# GUJARAT TECHNOLOGICAL UNIVERSITY

**Program Name: Bachelor of Engineering**
**Level: UG**
**Branch: Environmental Engineering**
**Subject Code: BE05013061**
**Subject Name: Estimation, Specifications and Project Management**

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|---|---|
| w. e. f. Academic Year: | 2024-25 |
| Semester: | 5 |
| Category of the Course: | Professional Elective – I |

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| **Prerequisite:** | Basic Knowledge of Environmental Engineering Structures and Engineering Mathematics |
| **Rationale:** | To learn the principles of estimation, specifications and project management techniques used in environmental engineering projects such as water supply systems, sewerage systems, treatment plants and sustainable infrastructure works |

**Course Outcomes:**

| Sr. No. | CO statement | Marks% weightage |
|---|---|---|
| CO-1 | Explain construction technologies and sustainable materials used in environmental engineering structures. | 10 |
| CO-2 | Prepare estimates, quantity calculations and rate analysis for environmental engineering works. | 40 |
| CO-3 | Develop technical specifications and interpret environmental engineering standards. | 10 |
| CO-4 | Summarize contracts, tendering procedures and conditions of contract for infrastructure projects. | 5 |
| CO-5 | Apply project management tools such as CPM and PERT for planning and scheduling environmental engineering projects. | 35 |

**Teaching and Examination Scheme:**

| Teaching / Learning Scheme (in Hours per semester) | | | | | Total Credits | Assessment Pattern and Marks | | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory | | Tutorial / Practical | | | |
| L | T | P | SL | Total no of hours per semester | | ESE (E) | PA / CA (M) | PA/CA (I) | TW/SL (I) | ESE (V) | |
| 45 | 30 | 0 | 15 | 90 | 3 | 70 | 30 | 20 | 30 | 0 | 150 |

**Contents:**

| Sr. No. | Content | Total Hrs |
|---|---|---|
| 1 | **Construction Technology for Environmental Engineering:** Subsurface investigation: soil exploration, soil sampling, bearing capacity, Foundations: Shallow and deep foundations, Foundations for treatment units, Masonry and RCC Construction, Waterproofing and Plastering, Sustainable Construction Materials: Fly ash bricks, Recycled materials | 05 |
| 2 | **Estimating and Costing:** Purpose and importance of estimation, Types of estimates: long wall-short wall method, centre line method, Rate analysis, Schedule of Rates (SOR), Rate analysis of excavation, PCC, RCC, brickwork, plastering, flooring Detailed estimation of retaining wall, water supply pipeline, underground water tank, overhead RCC tank, drainage system, septic tank, sewer line, sludge drying beds and rainwater harvesting systems | 16 |
| 3 | **Specifications:** Objectives and importance of specifications, Types of specifications, Specifications for excavation, PCC, RCC, brickwork, plastering, flooring, Environmental Standards: IS codes overview, CPHEEO guideline, environmental and safety provisions | 05 |
| 4 | **Contracts and Tenders:** Essential requirements and types of contracts, Tendering process, Tender documents Environmental clauses in contracts: waste disposal responsibility, environmental compliance, worker safety provisions, Conditions of contract: general provisions, security deposit, payment clauses, penalty clauses, arbitration, risk and insurance basics | 04 |
| 5 | **Project Management and Network Techniques:** Project planning, scheduling, monitoring and control, Bar charts, Milestone charts, Network techniques: activities and events, network development, time calculations CPM and PERT: critical path determination, float calculation and time estimates | 11 |
| 6 | **Modern Tools and Sustainable Project Practices:** Green project management, Smart Environmental Infrastructure: smart water distribution systems, SCADA overview, Resource allocation basics related to construction activities | 04 |
| | **TOTAL** | 45 |

**Suggested Specification table with Marks (Theory): (For B.E. only)**

| Distribution of Theory Marks | | | | | |
|---|---|---|---|---|---|
| R Level | U Level | A Level | N Level | E Level | C Level |
| **10** | **20** | **20** | **10** | **10** | **0** |

**R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

**The syllabus of Fundamentals of Air Pollution achieves following SDGs Goals**

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|---|---|
| SDG 6 | Clean Water and Sanitation |
| SDG 9 | Industry, Innovation and Infrastructure |
| SDG 11 | Sustainable Cities and Communities |
| SDG 12 | Responsible Consumption and Production |
| SDG 13 | Climate Action |

**Reference Books:**

1. Estimