS code | [AN] |
| C402.4 | Determine the properties of fresh and hardened concrete | [AN] |
| C402.5 | Enumerate the durability properties of concrete | [AN] |
| C402.6 | Apply the suitable special concrete based on the field requirement. | [AP] |

**Course Contents: Theory**

**Module 1: Engineering Geology** **15 Hrs.**

Geology in civil engineering – Branches of geology – Structure of earth and its composition, weathering of rocks - Classification of rocks; Igneous, Sedimentary and Metamorphic rocks - Engineering properties of rocks (Granite, Basalt, Sandstone, Limestone, Schist, Gneiss, marble) - Attitude of beds - Study of structures; folds, faults and joints, relevance to civil engineering - Tectonic plate - Seismology - Seismic zones in India

**Module 2: Mix design and Concrete Properties** **15 Hrs.**

Mix design: Introduction, concept of mix design – mix design methods – IS method of mix proportioning with admixtures - Manufacture of concrete; batching, mixing, transporting, placing, compaction, curing - Ready mix concrete - Fresh concrete - Properties: workability - factors affecting workability, segregation, bleeding - Test on fresh Concrete - Hardened concrete – Properties: strength, stress and strain characters, maturity, shrinkage – Test on Hardened Concrete.

**Module 3: Durability of Concrete and Special Concretes** **15 Hrs.**

Durability of Concrete; Permeability, creep, sulphate attack, alkali aggregate reaction, chloride attack, carbonation - Concrete in marine environment - Corrosion of concrete - Corrosion of reinforcement - Micro structures of concrete - Non destructive test; Ultrasonic pulse velocity test, rebound hammer test - Types and properties of Special Concretes; Lightweight concrete, High strength concrete, High performance concrete, Fibre reinforced concrete, Polymer concrete, Geo-polymer concrete - Self compacting concrete, Vacuum dewatering concrete – Mass concrete - Nano concrete.

| | |
|---|---|
| **Total Hours:** | **45 Hrs.** |

**Course Outcomes: Laboratory**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C402.1 | Design concrete mixes and apply statistical quality control Techniques | [AP] |
| C402.2 | Determine the workability of concrete | [AP] |

| | | |
|---|---|---|
| C402.3 | Determine the fresh concrete properties | [AP] |
| C402.4 | Determine the hardened concrete properties | [AP] |
| C402.5 | Investigate the durability properties of concrete. | [AN] |
| C402.6 | Examine the concrete qualities by applying NDT. | [AN] |

**Laboratory Component:**

| S. No. | List of Experiments | CO Mapping | RBT |
|---|---|---|---|
| 1. | Design the Concrete mix proportioning – IS Method | C402.1 | [AN] |
| 2. | Determine the workability by slump cone test | C402.2 | [AP] |
| 3. | Determine the workability by compaction factor test | C402.2 | [AP] |
| 4. | Determine the fresh concrete property by Vee-Bee consistometer test | C402.3 | [AP] |
| 5. | Determine the fresh concrete property by flow table test | C402.3 | [AP] |
| 6. | Determine the compressive strength of concrete | C402.4 | [AP] |
| 7. | Determine the splitting tensile strength of concrete | C402.4 | [AP] |
| 8. | Determine the modulus of rupture of concrete | C402.4 | [AP] |
| 9. | Determine the modulus of elasticity of concrete | C402.4 | [AP] |
| 10 | Determine the durability of concrete by test resistance against acid attack | C402.5 | [AP] |
| 11. | Determine the surface hardness of concrete structures by rebound hammer test | C402.6 | [AN] |
| 12. | Determine the quality of concrete structures by ultrasonic pulse velocity test | C402.6 | [AN] |

**Text Books :**

| | |
|---|---|
| 1. | Parbin singh Engineering and General Geology, S.K. Kataria & Sons Publications, New Delhi, 2019 |
| 2. | Shetty, M.S., Jain, A.K., Concrete Technology, Theory and Practice, S. Chand and Company Ltd, New Delhi, 2018 |
| 3. | Neville A.M. Concrete Technology, Pearson Education, New Delhi, 2019 |

**Suggested Readings**

| | |
|---|---|
| 1. | Varghese, P.C., Engineering Geology for Civil Engineering Prentice Hall of India Learning Private Limited, New Delhi, 2012. |
| 2. | Gambhir, M.L, Concrete Technology, McGraw Hill Publishing Company Ltd, New Delhi, 2017 |
| 3 | Santha Kumar A.R., “Concrete Technology”, Oxford University Press, New Delhi, 2018. |
| 4 | Mehta, P.K., "Concrete: Microstructure, PropertiesandMaterials " 4th edition, Tata McGraw Hill Education Private Limited, 2017 |

**IS Codes**

| | |
|---|---|
| 1. | IS10262-2009, Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 2009. |
| 2. | IS456-2000 Plain and Reinforced Concrete- Code of Practice, Bureau of Indian Standards, New Delhi, 2000. |
| 3. | SP: 23-1982, Handbook on concrete. |

**Web References:**

| | |
|---|---|
| 1. | https://geology.com/ |
| 2. | https://www.indianconcreteinstitute.org/ |
| **Online Resources:** | |
| 1. | https://nptel.ac.in/courses/105/102/105102012/ |
| 2. | https://onlinecourses.swayam2.ac.in/nou20_cs14/ |

**Tentative Assessment Methods and Levels (based on Revised Bloom's Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom's Level | Continuous Assessment | | | | End Semester Examination (Theory) [40 Marks] |
|---|---|---|---|---|---|
| | Theory | | | Practical | |
| | CIA-I [10 Marks] | CIA-II [10 Marks] | CIA-III [10 Marks] | Rubric based CIA [30 Marks] | |
| Remember | 10 | 10 | 10 | 10 | - |
| Understand | 10 | 10 | 10 | 10 | 20 |
| Apply | 30 | 20 | 40 | 40 | 30 |
| Analyse | 50 | 60 | 40 | 40 | 50 |
| Evaluate | - | - | - | | - |
| Create | - | - | - | | - |

**Course Articulation Matrix: Theory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | - | - | 1 | - | - | - | - | - | - | - | 1 | 2 | - | 2 |
| 2 | 3 | 1 | - | 1 | | - | - | - | - | - | - | 1 | 2 | - | 2 |
| 3 | 3 | 2 | 3 | 3 | - | - | 1 | - | - | - | - | 2 | 2 | - | 2 |
| 4 | 3 | 2 | - | 3 | - | - | - | - | - | - | - | 2 | 2 | - | 2 |
| 5 | 3 | 2 | - | 3 | 3 | - | - | - | - | - | - | 2 | 2 | - | 2 |
| 6 | 3 | 1 | 1 | - | 2 | - | 1 | - | - | - | - | 2 | 2 | - | 2 |
| **Avg** | **3** | **1.6** | **2** | **2.2** | **2.3** | **-** | **1** | **-** | **-** | **-** | **-** | **1.6** | **2** | **-** | **2** |

**Course Articulation Matrix: Laboratory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 2 | 2 | 2 | - | 1 | 1 | 2 | 2 | - | 2 | 2 | - | 2 |
| 2 | 3 | 2 | 1 | 1 | 1 | - | 2 | 2 | 2 | 2 | - | 2 | 2 | - | 2 |
| 3 | 3 | 3 | 2 | 2 | 2 | - | 1 | 1 | 2 | 2 | - | 2 | 2 | - | 2 |
| 4 | 3 | 3 | 2 | 2 | 2 | - | 2 | 2 | 1 | 2 | - | 2 | 2 | - | 2 |
| 5 | 3 | 3 | 2 | 2 | 3 | - | 1 | 2 | 2 | 2 | - | 2 | 2 | - | 2 |
| 6 | 3 | 2 | 1 | 1 | 3 | - | 2 | 1 | 2 | 2 | - | 2 | 2 | - | 2 |
| **Avg** | **3** | **2.6** | **1.6** | **1.6** | **2.1** | **-** | **1.5** | **1.5** | **1.8** | **2** | **-** | **2** | **2** | **-** | **2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed | |

| 20CE403 | ENVIRONMENTAL ENGINEERING | 3/0/2/4 |
|---|---|---|
| **Nature of Course** | Theory and Practical Application | |
| **Pre requisites** | Environmental Science | |

**Course Objectives:**

| | |
|---|---|
| 1. | To study the principles and concepts of unit operations and processes involved in water and wastewater treatment. |
| 2. | To evaluate the performance of water and wastewater treatment plants |
| 3. | To enable the students in designing water and waste water treatment plants for a community. |
| 4. | To study the various techniques for sludge disposal and disposal into land or water bodies. |

**Course Outcomes : Theory**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C403.1 | Cognize and assimilate the physical, chemical and biological characteristics of different sources of water | [AP] |
| C403.2 | Estimate the water demand and design a good water distribution system for a town/city | [AP] |
| C403.3 | Design an appropriate treatment system for the water available at the source | [AP] |
| C403.4 | Design the necessary treatment units for the Wastewater collected from the town/city | [AP] |
| C403.5 | Identify the suitable mode of disposal for the treated wastewater without endangering the environment | [AN] |
| C403.6 | Analyze the amount of Particulate Matter present in the Air and its control measures | [AN] |

**Course Content : Theory**

**Module 1: Water quality characteristics and water supply system** **15 Hrs.**

Physical, Chemical and Biological quality parameters. – Water quality requirements and standards – Planning – objectives – design period – population forecasting – water demand – Water distribution system- Methods of distribution – Analysis of network (Hardy cross method-Theory only). Water Treatment – objectives – unit operations and process – Clarifiers – Flocculators – Sedimentation tanks and sand filters – Disinfection – Aeration – Iron and manganese removal – defluoridation and demineralization – Membrane systems – Desalination – Recent advances

**Module 2: Primary and Secondary treatment of sewage** **15 Hrs.**

Sources of waste – Characteristics and composition of sewage – Factors – Primary treatment – Principles, Functions – Screens – Grit chambers – Primary sedimentation tanks – Secondary treatment – ASP – Attached culture process - UASB – Septic tanks -Trickling filters – oxidation ditches and aerated lagoons – waste stabilization ponds – Reclamation and reuse of sewage – Recent advances in sewage - Wastewater modelling by STEADY software.

**Module 3: Sewage Disposal and Air Pollution** **15 Hrs.**

Sludge Characteristics – Sludge Thickening - Sludge Digestion and Biogas Generation –

Sludge Drying beds – Conditioning and dewatering – Incineration – Deep well Injection – Sludge Disposal – Self-purification of natural water bodies – Land disposal and sewage farming – Disposal to lakes and sea – Sanitary practices in rural areas - Eutrophication - Impact on sea - Oxygen sag curve (Theory only) –Water less Urinals - Bio toilets – Air Pollution - Sources – Control measures - Monitoring methods.

| | |
|---|---|
| **Total Hours:** | **45 Hrs.** |

**Course outcomes: Laboratory**
**Upon completion of the Laboratory, students shall have ability to**

| | | |
|---|---|---|
| C403.1 | Determine the quality of water based on its physical characteristic using the suitable experimental procedures | [AP] |
| C403.2 | Calculate the type and quantum of chemical required for the removal of dissolved solid substances in water | [AP] |
| C403.3 | Investigate the oxygen content in various forms in water | [AN] |
| C403.4 | Determine the ionic concentration in water using sophisticated analytical methods | [AP] |
| C403.5 | Determine the elemental concentration in water using sophisticated analytical methods | [AP] |
| C403.6 | Investigate the ambient air quality characteristics and calculate the air quality index | [AN] |

**Course Content : Laboratory**

| S. No | List of Experiments | CO Mapping | RBT |
|---|---|---|---|
| 1. | Determination of pH, Turbidity and conductivity of the water and wastewater samples | C403.1 | [AP] |
| 2. | Determination of Dissolved Oxygen presents in the water | C403.2 | [AP] |
| 3. | Determination of Optimum Coagulant Dosage of the given water sample | C403.2 | [AP] |
| 4. | Determination of Bio-chemical Oxygen Demand | C403.3 | [AN] |
| 5. | Determination of Chemical Oxygen Demand | C403.3 | [AN] |
| 6. | Determination of Iron / Fluorides presents in the given waste water sample | C403.4 | [AP] |
| 7. | Determination of Sulphates presents in the given waste water sample | C403.4 | [AP] |
| 8. | Determination of Ammonia presents in given wastewater sample | C403.4 | [AP] |
| 9. | Determination of Sodium presents in the wastewater sample | C403.5 | [AP] |
| 10. | Determination of Nitrates in the given wastewater sample | C403.5 | [AP] |
| 11. | Modeling of Wastewater treatment plant using STEADY software | C403.5 | [AP] |
| 12. | Determination of Air pollutant - Particulate Matter and Gaseous pollutant analysis | C403.6 | [AN] |

**Text Books:**


| | |
|---|---|
| 1. | Garg S.K, “Water Supply Engineering”, Khanna publishers, 2017 |
| 2. | Metcalf and Eddy, “Wastewater Engineering Treatment and Reuse”, Tata McGraw Hill Publishers, New Delhi, 2010. |

| | |
|---|---|
| 3. | Punmia B.C, Ashok Jain, “Wastewater Engineering”, Laxmi publications Pvt. Ltd., 2016 |
| **Suggested Readings:** | |
| 1. | Birdie G.S., Water supply Engineering, Dhanpat rai publishing company, 2014 |
| 2. | Venugopal Rao P., “Textbook of Environmental Engineering”, Prentice Hall of India Pvt.Ltd, 2013 |
| 3. | Peavy, Rowe, Tchobanoglous, “Environmental Engineering”, McGraw Hill Publishers, NewDelhi, 2013. |
| 4. | Basak N.N, “Environmental Engineering”, McGraw Hill Education., 2017 |
| **IS Code References:** | |
| 1. | IS 10500:2012 Water Quality Standards, New Delhi, 2012 |
| 2. | IS SP 26 – Handbook on Water supply and Drainage. |
| **Web References:** | |
| 1. | http://mohua.gov.in/cms/Latest-Manual-part-a-Engineering.php |
| 2. | http://164.100.161.188/cms/Latest-Manual-Part-B-Operation-and-Maintenance-2013.php |
| 3. | http://mohua.gov.in/cms/Latest-Manual-Part-C-Management-2013.php |
| 4. | http://cpheeo.gov.in/cms/manual-on-municipal-solid-waste-management-2016.php |
| **Online Resources:** | |
| 1. | https://www.mooc-list.com/course/water-and-wastewater-treatment-engineering-physicochemical-technology-edx |
| 2. | http://nptel.ac.in/courses/105106119/ |

**Tentative Assessment Method & Level (based on Revised Bloom’s Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s Level | Continuous Assessment | | | | End Semester Examination (Theory) [40 Marks] |
|---|---|---|---|---|---|
| | Theory | | | Practical | |
| | CIA – I (10 Marks) | CIA – II (10 Marks) | CIA – III (10 Marks) | Rubric based CIA (30 Marks) | |
| Remember | 10 | 10 | 10 | 10 | 10 |
| Understand | 40 | 40 | 40 | 20 | 30 |
| Apply | 50 | 50 | 40 | 40 | 30 |
| Analyze | - | - | 10 | 30 | 30 |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

**Course Articulation Matrix : Theory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 3 | 2 | 2 | - | 2 | 2 | 2 | 2 | - | - | 3 | 1 | 3 | 2 |
| **2** | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | - | - | 2 | 2 | 2 | 2 |
| **3** | 2 | 2 | 2 | 2 | 1 | 1 | - | 2 | 1 | - | - | 2 | 1 | 2 | 2 |
| **4** | 3 | 3 | 2 | 1 | - | 1 | 1 | - | 1 | - | - | 3 | 1 | 3 | 2 |
| **5** | 2 | 2 | 2 | 1 | 1 | - | 1 | 1 | 2 | - | - | 2 | 1 | 2 | 2 |
| **6** | 3 | 3 | 3 | - | 1 | 2 | 2 | 1 | 1 | - | - | 3 | 2 | 3 | 2 |
| **Avg** | **2.6** | **2.5** | **2.2** | **1.6** | **1** | **1.5** | **1.6** | **1.6** | **1.5** | **-** | **-** | **2.5** | **1.3** | **2.5** | **2.0** |

**Course Articulation Matrix : Laboratory**

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

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **3** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | - | 1 | 2 | 1 | 2 | 2 |
| **4** | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | - | 2 | 1 | 2 | 3 | 2 |
| **5** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | - | 2 | 2 | 2 | 2 | 2 |
| **6** | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | - | 2 | 2 | 2 | 3 | 2 |
| **Avg** | **2.5** | **2.2** | **2.0** | **2.0** | **2.0** | **1.7** | **2.0** | **1.0** | **1.0** | **-** | **1.7** | **1.7** | **1.7** | **2.5** | **2.0** |
| **1** | **Reasonably Agreed** | | | | **2** | **Moderately Agreed** | | | | | **3** | **Strongly Agreed** | | | |

| 20CE404 | GEOTECHNICAL ENGINEERING | 3/0/2/4 |
|---|---|---|
| **Nature of Course** | Theory Application | |
| **Pre requisites** | Construction Materials and Techniques | |

**Course Objectives:**

| | |
|---|---|
| 1. | To study the fundamentals of soil mechanics and IS soil classification system. |
| 2. | To analyse the soil characteristics such as permeability, stress distribution and consolidation, shear strength. |
| 3. | To study the various techniques for slope stability in soil. |
| 4. | To design the shallow and deep foundations, pressure distribution behind retaining walls. |

**Course Outcomes : Theory**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C404.1 | Examine the basic properties of soil and classify the soil according to IS soil classification system. | [AN] |
| C404.2 | Determine the permeability, effective stress distribution and consolidation characteristics of the soils. | [AN] |
| C404.3 | Compute the shear strength of soils and analyze the different types of slopes, methods to improve its stability. | [AP] |
| C404.4 | Examine the soil exploration program for determining the geotechnical parameters required for the design of foundations. | [AP] |
| C404.5 | Estimate the bearing capacity of soils and settlement of foundations. | [AN] |
| C404.6 | Determine pile and pile group efficiency, earth pressure theory and examine the forces acting on the well foundation. | [AN] |

**Course Contents : Theory**

**Module 1: Soil Classification and its Characteristics** **15 Hrs.**

Soil Classification: Soil formation and soil types - Civil engineering problems related to soils - Nature of soil - basic definitions - Phase relationships - Determination of soil properties – Classification - Unified and Indian Soil classification system. Permeability: Darcy's law – Permeability (1D and 2D Flow) - Laboratory Methods – Field measurement of permeability - flow nets - uplift pressure – Piping, Capillarity and Seepage Force - Stress Distribution: Effective stress concept - Dry and saturated soils - Stress distribution in soil media - Boussinesq's Analysis – Westergard's Analysis - Intensity of vertical stress using influence charts - Consolidation: measurement of compressibility - e-log p curves – Terzaghi's one dimensional consolidation theory – Time rate of consolidation and settlement.

**Module 2: Shear Strength, Stability of Slopes and Soil Exploration Methods** **15 Hrs.**

Shear Strength: Mechanism of shear resistance- Effective and total shear strength parameters – Mohr's circle - Mohr– Coulomb failure criterion - Measurement of shear strength - Direct shear test- Triaxial shear test - Unconfined compression strength test - Vane shear test - Shear strength of clay soil and sand. Stability of Slopes: Types of slopes - Stability of infinite slope - Stability of Finite slope - Total stress Analysis - Method of slices and Bishop's method - Use of Taylor's stability number - Slope failure mechanism - Effect of Tension cracks - Improving slope stability by Geo-synthetics. Soil Exploration: Methods - types of samplers - Field test - SPT, CPT, DCPT - Geophysical Investigation - Plate load test

**Module 3: Bearing Capacity, Shallow and Deep Foundations** **15 Hrs.**

Bearing Capacity-Types of shear failure - Terzaghi's and Meyerhoff's bearing capacity theories - effect of water table - IS code method – Settlement and its components - Shallow

Foundation: Foundation Introduction - types, choice of foundations - proportioning of shallow foundation (no structural design) - Deep Foundation: pile foundation, classification and selection - load carrying capacity, static and dynamic formulae - design of pile groups and its efficiency – pile under lateral loading - negative skin friction - under reamed piles - Rankine's earth pressure theory for active and passive status in both cohesive and cohesionless soils - Coulomb earth pressure theory - well foundation. types and different shapes of wells - components and forces acting - sinking of wells - tilts and shifts.

| | **Total Hours:** | **45 Hrs** |
|---|---|---|

**Course Outcomes: Laboratory**

**Upon completion of the Laboratory, students shall have ability to**

| | | |
|---|---|---|
| C404.1 | Illustrate the soil behaviour and suitability of soil for structural purpose and its soil water movement. | [AP] |
| C404.2 | Report the compaction state of the soil and classify the index properties of the fine-grained soil. | [AP] |
| C404.3 | Calculate the permeability property of soil with different size to estimate the seepage in earthen dams and embankments. | [AP] |
| C404.4 | Apply the methods to report the soil strength and its suitability for structural foundation and its cohesive nature. | [AP] |
| C404.5 | Relate the water content and density of soil and calculate the settlement of the soil due to pressure exerted by the super structure. | [AP] |
| C404.6 | Report the strength parameters of the road and pavement, shear strength of the undrained soil, bearing capacity of the soil. | [AP] |

**Course Contents: Laboratory**

| **S. No** | **List of Experiments** | **CO Mapping** | **RBT** |
|---|---|---|---|
| 1. | Determination of Specific Gravity and Moisture content of Soil. | C404.1 | [AP] |
| 2. | Determination of Particle size distribution of cohesionless and cohesive soils | C404.1 | [AP] |
| 3. | Determination of Atterberg's limits of C-Phi Soils. | C404.2 | [AP] |
| 4. | Determination of relative density of cohesionless soils and Shrinkage factors of soil. | C404.2 | [AP] |
| 5. | Determination of permeability characteristics of soil using falling head / Constant head permeability method | C404.3 | [AP] |
| 6. | Determination of shear strength parameters of soil using direct shear method | C404.3 | [AP] |
| 7. | Determine the unconfined compressive strength of clay. | C404.4 | [AP] |
| 8. | Determination of maximum dry density of soil using standard proctor's compaction test | C404.4 | [AP] |
| 9. | Determination of field density of soil by using sand replacement method / core cutter method | C404.5 | [AP] |
| 10. | Determination of bearing capacity by Dynamic Cone penetration test | C404.6 | [AP] |
| 11. | Determination of the sensitivity of cohesive soil by laboratory vane shear test | C404.6 | [AP] |
| 12. | Determination of bearing capacity by standard penetration test | C404.6 | [AP] |

**Text Books:**

| | |
|---|---|
| 1. | Arora, K. R. “Soil Mechanics and Foundation Engineering”, Standard Publishers Distributors, New Delhi, 7th Edition Reprint, 2019. |
| 2. | Gopal Ranjan and Rao A S R, “Basic and Applied Soil Mechanics”, New Age International Pvt. Ltd., New Delhi, 2020. |
| 3. | Punmia B. C., Ashok K Jain and Arun K Jain, “Soil Mechanics and Foundation”, Laxmi Publications, New Delhi, Sixteenth Edition, 2019. |
| **Suggested Readings:** | |
| 1. | Murthy V N S, “Textbook of Soil Mechanics and Foundation Engineering”, CBS Publication, New Delhi, 2017. |
| 2. | Muni Budhu, “Soil Mechanics and Foundation Engineering”, Wiley India Publication, New Delhi, 2016. |
| 3. | Purushothama Raj P, “Soil Mechanics and Foundation Engineering” Pearson Education India, 2014. |
| 4. | Alam Singh, “Modern Geotechnical Engineering”, IBS Publications, New Delhi, 2010. |
| **IS Code of Practice:** | |
| 1. | IS 2720 (Reaffirmed 2006) Part 2 to 7, 10,13, 15, 28, 36, Method of test for soil – Code of Practice, Bureau of Indian Standards, New Delhi. |
| 2. | IS 1080 (1985), Design and construction of Shallow foundations in soils, Bureau of Indian Standards, New Delhi. |
| 3. | IS 1888 (1982), Method of load test on Soils – Code of Practice, Bureau of Indian Standards, New Delhi. |
| 4. | IS 1892 (1979), Code of practice for Subsurface Investigation for foundation, Bureau of Indian Standards, New Delhi. |
| 5. | IS 1904 (1986), Design and Construction of Foundations in Soils, General Requirements, Bureau of Indian Standards, New Delhi. |
| 6. | IS 2131 (1981), Method for Standard Penetration Test for Soils, Bureau of Indian Standards, New Delhi. |
| 7. | IS 6403 (1981), Code of Practice for determination of Bearing Capacity of Shallow Foundations, Bureau of Indian Standards, New Delhi. |
| 8. | IS 2911 Part 1 to 4, Design and Construction of Pile Foundations – Code of Practice, Bureau of Indian Standards, New Delhi. |
| 9. | IS 8000 Part 1 (1976), Code of Practice for calculation of settlements of foundations – Shallow foundations subjected to symmetrical static vertical loads, Bureau of Indian Standards, New Delhi. |
| **Web References:** | |
| 1. | https://freevideolectures.com/course/95/soil-mechanics |
| 2. | https://freevideolectures.com/course/2674/foundation-engineering |
| 3. | https://lecturenotes.in/subject/534/geotechnical-engineering-2 |
| 4. | https://www.youtube.com/playlist?list=PLbRMhDVUMngeiZjKPTPEFl1CByXmYX3Kv |
| **Online Resources:** | |
| 1. | https://nptel.ac.in/courses/105/105/105105168/ |
| 2. | https:// nptel.ac.in/courses/105/103/105103097/ |
| 3. | https://nptel.ac.in/courses/105/107/105107120/ |
| 4. | https://onlinecourses.nptel.ac.in/noc20_ce36/preview |

**Tentative Assessment Methods and Levels (based on Revised Bloom’s Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s | Continuous Assessment | | End Semester |
|---|---|---|---|
| | Theory | Practical | |

| Taxonomy | CIA-I [10 marks] | CIA-II [10 marks] | CIA III [10 marks] | Rubric Based CIA [30 Marks] | Examination (Theory) [40 Marks] |
|---|---|---|---|---|---|
| Remember | - | - | - | 10 | - |
| Understand | 10 | 10 | 10 | 20 | 10 |
| Apply | 50 | 50 | 50 | 30 | 50 |
| Analyse | 40 | 40 | 40 | 40 | 40 |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

**Course Articulation Matrix : Theory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 2 | - | 1 | - | - | - | - | - | - | - | 1 | 2 | - | - |
| **2** | 2 | 3 | - | 2 | - | 1 | - | - | - | - | - | - | 3 | - | - |
| **3** | 2 | 3 | - | 2 | - | 1 | - | - | - | - | - | - | 3 | 1 | - |
| **4** | 3 | 2 | - | 2 | 2 | 2 | 1 | 2 | 1 | 2 | - | 1 | 2 | 2 | 1 |
| **5** | 3 | 3 | - | 2 | 2 | 1 | - | 1 | - | - | - | 1 | 2 | 2 | - |
| **6** | 3 | 2 | - | 2 | 2 | 1 | - | 1 | - | - | - | - | 2 | 1 | - |
| **Avg** | **2.7** | **2.5** | **-** | **1.8** | **2.0** | **1.2** | **1.0** | **1.3** | **1.0** | **2.0** | **-** | **1.0** | **2.3** | **1.5** | **1.0** |

**Course Articulation Matrix : Laboratory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 2 | 2 | 3 | 3 | 1 | - | 2 | 1 | 1 | - | 1 | 2 | 1 | 1 |
| **2** | 2 | 2 | - | 3 | 2 | 1 | - | 2 | 1 | 1 | - | 1 | 2 | 1 | 1 |
| **3** | 2 | 2 | - | 3 | 2 | 2 | - | 2 | 1 | 1 | - | 1 | 2 | - | 1 |
| **4** | 2 | 2 | - | 3 | 2 | 2 | - | 2 | 1 | 1 | - | 1 | 2 | 1 | 1 |
| **5** | 2 | 2 | - | 3 | 2 | 2 | - | 2 | 1 | 1 | - | 1 | 2 | 1 | 1 |
| **6** | 2 | 2 | - | 3 | 2 | 1 | - | 2 | 1 | 1 | - | 1 | 2 | - | 1 |
| **Avg** | **2.2** | **2.0** | **2.0** | **3.0** | **2.2** | **1.5** | **-** | **2.0** | **1.0** | **1.0** | **-** | **1.0** | **2.0** | **1.0** | **1.0** |

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|

| 20CE405 | TRANSPORTATION ENGINEERING | 3/0/2/4 |
|---|---|---|
| **Nature of Course** | Theory Application | |
| **Pre requisites** | Surveying and Geomatics | |

**Course Objectives:**

| | |
|---|---|
| 1. | To know about highway planning and geometric design of roads. |
| 2. | To learn about pavement design and maintenance. |
| 3. | To know about the construction principles and maintenance of railway tracks. |
| 4. | To understand the processes involved in railway engineering. |

**Theory Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C405.1 | Understand and apply the basic concepts of highway planning. | [AP] |
| C405.2 | Plan the various geometric elements for highway construction. | [AN] |
| C405.3 | Outline and plan construction processes and alignment of railways. | [AN] |
| C405.4 | Investigate the working procedures in railways. | [AP] |
| C405.5 | Outline the airport components and services | [AP] |
| C405.6 | Plan the airport layout and describe the visual aid services | [AP] |

**Theory Course Content:**

**Module 1: Highway planning, design and construction** **15 Hrs.**

Significance of highway planning – History of road development in India – factors influencing highway alignment - Engineering surveys for alignment, Classification of highways. Highway components - Sight distances – Horizontal curves, Super elevation, transition curves, widening at curves – Vertical curves – Gradients, Testing of highway materials - Construction practice- WBM road – Bituminous road – Concrete road.

**Module 2: Railway planning, design, construction and maintenance** **15 Hrs.**

Role of Indian Railways in National Development – Railway cross sectional elements - Functions - Geometric Design of railway tracks, superelevation, cant deficiency and excess, negative superelevation. Points and Crossings – Working Principle - Signaling, Interlocking and Track Circuiting, Track Drainage, Railway Stations and Yards, Level Crossings – LRT & MRTS – Calculation of capacity of traffic.

**Module 3: Airport planning and design** **15 Hrs.**

Airports – Components of airports - Airport obstructions - Airport drainage - Airport lighting - Air traffic control -Runway and taxiway markings - Visual aids - Air traffic control network - Passenger facilities and services - Runway orientation - Cross wind component - Wind rose diagram (Problem) - Layout of taxiway and terminal area - Systems of aircraft parking - Circular Runways

| | |
|---|---|
| **Total Hours:** | **45 Hrs.** |

**Laboratory course outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C405.1 | Investigate the applicability of aggregates based on shape and density. | [AP] |
| C405.2 | Determine and evaluate the strength parameters of aggregates. | [AN] |
| C405.3 | Plan the vertical and horizontal alignment of pavements. | [AN] |
| C405.4 | Plan the geometric deign of railway tracks. | [AN] |

| | | |
|---|---|---|
| C405.5 | Design the airport runway orientation | [AP] |
| C405.6 | Examine the suitability of bitumen for usage in field. | [AP] |

**Laboratory Course Content:**

| S.No | List of Experiments | CO Mapping | RBT |
|---|---|---|---|
| 1 | Determination of specific gravity and water absorption of aggregates | C405.1 | [AN] |
| 2 | Determination of flakiness and elongation index of aggregates | C405.1 | [AN] |
| 3 | Determination of resistance offered by aggregate against gradual loading | C405.2 | [AP] |
| 4 | Determination of resistance offered by aggregates against impact loading | C405.2 | [AP] |
| 5 | Determination of resistance of aggregate against abrasion | C405.2 | [AP] |
| 6 | Design of alignment of pavements using software package | C405.3 | [AN] |
| 7 | Geometric design of railway tracks using software package | C405.4 | [AN] |
| 8 | Design of airport runway orientation using wind rose diagram | C405.5 | [AN] |
| 9 | Determination of Viscosity of bituminous binder | C405.6 | [AP] |
| 10 | Determination of Ductility of bituminous binder | C405.6 | [AP] |
| 11 | Determination of Softening point of bitumen | C405.6 | [AP] |
| 12 | Determination of Penetration of bitumen (Penetration Test) | C405.6 | [AP] |

**Text Books:**

| | |
|---|---|
| 1. | Rangwala, “Airport Engineering”, Charotar Publishing House, 2016. |
| 2. | Veeraragavan. A, Khanna S.K and Justo C E G, “Highway Engineering “, Nem Chand & Bros, 10th edition, 2015. |
| 3. | Arora .S.P and Saxena .S.C, “A Textbook of Railway Engineering”, CBS Publishers, 2017. |

**Suggested Readings:**

| | |
|---|---|
| 1. | Sharma S.K, “Principles Practices & Design of Highway Engineering” S.Chand & Co, 2014. |
| 2. | Satish Chandra and Agarwal.M.M, “Railway engineering” Prabha & Co, Delhi, 2012. |
| 3. | Partha Chraborthy and Animesh Das, “Principles of Transportation Engineering”, Tata McGraw Hill Co Ltd, New Delhi, 2012. |
| 4. | Norman J. Ashford, Saleh Mumayiz, Paul H. Wright, “Airport Engineering: Planning, Design, and Development of 21st Century Airports” Wiley; 4th edition, 2011 |

**IS Code of Practice**

| | |
|---|---|
| 1. | IS: 2386 – Part I to IV – 1963, “Methods of test for aggregates for concrete” . |
| 2. | IS 1203 to 1208 – 1978, “Methods for testing for tar and bituminous materials” |

**Web References:**

| | |
|---|---|
| 1. | https://www.designingbuildings.co.uk/wiki/Railway_engineering |
| 2. | https://www.brighthubengineering.com/building-construction-design/125227-highway-construction-and-engineering/ |

**Online Resources:**

| | |
|---|---|
| 1. | https://www.edx.org/course/railway-engineering-an-integral-approach-2 |
| 2. | https://www.mooc-list.com/tags/highway-engineering |

**Tentative Assessment Methods & Levels (based on Revised Blooms' Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom's Level | Continuous Assessment | | | | End Semester Examination (Theory) [40 marks] |
|---|---|---|---|---|---|
| | Theory | | | Practical | |
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA-III [10 Marks] | Rubric based CIA (30 Marks) | |
| Remember | 10 | 10 | - | - | - |
| Understand | 20 | 20 | 20 | - | 20 |
| Apply | 30 | 30 | 30 | 50 | 30 |
| Analyse | 40 | 40 | 50 | 50 | 50 |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

**Course Articulation Matrix : Theory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 2 | 1 | 1 | - | 1 | - | - | - | - | - | 1 | 2 | - | 1 |
| 2 | 3 | 2 | 1 | 1 | - | 1 | - | - | - | - | - | 2 | 2 | - | 1 |
| 3 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 | 2 | - | 1 |
| 4 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 | 2 | - | 1 |
| 5 | 3 | 2 | 1 | 2 | - | 1 | - | - | - | - | - | 2 | 2 | - | 1 |
| 6 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 | 2 | - | 1 |
| AVG | 3 | 2 | 1 | 1.2 | - | 1 | - | - | - | - | - | 1.3 | 2 | - | 1 |

**Course Articulation Matrix : Laboratory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 2 | 1 | 1 | 3 | - | 1 | 1 | 1 | 1 | - | 1 | 1 | - | 1 |
| 2 | 3 | 2 | 1 | 1 | 3 | - | 1 | 1 | 1 | 1 | - | 1 | 2 | - | 1 |
| 3 | 3 | 2 | 1 | 1 | 3 | - | 1 | 2 | 2 | 2 | - | 1 | 1 | - | 2 |
| 4 | 3 | 2 | 1 | 1 | 3 | - | 1 | 2 | 2 | 2 | - | 1 | 1 | - | 2 |
| 5 | 3 | 2 | 1 | 2 | 3 | - | 1 | 1 | 2 | 1 | - | 1 | 2 | - | 2 |
| 6 | 3 | 2 | 1 | 1 | 3 | - | 1 | 1 | 2 | 1 | - | 1 | 2 | - | 2 |
| AVG | 3 | 2 | 1 | 1.2 | 3 | - | 1 | 1.3 | 1.7 | 1.3 | - | 1 | 1.5 | - | 1.7 |

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|

**SEMESTER 5**

| 20CE501 | CONSTRUCTION PLANNING AND MANAGEMENT | 3/0/3/4.5 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory analytical |
| **Pre requisites** | Nil |

**Course Objectives:**

| | |
|---|---|
| 1. | To learn the basic concepts of Construction planning and management. |
| 2. | To understand project scheduling and use Cost control tools. |
| 3. | To know the assessment systems of quality control. |
| 4. | To study principles of safety and Health management systems. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C501.1 | Apply the elementary concepts in construction management and planning | [AP] |
| C501.2 | Model and plan construction problems using various network methods | [AN] |
| C501.3 | Apply the principles of scheduling for construction projects | [AP] |
| C501.4 | Examine the cost analysis using crashing in construction management | [AN] |
| C501.5 | Illustrate the ideas of quality control | [AP] |
| C501.6 | Examine the notions of safety and health management system | [AN] |

**Course Contents:**

**Module 1: Introduction to Management and Planning** **15 Hrs.**

Construction project planning - Stages of project planning: pre-tender planning, pre-construction planning, Framework, Importance of Planning - Types of organizations, role and responsibilities of project Manager, Resource planning - Project life cycle, Project feasibility reports based on socio-techno-economic, Process of development of plans and schedules, work break-down structure, Classification of Construction projects, Stages of construction, Resources, Contract – Types of contracts – Formation of contract

**Module 2: Schedule Management** **15 Hrs.**

Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks - Work Breakdown structure - PERT -–Activity float and schedules – Resource oriented scheduling–Scheduling with resource constraints and precedence's –Scheduling with uncertain durations – Crashing and time/cost trade-offs -Resource smoothing and Levelling, Critical Chain method, Introduction to computational scheduling. Software packages for project management

**Module 3: Construction Quality and Safety Management** **15 Hrs.**

Definition, Quality control, Quality Assurance, Cost of Quality-Quality Assessment system –Continuous process improvement - PDCA cycle, 5S, Kaizen - checklists for quality control, role of inspection, Principles of Safety – Safety and Health Management system – Safety Audit, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health. Last Planner System, Problems on safety (elementary).

| | |
|---|---|
| **Total Hours:** | **45 Hrs.** |

**Course Outcomes for Lab:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C501.1 | Categorize and create activities for the project | [AP] |
| C501.2 | Classify the tasks and milestones associated with a project | [AP] |
| C501.3 | Plan and allocate resource for the activities involved in a project | [AN] |
| C501.4 | Determine the critical path for the projects | [AN] |
| C501.5 | Analyze the optimum resource required by smoothing and leveling | [AN] |
| C501.6 | Examine and track the project status in the report | [AN] |

| S.No. | Laboratory Component | CO Mapping | RBT |
|---|---|---|---|
| 1 | Navigate and Customize the Project 2013 Interface, Adding Tasks and Resources to a Project. | C501.1 | [AP] |
| 2 | Creating Calendars and Changing Working Time with Calendars | C501.1 | [AP] |
| 3 | Determination of Summary Tasks and Milestones | C501.2 | [AP] |
| 4 | Allocation of Resources to tasks and Levelling Work Resources | C501.3 | [AN] |
| 5 | Use of MS Project to assign and Review the Over allocated Resources | C501.3 | [AN] |
| 6 | Determination of Critical path and activities using MS Project | C501.4 | [AN] |
| 7 | Identification of Critical path for simple and complex projects | C501.4 | [AN] |
| 8 | Resource allocation for activities involved in 2BHK Residential building | C501.5 | [AN] |
| 9 | Resource smoothing and Resource leveling for Commercial projects | C501.5 | [AN] |
| 10 | Use of MS Project for Scheduling of activities in a 2BHK Residential building | C501.5 | [AN] |
| 11 | Scheduling of activities in a G+3 Multistoried building using MS Project | C501.6 | [AN] |
| 12 | Tracking and Report generation for a project by updating the activities with the use of MS Project | C501.6 | [AN] |
| **Text Books:** | | | |
| 1. | Neeraj Kumar Jha,"Construction Project Management-Theory and Practice" Pearson Education India; 2nd edition, 2015. | | |
| 2. | Steven Mccabe, "Quality Improvement Techniques in Construction: Principles and Methods", Routledge, 2016. | | |
| 3. | Steve Rowlinson, "Construction Safety Management Systems", Routledge, 2019. | | |
| **Suggested Readings:** | | | |
| 1. | Charles Patrick, "Construction Project planning & Scheduling", Pearson, 2012. | | |
| 2. | Lock, Gower, "Project Management Handbook", 2013. | | |
| 3. | Jimmie W. Hinze, "Construction Planning and Scheduling", Prentice Hall Publication, 4th edition,2011 | | |
| 4. | Brian Thorpe and Peter Sumner, "Quality Assurance in Construction", Routledge. 2016. | | |
| **Web References:** | | | |
| 1. | https://lecturenotes.in/subject/547/construction-management-cm | | |
| 2. | https://www.transit.dot.gov/sites/fta.dot.gov/files/FTA_Report_No._0015.pdf | | |
| 3. | https://www.pmi.org/ | | |
| 4. | https://www.projectmanager.com/ | | |
| **Online Resources:** | | | |
| 1. | https://nptel.ac.in/courses/105104161/ | | |
| 2. | https://nptel.ac.in/courses/105103093/ | | |
| 3. | https://www.edx.org/course/project-management-of-engineering-projects-prepari | | |

| 4. | https://www.coursera.org/specializations/project-management |
|---|---|

**Tentative Assessment Methods & Levels (based on Revised Bloom's Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom's Level | Continuous Assessment | | | | End Semester Examination (Theory) [40 marks] |
|---|---|---|---|---|---|
| | Theory | | | Practical | |
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA-III [10 marks] | Rubric Based CIA [30 marks] | |
| Remember | 10 | - | - | 10 | 10 |
| Understand | 20 | 20 | 20 | 10 | 10 |
| Apply | 30 | 20 | 30 | 30 | 30 |
| Analyse | 40 | 60 | 50 | 50 | 50 |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

**Course Articulation Matrix– Theory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 2 | 1 | 2 | - | - | - | 2 | - | 2 | 3 | 2 | 2 | 2 | - |
| **2** | 3 | 2 | 1 | 2 | - | - | - | 2 | - | 2 | 3 | 2 | 2 | 2 | - |
| **3** | 3 | 3 | 2 | 2 | - | - | - | 2 | - | 2 | 3 | 1 | 2 | 2 | - |
| **4** | 3 | 2 | 1 | 2 | - | - | - | 2 | - | 2 | 3 | 2 | 2 | 2 | - |
| **5** | 3 | 2 | 1 | 2 | - | - | - | 2 | - | 2 | 3 | 1 | 2 | 2 | - |
| **6** | 3 | 3 | 2 | 2 | - | - | - | 2 | - | 2 | 3 | 2 | 2 | 2 | - |
| **Avg** | **3.0** | **2.3** | **1.3** | **2.0** | **-** | **-** | **-** | **2.0** | **-** | **2.0** | **3.0** | **1.6** | **2.0** | **2.0** | **-** |
| 1 | Reasonably agreed | | | | 2 | Moderately agreed | | | | | 3 | Strongly agreed | | | |

**Course Articulation Matrix : Laboratory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 2 | 1 | 2 | 3 | - | - | 2 | 2 | 2 | 3 | 1 | 2 | 2 | - |
| **2** | 3 | 2 | 1 | 2 | 3 | - | - | 2 | 2 | 2 | 3 | 1 | 2 | 2 | - |
| **3** | 3 | 3 | 2 | 2 | 3 | - | - | 2 | 2 | 2 | 3 | 1 | 2 | 2 | - |
| **4** | 3 | 2 | 1 | 2 | 3 | - | - | 2 | 2 | 2 | 3 | 1 | 2 | 2 | - |
| **5** | 3 | 2 | 1 | 2 | 3 | - | - | 2 | 2 | 2 | 3 | 1 | 2 | 2 | - |
| **6** | 3 | 3 | 2 | 2 | 3 | - | - | 2 | 2 | 2 | 3 | 1 | 2 | 2 | - |
| **Avg** | **3.0** | **2.3** | **1.3** | **2.0** | **3.0** | **-** | **-** | **2.0** | **2.0** | **2.0** | **3.0** | **1.0** | **2.0** | **2.0** | **-** |
| 1 | Reasonably agreed | | | | 2 | Moderately agreed | | | | | 3 | Strongly agreed | | | |

| 20CE502 | DESIGN OF REINFORCED CONCRETE STRUCTURES | 3/0/3/4.5 |
|---|---|---|
| **Nature of Course** | Problem Analytical | |
| **Pre-requisites** | Solid Mechanics; Engineering Geology and Concrete Technology | |

**Course Objectives:**

| | |
|---|---|
| 1. | To introduce the concepts for the analysis and design of reinforced concrete elements as per Limit State Design. |
| 2. | To impart knowledge on the latest Indian Standard codes of practice for the design of reinforced concrete elements |
| 3. | To understand the limit state of serviceability requirements, deflection and crack width |
| 4. | To draw the reinforcement detailing for various reinforced concrete elements. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C502.1 | Apply the philosophy of different methods for design of reinforced concrete elements. | [U] |
| C502.2 | Design the reinforced concrete beam subjected to bending and shear. | [AP] |
| C502.3 | Design slabs with different boundary conditions and RC Staircases. | [AP] |
| C502.4 | Design of underground and overhead water tank; design principle of retaining wall | [AN] |
| C502.5 | Design of short and long columns for axial, uniaxial and biaxial loading. | [AP] |
| C502.6 | Design of footings for axial load; design principle of combined and raft foundation. | [AN] |

**Course Contents:**

**Module 1: Design philosophy and Limit state design of beams** **15 Hrs.**

Introduction to reinforced concrete design - methods - Philosophy and principle of limit state design with assumptions - Stress block parameters, concept of balanced section, under reinforced and over reinforced section - Limit State design and detailing of singly, doubly reinforced rectangular and flanged beam for bending and shear - Design of beams for combined effect (bending, shear and torsion) as per IS-456. Check for serviceability: deflection and width of crack - Design for development length.

**Module 2: Design of slab, Water tank and Retaining wall** **15 Hrs.**

Design and detailing of one way and two-way rectangular slabs subjected to uniformly distributed load for various boundary conditions and corner effects - Design of grid floor- Design of flat slab (interior panel) - Design of staircase - waist slab (dog legged). Principle of working stress method with assumptions - Design and detailing of underground rectangular tanks - Design of overhead circular water tank (Design principle only) - Cantilever and counterfort retaining walls (Design principle only)

**Module 3: Limit State Design of Columns and Footings** **15 Hrs.**

Types of reinforced concrete column - Design concepts of the column - Limit state design and detailing of short and long columns for axially, uniaxial and biaxial load using interaction charts - Design and detailing of rectangular column footings with axial load and moment – Design and detailing of combined footings - Raft foundation (Design principle only)

| | |
|---|---|
| **Total Hours:** | **45 Hrs.** |

**Course Outcomes: ( laboratory)**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C502.1 | Design and Detailing of reinforced concrete beam. | **[AP]** |
| C502.2 | Design and Detailing of reinforced concrete slab | **[AP]** |

| | | |
|---|---|---|
| C502.3 | Design and Detailing of reinforced concrete retaining wall | **[AP]** |
| C502.4 | Design and Detailing of reinforced concrete water tank | **[AP]** |
| C502.5 | Design and Detailing of reinforced concrete column | **[AP]** |
| C502.6 | Design and Detailing of reinforced concrete footing | **[AP]** |

**Laboratory Component:**

| S. No. | List of Experiments | CO Mapping | RBT |
|---|---|---|---|
| 1. | Design and detailing of a singly reinforced beam using spread sheets and drafting package | C502.1 | [AN] |
| 2. | Design and detailing of a doubly reinforced beam using spread sheets and drafting package | C502.1 | [AN] |
| 3. | Design and detailing of a Tee beam using spread sheets and drafting package | C502.1 | [AN] |
| 4. | Design and detailing of a reinforced concrete one way slab using spread sheets and drafting package | C502.2 | [AN] |
| 5. | Design and detailing of a reinforced concrete Two way slab using spread sheets and drafting package | C502.2 | [AN] |
| 6. | Design and detailing of a cantilever retaining Wall using spread sheets and drafting package | C502.3 | [AN] |
| 7. | Design and detailing of a counterfort retaining Wall using spread sheets and drafting package | C502.3 | [AN] |
| 8. | Design and detailing of an underground rectangular water tank using spread sheets and drafting package | C502.4 | [AN] |
| 9. | Design and detailing of a overhead water tank using spread sheets and drafting package | C502.4 | [AN] |
| 10 | Design and detailing of columns using spread sheets and drafting package | C502.5 | [AN] |
| 11. | Design and detailing of isolated footing using spread sheets and drafting package | C502.6 | [AN] |
| 12. | Design and detailing of combined footing using spread sheets and drafting package | C502.6 | [AN] |

**Text Books :**


| | |
|---|---|
| 1. | Punmia B.C. and Jain A.K, Limit State Design of Reinforced Concrete, Laxmi Publications Pvt.Ltd, New Delhi, 2016. |
| 2. | Unnikrishna Pillai and Devdass Menon, Reinforced Concrete Design, Tata McGraw Hill Publishing Company Ltd. New Delhi, 2016. |
| 3. | Krishna Raju.N, Reinforced Concrete Design:IS:456-2000, Principles and Practice, New Age International Publishers, New Delhi, 2018. |


**Suggested Readings**


| | |
|---|---|
| 1. | Subramanian N., Design of Reinforced Concrete Structures, Oxford University Press,New Delhi, 2014. |
| 2. | Varghese,P.C.,Limit State Design of Reinforced Concrete, Prentice Hall of India, Pvt. Ltd., New Delhi, 2013. |
| 3. | Sinha,S.N.Reinforced Concrete Design–Tata McGrawHill Publishing Company Ltd. New Delhi, 2014. |

| | |
|---|---|
| 4. | Shah V L and Karve S R., Limit State Theory and Design of Reinforced Concrete, Structures Publications, Pune, 2013 |
| **IS Code Books :** | |
| 1. | IS 456:2000 Plain and Reinforced Concrete - Code of Practice, Bureau of Indian Standards, New Delhi. |
| 2. | IS 875:1987 Code of Practice for Design Loads (other than earthquake) for buildings and structures, Bureau of Indian Standards, New Delhi |
| 3. | National Building Code 2016, BIS, New Delhi. |
| 4. | SP16:1980 Design Aids for Reinforced Concrete to IS456 : 1978, BIS, New Delhi. |
| 5. | SP34:1987 Handbook on Concrete Reinforcement and Detailing, BIS, New Delhi. |
| 6. | IS 3370 (Part 1, 2, 3 and 4) - 2021 Concrete Structures for Retaining Aqueous Liquids, BIS, New Delhi. |
| 7. | IS 14458 : 1998 Retaining wall for hill area – Guidelines, BIS, New Delhi |
| **Web References:** | |
| 1. | https://geology.com/ |
| 2. | https://www.indianconcreteinstitute.org/ |
| **Online Resources:** | |
| 1. | https://nptel.ac.in/courses/105/102/105102012/ |
| 2. | https://onlinecourses.swayam2.ac.in/nou20_cs14/ |

**Tentative Assessment Methods and Levels (based on Revised Bloom's Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom's Level | Continuous Assessment | | | | End Semester Examination (Theory) [40 Marks] |
|---|---|---|---|---|---|
| | Theory | | | Practical | |
| | CIA-I [10 Marks] | CIA-II [10 Marks] | CIA-III [10 Marks] | Rubric based on CIA [30 Marks] | |
| Remember | 10 | 10 | 10 | - | 10 |
| Understand | 10 | 10 | 10 | 20 | 10 |
| Apply | 40 | 40 | 40 | 50 | 40 |
| Analyse | 40 | 40 | 40 | 30 | 40 |
| Evaluate | - | - | - | | - |
| Create | - | - | - | | - |

**Course Articulation Matrix : Theory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 1 | - | 1 | - | - | - | - | - | 1 | - | 3 | 2 | - | 2 |
| 2 | 3 | 2 | 3 | 2 | - | - | - | - | - | 1 | - | 3 | 2 | - | 2 |
| 3 | 3 | 2 | 3 | 2 | - | - | - | - | - | 1 | - | 3 | 2 | - | 2 |
| 4 | 3 | 2 | 3 | 2 | - | - | - | - | - | 1 | - | 3 | 2 | - | 2 |
| 5 | 3 | 2 | 3 | 2 | - | - | - | - | - | 1 | - | 3 | 2 | - | 2 |
| 6 | 3 | 2 | 3 | 2 | - | - | - | - | - | 1 | - | 3 | 2 | - | 2 |
| **AVG** | **3** | **1.83** | **3** | **1.83** | **-** | **-** | **-** | **-** | **-** | **1** | **-** | **3** | **2** | **-** | **2** |

**Course Articulation Matrix : Laboratory**

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

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 2 | 3 | 2 | 3 | - | - | 1 | 1 | 2 | - | 2 | 2 | - | 2 |
| 2 | 3 | 2 | 3 | 2 | 3 | - | - | 1 | 1 | 2 | - | 2 | 2 | - | 2 |
| 3 | 3 | 2 | 3 | 2 | 3 | - | - | 1 | 1 | 2 | - | 2 | 2 | - | 2 |
| 4 | 3 | 2 | 3 | 2 | 3 | - | - | 1 | 1 | 2 | - | 2 | 2 | - | 2 |
| 5 | 3 | 2 | 3 | 2 | 3 | - | - | 1 | 1 | 2 | - | 2 | 2 | - | 2 |
| 6 | 3 | 2 | 3 | 2 | 3 | - | - | 1 | 1 | 2 | - | 2 | 2 | - | 2 |
| **AVG** | **3** | **2** | **3** | **2** | **3** | **-** | **-** | **1** | **1** | **2** | **-** | **2** | **2** | **-** | **2** |
| 1 | Reasonably agreed | | | | 2 | Moderately agreed | | | | | 3 | Strongly agreed | | | |

| 20CE503 | MECHANICS OF MATERIALS | 2/1/3/4.5 |
|---|---|---|
| **Nature of Course** | Problem Analytical | |
| **Pre requisites** | Solid Mechanics | |

**Course Objectives:**

| | |
|---|---|
| 1. | To impart the energy principles to analyse the beams, frames and plane trusses |
| 2. | To check the beams and columns load carrying capacities using various theories |
| 3. | To compute the collapse load using plastic analysis theory. |
| 4. | To compute the load carrying capacity of structural members using various failure theories. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C503.1 | Apply the Energy principles to analyse the trusses, beams and frames. | [AP] |
| C503.2 | Analyze the indeterminate beams and sketch shear force and bending moments. | [AN] |
| C503.3 | Analyse the column stability and compute the critical load using various theories. | [AN] |
| C503.4 | Apply theory of structural plastic analysis to determine collapse load of structural members. | [AN] |
| C503.5 | Apply the failure theories to compute the load carrying capacity of structural members. | [AP] |
| C503.6 | Analyse thick cylinders and compound cylinders and compute the stresses. | [AN] |

**Course Contents: Theory**

**Module 1: Energy methods and Three moment theorem** **15 Hrs.**

General energy theorems - Castigliano's theorem, Maxwell Bettie's reciprocal theorem - Virtual work and unit load method for deflection - Application to problems of beams and trusses; Indeterminate Beams - Propped cantilever and fixed beams - fixed end moments and reactions for concentrated load, uniformly distributed load and combined load; Analysis of continuous beams - theorem of three moments - shear force and bending moment diagrams

**Module 2: Column stability and Plastic analysis** **15 Hrs.**

Columns **-** Stability of Structures - Euler's Formula for Pin-Ended Columns - Extension of Euler's Formula to Columns with Other End Conditions - eccentrically loaded columns – Rankine's-Gordon formula - Secant Formula – Plastic analysis: ultimate load carrying capacity of members in axial tension and compression - Plasticity in ductile materials, elasto-plastic behavior of beam in flexure - shape factor for different cross sections - concept of plastic hinge - Conditions and basic theorems of plastic analysis - determination of collapse load for beams and portal frames - bending moment diagram at collapse - limitations of plastic analysis.

**Module 3: Failures Theories and Thick Cylinders** **15 Hrs.**

Two-dimensional state of stress at a point - Mohr's Circle - Stress paths - Normal and shear stresses on any plane - Principal planes and principal stresses - Maximum shear stress - Theories of failure – Principal stress theory – Principal strain theory – Shear stress theory – strain energy theory and distortion energy theory - Thick cylinders - compound cylinders.

| | |
|---|---|
| **Total Hours:** | **45 Hrs** |

**Course outcomes: Laboratory**

| Upon completion of the Laboratory, students shall have ability to | | |
|---|---|---|
| C503.1 | Apply the basic principles for bending analysis of the beams | [AP] |
| C503.2 | Analyze and compute the material properties of beams using deflection measurements | [AN] |
| C503.3 | Analyze and compute the shear force and bending moments of beams and frames using analysis package. | [AN] |
| C503.4 | Analyze and compute the deflections of beams and columns using analysis package. | [AN] |
| C503.5 | Analyze and compute the member forces of a roof truss using analysis package | [AN] |
| C503.6 | Analyse and compute the spring stiffness, modulus of rigidity of the spring wire and maximum strain energy stored. | [AN] |

**Course Content : Laboratory**

| S.No. | List of Experiments | CO Mapping | RBT |
|---|---|---|---|
| 1 | Verification of Maxwell's reciprocal theorem | C503.1 | [AP] |
| 2 | Determine the modulus of elasticity of simply supported metal beam using four-point bending test | C503.1 | [AN] |
| 3 | Determine the modulus of elasticity of simply supported beam using three-point bending test | C503.1 | [AN] |
| 4 | Determine the bending stress of cantilever beam subjected to various load cases | C503.2 | [AN] |
| 5 | Determine the bending stress of propped cantilever beam subjected to various load cases | C503.2 | [AN] |
| 6 | Determine the modulus of elasticity of the given structural material by measuring deflection of continuous beam | C503.2 | [AN] |
| 7 | Computation of Shear Force and Bending Moment of beams for various supports and load conditions using analysis package | C503.3 | [AN] |
| 8 | Computation of Shear Force and Bending Moment of portal frames for various supports and load conditions using analysis package | C503.3 | [AN] |
| 9 | Computation of deflections for beams and trusses using analysis package | C503.4 | [AN] |
| 10 | Computation of member forces for a roof truss for various supports and load conditions using analysis package | C503.5 | [AN] |
| 11 | Determination of Elastic properties of open coiled helical spring | C503.6 | [AN] |
| 12 | Determination of Elastic properties of closed coiled helical spring | C503.6 | [AN] |

**Text Books:**


| | |
|---|---|
| 1. | Gere, J.M. and Goodno, B.J., "Mechanics of Materials", CENGAGE Learning Custom Publishing; 9th edition edition, 2017. |
| 2. | Bansal R.K, "Strength of Materials", Lakshmi Publications Ltd, New Delhi, 2012. |
| 3. | Punmia B.C and Jain A.K., "Mechanics of Materials", Laxmi Publications Ltd, New Delhi, 2012. |


**Suggested Readings:**


| | |
|---|---|
| 1. | William A. Nash, Strength of Materials, Tata McGraw-Hill Publishing Co. Ltd, New Delhi, 2010 |

| | |
|---|---|
| 2. | Gambhir.M.L. “Fundamentals of Solid Mechanics”, PHI Learning Private Ltd., New Delhi, 2010. |
| 3. | Kazimi S.M.A., “Solid Mechanics ", Tata McGraw-Hill Publishing Company, New Delhi, 2017 |
| 4. | Hibbeler, R.C. (2011). Mechanics of Materials, 8e, Pearson Prentice Hall. |
| **Web References:** | |
| 1. | http://nptel.iitk.ac.in/courses/Webcourse-contents/IIT-Delhi/Mechanics%20Of%20Solids/index.htm |
| 2. | http://textofvideo.nptel.iitm.ac.in/1053/lec1.pdf |
| 3. | http://www.nesoacademy.org/civil-engineering/mechanics of solids |
| **Online Resources:** | |
| 1. | http://nptel.ac.in/video.php?subjectId=105106116 |
| 2. | http://nptel.ac.in/video.php?subjectId=112107147 |

**Tentative Assessment Methods and Levels (based on Revised Bloom’s Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s Level | Continuous Assessment | | | | End Semester Examination (Theory) [40 Marks] |
|---|---|---|---|---|---|
| | Theory | | | Practical | |
| | CIA – I (10 Marks) | CIA – II (10 Marks) | CIA – III (10 Marks) | Rubric based CIA (30 Marks) | |
| Remember | 10 | 10 | 10 | 10 | 20 |
| Understand | 40 | 40 | 40 | 20 | 20 |
| Apply | 50 | 50 | 40 | 40 | 40 |
| Analyze | - | - | 10 | 30 | 20 |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

**Course Articulation Matrix : Theory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 3 | - | 3 |
| **2** | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 3 | - | 3 |
| **3** | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 3 | - | 3 |
| **4** | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 3 | - | 3 |
| **5** | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 3 | - | 3 |
| **6** | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 3 | - | 3 |
| **Avg** | **3** | **3** | **3** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | **-** | **3** |
| 1 | Reasonably agreed | | | | 2 | Moderately agreed | | | | | 3 | Strongly agreed | | | |

**Course Articulation Matrix : Laboratory**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 3 | 3 | 3 | 3 | | | | 2 | 2 | | 3 | 3 | | 2 |
| **2** | 3 | 3 | 3 | 3 | 3 | | | | 2 | 2 | | 3 | 3 | | 2 |
| **3** | 3 | 3 | 3 | 3 | 3 | | | | 2 | 2 | | 3 | 3 | | 2 |
| **4** | 3 | 3 | 3 | 3 | 3 | | | | 2 | 2 | | 3 | 3 | | 2 |
| **5** | 3 | 3 | 3 | 3 | 3 | | | | 2 | 2 | | 3 | 3 | | 2 |
| **6** | 3 | 3 | 3 | 3 | 3 | | | | 2 | 2 | | 3 | 3 | | 2 |
| **Avg** | **3** | **3** | **3** | **3** | **3** | | | | **2** | **2** | | **3** | **3** | | **2** |
| 1 | Reasonably agreed | | | | 2 | Moderately agreed | | | | | 3 | Strongly agreed | | | |

## PROFESSIONAL ELECTIVE COURSES

| 20CE901 | DAMAGE DETECTION AND REHABILITATION OF CONCRETE STRUCTURES | 3/0/0/3 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory Concept |
| **Pre requisites** | Concrete Technology |

**Course Objectives:**

| | |
|---|---|
| 1. | To recognize the importance of maintenance and assess quality of concrete by using various diagnosing techniques of concrete |
| 2. | To understand the various structural damages and apply the methods to repair the concrete structures. |
| 3. | To understand the retrofitting and rehabilitation techniques for structural members |
| 4. | To learn the concept used in various demolition techniques and case studies. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C901.1 | Inspect and evaluate the damaged structure. | [AN] |
| C901.2 | Suggest the suitable diagnosing techniques of concrete structures. | [AP] |
| C901.3 | Analyse the structural damages by various monitor techniques. | [AN] |
| C901.4 | Apply the surface repairing techniques in structures | [AP] |
| C901.5 | Apply suitable strengthening method for the damaged structure elements. | [AP] |
| C901.6 | Apply the different techniques for stabilization of structures | [AP] |

**Course Contents:**

**Module 1: Maintenance and Diagnosis of Damage** **15 Hrs.**

Facets of Maintenance - Importance of Maintenance - Various aspects of inspection - Assessment procedure for evaluating damaged structure - Design and construction errors - Deterioration of cementitious systems – Sulphate, Acid attack, Alkali Silica Reaction (ASR) - Diagnosis of concrete failures - Non-destructive testing systems - Assessment of rebar: Rebar detector and cover meter - Partially destructive testing systems: Penetration resistance, Pull-off resistance, Break-off resistance, Concrete core sampling and core testing.

**Module 2: Cracks, Corrosion and repair techniques** **15 Hrs.**

Causes of cracks in concrete structures - Types of Cracks in: Slab, Beam, Column - Methods to monitor crack width changes in concrete - Influencing factors of corrosion in reinforced concrete - Chloride and Carbonation induced reinforcement corrosion - Corrosion damage of reinforced concrete – Corrosion testing systems: half cell potential meter and linear polarization resistance - Methods of surface repair in RC structures – Material selection, surface preparation, placement of repair material- Repairs to overcome strength, deflection, cracking, corrosion, chemical disruption, weathering, leakage and marine exposure.

**Module 3: Strengthening and stabilization** **15 Hrs.**

Strengthening techniques: Foamed concrete, mortar and dry pack, gunite and shotcrete, epoxy injection, mortar repair for cracks, shoring and underpinning - Introduction of Strengthening of Structural elements - Flexural strengthening - Beam shear capacity strengthening - Column strengthening - Recent development of seismic retrofit methods - Rust eliminators and polymers coating for rebars during repair - Methods adopted in lifting of buildings / structures and its benefits. Case Study – Failure study on existing building (only

| | |
|---|---|
| for Internal Assessment) | |
| **Total Hours:** | **45 Hrs** |
| **Text Books:** | |
| 1. | Vidivelli B., Rehabilitation of Concrete Structures, Standard Publishers Distributors, 2018. |
| 2. | Bhattacharjee J., Concrete Structures Repair Rehabilitation and Retrofitting, CBS Publishers, 2017. |
| 3. | Poonam I. Modi, Chirag N. Patel, Repair and Rehabilitation of Concrete Structures, PHI Learning Pvt. Ltd, 2016. |
| **Suggested Readings:** | |
| 1. | Gupta B. L. and Amit Gupta, Maintenance & Repair of Civil structures, Standard Publishers Distributors, New Delhi, 2015. |
| 2. | Varghese P.C., Maintenance, Repair & Rehabilitation and Minor Works of Buildings, Prentice Hall India Learning Private Limited, 2014. |
| 3. | Guha P. K., Maintenance and Repairs of Buildings, New Central Book Agency (P) Ltd., 2017. |
| 4. | Gahlot P S, and Sanjay Sharma, Building Repair and Maintenance Managementll, CBS Publishers, 2015. |
| **Code Books :** | |
| 1. | IS 13311 (Part 1):1992 Non-Destructive Testing of Concrete - Methods of Test - Ultrasonic pulse velocity Test, BIS, New Delhi. |
| 2. | IS 13311 (Part 2):1992 Non-Destructive Testing of Concrete - Methods of Test - Rebound Hammer, BIS, New Delhi. |
| 3. | IS 6925:1975 Methods of test for determination of water soluble chlorides in concrete admixtures, BIS, New Delhi. |
| 4. | IS : 2366: 1963 Methods of test for aggregates for concrete |
| 5. | ASTM C876 - 91(1999) Standard Test Method for Half-Cell Potentials of Uncoated Reinforcing Steel in Concrete |
| **Web References:** | |
| 1. | https://cpwd.gov.in/units/handbook.pdf |
| 2. | https://icjonline.com/journals/201202feb/files/2012_02_icj%20e%20journal.pdf |
| **Online Resources:** | |
| 1. | https://nptel.ac.in/courses/114106035/38 |
| 2. | https://nptel.ac.in/courses/105104030/38 |

**Tentative Assessment Methods & Levels (based on Revised Bloom's Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom's Level | Assessment Component | Marks |
|---|---|---|---|
| C901.1 | Apply | Assignment | 5 |
| C901.2&C901.3 | Apply | Technical Presentation | 5 |
| C901.4 | Apply | Online Technical Quiz | 5 |
| C901.5 & C901.6 | Apply | Case Study Report | 5 |

**Summative assessment based on Continuous and End Semester Examination**

| | Continuous Assessment | End |
|---|---|---|

| Revised Bloom's Level | CIA-I [10 marks] | CIA-II [10 marks] | CIA-III [10 marks] | Semester Examination (Theory) [50 marks] |
|---|---|---|---|---|
| Remember | 20 | 10 | 10 | 10 |
| Understand | 30 | 20 | 30 | 20 |
| Apply | 20 | 40 | 60 | 40 |
| Analyse | 30 | 30 | - | 30 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 2 | 1 | 1 | - | - | 1 | 1 | 1 | 1 | - | 2 | 3 | 1 | 1 |
| **2** | 3 | 2 | 1 | 1 | - | - | 1 | 1 | 1 | 1 | - | 2 | 3 | 1 | 1 |
| **3** | 3 | 2 | 1 | 1 | - | - | 1 | 1 | 1 | 1 | - | 2 | 3 | 1 | 1 |
| **4** | 3 | 2 | 1 | 1 | - | - | 1 | 1 | 1 | 1 | - | 2 | 3 | 1 | 1 |
| **5** | 3 | 2 | 1 | 1 | - | - | 1 | 1 | 1 | 1 | - | 2 | 3 | 1 | 1 |
| **6** | 3 | 2 | 1 | 1 | - | - | 1 | 1 | 1 | 1 | - | 2 | 3 | 1 | 1 |
| **Avg** | **3.0** | **2.0** | **1.0** | **1.0** | **-** | **-** | **1.0** | **1.0** | **1.0** | **1.0** | **-** | **2.0** | **3.0** | **1.0** | **1.0** |

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|

| 20CE902 | DESIGN OF SUBSTRUCTURES | 3/0/0/3 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory and Application |
| **Pre-requisites** | Geotechnical Engineering |

**Course Objectives:**

| | |
|---|---|
| 1. | To identify the significance of bearing capacity and settlement in the design of substructure |
| 2. | To design shallow and deep foundation considering the load and subsurface soil conditions |
| 3. | To design earth retaining structures and bridge substructures |
| 4. | To apply suitable design method for special foundations considering codal provisions |

**Course Outcomes:**

**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C902.1 | Compute bearing capacity and settlement for shallow foundation | [AP] |
| C902.2 | Design suitable shallow foundation based on bearing capacity and settlement estimates from equations or in-situ test data | [AP] |
| C902.3 | Analyze the concept of load carrying capacity of pile groups | [AN] |
| C902.4 | Design pile foundation for different loading conditions on the pile head and shaft | [AP] |
| C902.5 | Apply suitable design for earth retaining structures and bridge sub-structures | [AP] |
| C902.6 | Design foundation for machine and tower structures | [AP] |

**Course Contents:**

**Module1: Shallow Foundation** **12 Hrs.**

Bearing Capacity Equations (Terzaghi's, Skempton's, Meyerhof's, Hansen's, Vesics's, IS Code Method)–Effect of Water Table– Bearing Capacity and Settlement from In-situ Test Data – Design of Individual and Combined Footings - Design of Raft Foundation– Seismic Load Considerations -Codal Provisions

**Module2: Deep Foundation** **18 Hrs.**

Load Carrying Capacity of Pile Groups – Design of Under-reamed Piles – Design of Laterally Loaded Piles - Pile Caps –Settlement of Pile Foundation – Well Foundation - Design of Offshore Piles in Rock Strata – Seismic Load Considerations – Codal Provisions

**Module3: Earth Retaining Structure and Special Foundation** **15 Hrs.**

Design of Retaining Walls –Design of Bridge Substructures – Abutments and Piers – Introduction to Ring and Shell Foundation – Design of Machine Foundation –Design of Tower Foundation – Seismic Load Considerations - Codal Provisions

**Total Hours: 45 Hrs.**

**Text Books:**

| | |
|---|---|
| 1. | Swami Saran, "Analysis and Design of Substructure: Limit State Design", Oxford & IBH Publishing Co Pvt. Ltd, 2018. |
| 2. | Arora, K.R."Soil Mechanics and Foundation Engineering", Standard Publisher Dist., 2020 |
| 3. | Murthy V.N.S., "Textbook of Soil Mechanics and Foundation Engineering Geotechnical Engineering Series", CBS Publishers & Distributors Pvt. Ltd., 2018 |

**Suggested Readings**

| | |
|---|---|
| 1. | Wai-Fah Chen and Lian Duan, “Bridge Engineering Handbook - Substructure Design”, CRC Press, 2014 |
| 2. | Kameswara Rao, N.S.V. “Foundation Design – Theory and Practice”, Wiley Publisher, 2011 |
| 3. | Yung Ming Cheng, Chi Wai Law, Leilei Liu, “Analysis, Design and Construction of Foundations”, CRC Press, 2021 |
| 4. | K Aruna Moy Ghosh, “Foundation Design in Practice”, PHI, 2009 |
| **Code Books** | |
| 1. | IS 1904: 1986 – Code of Practice for Design and Construction of Foundations in Soils: General Requirements |
| 2. | IS 1080: 1985 – Code of Practice for Design and Construction of Shallow Foundations in Soils (Other than Raft, Ring and Shell) |
| 3. | IS 6403: 1981 – Code of Practice for Determination of Bearing Capacity of Shallow Foundations |
| 4. | IS 2950 (Part 1): 1981 – Code of Practice for Design and Construction of Raft Foundations |
| 5. | IS 8009 (Part 1 and 2): 1976 – Code of Practice for Calculation of Settlements of Foundations |
| 6. | IS 11089: 1984 – Code of Practice for Design and Construction of Ring Foundation |
| 7. | IS 9456: 1980 – Code of Practice for Design and Construction of Conical and Hyperbolic Paraboloidal Types of Shell Foundations |
| 8. | IS 2911 (Part 1 to 4): 2010 - Code of Practice for Design and Construction of Pile Foundations – Concrete Piles, |
| 9. | IS 2974 (Part 1 to 5): 1982 - Code of Practice for Design and Construction of Machine Foundations |
| 10. | IRC 78: 2000 – Standard Specifications and Code of Practice for Road Bridges – Section 7 – Foundations and Substructure |
| 11. | IS 9527: 1981 (Part 1) – Code of Practice for Design and Construction of Port and Harbour Structures – Concrete Monoliths |
| 12. | IS 4091: 1979 – Code of Practice for Design and Construction of Foundations for Transmission Line Towers and Poles |
| **Web References:** | |
| 1. | https://theconstructor.org/geotechnical/caisson-types-construction-advantages/503/ |
| 2. | http://home.iitk.ac.in/~vinaykg/Iset495.pdf |
| **Online Resources:** | |
| 1. | https://nptel.ac.in/content/storage2/courses/105101083/download/lec16.pdf |
| 2. | https://nptel.ac.in/content/storage2/courses/105101083/download/lec20.pdf |

**Tentative Assessment Methods and Levels (based on Revised Bloom’s Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom’s Level | Assessment Component | Marks |
|---|---|---|---|
| C902.1 - 6 | Analyze | Group Assignment | **5** |
| C902.1-6 | Apply | Tutorial Problem | **10** |
| C902.1–6 | Apply | Case Study | **5** |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s Level | Continuous Assessment | | | End Semester Examination (Theory) [50Marks] |
|---|---|---|---|---|
| | CIA-I [10Marks] | CIA-II [10Marks] | CIA-III [10Marks] | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Remember | | | - | | - | | | - | | | - | | | - | |
| Understand | | | 10 | | 10 | | | 10 | | | 20 | | | | |
| Apply | | | 50 | | 50 | | | 50 | | | 40 | | | | |
| Analyse | | | 40 | | 40 | | | 40 | | | 40 | | | | |
| Evaluate | | | - | | - | | | - | | | - | | | | |
| Create | | | - | | - | | | - | | | - | | | | |
| **Course Articulation Matrix** | | | | | | | | | | | | | | | |
| **CO** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO1** | **PSO2** | **PSO 3** |
| **1** | 3 | 2 | 1 | - | - | 1 | - | 2 | 2 | 2 | - | 2 | 2 | - | 1 |
| **2** | 3 | 2 | 1 | - | - | 1 | - | 1 | 2 | 2 | - | 2 | 2 | - | 1 |
| **3** | 3 | 2 | 1 | - | - | 1 | - | 1 | 2 | 2 | - | 2 | 2 | - | 1 |
| **4** | 3 | 2 | 1 | - | - | 1 | 1 | 1 | 2 | 2 | - | 2 | 2 | - | 1 |
| **5** | 3 | 2 | 1 | - | - | 1 | 1 | 1 | 2 | 2 | - | 2 | 2 | - | 1 |
| **6** | 3 | 2 | 1 | - | - | 1 | | 2 | 2 | 2 | - | 2 | 2 | - | 1 |
| **Avg** | 3 | 2 | 1 | - | - | 1 | 1 | 1.3 | 2 | 2 | - | 2 | 2 | - | 1 |
| **1** | **Reasonably agreed** | | | | **2** | **Moderately agreed** | | | | | **3** | **Strongly agreed** | | | |

| 20CE904 | GREEN BUILDING TECHNOLOGY | 3/ 0/ 0/ 3 |
|---|---|---|
| **Nature of Course** | Theory Concept | |
| **Pre- requisites** | Nil | |

**Course Objectives:**

| | |
|---|---|
| 1. | To understand the concepts of sustainability, energy and environment. |
| 2. | To select materials to decrease environmental impacts. |
| 3. | To understand the green buildings system implementation and its efficiency. |
| 4. | To study and identify green building rating system and their economic Aspects. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C904.1 | Practice the ideology of green building concepts and demonstrate the Conventional Vs Green buildings. | AP |
| C904.2 | Illustrate the philosophies of Integrated design, Ecological design and Regenerative design. | AP |
| C904.3 | Assess and implement the different systems involved in green building design – water, energy, materials, land, air. | AP |
| C904.4 | Appraise the implementation of the design and aspects involved in building commissioning- benefits. | AP |
| C904.5 | Evaluate the design on various rating systems -LEED, Green globes, GRIHA and EDGE. | AP |
| C904.6 | Interpret economic aspects of green building – quantifying short term and long-term benefits. | AP |

**Course Contents:**

**Module 1: Introduction:** **15 Hrs**

Historical Perspective Buildings - Conventional versus Green Buildings - Comparison. Minor and major aspects of Green Buildings - The Integrated Design Process. Green Building Documentation Requirements. Conventional, Contemporary and Future Ecological Design - Green Design to Regenerative Design - Eco Charette process - SWOT analysis- Environmental, Social and Governance- Criteria

**Module 2: Green building systems and its Implementation**: **15 Hrs**

Sustainable sites and landscaping - Enhancing ecosystems. Building envelope - selection of green materials, products and applications. Passive design strategies. Internal load reduction - Indoor environment quality - Building water and waste water management - Use of LEED / IGBC standards - Site Planning, Health and Safety Planning, Construction and Demolition -Waste Management - Reducing the Footprint of Construction Operations - Maximizing the Value of Building Commissioning - HVAC Systems, Lighting and cleaning systems for green buildings - Costs and Benefits of Building Commissioning - use of LEED/ IGBC standards -

**Module 3: Assessment and Economics of Green building:** **15 Hrs**

International Building Assessment Systems - The USGBC/ LEED Building Assessment Standard - The LEED Certification Process - The Green Globes Building Assessment Protocol - Example of a Platinum / Gold / Silver Building. Comparison of present Building Rating Systems - Code compilation requirements - LEED, GRIHA -EDGE- Economic aspects of Green Buildings - Quantifying Green Building Benefits - Managing Costs and Barriers. Short - & long -term environment benefits. Some typical case studies of Green

| | |
|---|---|
| Buildings | |
| **Total Hours:** | **45 Hrs** |
| **Text Books:** | |
| 1. | Jerry Edelson, “Green Buildings A to Z”, Understanding the buildings, www. newsociety.com,2008. |
| 2. | “Greenbuildingguidelines:Meetingthedemandforlow-energy,resource-efficienthomes”,Sustainable Buildings Industry Council, 2004. |
| 3. | Guttila Yugantha Jayasinghe,” A text book on Green Buildings “Lambert Academic Publishing,2018. |
| **Suggested Readings:** | |
| 1. | CharlesJ.Kibert,“SustainableConstruction:GreenBuildingDesignandDelivery”,2nd Edition, Wiley, 2007. |
| 2. | Jerry Yudelson, “Green Buildings through Integrated Design”, Tata McGraw Hill, 2008. |
| 3. | Jeannie Leggett Sikora,”Green Building Strategies: From Plan to Profit” Builder Books 2012. |
| 4. | Mike Montoya “Green Building Fundamentals: Practical Guide to Understanding and Applying Fundamental Sustainable Construction Practices and the Leed System” Pearson 2 nd edition - 2010. |
| **Web References:** | |
| 1. | http://www.grihaindia.org/events/inno/pdf/25nov/sudarshan.pdf |
| 2. | https://archive.epa.gov/greenbuilding/web/html/about.htm |
| **Online Resources:** | |
| 1. | https://www.coursera.org/learn/renewable-energy-entrepreneurship |
| 2. | https://www.edx.org/course/sustainability-in-architecture-an-interdisciplinary-introduction-0 |

**Assessment Methods & Levels (based on Bloom’s Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom’s Level | Assessment Component | Marks |
|---|---|---|---|
| C904.1 | Apply | Class Room Quiz | 5 |
| C904.2 | Apply | Group Assignment | 5 |
| C904.3 - C904.4 | Analyze, Apply | Group Mini Project | 5 |
| C904.5 - C904.6 | Apply | Technical Presentation | 5 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s Level | Continuous Assessment | | | End Semester Examination (Theory) [50 marks] |
|---|---|---|---|---|
| | CIA-I [10 marks] | CIA-II [10marks] | Term End Examination [10 marks] | |
| Remember | 10 | 10 | 10 | 10 |
| Understand | 40 | 40 | 40 | 50 |
| Apply | 40 | 40 | 40 | 20 |
| Analyze | 10 | 10 | 10 | 20 |
| Evaluate | - | - | - | - |

| Create | | - | | - | | - | | - | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Articulation Matrix – Theory** | | | | | | | | | | | | | | |
| **CO** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| 1 | 3 | 2 | 1 | - | - | - | 2 | 2 | 2 | - | - | - | 1 | 2 | 1 |
| 2 | 3 | 2 | 1 | - | - | - | 2 | 2 | 2 | - | - | - | 1 | 2 | 1 |
| 3 | 3 | 2 | 1 | - | - | - | 2 | 2 | 2 | - | - | - | 1 | 2 | 1 |
| 4 | 3 | 2 | 1 | - | - | - | 2 | 2 | 2 | - | - | - | 1 | 2 | 1 |
| 5 | 3 | 2 | 1 | - | - | - | 2 | 2 | 2 | - | - | - | 1 | 2 | 1 |
| 6 | 3 | 2 | 1 | - | - | - | 2 | 2 | 2 | - | - | - | 1 | 2 | 1 |
| **Avg** | **3** | **2** | **1** | **-** | **-** | **-** | **2** | **2** | **2** | **-** | **-** | **-** | **1** | **2** | **1** |

| 20CE905 | GROUND IMPROVEMENT AND LAND RECLAMATION METHODS | 3/0/0/3 |
|---|---|---|
| **Nature of Course** | Theory and Application | |
| **Pre-requisites** | Geotechnical Engineering | |

**Course Objectives:**

| | |
|---|---|
| 1. | To identify various challenges existing in ground improvement |
| 2. | To acquaint with different ground improvement techniques |
| 3. | To analyze the application of various Geosynthetics as soil reinforcement |
| 4. | To recommend suitable ground improvement and reclamation for any field situation |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C905.1 | Comprehend the scope of ground improvement in the real time projects | [AN] |
| C905.2 | Identify various ground improvement techniques based on soil conditions | [AN] |
| C905.3 | Analyze the application of geotextiles, geogrids, geonets, geocomposites as soil reinforcement | [AN] |
| C905.4 | Apply suitable ground improvement techniques in Roads, Retaining Walls, Embankments and Landfills | [AP] |
| C905.5 | Recognize various methods existing for land reclamation | [AN] |
| C905.6 | Recommend suitable methods for an effective land reclamation in any field situation | [AP] |

**Course Contents:**

**Module 1: Ground Improvement** **15 Hrs.**

Challenges in Ground Improvement – Principles of Compaction – Shallow Stabilization with additives – Lime, Fly ash and Cement – Deep Stabilization using Stone Column - Sand Drains - Prefabricated Drains - Soil-Lime Column - Vibro-floatation - Dynamic Compaction - Electro-osmosis – Grouting – Permeation, Compaction and Jet - Dewatering Systems - Case Studies

**Module 2: Geosynthetics and Soil Reinforcement** **15 Hrs.**

Geosynthetics – Types and Materials – Reinforced Soil Structures – Principles of Soil Reinforcement –Geotextiles and Geogrids in Roads, Retaining Walls and Embankments – Geonets and Geocomposites as Drains and Filters - Geosynthetics as Covers and Liners in Landfills and Slurry Ponds - Case Studies

**Module 3: Land Reclamation Methods** **15 Hrs.**

Land Reclamation – Methods – Stabilization/Solidification - Soil Vapour Extraction, Thermal Desorption, Vitrification - Soil Washing, Permeable Reactive Barrier, Electrokinetics, In-situ Chemical Oxidation, Bioremediation - Phytoremediation - Nanoremediation- Integrated Reclamation Methods

| | |
|---|---|
| **Total Hours:** | **45 Hrs** |

**Text Books:**

| | |
|---|---|
| 1. | Purushothama Raj, P. "Ground Improvement Techniques", Laxmi Publications, 2016. |

| | |
|---|---|
| 2. | Jie Han, “Principles and Practice of Ground Improvement”, John Wiley Publications, 2018. |
| 3 | Yong Sik Ok, Jörg Rinklebe, Deyi Hou, Daniel C.W. Tsang, Filip M.G. Tack, “Soil and Groundwater Remediation Technologies”, CRC Press, 2020 |
| **Suggested Readings** | |
| 1. | Bikas Chandra Chattopadhyay, Ground Improvement Techniques, PHI Learning, 2017. |
| 2. | Nihar Ranjan Parta, “Ground Improvement Techniques” Vikas Publishing House, 2012. |
| 3. | Peter G. Nicholson, —”Soil Improvement and Ground Modification Methods”, Butterworth Heinemann, 2014. |
| 4. | Maria C. Hernandez Soriano, “Environmental Risk Assessment of Soil Contamination”, Intech Open, 2014. |
| **IS Code Books** | |
| 1. | IS 13094:1992 - Selection of ground improvement techniques for foundation in weak soils -Guidelines |
| 2. | IS 15284-1:2003 - Design and construction for ground improvement – Guidelines, Part 1: Stone columns |
| 3. | IS 15284-2: 2004 - Design and construction for ground improvement – Guidelines, Part 2: Preconsolidation using vertical drains |
| **Web References:** | |
| 1. | https://link.springer.com/chapter/10.1007/978-3-642-04460-1_25 |
| 2. | http://www.igs.org.in:8080/portal/igc-proceedings/igc-2019-surat-proceedings/TH9/TH9-9.pdf |
| **Online Resources:** | |
| 1. | https://nptel.ac.in/courses/105/108/105108075/ |
| 2. | https://nptel.ac.in/courses/105/107/105107181/ |

**Tentative Assessment Methods and Levels (based on Revised Bloom’s Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom’s Level | Assessment Component | Marks |
|---|---|---|---|
| C905.1 - 6 | Evaluate | Group Assignment | **5** |
| C905.1 - 6 | Analyze | Online Quiz | **5** |
| C905.1 – 6 | Apply | Case Study and PowerPoint Presentation | **10** |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s Level | Continuous Assessment | | | End Semester Examination (Theory) [50 Marks] |
|---|---|---|---|---|
| | CIA-I [10 Marks] | CIA-II [10 Marks] | CIA-III [10 Marks] | |
| Remember | - | - | - | - |
| Understand | 20 | 20 | 20 | 20 |
| Apply | 40 | 40 | 40 | 50 |
| Analyse | 40 | 40 | 40 | 30 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

| Course Articulation Matrix | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| **1** | 3 | 2 | 1 | - | - | 1 | - | 2 | 2 | 2 | - | 2 | 2 | - | 1 |
| **2** | 3 | 2 | 1 | - | - | 1 | - | 1 | 2 | 2 | - | 1 | 2 | - | 1 |
| **3** | 3 | 2 | 1 | - | - | 1 | - | 1 | 2 | 2 | - | 1 | 2 | - | 1 |
| **4** | 3 | 2 | 1 | - | - | 1 | 1 | 1 | 2 | 2 | - | 1 | 2 | - | 1 |
| **5** | 3 | 2 | 1 | - | - | 1 | 1 | 1 | 2 | 2 | - | 1 | 2 | - | 1 |
| **6** | 3 | 2 | 1 | - | - | 1 | | 2 | 2 | 2 | - | 1 | 2 | - | 1 |
| **Avg** | **3** | **2** | **1** | **-** | **-** | **1** | **1** | **1.3** | **2** | **2** | **-** | **1** | **2** | **-** | **1** |
| 1 | Reasonably agreed | | | | 2 | Moderately agreed | | | | 3 | | Strongly agreed | | | |

| 20CE906 | PREFABRICATED STRUCTURES | 3/0/0/3 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Practical application |
| **Pre requisites** | Nil |

**Course Objectives:**

| | |
|---|---|
| 1. | To understand the different types of prefabricated elements and the concepts of modular construction. |
| 2. | To understand the technologies used for fabrication and erection of prefabricated elements. |
| 3. | To study the different types of joints used for structural connection in prefabricated structures |
| 4. | To understand the applications of codal provisions for abnormal loadings and progressive collapse. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C906.1 | Apply prefabrication techniques on various components based on the requirements | [AP] |
| C906.2 | Apply the standardization techniques on prefabricated elements | [AP] |
| C906.3 | Apply suitable structural connections for prefabricated members | [AP] |
| C906.4 | Handle the problems during connections on prefabricated members | [AP] |
| C906.5 | Apply the suitable methods to avoid progressive collapse of the structure | [AP] |
| C906.6 | Apply the various Codal provisions for abnormal loads to avoid structural collapse | [AP] |

**Course Contents:**

**Module 1: Prefabricated Components and Structures** **15 Hrs**

Need for prefabrication – Principles – Materials – Comparison with conventional and Precast Prestressed construction under time and cost aspects - Types of prefabrication – Site and plant prefabrication - Economy of prefabrication - Plant layout - Modular coordination – Standardization – Systems – Production – Transportation – Erection. Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs-Ribbed floor panels – Wall panels – Columns – Shear walls- Footings-Storage of precast elements – Dimensional tolerances.

**Module 2: Joint in Structural Members** **15 Hrs**

Disuniting of structures- Design concepts of prefabricated elements - erection loads - joint flexibility – Ductile detailing - Allowance for joint deformation - Joints for different structural connections – Dimensions and detailing - Effective sealing of joints for waterproofing – Provisions for non-structural fastenings – Expansion joints

**Module 3: Design for Abnormal Loads and its Applications** **15 Hrs**

Progressive collapse - Importance of avoidance of progressive collapse - Methods to prevent progressive collapse - Code provisions - Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc. - Case studies related to application of prefabricated components and progressive collapse

**Total Hours: 45 Hrs**

**Text Books:**

| | |
|---|---|
| 1. | Alfred Steinle, Hubert Bachmann and Mathias Tillmann, “Precast Concrete Structures”, Wiley, Ernst & Sohn GmbH & Co. KG, Berlin, Germany, 2019. |
| 2. | Kim S. Elliott. “Precast Concrete Structures”, CRC Press, 2019 |
| 3. | “Handbook on Precast concrete for buildings”, ICI Bulletin 02, Indian Concrete Institute, 2016 |

**Suggested Readings:**

| | |
|---|---|
| 1. | Alejandro Bahamon, “Prefab-Prefabricated and Movable Architecture”, |

| | |
|---|---|
| | HarperCollins Design International, November 2002. |
| 2. | Mokk L, “Prefabricated Concrete for Industrial and Public Structures”, Publishing House of the Hungarian Academy of Sciences, Budapest, 2007. |
| 3. | Kim S. Elliott, “Precast Concrete Structures”, Butterworth-Heinemann Publications, 2002. |
| 4. | “Structural Precast concrete Handbook”, Technology Development Division of the Building and Construction Authority, May 2001 |
| **Code Books** | |
| 1 | IS 3414-1968 Reaffirmed 2000, Code of Practice for Design and Installation for Joints in Buildings, BIS, New Delhi. |
| 2 | IS 10297-1982 Reaffirmed 2008, Code of Practice for Design and Construction of Floors and Roofs using Precast Reinforced/Prestressed Concrete Ribbed or Cored Slab Units, BIS, New Delhi. |
| 3 | IS 11447-1985 Reaffirmed 2003, Code of Practice for construction with Large Panel Prefabricates, BIS, New Delhi. |
| 4 | IS 15916 – 2010, Building design and erection using prefabricated concrete — code of practice, BIS, New Delhi. |
| 5 | IS 4326-1993 Reaffirmed 2003, Earth Quake resistant design & construction of building - Code of practice, BIS, New Delhi. |
| 6 | IS 13920-1993 Reaffirmed 2003, Ductile Detailing of Reinforced Concrete Structures subjected to seismic force - Code of practice, BIS, New Delhi. |
| 7 | National Building Code of India 2005- Section 7, SP 7 (Group 1), Bureau of Indian Standards, New Delhi. |
| **Web References:** | |
| 1. | https://civildigital.com/prefabricated-structures-prefabrication-concept-components-advantages-ppt/ |
| 2. | www.metcolleges.ac.in/Notes/CIVIL/FinalYear/CE2045/CE2045.docx |
| **Online Resources:** | |
| 1. | https://www.concrete.org/topicsinconcrete/topicdetail/precast |
| 2. | https://precast.org/education/classes/ |

**Tentative Assessment Methods & Levels (based on Revised Bloom’s Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom’s Level | Assessment Component | Marks |
|---|---|---|---|
| C906.1&C906.2 | Apply | Outside Classroom Learning Experience - Report 1 | 5 |
| C906.3 &C906.4 | Apply | Outside Classroom Learning Experience - Report 2 | 5 |
| C906.5 | Analyse | Assignment | 5 |
| C906.6 | Analyse | Quiz | 5 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s Level | Continuous Assessment | | | End Semester Examination (Theory) [50 marks] |
|---|---|---|---|---|
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA-III [10 marks] | |
| Remember | 20 | 10 | 10 | 10 |
| Understand | 30 | 30 | 20 | 20 |
| Apply | 20 | 30 | 40 | 40 |
| Analyse | 30 | 30 | 30 | 30 |
| Evaluate | - | - | - | - |

| Create | - | - | - | - |
|---|---|---|---|---|

**Course Articulation Matrix**

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

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|

| 20CE912 | ENVIRONMENTAL HAZARD, RISK ASSESSMENT AND MANAGEMENT | 3/0/0/3 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory application |
| **Pre requisites** | Nil |

**Course Objectives:**

| | |
|---|---|
| 1 | To attain knowledge in the field of hazard identification and risk analysis. |
| 2 | To recognize important processes that control contaminant transport. |
| 3 | To identify the availability and usage of tools in predicting and estimating the health risk of human. |
| 4 | To accomplish awareness on risk management and planning through case studies. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C912.1 | Identify various sources of environmental hazards and risk | [U] |
| C912.2 | Assess the level of toxicity through various exposures | [AN] |
| C912.3 | Utilize modern methods and tools to analyze and assess the risk. | [AN] |
| C912.4 | Estimate contaminant concentrations in air, water, soils, vegetation and animal products | [AN] |
| C912.5 | Acquire technical knowledge in environmental risk management | [U] |
| C912.6 | Prepare risk management plan from the case studies. | [AP] |

**Course Contents:**

**Module-1: Hazard Identification and Risk Analysis** **15 Hrs.**

Sources of Environmental hazards – Environmental risk assessment framework – Hazard identification and accounting – Fate and behaviour of toxics and persistent substances in the environment – Properties, processes and parameters that control fate and transport of contaminants – Receptor exposure to Environmental Contaminants – Exposure Assessment – Exposure Factors, Slope Factors, Dose Response calculations and Conversion Factors – Risk Characterization and consequence determination – Vulnerability assessment – Uncertainty analysis.

**Module-2: Tools and Methods for Risk Assessment** **15 Hrs.**

HAZOP and FEMA methods – Cause failure analysis – Event tree and fault tree modeling and analysis – Multimedia and multipath way exposure modeling of contaminant migration for estimation of contaminant concentrations in air, water, soils, vegetation and animal products - Estimation of carcinogenic and non-carcinogenic risks to human health – Methods in Ecological risk assessment – Probabilistic risk assessments – radiation risk assessment – Data sources and evaluation.

**Module- 3: Environmental Risk Management** **15 Hrs.**

Risk communication and Risk Perception – comparative risks – Risk based decision making – Risk based environmental standard setting – Risk Cost Benefit optimization and tradeoffs – Emergency Preparedness Plans – Emergency planning for chemical agent release – Design of risk management programs – risk based remediation; Risk communication, adaptive management, precaution and stake holder involvement. Case studies on risk assessment and management for hazardous chemical storage.

| | |
|---|---|
| **Total Hours:** | **45 Hrs.** |

**Text Books:**

| | |
|---|---|
| 1 | Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999. |

| | |
|---|---|
| 2 | Kolluru Rao, Bartell Steven, Pitblado R and Stricoff “Risk Assessment and Management Handbook”, McGraw Hill Inc., New York,1996. |
| 3 | Kofi Asante Duah “Risk Assessment in Environmental management”, John Wiley and sons, Singapore, 1998. |
| **Suggested Readings:** | |
| 1 | Kasperson J.X. and Kasperson R.E., “Global Environmental Risks”, V.N.University Press, New York, 2003. |
| 2 | Susan L Cutter, “Environmental Risks and Hazards” Prentice Hall of India, New Delhi 1999. |
| 3 | Joseph F Louvar and B Diane Louver, “Health and Environmental Risk Analysis fundamentals with applications”, Prentice Hall, New Jersey 1997. |
| 4 | Peter P. Calow, “Handbook of Environmental Risk Assessment and Management”, Wiley, 1998. |
| **Online Courses:** | |
| 1 | https://www.coursera.org/learn/environmental-hazards-and-global-public-health |
| 2 | https://ii-es.com/events/environmental-human-health-risk-assessment-e-course/ |
| 3 | https://alison.com/course/hazard-recognition-and-risk-assessment |
| 4 | https://nptel.ac.in/courses/114/106/114106017/ |
| **Web References:** | |
| 1 | https://www.ccohs.ca/oshanswers/hsprograms/risk_assessment.html |
| 2 | https://www.britsafe.org/training-and-learning/find-the-right-course-for-you/informational-resources/risk-assessment/ |
| 3 | https://www.assp.org/news-and-articles/conducting-a-risk-assessment |

**Tentative Assessment Methods & Levels (based on Blooms’ Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom’s Level | Assessment Component | Marks |
|---|---|---|---|
| C912.1 & C912.6 | AN | **Project Based Learning system** (Project demonstration, Presentation and Report writing) | 20 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s Level | Continuous Assessment | | | End Semester Examination (Theory) [50 marks] |
|---|---|---|---|---|
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA-III [10 marks] | |
| Remember | - | - | - | - |
| Understand | 40 | 20 | 20 | 26 |
| Apply | 60 | 60 | 60 | 60 |
| Analyse | - | 20 | 20 | 14 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | 3 | - | - | - | 1 | - | 1 | - | - | - | 1 | - | - | - |
| **2** | 3 | 2 | - | 2 | - | 1 | - | - | - | - | - | - | 1 | - | - |
| **3** | 2 | 1 | - | 1 | 3 | - | - | - | 1 | - | - | 1 | 2 | 1 | 3 |
| **4** | 3 | 2 | - | 2 | - | - | - | 1 | - | 1 | - | - | 1 | 1 | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **5** | 2 | - | - | - | - | 1 | 1 | - | - | - | - | - | - | - | - |
| **6** | 1 | 2 | 3 | 1 | - | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 |
| **Avg** | **2.2** | **2.0** | **3.0** | **1.5** | **3.0** | **1.0** | **1.0** | **1.0** | **1.0** | **1.0** | **2.0** | **1.0** | **1.3** | **1.0** | **2.5** |

| | | | | | |
|---|---|---|---|---|---|
| **1** | **Reasonably agreed** | **2** | **Moderately agreed** | **3** | **Strongly agreed** |

| 20CE913 | GIS FOR ENVIRONMENTAL ENGINEERING | 3/0/0/3 |
|---|---|---|
| **Nature of Course** | Theory Concepts | |
| **Pre requisites** | Nil | |

**Course Objectives:**

| | |
|---|---|
| 1. | To achieve knowledge on GIS techniques and map projections. |
| 2. | To understand about data models and data structures. |
| 3. | To accustom with several advanced modeling using GIS. |
| 4. | To attain knowledge on application of GIS in the field of Civil Engineering. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C913.1 | Understand the basic components involved in GIS techniques. | [U] |
| C913.2 | Comprehend the geo-referencing and map projection system and its application in GIS. | [AP] |
| C913.3 | Apply the concepts of data analysis and data models involved in GIS | [AP] |
| C913.4 | Analyse the concepts involved in GIS by using modern methods | [AN] |
| C913.5 | Identify field applications of GIS in various resource management | [AP] |
| C91.3.6 | Apply the advanced technologies of GIS in environmental engineering | [AP] |

**Course Contents:**

**Module 1: GIS and Data Structures** **15 Hrs.**

Introduction to remote sensing and GIS - Components of GIS – Data: Spatial and Non-Spatial - Maps and Projections - Types of Projection - Coordinate system – Geo-referencing and Data Input - Digitizer, Scanner - Editing - Raster and Vector data structures - Comparison of Raster and Vector data structure - Analysis using Raster and Vector data - Retrieval, Reclassification, Overlaying, Buffering - Data Output.

**Module 2: Data analysis and Interpretation Techniques** **15 Hrs.**

Data Analysis - Visual interpretation and digital image processing - Data Retrieval - Query - Simple Analysis - Spatial Analysis - Spatial DBMS - Data storage - Overlay - Vector Data Analysis - Raster Data Analysis - Modeling and analysis using GIS software - Digital Elevation Model – Digital Terrain Modeling - Interpolation - Cost and path analysis - Expert Systems - Google Earth Tools - Sources of Errors - Types of Errors - Elimination - Accuracies.

**Module 3: Application of GIS in resource management** **15 Hrs.**

Applications of GIS - Management and Monitoring of Land, air, water and pollution studies - conservation of natural resources and agriculture - coastal zone management - Water resources and groundwater monitoring - Wasteland management - Social resources - Cadastral records - LIS - Case Studies (Election GIS, School GIS, Health GIS).

| | |
|---|---|
| **Total Hours** | **45 Hrs.** |

**Text Books:**

| | |
|---|---|
| 1. | Anji Reddy.M, “Text book of Remote sensing and GIS”, B.S. Publications., 2019 |
| 2. | Michael N Demers, Fundamentals of Geographical Information Systems, Third Edition, John Wiley Publications, 2014. |
| 3. | Paul Bolstad, “GIS Fundamentals”, XanEdu Publishing Inc.,2016. |

**Suggested Readings:**

| | |
|---|---|
| 1. | Kang-tsung Chang, Introduction to Geographic Information Systems: 9th Edition, 9781259929649, McGraw-Hill Education, 2018 |
| 2. | Burrough P A, Principles of GIS for Land Resources Assessment, Oxford Publication, 2014. |
| 3. | Manugula.S.S and Veeranna Bommakanti, “Photogrammetry, GIS and Remote sensing”, Educreation Publishing., 2018 |

| | |
|---|---|
| 4. | Lo, C.P. and Yeung, Albert K.W., Concepts and Techniques of Geographic Information Systems, Pearson, 2016 |
| **Web References:** | |
| 1. | http://www.gdmc.nl/oosterom/PoGISHyperlinked.pdf |
| 2. | https://www.researchgate.net/publication/323945547_Fundamentals_of_GIS |
| 3. | http://giswin.geo.tsukuba.ac.jp/sis/tutorial/Fundamentals_of_GIS_Estoque.pdf |
| 4. | https://webapps.itc.utwente.nl/librarywww/papers_2009/general/principlesgis.pdf |
| **Online Resources:** | |
| 1. | https://doc.arcgis.com/en/arcgis-online/reference/what-is-agol.htm |
| 2. | https://geogeek.xyz/download-gis-book-pdf-fundamentals-gis-arcgis-10-manual.html |
| 3. | https://2012books.lardbucket.org/pdfs/geographic-information-system-basics.pdf |

**Tentative Assessment Methods & Levels (based on Revised Bloom's Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom's Level | Assessment Component | Marks |
|---|---|---|---|
| C913.1 | Understand | Assignment | 5 |
| C913.2 & C91.3. | Apply | Online Quiz | 5 |
| C913.4 | Analyse | Technical Presentation | 5 |
| C913.5 & C913.6 | Apply | Case study | 5 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom's Level | Continuous Assessment | | | End Semester Examination (Theory) [50 marks] |
|---|---|---|---|---|
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA - III [10 marks] | |
| Remember | 20 | - | - | 10 |
| Understand | 20 | 20 | 30 | 20 |
| Apply | 60 | 50 | 50 | 50 |
| Analyse | - | 30 | 20 | 20 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

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

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|

| 20CE914 | INDUSTRIAL WASTE TREATMENT AND DISPOSAL | 3/0/0/3 |
|---|---|---|
| **Nature of Course** | Theory Application | |
| **Pre requisites** | Nil | |

**Course Objectives:**

| | |
|---|---|
| 1. | To attain basic knowledge on the management of Industrial solid and liquid waste |
| 2. | To understand various types of collection, transport and disposal of Industrial solid waste |
| 3. | To identify effective technologies for waste management in industries |
| 4. | To recognize the types and management of hazardous waste in industries |

**Course Outcomes**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C914.1 | Understand the characteristics of Industrial Waste and their effect on the environment. | U |
| C914.2 | Apply cleaner production techniques for process , reuse, recycle and recovery of industrial waste. | AP |
| C914.3 | Analyze the characteristics of wastewater from major Industries and their reclamation concept. | AN |
| C914.4 | Identify industrial hazardous waste and suggest its collection, segregation and treatment | AP |
| C914.5 | Identify the suitable treatment technique based on the characteristics of wastewater. | AN |
| C914.6 | Apply the suitable disposal techniques for industrial waste | AP |

**Theory Course Contents**

**Module 1: Characteristics of Industrial Waste and Cleaner Production** **15 Hrs.**

Types of industries and industrial pollution - Characteristics of industrial wastes and its source - Population equivalent - Bioassay studies - effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health –Environmental Social Governance criteria- Environmental policy and legislations related to prevention and control of industrial effluents and hazardous wastes. **Cleaner production** -Waste management Approach - Waste Audit - Zero discharge - Volume and strength reduction - Material and process modifications - Recycle, reuse and byproduct recovery - Applications.

**Module 2: Industrial process in major Industries** **15 Hrs.**

Sources, Characteristics, waste treatment flow sheets for selected industries: Textiles- Tanneries- Pharmaceuticals- Electroplating industries- Dairy- Sugar- Paper- distilleries- Steel plants- Refineries- fertilizer- thermal power plant. Hazardous wastes types - Sources & Characterization- collection, segregation - Physico chemical treatment

**Module 3: Treatment Technologies and Disposal Methods** **15 Hrs.**

Equalization - Neutralization - Removal of suspended and dissolved organic solids – Chemical oxidation - Adsorption - Removal of dissolved inorganics - Combined treatment of industrial and municipal wastes - Residue management - Dewatering - sludge Disposal- solidification - incineration -Secured landfills - Bioremediation of contaminated sites - Regulatory aspects.

**Total Hours: 45 Hrs.**

**Text Books:**


| | |
|---|---|
| 1. | Rao M.N.and Dutta, A.K.Wastewater Treatment, Oxford - IBH Publication,2017 |
| 2. | Eckenfelder Jr. W.W., Industrial Water Pollution Control, McGraw-Hill Book Company, New Delhi, 2000 |
| 3. | Shen, T.T.Industrial Pollution Prevention, Springer, 1999. |

| Suggested Readings: | |
|---|---|
| 1. | Stephenson R.L.and J.B.Blackburn, Jr., Industrial Wastewater Systems Hand book, Lewis Publisher, New York, 1998 |
| 2. | Freeman H.M., Industrial Pollution Prevention Hand Book, McGraw-Hill Inc., New Delhi, 1995. |
| 3. | Bishop, P.L., Pollution Prevention: Fundamental & Practice, McGraw-Hill, 2000. |
| 4. | Bhatia S.C, Handbook of Industrial Pollution and Control, Volume I & II, CBS Publishers, New Delhi, 2003 |
| **Web References:** | |
| 1. | http://nptel.ac.in/courses/105106119/36 |
| 2. | https://www.water.wa.gov.au/__data/assets/pdf_file/0008/4040/89343.pdf |
| 3. | http://cpheeo.gov.in/upload/uploadfiles/files/chap6.pdf |
| **Online Courses** | |
| 1. | https://www.un-ihe.org/online-course-industrial-effluent-treatment |
| 2. | https://onlinecourses.nptel.ac.in/noc19_ce32/preview |
| 3. | https://alison.com/course/advanced-diploma-in-wastewater-treatment-and-recycling |

**Tentative Assessment Methods and Levels (based on Revised Bloom's Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom's Taxonomy Level | Assessment Component | Marks |
|---|---|---|---|
| C914.1 | Understand | Online Quiz | 5 |
| C914.2 | Apply | Group Assignment | 5 |
| C914.3, C914.4 | Apply | Technical Video Presentation | 5 |
| C914.5, C914.6 | Analyse | Case Study presentation | 5 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom's Taxonomy | Continuous Assessment | | | End Semester Examination (Theory) [50 Marks] |
|---|---|---|---|---|
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA III [10 marks] | |
| Remember | - | - | - | - |
| Understand | 10 | 10 | 10 | 10 |
| Apply | 50 | 50 | 50 | 50 |
| Analyse | 40 | 40 | 40 | 40 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | 2 | 3 | | | | | | 1 | 2 | 1 | 2 | 2 | 2 | 3 |
| **2** | | 2 | | | | 3 | | | 1 | 2 | 1 | 2 | 2 | 2 | 3 |
| **3** | 2 | 2 | | | | | 3 | | 1 | 2 | 1 | 2 | 2 | 2 | 3 |
| **4** | 2 | 2 | 3 | | | | | | 1 | 2 | 1 | 2 | 2 | 2 | 3 |
| **5** | 2 | 2 | | | | | | | 1 | 2 | 1 | 2 | 2 | 2 | 3 |
| **6** | 2 | 2 | | | | | | | 1 | 2 | 1 | 2 | 2 | 2 | 3 |
| **Avg** | 2.0 | 2.0 | 3.0 | | | 3.0 | 3.0 | | 1.0 | 2.0 | 1.0 | 2.0 | 2.0 | 2.0 | 3.0 |

| 20CE920 | CONSTRUCTION METHODS AND EQUIPMENT MANAGEMENT | 3/0/0/3 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory |
| **Pre-requisites** | Construction Materials and Techniques |

**Course Objectives**

| | |
|---|---|
| 1 | To study and understand the various types of Sub Structure construction methods |
| 2 | To study and understand the various types of Super Structure construction methods |
| 3 | To analyse the methods of Equipment management |
| 4 | To make students know the Equipment used in Construction process |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C920.1 | Identify various equipment utilized for substructure construction | [U] |
| C920.2 | Apply suitable techniques for the construction of substructure | [AP] |
| C920.3 | Identify various Super Structural Construction techniques | [AP] |
| C920.4 | Analyze the characteristics and applications of Super Structural equipment and its working | [AN] |
| C920.5 | Examine the equipment planning management during the process of construction | [AP] |
| C920.6 | Analyze the replacement, control and safety management of construction equipment | [AN] |

**Course Contents:**

**Module 1: Substructure Construction methods** **15 Hrs.**

Techniques and equipment for Box jacking and Pipe jacking - Construction of diaphragm walls and basement – Piling techniques and equipment: Pile driving hammers, vibratory drivers - Special equipment for Offshore construction: Caissons, Cofferdams, Foundation grouting - Tunnelling techniques and equipment - Tunnel Boring Machine - Blasting techniques and equipment: blasting material, firing charge, safety fuse, electric blasting caps, drilling patterns, transporting and handling of explosives- Method of construction of Retaining wall and equipment used

**Module 2: Super Structure Construction methods** **15 Hrs.**

Shoring, Scaffolding methods and equipments - Special Concreting methods and equipments - Steel Construction techniques and equipments - Equipment and methods of Composite structures – Techniques and equipment: Prefabricated, Pre-Engineered structures, Pre-Tensioning and Post Tensioning methods - Bridge Construction methods and equipment: incremental launching, using false work and its criteria, balanced cantilever construction method, plate girder method

**Module 3: Construction Equipment management** **15 Hrs.**

Identification Identification of equipment – Planning of equipment – Selection of Equipment - Equipment Management in Projects - Maintenance Management – Equipment cost – Operating cost – Cost Control of Equipment - Depreciation Analysis – Replacement of Equipment- Replacement Analysis - Safety Management - Factors affecting the performance of equipment – IOT integration of equipments

| | |
|---|---|
| **Total Hours** | **45 Hrs.** |

**Text Books:**

| | |
|---|---|
| 1 | Jerry Irvine, Advanced Construction Techniques, CA Rocketr, 2014. |
| 2 | Purifoy, R.L., Ledbetter, W.B. and Schexnayder,C.., Construction Planning, Equipment and Methods, McGraw Hill, Singapore, 2018 |
| 3 | Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 2002. |
| **Suggested Readings:** | |
| 1 | Deodhar, S.V. Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 2012. |
| 2 | Dr. Mahesh Varma, Construction Equipment and its planning and Application, Metropolitan Book Company, New Delhi, 2003. |
| 3 | Robertwade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 2001. |
| 4 | Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008. |
| **Web Reference:** | |
| 1 | https://www.concretecentre.com |
| 2 | https://www.usu.edu/controllers/files/policies-procedures/equipment-manual.pdf |
| **Online Resources:** | |
| 1 | https://www.udemy.com/course/methods-of-building-construction/ |
| 2 | https://www.udemy.com/courses/search/?q=construction+equipment+management&src=sac&kw=construction+equ |

**Tentative Assessment methods and Levels (Based on revised Bloom's Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom's level | Assessment Component | Marks |
|---|---|---|---|
| C920.1 - C920.4 | Understand | Online Quiz | 5 |
| | | Assignment | 5 |
| C920.5 & C920.6 | Apply | Group Assignment<br>Classroom Quiz | 10 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom's level | Continuous Assessment | | | End Semester Examination (Theory) [50 Marks] |
|---|---|---|---|---|
| | CIA – I [10 Marks] | CIA – II [10 Marks] | CIA – III [10 Marks] | |
| Remember | 10 | 10 | 10 | 10 |
| Understand | 30 | 30 | 30 | 30 |
| Apply | 30 | 30 | 30 | 30 |
| Analyse | 30 | 30 | 30 | 30 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

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

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **3** | 3 | 2 | - | - | - | - | - | - | - | - | 2 | 2 | - | 2 | 3 |
| **4** | 3 | 2 | - | - | - | - | - | - | - | - | 2 | 2 | - | 2 | 3 |
| **5** | 3 | 2 | - | - | - | - | - | - | - | - | 2 | 2 | - | 2 | 3 |
| **6** | 3 | 2 | - | - | - | - | - | - | - | - | 2 | 2 | - | 2 | 3 |
| **Avg** | 3 | 2 | - | - | - | - | - | - | - | - | 2 | 2 | - | 2 | 3 |
| 1 | Reasonably agreed | | | | 2 | Moderately agreed | | | | | 3 | Strongly agreed | | | |

| 20CE921 | DISASTER MANAGEMENT PLANNING AND MITIGATION | 3/0/0/3 |
|---|---|---|
| **Nature of Course** | Theory | |
| **Pre requisites** | Nil | |

**Course Objectives:**

| | |
|---|---|
| 1. | To understand the knowledge of disaster management and its influence. |
| 2. | To study and analyze the vulnerability. |
| 3. | To study and assess the building behavior during various disasters. |
| 4. | To understand the policy and procedure involved during a disaster. |

**Course Outcomes:**
**Upon completion of the course, students shall have the ability to**

| | | |
|---|---|---|
| C921.1 | Analyze the various types of disasters | [AN] |
| C921.2 | Identify the potential deficiency of existing building during a disaster with remedial measures | [AP] |
| C921.3 | Distinguish the protection measures against all disasters | [AN] |
| C921.4 | Examine the hazard assessment procedure for all disaster | [AN] |
| C921.5 | Plan the capacity building and programs for all the disasters | [AP] |
| C921.6 | Discuss the policy and schemes for disaster management in India | [AN] |

**Course Contents:**

**Module 1: Dimensions of Disasters** **15 Hrs.**

Dimensions of natural & anthropogenic disasters - Difference between hazard and disaster- Types of disaster - Phases of disaster management- Principles/Components of disaster management, Relationship between Disasters and Development - Natural disasters and mitigation efforts: Flood control – Drought management – Cyclones – Land use planning - NBC threat and safety measures – Forest fires – Oil fires – Crisis in power Sector – Accidents in coal mines - Hazard affecting buildings - Building safety against hazards: Floods, Cyclone, Landslides, Fire, Earthquakes – Case Studies.

**Module 2: Disaster Mitigation and Planning** **15 Hrs.**

Disaster Mitigation and Planning – Seismic hazard assessment - Vulnerability assessment – Community planning and community contingency plan – Retrofitting of existing buildings: reinforced concrete and masonry structures – Performance of ground and buildings in past earthquakes - Seismic strengthening of structural and nonstructural components – Earthquake hazard map - Landslide zoning map – Flood zoning map – Tropical cyclone and its effects on buildings – Effect of Tsunami on built structures – Protection measures for damages in the buildings – Nuclear Disasters, Chemical and Industrial accidents – Mitigation strategies – Case Studies.

**Module 3: Disaster Management Policy and Procedure in India** **15 Hrs.**

Disaster management in India – Disaster Management Act, 2005 – DM Policy, 2009 for Disaster preparedness and programs – Organizational structure for disaster management – Disaster management schemes – Planning commission: Tsunami – Role of NDRF and news media in disaster management – Forecasting and warning of disasters – Medical first responder – Psychological and social dimensions in disasters – Trauma and Stress – Emotional Intelligence.

| | |
|---|---|
| **Total Hours:** | **45 Hrs** |

**Text Books:**


| | |
|---|---|
| 1. | Singh. R. B. “Disaster Management”, Rawat publications, 2012. |
| 2. | Ghosh G. K. “Disaster Management”, A.P.H Publishing Corporation, 2015. |
| 3. | Geol S.L “Encyclopedia of Disaster Management”, Deep and deep publication Pvt. Ltd, 2015. |

| Suggested Readings: | |
|---|---|
| 1. | Brian Tomaszewski, Geographic Information Systems (GIS) for Disaster Management, CRC Press, Taylor and Francis Group of publication, 2015. |
| 2. | Sharma S.C., “Disaster Management”, Khanna Publishing House, 2019. |
| 3. | Sathish Modh, Introduction to Disaster Management, Macmillan publishers, 2nd edition, New Delhi, 2009. |
| 4. | Singh B.K.,” Handbook of Disaster Management: Techniques and Guidelines”, Rajat Publications, 2008. |
| **IS Code of Practice:** | |
| 1. | The Disaster Management Act 2005, Ministry of Law and Justice, New Delhi. |
| 2. | National Policy on Disaster Management 2009, National Disaster Management Authority, Ministry of Home Affairs, Government of India, New Delhi. |
| 3. | IS:1893 (Part I) - 2009 “Code of practice for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi. |
| **Web References:** | |
| 1. | https://ndma.gov.in/ |
| 2. | https://nidm.gov.in/ |
| 3. | https://tnsdma.tn.gov.in/ |
| **Online Resources:** | |
| 1. | https://nptel.ac.in/courses/124/107/124107010/ |
| 2. | https://www.coursera.org/learn/disaster-preparedness |
| 3. | https://www.edx.org/course/natural-disasters |

**Assessment Methods & Levels (based on Revised Bloom’s Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom’s Level | Assessment Component | Marks |
|---|---|---|---|
| C921.1 | Analyze | Case Study Report | 5 |
| C921.2<br>C921.5 | Apply | Technical Report | 5 |
| C921.3<br>C921.4 | Analyze | Technical Presentation | 5 |
| C921.6 | Analyze | Technical Quiz | 5 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s Level | Continuous Assessment | | | End Semester Examination (Theory) [50 Marks] |
|---|---|---|---|---|
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA III [10 marks] | |
| Remember | 10 | 10 | 10 | 10 |
| Understand | 20 | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 | 30 |
| Analyze | 40 | 40 | 40 | 40 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

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

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **4** | 3 | 2 | 1 | 2 | - | 2 | - | 2 | - | - | - | 1 | 3 | - | 2 |
| **5** | 3 | 3 | 2 | 3 | - | 1 | - | 2 | - | 2 | - | 2 | 3 | - | 2 |
| **6** | 3 | 2 | 1 | 2 | - | 2 | - | 2 | - | - | - | 1 | 3 | - | 2 |
| **Avg.** | **3.0** | **2.8** | **1.3** | **2.8** | **-** | **1.7** | **-** | **2.0** | **-** | **0.7** | **-** | **1.3** | **3.0** | **-** | **2.0** |
| 1 | Reasonably agreed | | | | 2 | Moderately agreed | | | | | 3 | Strongly agreed | | | |

| 20CE924 | Project Safety Management | 3/0/0/3 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory and Concept |
| **Pre-requisites** | Nil |

**Course Objectives**

| | |
|---|---|
| 1 | To understand the causes and factors of accidents in construction industry |
| 2 | To understand the safety practices and systems in construction industry. |
| 3 | To study the construction accidents, safety programmes, contractual obligations, and design for safety |
| 4 | To analyse the roles and responsibilities of engineers in safety management |

**Course Outcomes:**

**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C924.1 | Understand the concepts of construction safety management | [U] |
| C924.2 | Assessment of important key legislations in safety management | [AP] |
| C924.3 | Analyze the risk assessment method followed in construction projects | [AN] |
| C924.4 | Assess modern construction safety techniques to be adopted in the construction of buildings and special structures | [AP] |
| C924.5 | Identify the owner's responsibilities in construction safety management | [AP] |
| C924.6 | Analyze the alertness against accidents and safety management. | [AN] |

**Course Contents:**

**Module 1: Principles of Safety Management** **15 Hrs.**

Safety - importance and principle - accidents and causes – human factors in construction safety – costs of construction injuries – occupational and safety hazard assessment – legal implications - challenges in construction safety – elements of an effective safety programme – job-site safety assessment – safety meetings and incentives - OSHAS act and standard - History of safety movement: ILO – UNDP – NSC – BSC – ROSPA – CIS – NSC – LPA (India)

**Module 2: Safety Systems and Practices in Construction Operations** **15 Hrs.**

Safety Culture – safety for first line supervisors, middle managers and top management practices - company activities and safety – safety personnel – sub contractual obligation – project coordination and safety procedures – workers compensation - safety policy – planning for safety and productivity – safety management techniques: sampling and auditing – job analysis – accident recall technique – factories act – insurance and compensation

**Module 3: Contractual Obligations and Equipment Handling** **15 Hrs.**

Safety in construction contracts – substance abuse – safety record keeping - management's commitment towards safety: owner's responsibility and preparedness for safety - role of designer in ensuring safety - safety clause in design document - safety in equipment handling: hand tools, grinding, hoisting apparatus and conveyors, mobile cranes - safety during excavation, blasting, timbering, scaffolding - first aid on site - fire hazards and preventing methods - safety in construction material storage - safety awareness program

| | |
|---|---|
| **Total Hours** | **45 Hrs.** |

**Text Books:**

| | |
|---|---|
| 1 | Patrick X.W. Zou and RizaYosiaSunindijo, ―Strategic Safety Management in 169 Construction and Engineering‖, John Wiley and Sons, USA, 2015. |
| 2 | Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and |

| | |
|---|---|
| | Health Management, Prentice Hall Inc., 2011. |
| 3 | Einrich, H.W., Industrial Accident Prevention, McGraw Hill Company, New York, 2010. |
| **Suggested Readings:** | |
| 1 | Raymond E. Levitt, Nancy M. Samelson,. Construction Safety Management, John Wiley & Sons Inc, 2005. |
| 2 | Mishra R. K., Construction Safety, Atbs Publisher, 2012. |
| 3 | Tamil Nadu Factory Act, Department of Inspectorate of factories, Tamil Nadu. Health Management, Prentice Hall Inc., 2001. |
| 4 | BIS Code of practice for Safety Management |
| **Web Reference:** | |
| 1 | https://www.osha.gov/shpguidelines/hazard-Identification.html |
| 2 | https://www.pmi.org/learning/library/project-managers-role-safety-champion-8879 |
| 3 | http://www.nsc.org.in/index.php?option=com_content&view=article&id=56&Itemid=84 |
| 4 | https://www.iseindia.in/ |
| **Online Resources:** | |
| 1 | https://www.google.com/search?q=1.%09Risk+assessment+A+Practical+Guide%2C+Institution+of+Occupational+Safety+and+Health%2C+United+Kingdom%2C1993.&ie=utf-8&oe=utf-8&client=firefox-b-ab |
| 2 | https://albertabcsafety.com/ |

**Tentative Assessment methods and Levels (Based on revised Bloom's Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom's level | Assessment Component | Marks |
|---|---|---|---|
| C924.1 - C924.6 | Apply | Online Quiz | 5 |
| | | Assignment | 5 |
| C924.1 - C924.6 | Analyze | Online Course with Minimum 8 Week duration **(Assessment marks will be provided based on assignment submission and Pass percentage)** | 10 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom's level | Continuous Assessment | | | End Semester Examination (Theory) [50 Marks] |
|---|---|---|---|---|
| | CIA – I [10 Marks] | CIA – II [10 Marks] | CIA – III [10 Marks] | |
| Remember | 10 | 10 | 10 | 10 |
| Understand | 30 | 30 | 30 | 30 |
| Apply | 40 | 40 | 40 | 40 |
| Analyse | 20 | 20 | 20 | 20 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | 2 | - | - | - | 3 | 3 | 2 | - | - | 2 | 3 | - | 2 | 3 |
| **2** | 3 | 3 | - | - | - | 3 | 3 | 2 | - | - | 2 | 3 | - | 2 | 3 |
| **3** | 3 | 3 | - | - | - | 3 | 3 | 3 | - | - | 2 | 3 | - | 2 | 3 |
| **4** | 3 | 3 | - | - | - | 3 | 3 | 2 | - | - | 2 | 3 | - | 2 | 3 |
| **5** | 3 | 2 | - | - | - | 3 | 3 | 3 | - | - | 2 | 3 | - | 2 | 3 |
| **6** | 2 | 2 | - | - | - | 3 | 3 | 2 | - | - | 2 | 3 | - | 2 | 3 |
| **Avg** | 2.7 | 2.5 | - | - | - | 3 | 3 | 2.3 | - | - | 2 | 3 | - | 2 | 3 |
| 1 | Reasonably agreed | | | | 2 | Moderately agreed | | | | | 3 | Strongly agreed | | | |

**EMERGING ELECTIVE**

| 20CE007 | BUILDING SERVICES AND MANAGEMENT | 3/0/0/3 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory and Application |
| **Pre requisites** | Nil |

**Course Objectives:**

| | |
|---|---|
| 1. | To study and plan essential services for a structure. |
| 2. | To understand the importance of electrical and mechanical services available in buildings |
| 3. | To recognize the principles of lighting and plumbing. |
| 4. | To identify the safety measures present in a building. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C007.1 | Plan the essential machineries in a building | [AP] |
| C007.2 | Select appropriate electrical and wiring equipment | [AN] |
| C007.3 | Recognize the basic principles of lighting and plan for Lighting facilities based on the building function | [AN] |
| C007.4 | Identify the basic plumbing equipment and their installation | [AP] |
| C007.5 | Choose appropriate HVAC systems based on building function | [AN] |
| C007.6 | Plan fire safety for buildings and their installation | [AP] |

**Course Contents:**

**Module 1: Machineries and Electrical Systems in Buildings** **15 Hrs.**

Lifts and Escalators, Universal design, Conveyors, AC/DC motors, Generators. Basics of electricity, Single/Three phase supply, Protective devices in electrical installations, Earthing for safety, Types of wires, wiring systems and their choice, Planning electrical wiring for buildings, Main and distribution boards, NZEB & ZEB.

**Module 2: Principles of lighting and plumbing**: **15 Hrs.**

Lighting nomenclature - Design of modern lighting, lighting for stores, offices, schools, hospitals and house lighting, Universal design for lighting – Alpha, Rhinoceros, passive design features - design for effective daylighting, lighting sensors and controls, lighting simulation using open source software, BUG rating for assessing exterior lights - Principles of design of water supply in buildings -House service connection -Fixtures and fittings -Systems of plumbing and drawings.

**Module 3: HVAC systems and Safety Installation:** **15 Hrs.**

Concepts of Air conditioning systems - Principles of air conditioning - HVAC systems - HVAC controls, Psychometric chart - Commissioning of building systems - Building management systems, indoor air quality - Overview of ASHRAE - Causes of fire in buildings - Safety regulations: NBC, ECBC, Planning considerations in building like non-combustible materials, Staircases and lift lobbies, fire escapes and AC systems - Building evacuation process, Fire Protection devices, Integration of services.

| | |
|---|---|
| **Total Hours:** | **45 Hrs.** |

**Text Books:**

| | |
|---|---|
| 1. | Roger Greeno and Fred Hall, “Building Services Handbook”, (8th edition), Routledge Publishers, New Delhi, 2015. |

| | |
|---|---|
| 2. | William Paul Gerhard, “House-Drainage and Sanitary Plumbing”, General Books. 2012. |
| 3. | Udhayakumar, R., “A text book of Building services”, Eswar Press, Chennai, 2013. |
| **Suggested Readings:** | |
| 1. | “National Building Code of India”, BIS 2005. Reaffirmed 2016. |
| 2. | “Energy Conservation Building Code”, Bureau of Energy Efficiency, 2017 |
| 3. | Garg, S.K., "Environmental Engineering", Khanna Publishers, New Delhi, 2010. |
| 4. | “Handbook of Building Engineers in Metric Systems”, NBC, New Delhi, 2015. |
| **Web References:** | |
| 1. | http://www.handbook.curtin.edu.au/units/31/318930.html |
| 2. | https://www.ljmu.ac.uk/study/courses/undergraduates/2017/building-services-engineering |
| 3. | https://armstrongfluidtechnology.com/en/resources-and-tools/education-and-training/webinar-library |
| 4. | Schneider Electric University \| by Schneider Electric (schneideruniversities.com) |
| **Online Resources:** | |
| 1. | http://www.handbook.curtin.edu.au/units/31/318930.html |
| 2. | https://www.ljmu.ac.uk/study/courses/undergraduates/2017/building-servicesengineering |
| 3. | IBPSA USA - YouTube |
| 4. | Indo-Swiss Building Energy Efficiency Project (BEEP) - YouTube |
| **Code Books:** | |
| 1. | ASHRAE 62.1, Ventilation for Acceptable Indoor Air Quality, 2019. |
| 2. | ASHRAE 55, Thermal Environmental Conditions for Human Occupancy, 2021. |
| 3. | ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings, 2019 |

**Tentative Assessment Methods & Levels (based on Revised Bloom’s Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom’s Level | Assessment Component | Marks |
|---|---|---|---|
| C007.1 - 6 | Apply | Project Based Learning (Using software package – Lighting/MEP) | 10 |
| C007.1 – 6 | Apply | Quiz | 5 |
| C007.1 – 6 | Apply | Assignment | 5 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s Level | Continuous Assessment | | | End Semester Examination - Theory [50 marks] |
|---|---|---|---|---|
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA - III [10 marks] | |
| Remember | 20 | 20 | 20 | 20 |
| Understand | 20 | 20 | 20 | 20 |

| | | | | |
|---|---|---|---|---|
| Apply | 20 | 30 | 30 | 30 |
| Analyse | 40 | 30 | 30 | 30 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | - | 1 | - | - | - | - | 2 | 2 | - | 2 | 2 | - | 2 |
| **CO2** | 3 | 2 | 1 | 1 | 2 | - | - | 3 | 2 | 2 | - | 2 | 2 | 1 | 2 |
| **CO3** | 2 | 1 | - | 1 | - | 1 | - | 3 | 2 | 2 | - | 2 | 2 | - | 2 |
| **CO4** | 3 | 2 | 1 | 1 | 2 | 2 | - | - | 2 | 2 | - | 3 | 2 | 1 | 2 |
| **CO5** | 2 | 1 | - | 1 | - | 1 | 2 | 2 | 2 | 2 | - | 2 | 2 | - | 2 |
| **CO6** | 3 | 2 | 1 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | - | 2 | 2 | 1 | 2 |
| **AVG** | **2.5** | **1.5** | **1** | **1** | **2** | **1.5** | **2** | **2.8** | **2** | **2** | **-** | **2.2** | **2** | **1** | **2** |

| | | | | | |
|---|---|---|---|---|---|
| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |

| 20CE009 | FINANCING AND COSTING MANAGEMENT FOR CIVIL ENGINEERS | 3/0/0/3 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory and Concept |
| **Pre-requisites** | Nil |

**Course Objectives**

| | |
|---|---|
| 1 | To study the concept of Construction economics and finance. |
| 2 | To compare and evaluate alternative proposals and investments. |
| 3 | To facilitate the knowledge on management of funds in construction. |
| 4 | To understand and perform the management accounting. |

**Course Outcomes:**

**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C009.1 | Understand the concepts of economics and finance in constructions. | [U] |
| C009.2 | Examine the basic aspects of management accounting. | [AN] |
| C009.3 | Assess and manage the funds involved in the construction sector. | [AP] |
| C009.4 | Implement International fund management and foreign currency management. | [AP] |
| C009.5 | Relate the worth of money involved in the construction activities. | [AP] |
| C009.6 | Analyse the alternative investment plan in construction. | [AN] |

**Course Contents:**

**Module 1: Fundamentals of management accounting** **12 Hrs.**

Time Value of Money – Cash Flow diagram – Management accounting: Actual and overhead cost of construction, Tendering process - Financial accounting principles: basic concepts, financial statements, funds flow statement – cash flow statement - Balance sheet – Accounting ratios.

**Module 2: Funds management** **15 Hrs.**

Project Finance – Sources of finance – Long term and short-term finance, Working Capital Management, Inventory valuation, Mortgage Financing – International financial management – foreign currency management – Target value design – Target value costing.

**Module 3: Evaluating alternative proposals and investments** **18 Hrs.**

Comparing alternatives – Present Worth Analysis, Annual Worth Analysis, Future Worth Analysis, Rate of Return Analysis, Incremental Rate of Return Analysis, Benefit/Cost Analysis. Real Estate – Investment property, Equipment Replace Analysis, Depreciation – Tax before and after depreciation – Value added Tax (VAT) – Inflation – Case studies.

**Total Hours** **45 Hrs.**

**Text Books:**

| | |
|---|---|
| 1 | Bose, D. C.,"Fundamentals of Financial management", 2nd ed., PHI, New Delhi, 2010 |
| 2 | Newnan, D. G.,Eschenbach, T. G. and Lavelle, J.P.,"Engineering Economic Analysis", Indian Edition, Oxford University Press, 2010. |
| 3 | Peurifoy, R. L.,Schexnayder, C. J. and Shapira,A., "Construction Planning, Equipment, and Methods, 7th ed., Tata McGraw-Hill, New Delhi, 2010. |

**Suggested Readings:**

| | |
|---|---|
| 1 | Sullivan, W. G.,Bontadelli, J.A. and Wicks,E. M., "Engineering Economy", 11th ed., Prentice Hall, Upper Saddle River, New Jersey, 2001. |
| 2 | Peterson,S. J., "Construction Accounting and Financial Management", Pearson Education, Upper Saddle River, New Jersey, 2005. |
| 3 | Schexnayder, C. J. and Mayo, R.E.,"Construction Management Fundamentals", |

| | |
|---|---|
| | International Edition, McGraw-Hill, 2003. |
| 4 | Peurifoy, R. L. and Oberlender, G. D.,“Estimating Construction Costs”, 5th ed., McGraw Hill, New Delhi, 2002 |
| **Web Reference:** | |
| 1 | https://college-corner.com/civil-engineering-vs-finance-major/ |
| 2 | https://www.cmu.edu/cee/projects/PMbook/07_Financing_of_Constructed_Facilities.html |
| 3 | https://en.wikipedia.org/wiki/Engineering_economics_(civil_engineering) |
| **Online Resources:** | |
| 1 | https://nptel.ac.in/courses/105/104/105104178/ |
| 2 | https://www.classcentral.com/course/swayam-introduction-to-accounting-and-finance-for-civil-engineers-17650 |

**Tentative Assessment methods and Levels (Based on revised Bloom’s Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom’s level | Assessment Component | Marks |
|---|---|---|---|
| C009.1 – C009.6 | Apply | Online Quiz | 5 |
| | | Class Presentation | 5 |
| C009.1 – C009.6 | Analyze | Group Assignment | 10 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s level | Continuous Assessment | | | End Semester Examination (Theory) [50 Marks] |
|---|---|---|---|---|
| | CIA – I [10 Marks] | CIA – II [10 Marks] | CIA – III [10 Marks] | |
| Remember | 10 | 10 | 10 | 10 |
| Understand | 20 | 30 | 20 | 30 |
| Apply | 40 | 40 | 40 | 40 |
| Analyse | 30 | 20 | 30 | 20 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | 1 | | | | | | | | | 3 | 3 | 3 | 2 | 2 |
| **2** | 2 | 1 | | | | | | | | | 3 | 3 | 3 | 2 | 2 |
| **3** | 2 | 2 | | | | | | | | | 3 | 3 | 3 | 3 | 2 |
| **4** | 2 | 1 | | | | | | | | | 3 | 3 | 3 | 3 | 2 |
| **5** | 1 | 1 | | | | | | | | | 3 | 3 | 3 | 2 | 2 |
| **6** | 1 | 1 | | | | | | | | | 3 | 3 | 3 | 3 | 2 |
| **Avg** | **1.6** | **1.2** | | | | | | | | | **3** | **3** | **3** | **2.5** | **2** |

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|

| 20CE010 | INSTRUMENTATION AND SENSOR TECHNOLOGIES FOR CIVIL ENGINEERING APPLICATIONS | 3/0/0/3 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory Concept |
| **Pre Requisites** | Basics of Electrical and Electronics Engineering |

**Course Objectives:**

| | |
|---|---|
| 1. | Cognize the principles of operation and characteristics of instrumentation and Integrated sensor systems. |
| 2. | Diagnose and apply measurement best practice and identify ways to improve measurement and evaluation |
| 3. | Troubleshoot and solve problems in instrumentation and measurement systems |
| 4. | Interpretation of signals to get deeper insight into physical phenomena |

**Course Outcomes**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C010.1 | Choose right use of sensors and instruments for different applications along with limitations | [AP] |
| C010.2 | Differentiate the sensors and their modes of operation measurements | [AN] |
| C010.3 | Suggest proper sensor technologies for specific applications | [AN] |
| C010.4 | Implement his knowledge gained to set up quantification systems | [AP] |
| C010.5 | Analyse the data from signal processing | [AN] |
| C010.6 | Characterize the requirements during the transmission of measured signals | [AP] |

**Course Contents :**

**Module 1: Fundamentals of Measurement, Sensing and Instrumentation 12 Hrs.**
Definition of measurement and instrumentation - physical variables - common types of sensors and their functions - Sensor applications – interpretation of signals from a known sensor type - types of instrumentation - Sensor Specifics. Basic IoT Sensor - Motion Detector, Liquid Level Detector, Humidity and Pressure Measurement.

**Module 2: Sensor Installation, Operation, Analysis and Interpretation 18 Hrs.**
Predict the response of sensors to various inputs - Construct a conceptual instrumentation and monitoring program - sensor installation - Differentiate between types of sensors and their modes of operation and measurement - Piezometer, Inclinometer, Strain gauge - Time domain signal processing - Discrete signals, Signals and noise - a few examples of statistical information to calculate are: Average value (mean), On average, how much each measurement deviates from the mean (standard deviation), Midpoint between the lowest and highest value of the set (median), Most frequently occurring value (mode), Span of values over which your data set occurs (range).

**Module 3: Frequency Domain Signal Processing and Analysis 15 Hrs.**
Need for frequency domain analysis and its principles - Draw conclusions about physical processes based on analysis of sensor data - Combine signals in a meaningful way to gain deeper insight into physical phenomena - Basic concepts in frequency domain signal processing and analysis - Fourier Transform - FFT (Fast Fourier Transform) - Example problems: Noise reduction with filters, Leakage, Frequency resolution.

**Total Hours: 45 Hrs.**

**Text Books:**

| | |
|---|---|
| 1. | David A. Bell, “Electronic Instrumentation and Measurements”, Oxford University Press, India, 2013. |
| 2. | Ilya Gertsbakh, “Measurement Theory for Engineers”, Springer, 2010. |
| 3. | Aruthur Whitemore Smith, “Principles of Electrical Measurements”, Nabu Press, 2010. |

**Suggested Readings:**

| | |
|---|---|
| 1. | Albert D. Helfrick, “Modern Electronic instrumentation and measurement techniques”, Pearson Education, India, 2015. |
| 2. | Rajput R. K., “Electrical and Electronic Measurements and Instrumentation”, S Chand and Company, 2016. |
| 3. | Navani J. P., “Electronic Measurement and Instrumentation”, S Chand and Co. Ltd, 2015. |
| 4. | Johnson, “Process Control Instrumentation Technology”, Pearson Education India, 2015 |
| **Web References:** | |
| 1. | https://lecturenotes.in/subject |
| 2. | www.worldsensing.com |
| **Online Resources:** | |
| 1. | https://youtu.be/qbKnW42ZM5c |
| 2. | www.ivt.ntnu.no/imt/courses |

**Tentative Assessment Methods & Levels (based on Revised Bloom’s Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom’s Level | Assessment Component | Marks |
|---|---|---|---|
| C010.1 – C010.6 | Analyse | Project Based Learning | 20 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s Level | Continuous Assessment | | | End Semester Examination (Theory) [50 Marks] |
|---|---|---|---|---|
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA III [10 marks] | |
| Remember | - | - | - | - |
| Understand | 60 | 40 | 30 | 30 |
| Apply | 40 | 40 | 30 | 30 |
| Analyse | - | 20 | 40 | 40 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | - | - | 1 | - | - | - | 1 | - | - | - | 1 | 1 | 1 | 1 |
| **2** | 3 | 3 | - | 1 | 2 | - | - | - | 2 | - | 1 | 1 | 2 | - | - |
| **3** | 3 | 2 | - | 2 | 2 | - | - | - | 2 | - | 1 | 1 | 1 | 1 | 1 |
| **4** | 3 | 2 | - | - | 2 | - | - | - | 2 | - | 1 | 1 | 3 | 1 | 1 |
| **5** | 2 | 3 | - | 2 | 2 | - | - | - | 2 | - | 1 | 1 | 3 | - | - |
| **6** | 1 | 3 | - | - | | - | - | - | - | - | - | 1 | 1 | - | - |
| **Avg** | **2.5** | **2.6** | **-** | **1.5** | **2.0** | **-** | **-** | **1.0** | **2.0** | **-** | **1.0** | **1.0** | **1.8** | **1.0** | **1.0** |

1 Reasonably agreed 2 Moderately agreed 3 Strongly agreed

| 20CE015 | RURAL WATER SUPPLY AND ONSITE SANITATION SYSTEMS | 3/0/0/3 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory application |
| **Pre requisites** | Nil |

**Course Objectives:**

| | |
|---|---|
| 1 | To Understand healthful housing and swimming pool operation and maintenance |
| 2 | To Understand Refuse and food sanitation |
| 3 | To Understand Rural and Urban water supply and sanitation |
| 4 | To educate Rural and Urban water supply and sanitation |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C015.1 | Identify the problems pertaining to rural water supply and sanitation. | [U] |
| C015.2 | Design water supply and sanitation systems for rural communities. | [AP] |
| C015.3 | Design low-cost waste management systems for rural areas | [AP] |
| C015.4 | Plan and design an effluent disposal mechanism. | [AP] |
| C015.5 | Apply the various process involved in the solid waste management system | [AP] |
| C015.6 | Analyze the concepts of various solid waste disposal systems in rural sanitation | [AN] |

**Course Contents:**

**Module-1: Rural water supply and treatment methods** **15 Hrs.**

Rural Water Supply: Issues of rural water supply –Various techniques for rural water supply- merits- National rural drinking water program- rural water quality monitoring and surveillance- operation and maintenance of rural water supplies - Low -Cost Water Treatment: Introduction – Epidemiological aspects of water quality- methods for low- cost water treatment - Specific contaminant removal systems

**Module-2: Rural Sanitation and disposal methods** **15 Hrs.**

Rural Sanitation: Introduction to rural sanitation- Community and sanitary latrines - Planning of wastewater collection system in rural areas- Treatment and Disposal of wastewater - Compact and simple wastewater treatment units and systems in rural areas- stabilization ponds - septic tanks - Imhoff tank- soak pits- low-cost excreta disposal systems- Effluent disposal.

**Module- 3: Rural and onsite Solid waste Management** **15 Hrs.**

Industrial Hygiene and Sanitation: Occupational Hazards- Schools- Public Buildings- Hospitals- Eating establishments- Swimming pools – Cleanliness and maintenance and comfort- Industrial plant sanitation - Disposal of Solid Wastes- Composting- land filling- incineration- Biogas plants - Rural health - Other specific issues and problems encountered in rural sanitation.

**Total Hours: 45 Hrs.**

**Text Books:**


| | |
|---|---|
| 1 | C. E. McCombs, “Municipal and Rural Sanitation”, McGraw Hill Company, 2003. |
| 2 | Sanjay Gupta, “Rural Water Supply and Sanitation”, Vayu Education of India, 1st Edition, 2014. |
| 3 | Green Well Allan, “Rural Water Supply”, BiblioLife, 2012. |


**Suggested Readings:**

| | |
|---|---|
| 1 | Richard C. Carter, “Rural Community Water Supply”, Practical Action Publishing, 2008. |
| 2 | Forrest Blythe Wright, “Rural Water Supply and Sanitation”, Krieger Publishing Company, 3rd Edition, 2007. |
| 3 | E.G. Wagner and J.N. Lanoix, “Excreta Disposal for Rural areas and small communities”, W.H.O. Publication, Geneva,2003. |
| 4 | Babbit H.E and Donald J.J., “Water supply Engineering”, Mc - Graw Hill Book Co., New York, 2012. |
| **Online Courses:** | |
| 1 | https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-ce16/ |
| 2 | https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-ce45/ |
| **Web References:** | |
| 1 | https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-ce07/ |
| 2 | https://www.ircwash.org/sites/default/files/503-96RU-14531.pdf |

**Tentative Assessment Methods & Levels (based on Blooms’ Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom’s Level | Assessment Component | Marks |
|---|---|---|---|
| C015.1 – C015.6 | Apply | Assignment | 5 |
| | Apply | Quiz | 5 |
| | Apply | MOOC Online Courses | 10 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s Level | Continuous Assessment | | | End Semester Examination (Theory) [50 marks] |
|---|---|---|---|---|
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA-III [10 marks] | |
| Remember | 10 | 20 | 20 | 20 |
| Understand | 30 | 20 | 20 | 20 |
| Apply | 50 | 60 | 30 | 30 |
| Analyse | - | | 30 | 30 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | - | - | 1 | - | - | 1 | 1 | - | - | - | 1 | 1 | 1 | 1 |
| **2** | 3 | - | - | 1 | - | - | 2 | - | 2 | - | 1 | 1 | 2 | - | - |
| **3** | 3 | - | - | 2 | - | - | 2 | - | 2 | - | 1 | 1 | 1 | 1 | 1 |
| **4** | 3 | - | - | - | - | - | 1 | - | 2 | - | 1 | 1 | 3 | 1 | 1 |
| **5** | 2 | - | - | 2 | - | - | 2 | - | 2 | - | 1 | 1 | 3 | - | - |
| **6** | 1 | - | - | - | | - | 1 | - | - | - | - | 1 | 1 | - | - |
| **Avg.** | **2.5** | **-** | **-** | **1.5** | **-** | **-** | **1.3** | **1.0** | **2.0** | **-** | **1.0** | **1.0** | **1.8** | **1.0** | **1.0** |

1 Reasonably agreed 2 Moderately agreed 3 Strongly agreed

## OPEN ELECTIVE

| 20CE001 | DISASTER MANAGEMENT | 3/0/0/3 |
|---|---|---|
| **Nature of Course** | Theory Concept | |
| **Pre requisites** | Nil | |

**Course Objectives:**

| | |
|---|---|
| 1. | To understand the knowledge of the disaster phenomenon, disaster schemes and its different contextual aspects, impacts, and public health consequences. |
| 2. | To analyze the disaster management activities in India. |
| 3. | To apply disaster management in forecasting and warning of disasters. |
| 4. | To understand recent trends in disaster management. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C001.1 | Identify the disaster management schemes and components. | [AP] |
| C001.2 | Analyze the potential effects of disasters and methods to deliver public health response to avert these effects and as well risk and vulnerability in disaster management. | [AN] |
| C001.3 | Construct the risk assessment to resolve the uncertainty and risk occurs due to disaster. | [AP] |
| C001.4 | Apply disaster management in Forecasting and warning of disasters and disaster management technique in Statistical seismology. | [AP] |
| C001.5 | Examine the recent trends in disaster management. | [AN] |
| C001.6 | Classify the Emergency Management System for all the disasters. | [AN] |

**Course Contents:**

**Module 1: Dimensions of Disasters** **15 Hrs.**

Dimensions of natural and anthropogenic disasters – Principles/Components of disaster management – Classification of Disasters - Organizational structure for disaster management –Disaster management schemes - Natural disasters and mitigation efforts: Flood control – Drought management – Cyclones – Land use planning - NBC threat and safety measures – Forest fires – Oil fires – Crisis in power Sector – Accidents in coal mines – Case Studies – Relationship between Disaster and Development..

**Module 2: Disaster Management in India** **15 Hrs.**

Disaster management in India - Disaster Management Act 2005 – DM Policy 2009 - Coastal Hazards - Assessing risk and vulnerability - Disaster preparedness – Disaster mitigation – Forecasting and warning of disasters - Role of news media and NDRF in Disaster management –Rehabilitation of victims - Operations Management(OM) – Risk assessment and disaster response – NGO management – SWOT analysis based on design and formulation strategies – Insurance & risk management, Institution awareness and safety programs - Funding's for disaster management.

**Module 3: Recent Trends in Disaster Management and Implementations** **15 Hrs.**

Recent trends in disaster information provider – Electronic warning systems -Geo-Informatics - Psychological and social dimensions in disasters– Trauma and stress – Emotional intelligence -Applications in disaster management – Management of epidemics – Bio-Terrorism – Forecasting and Management of casualties - Emergency Management Systems (EMS).

| | |
|---|---|
| **Total Hours:** | **45 Hrs** |

| | |
|---|---|
| **Text Books:** | |
| 1. | Palanivel K., “Disaster Management”, Allied Publishers, 2015. |
| 2. | Sulphey M.M., “Disaster Management” PHI Learning Publications, 2017. |
| 3. | Singh A., Punia M, Haran N P and Singh T B., “Development and Disaster Management”, Springer, 2018. |
| **Suggested Readings:** | |
| 1. | Rajendra Kumar Pandey., “Disaster Management in India”, SAGE Publications Pvt. Ltd., 2020. |
| 2. | Shrivastava A.K., “Text book of Disaster Management”, Scientific Publications, 2021. |
| 3. | Arulsamy S., and Jeyadevi J., “Disaster Management”, Neelkamal Publications, 2016. |
| 4. | Hand Books on Disaster Management, Disaster Management Cell, Regional Centre for Urban and Environmental Studies, Lucknow University Campus, Lucknow. |
| **IS Code of Practice:** | |
| 1. | The Disaster Management Act 2005, Ministry of Law and Justice, New Delhi. |
| 2. | National Policy on Disaster Management 2009, National Disaster Management Authority, Ministry of Home Affairs, Government of India, New Delhi. |
| **Web References:** | |
| 1. | https://ndma.gov.in/ |
| 2. | https://nidm.gov.in/ |
| 3. | https://tnsdma.tn.gov.in/ |
| **Online Resources:** | |
| 1. | https://nptel.ac.in/courses/124/107/124107010/ |
| 2. | https://www.coursera.org/learn/disaster-preparedness |
| 3. | https://www.edx.org/course/natural-disasters |

**Tentative Assessment Methods & Levels (based on Revised Bloom’s Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom’s Level | Assessment Component | Marks |
|---|---|---|---|
| C001.1 to C001.6 | Apply | MOOC Certifications | 5 |
| C001.1 to C001.6 | Analyze | Technical Report | 5 |
| C001.1 to C001.6 | Apply | Assignment | 5 |
| C001.1 to C001.6 | Analyze | Technical Quiz | 5 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s Level | Continuous Assessment | | | End Semester Examination (Theory) [50 marks] |
|---|---|---|---|---|
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA-III [10 marks] | |
| Remember | 10 | 10 | 10 | 10 |
| Understand | 20 | 20 | 20 | 20 |
| Apply | 40 | 40 | 40 | 40 |
| Analyze | 30 | 30 | 30 | 30 |

| | | | | |
|---|---|---|---|---|
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | 2 | 1 | 2 | - | 2 | - | 2 | - | - | - | 1 | 3 | - | 3 |
| **2** | 3 | 3 | 2 | 3 | - | 1 | - | 2 | - | 2 | - | 2 | 3 | 2 | 3 |
| **3** | 3 | 2 | 1 | 2 | - | 2 | - | 2 | - | - | - | 1 | 3 | 2 | 2 |
| **4** | 3 | 2 | 1 | 2 | - | 2 | - | 2 | - | - | - | 2 | 3 | 3 | 3 |
| **5** | 3 | 3 | 2 | 3 | - | 1 | - | 2 | - | 2 | - | 3 | 3 | 3 | 3 |
| **6** | 3 | 2 | 1 | 2 | - | 2 | - | 2 | - | - | - | 1 | 3 | - | 2 |
| **Avg.** | **2.8** | **2.3** | **1.3** | **2.3** | **-** | **1.7** | **-** | **2.0** | **-** | **2.0** | **-** | **1.7** | **3.0** | **2.5** | **2.7** |
| 1 | Reasonably agreed | | | | 2 | Moderately agreed | | | | | 3 | Strongly agreed | | | |

| 20CE002 | ENGINEERING RISK AND UNCERTAINTY | 3/0/0/3 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory and Application |
| **Pre requisites** | Nil |

**Course Objectives:**

| | |
|---|---|
| 1. | To understand the feasibility of risk and uncertainty in engineering |
| 2. | To identify risk and uncertainty in engineering projects |
| 3. | To relate risk and uncertainty in decision making process |
| 4. | To analyze, evaluate and manage risk and uncertainty in engineering projects |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C002.1 | Acquire knowledge about risk and uncertainty in engineering | [AN] |
| C002.2 | Identify the risk and uncertainty in engineering projects | [AN] |
| C002.3 | Analyze risk and uncertainty using existing methods and models | [AN] |
| C002.4 | Assess the risk and uncertainty and make decisions in engineering | [AP] |
| C002.5 | Mitigate risk using various methods and tools | [AP] |
| C002.6 | Manage risk and uncertainty in engineering projects | [AP] |

**Course Contents:**

**Module 1: Concepts of Risk and Uncertainty** **15 Hrs.**

Importance of Risk – Source and Types of risks in Civil Engineering - Quantifiable and Unquantifiable Risks – Types of Uncertainty – Measure of Uncertainty – Difference between Risk and Uncertainty - Risk analysis in Construction Projects – Quantitative and Qualitative Analysis – Probability Impact Matrix – Consequences of Ignoring Risk – Risk Registers – Risk priority number – Risk identification, Risk Acceptance Criteria

**Module 2: Analysis of Risk and Uncertainty** **15 Hrs.**

Mathematical Models - Stochastic and Statistical Methods – Preliminary Hazard Analysis (PHA) – Hazards and Operability Analysis (HAZOP) – Job Safety Analysis (JSA) – Failure Modes and Effects Analysis (FMEA) – Fault Tree Analysis (FTA) – Event Tree Analysis (ETA) – Decision Analysis - Cause-Consequence Analysis (CCA) – Probabilistic and Reliability Risk Assessment

**Module 3: Management of Risk and Uncertainty** **15 Hrs.**

Decision Making under Risk and Uncertainty - Concept of simulation – Monte Carlo Simulation – Use of Simulation in Risk Identification, Analysis and Mitigation – Risk Mitigation – Residual Risk – Coverage of Risk through Various Policies – Role of Insurance in Risk Management – Interlinking Risk Analysis and Risk Management – Optimization Criteria - Risk Analysis And Management for Projects (RAMP) – Cost Benefit Analysis – Environmental Health and Safety Risk Assessment

| | |
|---|---|
| **Total Hours:** | **45 Hrs.** |

**Text Book**

| | |
|---|---|
| 1. | Mohammad Modarres, Risk Analysis in Engineering - Techniques, Tools and Trends, Taylor & Francis Group, CRC Press, 2019 |
| 2. | Sergio E.Serrano, Engineering uncertainty and risk analysis, Hydro science Inc., 2011 |
| 3 | Supreet Singh Bahga, Experimental Uncertainty Analysis – A textbook for Science and Engineering Students, White Falcon Publishing, 1 st edition, 2021 |

**Suggested Readings:**

| | |
|---|---|
| 1. | John Bartlett, Project Risk Analysis and Management Guide, APM Publishing Limited, 2nd Edition, 2010 |
| 2. | Ehsan Goodarzi, Mina Ziaei and Lee Teang Shui, —Introduction to risk and uncertainty in hydrosystem engineering, Springer, 2013 |

| | |
|---|---|
| 3 | Mohammad Modarres, Mark P.Kaminskiy and VasiliyKrivitsov, Reliability Engineering and Risk Analysis, Taylor & Francis Group, CRC Press, 2017 |
| 4. | Ayyub B. M., —Risk Analysis in Engineering and Economics, Chapman and Hall/CRC Press, 2014. |
| **Online Resources:** | |
| 1. | https://www.ice.org.uk/getattachment/knowledge-and-resources/best-practice/design-risk-management/DRM-Guidance-Version-2-March-2020.pdf.aspx |
| 2. | https://www.researchgate.net/publication/290883771_Risk_Assessment_Handbook |
| **Web Resources:** | |
| 1. | https://ocw.mit.edu/courses/engineering-systems-division/esd-72-engineering-risk-benefit-analysis-spring-2007/index.htm |
| 2. | https://www.pmi.org/learning/library/risk-analysis-project-management-7070 |
| 3. | https://www.guru99.com/risk-analysis-project-management.html |

**Tentative Assessment Methods & Levels (based on Revised Bloom's Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom's Level | Assessment Component | Marks |
|---|---|---|---|
| C002.1 - 6 | Analyze | Assignment | 5 |
| C002.1 - 6 | Analyze | Quiz | 5 |
| C002.1 - 6 | Apply | Group Project and Presentation | 10 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom's Level | Continuous Assessment | | | End Semester Examination (Theory) [50 marks] |
|---|---|---|---|---|
| | CIA- I [10 marks] | CIA-II [10 marks] | CIA - III [10 marks] | |
| Remember | | - | - | |
| Understand | 20 | 20 | 20 | 20 |
| Apply | 40 | 40 | 40 | 40 |
| Analyze | 40 | 40 | 40 | 40 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | 3 | 2 | - | - | 2 | - | 2 | 3 | 3 | 3 | 3 | 2 | - | 2 |
| **2** | 2 | 3 | 2 | - | - | 2 | - | 1 | 3 | 3 | 3 | 3 | 2 | - | 2 |
| **3** | 3 | 3 | 3 | - | - | 3 | - | 2 | 3 | 3 | 3 | 3 | 3 | - | 3 |
| **4** | 3 | 3 | 3 | - | - | 3 | - | 2 | 3 | 3 | 3 | 3 | 3 | - | 3 |
| **5** | 3 | 3 | 3 | - | - | 3 | - | 1 | 3 | 3 | 3 | 3 | 3 | - | 3 |
| **6** | 2 | 3 | 2 | - | - | 2 | - | 1 | 3 | 3 | 3 | 3 | 2 | - | 2 |
| **Avg** | **2.5** | **3** | **2.5** | **-** | **-** | **2.5** | **-** | **1.5** | **3** | **3** | **3** | **3** | **2.5** | **-** | **2.5** |

| | | | | | |
|---|---|---|---|---|---|
| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |

| 20CE003 | ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE ANALYSIS | 3/0/0/3 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory application |
| **Pre requisites** | Nil |

**Course Objectives:**

| | |
|---|---|
| 1. | To acquire knowledge regarding the methods of assessing the impact |
| 2. | To know about the various impacts of development projects on environment and the mitigating measures |
| 3. | To understand the risk assessment related to the environment |
| 4. | To know about the Life Cycle Analysis and its importance in industrial sectors |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C003.1 | Understand the detailed process involved in EIA methodologies and methods to obtain the EIA clearance | [U] |
| C003.2 | Apply the concepts of various assessment tools for the preparation of EIA report and Environment Management plan | [AP] |
| C003.3 | Evaluate the risk assessment based on response analysis | [AP] |
| C003.4 | Apply the concepts of Risk assessment tools and the mitigation measures for various engineering projects | [AP] |
| C003.5 | Apply the process of Life Cycle assessment and the challenges facing by the industries in recent days | [AP] |
| C003.6 | Identify the problems and analyse the various concepts of LCA to overcome the various issues | [AN] |

**Course Contents:**

**Module-1: EIA Methodologies and Assessment of EMP** **15 Hrs.**

Evolution of Environmental Impact Assessment (EIA)-Baseline Study- Framework of EIA-Stages of EIA-Environmental Impact Statement (EIS) –Terms of Reference- EIA capability and limitations – Legal provisions on EIA. Methods of EIA -Check lists - Matrices - Networks – Overlay -Cost-benefit analysis. Assessment of Impact and mitigation measures of impact on: land, water, air, noise, social, cultural flora and fauna - Public participation – Documentation of EIA Findings and Report Preparation - Rapid EIA. Environmental Management Plan - Environmental legislation in India and Environmental Audit**.**

**Module-2: Environmental Risk Management& Case Studies** **15 Hrs.**

Environmental risk assessment framework-Hazard identification – Exposure Assessment – Exposure Factors, Tools for Environmental Risk Assessment– HAZOP and FEMA methods - Risk Characterization -Risk communication - Emergency Preparedness Plans-Case Studies: EIAfor infrastructure projects –Large scale Industries-Mining-Hydropower projects- Bridges - Highways - Dams - Water Supply and Drainage Projects.

**Module- 3: Life Cycle Analysis& Assessment** **15 Hrs.**

Introduction to Sustainability Concepts and Life Cycle Analysis - Life Cycle Assessment – Detailed Methodology and ISO Framework - Environmental Data Collection and LCA Methodology - Life Cycle Inventory and Impact Assessments - Factors for Good LCA Study - Design for Sustainability - Case Studies.

| | |
|---|---|
| **Total Hours:** | **45 Hrs.** |

**Text Books:**

| | |
|---|---|
| 1 | Anjaneyulu,Y, ”Environmental Impact Assessment methodologies”, B.S. Publications, 2011 |

| | |
|---|---|
| 2 | Anji Reddy Mareddy, “Environmental Impact Assessment – Theory and Practice”, B S Publications, 2017 |
| 3 | Michael Z. HauschildRalph K. RosenbaumStig Irving Olsen, “Life Cycle Assessment – Theory and Practice” Springer, 2018 |
| **Suggested Readings:** | |
| 1 | Barthwal R R., “Environmental Impact Assessment” New age International Pvt.Ltd., 2012 |
| 2 | Angus Morrison, “Advanced Introduction to Environmental Impact Assessment”, Edward Elgar Publising Ltd., 2018. |
| 3 | SalimMomtaz, ZobaidulKabir S M., “Evaluating Environmental and Social Impact Assessment in Developing Contries”, Elsevier Publications, 2013 |
| 4 | Walter Klöpffer., “Life Cycle Assessment (LCA): A Guide to Best Practice” 1st Edition, Wiley-VCH, 2014 |
| **Online Courses:** | |
| 1 | https://nptel.ac.in/courses/120108004/ |
| 2 | https://nptel.ac.in/courses/123105001 |
| **Web References:** | |
| 1 | https://nptel.ac.in/courses/120108004/ |
| 2 | https://nptel.ac.in/courses/123105001 |

**Tentative Assessment Methods & Levels (based on Blooms’ Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom’s Level | Assessment Component | Marks |
|---|---|---|---|
| C003.1 – C003.6 | Apply | Assignment | 5 |
| | Apply | Quiz | 5 |
| | Apply | MOOC Online Courses | 10 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s Level | Continuous Assessment | | | End Semester Examination (Theory) [50 marks] |
|---|---|---|---|---|
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA-III [10 marks] | |
| Remember | 10 | 20 | 20 | 20 |
| Understand | 40 | 40 | 20 | 20 |
| Apply | 50 | 40 | 30 | 30 |
| Analyse | - | | 30 | 30 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | | | | | | - | - | | | | 2 | | 1 | 1 |
| **2** | 2 | | | | | | 2 | - | | | | 2 | | | 2 |
| **3** | 3 | - | 3 | 3 | - | - | 2 | - | 2 | 1 | | 3 | 2 | 2 | 2 |
| **4** | 2 | | | | | | 2 | - | | | | 2 | | 1 | 1 |
| **5** | 3 | - | 2 | 2 | - | - | 1 | - | 2 | 1 | | 3 | 2 | | 2 |
| **6** | 2 | - | | 1 | | | 2 | - | | | | 2 | | | 2 |
| **Avg.** | **2.3** | **-** | **1.0** | **1.3** | **-** | **-** | **1.7** | **2.0** | **2.0** | **1.0** | | **2.3** | **2** | **1.3** | **1.7** |
| 1 | Reasonably agreed | | | | 2 | Moderately agreed | | | | | 3 | Strongly agreed | | | |

| 20CE004 | GEOGRAPHICAL INFORMATION SYSTEM | 3/0/0/3 |
|---|---|---|
| **Nature of Course** | Theory Concepts | |
| **Pre requisites** | Nil | |

**Course Objectives:**

| | |
|---|---|
| 1. | To acquire knowledge on GIS techniques and map projections. |
| 2. | To have a clear understanding about data models and data structures. |
| 3. | To acquaint with several advanced modeling and application of GIS. |
| 4. | To comprehend and apply social and environmental systems information in the design and planning process. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C004.1 | Understand the basic components involved in GIS techniques. | [U] |
| C004.2 | Comprehend the Geo-referencing and map projection system and its application in GIS. | [AP] |
| C004.3 | Apply the concepts of data analysis and data models involved in GIS | [AP] |
| C004.4 | Analyse the concepts involved in GIS by using modern methods | [AN] |
| C004.5 | Identify field applications of GIS in various resource management | [AP] |
| C004.6 | Apply the advanced technologies of GIS in various fields. | [AP] |

**Course Contents:**

**Module 1: GIS and map projections** **15 Hrs.**

Introduction to Remote sensing and GIS - Components of GIS – Data; Spatial and Non-Spatial - Maps and Projections – Map Scale - Types of Projection - Coordinate system – Geo-referencing and Data Input - Digitizer, Scanner - Editing - Raster and Vector data structures - Comparison of Raster and Vector data structure - Analysis using Raster and Vector data - Retrieval, Reclassification, Overlaying, Buffering - Data Output.

**Module 2: Data analysis and Image Processing** **15 Hrs.**

Data Analysis - Visual interpretation and digital image processing - Data Retrieval - Query - Simple Analysis - Spatial Analysis - Spatial DBMS - Data storage - Overlay - Vector Data Analysis - Raster Data Analysis - Data models - Modeling and analysis using ARC GIS - Digital Elevation Model – Digital Terrain Modeling - Interpolation - Cost and path analysis - Expert Systems - Google Earth Tools.

**Module 3: Application of GIS in resource management** **15 Hrs.**

Applications of GIS - Management and Monitoring of Land, air, water and pollution studies - conservation of natural resources and agriculture - coastal zone management - Water resources and groundwater monitoring - Wasteland management - Social resources - Cadastral records - LIS - Limitations - AM/FM - Utility Network Management - Integration with Remote Sensing - Knowledge based techniques - multi-criteria Techniques.

| | |
|---|---|
| **Total Hours:** | **45 Hrs.** |

**Text Books:**

| | |
|---|---|
| 1. | Anji Reddy.M, “Text book of Remote sensing and GIS”, B.S.Bublications., 2019 |
| 2. | Michael N Demers, Fundamentals of Geographical Information Systems, Third Edition, John Wiley Publications, 2014. |
| 3. | Sinha.S.K “ Remote sensing and GIS”, Ayushman Publication house., 2014 |

**Suggested Readings:**

| | |
|---|---|
| 1. | Lo, C.P. and Yeung, Albert K.W., Concepts and Techniques of Geographic Information Systems, Pearson, 2016 |
| 2. | Burrough P A, Principles of GIS for Land Resources Assessment, Oxford Publication, 2014. |
| 3. | Manugula.S.S and Veeranna Bommakanti, “Photogrammetry, GIS and Remote |

| | |
|---|---|
| | sensing", Educreation Publishing., 2018 |
| 4. | Kang-tsung Chang, Introduction to Geographic Information Systems: 9th Edition, 9781259929649, McGraw-Hill Education, 2018 |

**Web References:**

| | |
|---|---|
| 1. | http://www.gdmc.nl/oosterom/PoGISHyperlinked.pdf |
| 2. | https://www.researchgate.net/publication/323945547_Fundamentals_of_GIS |
| 3. | http://giswin.geo.tsukuba.ac.jp/sis/tutorial/Fundamentals_of_GIS_Estoque.pdf |
| 4. | https://webapps.itc.utwente.nl/librarywww/papers_2009/general/principlesgis.pdf |

**Online Resources:**

| | |
|---|---|
| 1. | https://doc.arcgis.com/en/arcgis-online/reference/what-is-agol.htm |
| 2. | https://geogeek.xyz/download-gis-book-pdf-fundamentals-gis-arcgis-10-manual.html |
| 3. | https://2012books.lardbucket.org/pdfs/geographic-information-system-basics.pdf |

**Tentative Assessment Methods & Levels (based on Revised Bloom's Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom's Level | Assessment Component | Marks |
|---|---|---|---|
| C004.1 | Understand | Assignment | 5 |
| C004.2 & C004.3. | Apply | Online Quiz | 5 |
| C004.4 | Analyse | Technical Presentation | 5 |
| C004.5 & C004.6 | Apply | Case study | 5 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom's Level | Continuous Assessment | | | End Semester Examination (Theory) [50 marks] |
|---|---|---|---|---|
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA - III [10 marks] | |
| Remember | 20 | - | - | 10 |
| Understand | 20 | 20 | 30 | 20 |
| Apply | 60 | 50 | 50 | 50 |
| Analyse | - | 30 | 20 | 20 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

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

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|

| 20CE005 | INDUSTRIAL POLLUTION CONTROL AND PREVENTION TECHNIQUES | 3/0/0/3 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory Application |
| **Pre requisites** | Nil |

**Course Objectives:**

| | |
|---|---|
| 1. | To acquire knowledge on types of industrial pollutants and its source, environmental pollution prevention policy and legislations, concepts, and terminologies |
| 2. | To recommend suitable techniques and approaches for minimizing the generation of wastewaters at the source and to reduce energy consumption |
| 3. | To attain knowledge on application of physico-chemical, biological and advanced treatment methods for recovery, reuse and disposal of wastewater for effective pollution control from industries |
| 4. | To understand the process and types of pollution and technology for managing pollution from different industries |

**Course Outcomes**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C005.1 | Recognize the types and sources of industrial pollutants | U |
| C005.2 | Apply the environmental policy and legislations for industries to dispose the wastewater | AP |
| C005.3 | Apply cleaner production, waste minimization techniques and management strategies to industries. | AP |
| C005.4 | Identify the suitable treatment and disposal technique based on the pollutant from industries | AP |
| C005.5 | Differentiate the type of pollutants from various industries | AN |
| C005.6 | Suggest suitable pollution control and prevention techniques for different industries | AN |

**Course Contents**

**Module 1: Environmental Concern by Industries** **15 Hrs.**

Man and the environment - Consequences of industrial growth - Impact on environment by industrial growth - Sources - Types of Industrial pollutants and their source of industry - Mass and Energy balance system-Industrial management Concept - effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health - Environmental legislations related to prevention and control of industrial pollution - Waste Audit - Zoning Atlas and guidelines.

**Module 2: Pollution Prevention Technologies** **15 Hrs.**

Cleaner Production - Life Cycle Assessment – Environmental Impact Assessment - Waste Management Strategies - Remediation techniques: Physical, Chemical, Biological and Thermal treatment technologies - Zero Effluent Discharge - ETP & CETP - Sludge disposal techniques - Air pollutant emissions and control – Noise Pollution control measures.

**Module 3: Case Studies on Industrial Process and pollution prevention** **15 Hrs.**

Industrial Process and pollution prevention: Tannery Industry - Textile Industry - Petroleum Industry - Chemical Industry - Pulp & Paper Industry - Cement Industry.

| | |
|---|---|
| **Total Hours:** | **45 Hrs.** |

**Text Books:**

| | |
|---|---|
| 1. | M.N. Rao & A.K.Dutta, Wastewater Treatment, Oxford - IBH Publication,2017 |
| 2. | W .W. Eckenfelder Jr., Industrial Water Pollution Control, McGraw-Hill Book |

| | |
|---|---|
| | Company, New Delhi, 2000 |
| 3. | S.C.Bhatia, Handbook of Industrial Pollution and Control, Volume I & II, CBS Publishers, New Delhi, 2003 |
| **Suggested Readings:** | |
| 1. | R.L.Stephenson and J.B.Blackburn, Jr., Industrial Wastewater Systems Hand book, Lewis Publisher, New York, 1998 |
| 2. | H.M.Freeman, Industrial Pollution Prevention Hand Book, McGraw-Hill Inc., New Delhi, 1995. |
| 3. | Bishop, P.L., Pollution Prevention: Fundamental & Practice, McGraw-Hill, 2000. |
| 4 | T.T.Shen, Industrial Pollution Prevention, Springer, 1999. |
| **Web References:** | |
| 1. | http://www.cpcb.nic.in |
| 2. | http://www.moef.nic.in/report/0203/chap-05.pdf |
| 3. | http://www.moef.gov.in/citizen/specinfo/enguin.html |
| **Online Courses** | |
| 1. | https://www.un-ihe.org/online-course-industrial-effluent-treatment |
| 2. | https://onlinecourses.nptel.ac.in/noc19_ce32/preview |
| 3. | https://alison.com/course/advanced-diploma-in-wastewater-treatment-and-recycling |

**Tentative Assessment Methods and Levels (based on Revised Bloom's Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom's Taxonomy Level | Assessment Component | Marks |
|---|---|---|---|
| C005.1 | Understand | Online Quiz | 5 |
| C005.2 | Apply | Group Assignment | 5 |
| C005.3, C005.4 | Apply | Technical Video presentation | 5 |
| C005.5, C005.6 | Analyse | Case Study presentation | 5 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom's Taxonomy | Continuous Assessment | | | End Semester Examination (Theory) [50 Marks] |
|---|---|---|---|---|
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA III [10 marks] | |
| Remember | - | - | - | - |
| Understand | 10 | 10 | 10 | 10 |
| Apply | 50 | 50 | 50 | 50 |
| Analyse | 40 | 40 | 40 | 40 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | 2 | 3 | | | | | 2 | 1 | 1 | | 1 | 1 | 3 | 3 |
| **2** | | 2 | | | | 3 | | 2 | 1 | 1 | | 1 | 1 | 2 | 3 |
| **3** | 2 | 2 | | | | | 3 | 2 | 1 | 1 | | 1 | 1 | 2 | 3 |
| **4** | 2 | 2 | 3 | | | | | 2 | 1 | 1 | | 1 | 1 | 2 | 3 |
| **5** | 2 | 2 | | | | | | 2 | 1 | 1 | | 1 | 1 | 1 | 3 |
| **6** | 2 | 2 | | | | | | 2 | 1 | 1 | | 1 | 1 | 1 | 3 |
| **Avg.** | 2.0 | 2.0 | 3.0 | | | 3.0 | 3.0 | 2.0 | 1.0 | 1.0 | | 1.0 | 1.0 | 2.7 | 3.0 |

| 20CE006 | SUSTAINABILITY AND INFRASTRUCTURE | 3/0/0/3 |
|---|---|---|
| **Nature of Course** | Theory Application | |
| **Pre-requisites** | Nil | |

**Course Objectives:**

| | |
|---|---|
| 1. | To correlate the context of sustainability in infrastructure design, construction and maintenance. |
| 2. | To interpret the systems of Hydrology and transportation in sustainable infrastructure management. |
| 3. | To infer the economic aspects of sustainable infrastructure and its impact in implementation effectiveness. |
| 4. | Illustrate the role of land use policies in shaping sustainable infrastructure and cities for future. |

**Course Outcomes: Theory Component**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C006.1 | Interpret the context of sustainability in Infrastructure and its importance in recent times. | AP |
| C006.2 | Illustrate the landscape ecology, its resilient capacity and role of solid waste management in it. | AP |
| C006.3 | Appraise the system of Hydrology and its impact by human development - Remedies | AP |
| C006.4 | Infer the role of transportation in sustainable urban management and importance of public transit. | AP |
| C006.5 | Categorize the economic aspects of sustainable infrastructures-design, construct and operation phases. | AP |
| C006.6 | Interpret the significance of green ways in urban context and infer land use policies. | AP |

**Course Contents**

**Module 1: Green Infrastructure and Ecology** **15 Hrs.**

Definitions-Overview, goals and objectives of green infrastructure - Building the Case for Green Infrastructure: State of the Planet-History of the development of green infrastructure, emphasis on the environmental and green movements - Introduction to landscape ecology and resilience- Landscape ecology- Human health and well-being-Health, wellness and restorative landscapes-Recreational Landscapes-Cultural Landscapes and Green Infrastructure-Perception of sustainable landscapes and building public acceptance - Solid waste management

**Module 2: Water, Transportation and Energy** **15 Hrs.**

Introduction to Water Resources management - as a system – influences of human development at multiple scales-significance of spatial scale and multi-functionality - Transportation and Energy: Transportation, Federal Highway Administration, Federal Transit Administration, Livability in Transportation–Energy: Climate-Climate mitigation at the local and regional level – Micro-climate regulation

**Module3: Economic aspects and Green ways** **15 Hrs.**

Introduction to greenways-Greenways: an integral part of sustainable community development-multi-functionality of greenways-International greenway: Planning and design-Economic Aspects of Green Infrastructure-Land Use Planning and Policy related to Green Infrastructure-Land use and zoning- current limitations in most urban areas

| | |
|---|---|
| **Total Hours** | **45 Hrs.** |

| | |
|---|---|
| **Text Books:** | |
| 1. | Mark A. Benedict, Edward T McMahon, “Green Infrastructure: Linking Landscapes and Communities”. Washington: Island Press, 2015 |
| 2. | Sarté, S.B. 2010. Sustainable Infrastructure: The Guide to Green Engineering and Design. Hoboken, NJ: Wiley Press,2016 |
| 3. | Elisabeth M Hamin, “Planning for Climate Change: A Reader in Green Infrastructure and Sustainable Design for Resilient Cities”Routledge,2018 |
| **Suggested Readings** | |
| 1. | Gary Austin,”Green Infrastructure for Landscape Planning: Integrating Human and Natural Systems” 1st Edition, Routledge; 2014. |
| 2. | John W. Dover,” Green Infrastructure: Incorporating Plants and Enhancing Biodiversity in Buildings and Urban Environments” Routledge,2015 |
| 3. | Robert A. Francis,” Urban Landscape Ecology: Science, policy and practice, Routledge, 2016 |
| 4. | Robert C Bears, “Blue and Green Cities : The Role of Blue – Green Infrastructure in Managing urban water resources” Palgrave Macmillan,2020. |
| **Code Bookss:** | |
| 1. | Energy Conservation Building Code (ECBC 2017), Bureau of Energy Efficiency, Ministry of Power, Government of India |
| **Web References:** | |
| 1. | https://www.unep.org/news-and-stories/story/sustainable-infrastructure-can-drive-development-and-covid-19-recovery-unep |
| 2. | https://www.iisd.org/savi/faq/what-is-sustainable-infrastructure-2/ |
| **Online Resources:** | |
| 1. | https://www.coursera.org/lecture/gte-sustainable-cities/the-urban-green-part-2-sdYvx |
| 2. | https://www.edx.org/course/building-expertise-on-developing-sustainable-and-r?index=product&queryID=4f368baafb57deb425b5a3ed38a66c39&position=1 |

**Tentative Assessment Methods and Levels (based on Revised Bloom’s Taxonomy)**

**Formative Assessment based on capstone model (Max. Marks:20)**

| Course Outcome | Revised Blooms Level | Assessment Component | Marks |
|---|---|---|---|
| C006.1-C006.6 | AN | Assignment | 5 |
| | AN | Case studies | 5 |
| | AN | Quiz | 5 |
| | AN | Group Seminar | 5 |

**Summative assessment based on Continuous and End Semester Examination**

| Revised Bloom’s Level | Continuous Assessment – Theory | | | End Semester Examination (Theory) [50 Marks] |
|---|---|---|---|---|
| | CIA-I [10 Marks] | CIA-II [10 Marks) | CIA-III [10 Marks] | |
| Remember | - | - | - | - |
| Understand | 30 | 20 | 20 | 20 |
| Apply | 50 | 60 | 70 | 70 |
| Analyse | 20 | 20 | 10 | 10 |
| Evaluate | - | - | - | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Create | | | - | | | - | | | - | | | - | | | |
| **Course Articulation Matrix** | | | | | | | | | | | | | | | |
| **CO** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| **1** | 3 | 2 | 1 | | | | 2 | | | 1 | | 1 | 2 | 2 | 1 |
| **2** | 3 | 2 | 1 | | | | 2 | | | 1 | | 1 | 2 | 2 | 1 |
| **3** | 3 | 2 | 1 | | | | 2 | | | 1 | | 1 | 2 | 2 | 1 |
| **4** | 3 | 2 | 1 | | | | 2 | | | 1 | | 1 | 2 | 2 | 1 |
| **5** | 3 | 2 | 1 | | | | 2 | | | 1 | | 1 | 2 | 2 | 1 |
| **6** | 3 | 2 | 1 | | | | 2 | | | 1 | | 1 | 2 | 2 | 1 |
| **Avg** | 3 | 2 | 1 | | | | 2 | | | 1 | | 1 | 2 | 2 | 1 |
| 1 | Reasonably agreed | | | 2 | Moderately agreed | | | 3 | Strongly agreed | | | | | | |

## MANDATORY COURSES

| 20MC101 | INDUCTION PROGRAMME<br>(FOR ALL BRANCHES OF B.E / B.TECH PROGRAMMES) | 1/0/0/0 |
|---|---|---|
| **Nature of Course** | Induction Programme | |
| **Pre requisites** | Nil | |
| **Course Objectives:** | | |
| 1. | To have broad understanding of society and relationships | |
| 2. | To nurture the character and fulfil one's responsibility as an engineer, a citizen and a human being | |
| 3. | To incorporate meta skills and values | |
| **Course Outcomes:**<br>**Upon completion of the course, students shall have ability to** | | |
| C101.1 | Explore academic interest and activities | [AP] |
| C101.2 | Work for excellence | [AP] |
| C101.3 | Promote bonding and give a broader view of life and character | [AP] |

**Course Contents:**

**PHYSICAL ACTIVITY:** Research over the past years has shown Yoga to have stress-relieving powers on students, paving the way for improved academic performance with the practice of asanas, meditation and breathing exercises. To prove these words Yoga classes has been planned in this module.(CO mapping: C101.1, C101.2, C101.3)

**CREATIVE ARTS (students can select any one of their choice):** Cultural development supports students to understand, feel comfortable with, value and appreciate the potential enrichment of cultural diversity. They should challenge discrimination, whether based on cultural or racial difference. Students should experience cultural traditions embedded in arts, crafts, language, literature, theatre, song, music, dance, sport, Science, technology and travel. Students should develop an appreciation of beauty both in experiencing artistic expression and by exploring their own creative powers. To inculcate those skills they are given a chance to exhibit their talents through painting, sculpture, pottery, music, dance, craft making and so on. .(CO mapping: C101.1, C101.2, C101.3)

**UNIVERSAL HUMAN VALUES:** Moral development involves supporting students to make considered choices around their behaviour and the values that provide a framework for how they choose to live. Moral development is also learning about society's values, understanding the reasons for them, how they are derived and change; and how disagreements are resolved. Students must consider the consequences of personal and societal decisions on the wider community – local and global- and on the environment and future generations. To acquire this the students are exposed to training to enhance their soft skills. .(CO mapping: C101.1, C101.2, C101.3)

**LITERARY AND PROFICIENCY MODULES:**Social development helps students to work effectively together, developing the inter-personal skills required to relate positively with their peers and people of all ages. Students must also understand how to participate productively in a diverse and plural society and learn about, and how to effectively engage with societal

institutions and processes. They should understand that a person may have different roles and responsibilities within society. To reach this the following aspects are given in the form of Reading, writing, speaking – debate, role play etc. Communication and computer skills. (CO mapping: C101.1, C101.2, C101.3)

**LECTURES BY EMINENT PEOPLE:** Teaching with Lectures. ... It is essential to see lectures as a means of helping students learn to think about the key concepts of a particular subject, rather than primarily as a means of transferring knowledge from instructor to student. During the induction period students will attend to Guest lectures by subject experts.(CO mapping: C101.1, C101.2, C101.3)

**VISIT TO LOCAL AREAS: Traveling** is in fact a way of learning to learn. You are out of your comfort zone and so you must learn to be able to adapt to a new learning environment in a very short time. It also helps in your overall learning as well. In the induction period students will be taken to different places near college to learn new things. Eg. Meditation centre/orphanage/Hospital.(CO mapping: C101.1, C101.2, C101.3)

**FAMILIARIZATION TO DEPARTMENT/BRANCH INNOVATION:** Hod's of different branches will present about their department followed by department visit to view various facilities available at their department, new innovations from students and faculties etc. .(CO mapping: C101.1, C101.2, C101.3)

**Course Articulation Matrix**

| CO | PO 1 | PO 2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | | | | | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | | 1 |
| **2** | | | | | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | | 1 |
| **3** | | | | | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | | 1 |
| **Avg** | | | | | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | | 1 |
| 1 | Reasonably agreed | | | | 2 | Moderately agreed | | | | | 3 | Strongly agreed | | | |

| 20MC102 | ENVIRONMENTAL SCIENCES | 2 /0 /0 /0 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Theory Concept |
| **Pre requisites** | Basics in Environmental Studies |

**Course Objectives:**

| | |
|---|---|
| 1 | To learn the integrated themes on various natural resources. |
| 2 | To gain knowledge on the type of pollution and its control methods. |
| 3 | To have an awareness about the current environmental issues and the social problems. |

**Course Outcomes:**

**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C102.1 | Recall and play an important role in transferring a healthy environment for future generation. | [R] |
| C102.2 | Understand the importance of natural resources and conservation of biodiversity. | [U] |
| C102.3 | Understand and analyze the impact of engineering solutions in a global and societal context. | [U] |
| C102.4 | Apply the gained knowledge to overcome pollution problems. | [AP] |
| C102.5 | Apply the gained knowledge in various environmental issues and sustainable development. | [AP] |

**Course Contents:**

**Module 1: Natural Resources** **10 Hrs.**

Introduction-Forest resources: Use and abuse, case study-Major activities in forest-Water resources-over utilization of water, dams-benefits and problems. Mineral resources-Use and exploitation, environmental effects of mining- case study–Food resources- World food problems, case study. Energy resources -Renewable and non-renewable energy sources Land resources- Soil erosion and desertification – Role of an individual in conservation of natural resources.

**Module 2: Environmental Pollutions** **10 Hrs.**

Definition – causes, effects and control measures of: a. Air pollution-Acid rain - Green house effect-Global warming- Ozone layer depletion – case study- Bhopal gas tragedyb. Water pollution c. Solid waste management-Recycling of plastics-Pyrolysis method- causes, effects and control measures of municipal solid wastes d. Noise pollution. e. Nuclear hazards-case study-Chernobyl nuclear disaster-Role of an individual in prevention of pollution.

**Module 3: Social issues and the Environment** **10 Hrs.**

Sustainable development-water conservation, rain water harvesting, E-Waste Management – Environmental ethics: 12 Principles of green chemistry-Scheme of labelling of environmental friendly products (Eco mark) – Emission standards – ISO 14001 standard. HIV AIDS.

| | |
|---|---|
| **Total Hours:** | **30 Hrs.** |

**Text Books:**

| | |
|---|---|
| 1 | AnubhaKaushik and C P Kaushik “Perspectives in Environmental Studies”4th Edition, Newage International (P) Limited, Publisher Reprint 2014. New Delhi |

| | |
|---|---|
| 2 | Rajagopalan, R, “Environmental Studies-From Crisis to Cure”, Oxford University Press 2015. |
| **Suggested Readings:** | |
| 1 | Tyler Miller, Jr., “Environmental Science”, Brooks/Cole a part of Cengage Learning, 2014. |
| 2 | William Cunningham and Mary Cunningham, “Environmental Science”, 13th Edition, McGraw Hill,2015. |
| 3 | Gilbert M. Masters, “Introduction to Environmental Engineering and Science”, Third Edition, Pearson Education, 2014. |
| **Web References:** | |
| 1 | http://nptel.ac.in/courses/104103020/20 |
| 2 | http://nptel.ac.in/courses/120108002 |
| 3 | http://nptel.ac.in/courses/122106030 |
| 4 | http://nptel.ac.in/courses/120108004/ |
| 5 | http://nptel.ac.in/courses/122102006/20 |
| **Online Resources:** | |
| 1 | https://www.edx.org/course/subject/environmental-studies |
| 2 | www.environmentalscience.org |

**Tentative Assessment Methods & Levels (based on Revised Bloom’s Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:40)**

| Course Outcome | Bloom’s Level | Assessment Component | Marks |
|---|---|---|---|
| C102.1 | Remember | Quiz | **5** |
| C102.2 | Understand | Mini project based on environmental aspect | **15** |
| C102.3 | Understand | Class Presentation | **10** |
| C102.4<br>C102.5 | Apply | Group Assignment | **10** |

**Summative assessment based on Continuous Assessment**

| Revised Bloom’s Level | Term End Assessment Examination (Theory) [60 marks] |
|---|---|
| Remember | 30 |
| Understand | 40 |
| Apply | 30 |
| Analyse | - |
| Evaluate | - |
| Create | - |

**Course Articulation Matrix**

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

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Reasonably agreed | 2 | Moderately agreed | | 3 | Strongly agreed | |

| 20MC103 | SOFT SKILLS | 2/0/0/0 |
|---|---|---|
| **Nature of Course** | Theory Concept | |
| **Pre requisites** | Technical Communication Skills | |

**Course Objectives:**

| | |
|---|---|
| 1. | To develop the students competency level and their capabilities. |
| 2. | To teach the students to be effective in workplace and social environments. |
| 3. | To create self confidence among the students and to resolve stress and conflict within themselves. |
| 4. | To help the students to enhance their career skills by increasing their productivity and performances. |
| 5. | To concentrate more on conversation skills, presentation skills, verbal ability, critical and creative thinking. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C103.1 | Remember the principles of soft skills required for their profession. | [R] |
| C103.2 | Understand the importance of Interpersonal communication Skills among individuals, groups and cultures. | [U] |
| C103.3 | Apply verbal and non verbal communication skills in corporate environment. | [AP] |
| C103.4 | Analyse and apply creativity skills, critical thinking skills and problem solving skills. | [AN] |
| C103.5 | Articulate oral and written messages in an appropriate and persuasive manner to suit specific purposes, audiences and contexts at work place. | [AP] |
| C103.6 | Apply good teamwork skills and Leadership Skills | [AP] |

**Course Contents:**

**Module 1: Professional Communication Skills** **10 Hrs**

Introduction to the Soft Skills, Performance Evaluation 1 –Significance of Soft Skills- Understanding the basic Communication Principles –Listening Skills- Listening Exercises- Speaking Skills- How to start and Sustain a Conversation- Speaking in Groups- Understanding self and Personal Branding, attitude, types of attitude, Positive Attitude, Self Confidence and Self-Motivation - Personal Application/Action Taken.

Advanced Writing Skills-Principles of Business Writing- E mails- Writing Reports- Types of Reports- Strategies for Report Writing- Personal Application/Action Taken.

Verbal Ability- Analogy- Classification- Odd One Out- Idioms and Phrases- Sentence Correction- Empathy and its importance in career -Personal Application/Action Taken.

**Module 2: Interpersonal Communication** **10 Hrs**

Nonverbal Communication- Individual, Groups and Cultures- Body Language- Attire and Etiquettes- Interpersonal Skills- dealing with diverse People- Networking- Emotional Intelligence and its importance. Personal Application/Action Taken. Developing Creativity- Critical Thinking and Problem Solving Skills- Making the Right Choice- Never Give Up- Begin to Grow- Personal Application/Action Taken.

Interviews- Facing Job Interviews - Planning and Preparing- Effective Resume along with Covering Letter- Planning and Preparing- Personal Application/Action Taken.

Self-Discipline - Self Presentation - Personal Application/Action Taken.

**Module 3: Teamwork and Leadership Skills** **10 Hrs**

Industry Expectations- Universal Hiring Rule- Personal Application/Action Taken.
Importance of Human Values-Importance of Team Work- Developing Key Traits in Motivation, Persuasion, Negotiation and Leadership Skills- Being an Effective Team Player- Personal Application/Action Taken.
Planning- Prioritization - Delegation- Conflict Management- Decision and its necessity in crucial situations- Group Discussion- Personal Application/Action Taken.
Essential Skills in working Strategies- Presentation and Interaction Skills- What to Present and How- Being Assertive- Multimedia Presentation-Making Effective Presentations.
Interview Skills- Do's and Don'ts - Body Language – Answering the Common Questions of Interview- Performance Evaluation 2- Mock Interview

| | |
|---|---|
| **Total Hours:** | **30 Hrs.** |

**Text Books:**

| | |
|---|---|
| 1. | Business Communication for managers: An advanced approach, by Penrose, Cengage learning. |
| 2. | Professional Communication in Engineering. by H.E. Sales. Palgrave Macmillan 2009. |
| 3. | Communication for professional engineers by W. P. Scott, Bertil Billing. Thomas Telford, 1998. |

**Suggested Readings:**

| | |
|---|---|
| 1. | Reason and professional ethics by Peter Davson-Galle. Ashgate Publishing, Ltd., 2009. |
| 2. | Cross Cultural and Inter Cultural Communication. by William B. Gudykunst. Sage Publications India Pvt Ltd, New Delhi.2003. |
| 3. | Corporate Communications: Theory and Practice. byJoepCornelissen. Sage Publications India Pvt Ltd, New Delhi.2004. |

**Web References:**

| | |
|---|---|
| 1 | https://onlinecourses.nptel.ac.in/noc16_hs15/preview |
| 2 | https://www.getinternship.switchidea.com/NTAT/syllabus/Interpersonal-Communication. |
| 3 | https://smude.edu.in/smude/programs/bca/soft-skills.html |

**Online Resources:**

| | |
|---|---|
| 1 | https://swayam.gov.in/course/4047-developing-soft-skills-and-personality |
| 2 | https://www.clearias.com/interpersonal-skills-including-communication-skills-for-csat/ |
| 3 | https://www.bizlibrary.com/soft-skills-training/ |

**Tentative Assessment Methods & Levels (based on Revised Bloom's Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:40)**

| Course Outcome | Revised Bloom's Level | Assessment Component | Marks |
|---|---|---|---|
| C103.1 | Remember | Group Discussion | 10 |
| C103.2 & C103.3 | Understand | Listening Skills | 10 |
| C103.4 | Apply | Interview | 10 |
| C103.5 & C103.6 | Apply | Formal Presentation | 10 |

**Summative assessment based on Continuous Assessment**

| Revised Bloom's | Tentative End Assessment Examination (Theory) |
|---|---|

| Level | [60 marks] |
|---|---|
| Remember | 30 |
| Understand | 40 |
| Apply | 30 |
| Analyse | - |
| Evaluate | - |
| Create | - |

**Course Articulation Matrix**

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

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|

| 20MC104 | MANAGEMENT ORGANIZATIONAL BEHAVIOUR | 2/0/0/0 |
|---|---|---|
| **Nature of Course** | Theory Concept | |
| **Pre requisites** | Nil | |

**Course Objectives:**

| | |
|---|---|
| 1. | The objective of the course is to provide basic knowledge about management to familiarize the students with the management principles and organizational behavior. |
| 2. | The course is designed to enable the students to adapt & apply theoretical concepts in business |
| 3. | To know about the role of manager in the area of management. |
| 4. | To create and implement team building strategies for organization building. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C104.1 | Identify and understand different management principles techniques in business environment. | [U] |
| C104.2 | Apply management fundamentals and planning to solve organization problems and make effective decisions. | [AP] |
| C104.3 | Understand and analyze the changes within an individual will change the group as well as the organization | [AN] |
| C104.4 | Understand and analyze the leadership style and organization theories to create a productive environment to workforce. | [AN] |
| C104.5 | Analyze the organizational climate and change management strategies and tactics | [AN] |
| C104.6 | Apply the empowerment strategy and tactics for productivity | [AP] |

**Course Contents:**

**Module 1: Fundamentals of Management, Planning and Decision Making** **10 Hrs**

Introduction to Management- Concept and functions- Thought Managerial roles and styles- Principles of Management - Levels of Management- Theories of Management - Classical, Scientific, Administrative, Behavioral, Management Sciences Theories. Organizational planning - Vision, Mission and goals, Types of plans, steps in planning process, Approaches to planning, Planning in Dynamic Environment. Decision making process, types of decisions, decision making styles, Behavioural influences on decision making - Group decision making - Vroom's Participative decision-making model.

**Module 2: Individual, interpersonal and group behavior** **10 Hrs**

Definition, need and importance of Organizational behavior –Learning-Nature -Importance of Learning- Introduction and theories Motivation: Content and process theories-Leadership: Styles and Theories - Perception-Personality – Attitudes- Definition, need and importance - Nature and scope-Importance of Groups and Teams- Role relationships and conflict-Group dynamics- Work values. Organization Theories: Maslow's needs hierarchy theory, two factor theory of motivation, McGregor's theory, ERG theory, McClelland's needs theory, Valance Theory.

**Module 3: Organizational Development** **10 Hrs**

Organizational culture: Elements - Organizational climate– Factors affecting organizational climate-Organizational Commitment, Organizational schange- Importance- Stability Vs Change- Proactive Vs Reaction change- Change process– Resistance to change- Managing changes- Managing International Workforce – Productivity- Alternative change management approaches and cultural contingencies - power to manage effectively; Empowerment and Participation strategies and tactics.

| | |
|---|---|
| **Total Hours:** | **30 Hrs** |

**Text Books:**

| | |
|---|---|
| 1. | Nelson, Quick, Khandelwal, “Organizational Behavior”, 2nd edition, Cengage Learning, 2016. |
| 2. | Williams, Tripathy, “Principles of Management”, Cengage Learning, 2016. |
| 3. | Aswathappa, K, “Organizational Behavior”, 12th Edition, Himalaya Publication, 2016. |
| 4. | Stephen Robbins, Timothy A. Judge, “Organizational Behavior”, 16th edition, Prentice Hall India Pvt. Ltd, 2014. |
| **Suggested Readings:** | |
| 1. | Chandrani Singh, Aditi Khatri, “Principles and Practices of Management and Organizational Behavior”, Sage Publications, 2016. |
| 2. | Richard L. Daft, “Understanding the Theory and Design of Organizations”, 11th edition, Cengage Learning, 2013. |
| 3. | John M Ivancevich and Robert Konopaske, “Organizational Behavior and Management”, McGraw-Hill Education, 2013. |
| 4. | UdaiPareek, Sushama Khanna, “Organization Behavior”, 3rd edition, Oxford Publishing, 2012. |
| **Web References:** | |
| 1. | https://iedunote.com/fundamental-concepts-of-organizational-behavior |
| 2. | https://nscpolteksby.ac.id/ebook/ |
| 3. | https://ebooks.lpude.in/management/mba/term_1/DMGT402_MANAGEMENT PRACTICES_AND_ORGANIZATIONAL_BEHAVIOUR.pdf |
| 4. | https://www.studocu.com/in/document/vellore-institute-of-technology/organizational-behaviour/lecture-notes/ob-notes/3208134/view |
| **Online Resources:** | |
| 1. | https://nptel.ac.in/syllabus/110105034/ |
| 2. | https://nptel.ac.in/courses/110/105/110105033/ |
| 3. | https://freevideolectures.com/course/3502/organizational-behaviour-i |
| 4. | https://nptel.ac.in/courses/110/106/110106145/ |

**Tentative Assessment Methods & Levels (based on Revised Bloom’s Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Revised Bloom’s Level | Assessment Component | Marks |
|---|---|---|---|
| C104.1 | Understand | Online Quiz | 5 |
| C104.2<br>C104.6 | Apply | | |
| C104.3 | Analyze | Online Course | 10 |
| C104.4<br>C104.5 | Apply | Technical Presentation | 5 |

**Summative assessment based on Continuous and End Semester Examination**

| | Continuous Assessment | | | Term End Assessment Examination (Theory) [50 Marks] |
|---|---|---|---|---|
| Revised Bloom’s Level | CIA-I [10 marks] | CIA-II [10marks ] | CIA III [10marks ] | |
| Remember | 40 | 30 | 20 | 20 |
| Understand | 20 | 20 | 20 | 30 |
| Apply | 10 | 20 | 30 | 30 |
| Analyse | 30 | 30 | 30 | 20 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

**Course Articulation Matrix**

| CO | PO | PO | PO | PO | PO | PO | PO | PO | PO | PO | PO | PO | PSO | PSO | PSO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 1 | 2 | 3 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 3 | 1 | 1 | 3 | 2 |
| **2** | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |
| **3** | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 1 | 1 | 3 | 2 |
| **4** | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |
| **5** | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 |
| **6** | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 1 |
| **Avg** | **2.2** | **2.3** | **2.8** | **2.5** | **2.3** | **2.5** | **2.0** | **3.0** | **3.0** | **2.7** | **3.0** | **1.7** | **1.7** | **3.0** | **2.2** |

| | | | | | |
|---|---|---|---|---|---|
| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |

| 20MC105 | GENERAL APTITUDE | 2/0/0/0 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | Problem analytical |
| **Pre requisites** | Basic Mathematical calculations |

**Course Objectives:**

| | |
|---|---|
| 1 | To ensure that students learn to think critically about mathematical models for relationships between different quantities and use those models effectively to solve problems and reach conclusions about them. |
| 2 | To impart skills that enable students to effectively use and interpret data, formulas, and graphs in the workplace. |
| 3 | To instills confidence in facing technical aptitude questions interviewed by recruiters. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C105.1 | To teach the basics of Quantitative Techniques in a graded manner. | [R] |
| C105.2 | Understand the verbal and non-verbal nature of problems in reality and know the shortcut methods of solving it. | [U] |
| C105.3 | Solve problems using their general mental ability. | [AP] |
| C105.4 | To give intense focus on improving and increasing the ability of solving real problems. | [AP] |
| C105.5 | Think critically about mathematical models for relating different quantities to reach conclusion. | [AP] |
| C105.6 | Enable effective use of data interpretation, formulas, graphs and assumptions. | [AP] |

**Course Contents:**

**Module 1: Number Theory and Statistics** **14 Hrs.**

Number Systems– HCF and LCM of Numbers – Decimal Fractions – Simplification – Square Root and Cube Root of a number – Surds and Indices – Problems on numbers – Percentage – Ratio and Proportion – Divisibility – Mixtures – Averages- Polynomials – Solving Equations and Inequalities – Discard's rule of signs – Problems on ages – Chain rule – Time and Work – Time and Distance – Problems on Trains – Problems on Boats and Streams- Measures of central tendency – Mean, Median and Mode – Variance and Standard deviation Logarithms – Profit and Loss – Simple Interest – Compound Interest.

**Module 2: Logic and Decision Making** **8 Hrs.**

Analogy – Classification – Series completion – Coding and Decoding – Blood Relations – Puzzle Test – Direction Sense test – Logical Venn Diagrams - Number Ranking and Time Sequence Test – Decision Making – Assertion and Reason– Inserting the missing one – Logical Sequence of words – Syllogisms.

**Module 3: Reasoning** **8 Hrs.**

Logic – Statement and Arguments – Statements and Assumptions – Statements and Course of Action – Statements and Conclusions – Deriving conclusions from passages – Functions – Different kinds of functions – Miscellaneous sets- Series – Analogy – Classifications – Analytical Reasoning – Problems on Cubes and Dice – Mirror Images – Water Images – Rule Detection.

**Total Hours: 30 Hrs**

**Text Books:**

| | |
|---|---|
| 1 | Aggarwal R. S. "Quantitative Aptitude" Revised Edition, S. Chand Publication. |
| 2 | Abhijit Guha "Quantitative Aptitude" 5th Edition, McGraw Hill Education. |

**Suggested Readings:**

| | |
|---|---|
| 1 | Edgar Thorpe “Mental Ability & Quantitative Aptitude” 3rd Edition, McGraw Hill Education. |
| **Web References:** | |
| 1 | https://www.wiziq.com/tutorial/815468-quantitative-aptitude-reasoning-data-interpretation-video-lectures |
| 2 | https://learningpundits.com/contest?referrer=harsh.cse15@nituk.ac.in |
| 3 | https://nptel.ac.in/courses/114106041/8 |
| 4 | https://nptel.ac.in/courses/111103020/2 |
| **Online Resources:** | |
| 1 | http://aptitudetraining.in/home/index.php |
| 2 | https://www.udemy.com/vedicmaths/ |
| 3 | https://www.youtube.com/channel/UCtmn-DsF4BhPug-ff9LiDAA?disable_polymer=true |

**Tentative Assessment Methods & Levels (based on Revised Bloom’s Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:40)**

| Course Outcome | Revised Bloom’s Level | Assessment Component | Marks |
|---|---|---|---|
| C105.1 | Remember | Classroom or Online Quiz | 10 |
| C105.2 & C105.3 | Understand | Formal presentation | 10 |
| C105.4, C105.5 & C105.6 | Apply | Formal interview tests | 20 |

**Summative assessment based on Continuous and End Semester Examination**

| Bloom’s Level | Term End Assessment Examination (Theory) [60 marks] |
|---|---|
| Remember | 20 |
| Understand | 40 |
| Apply | 40 |
| Analyse | - |
| Evaluate | - |
| Create | - |

**Course Articulation Matrix**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| **2** | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| **3** | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| **4** | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| **5** | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| **6** | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| **Avg** | **3** | **2.5** | **1** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | **-** | **-** |

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|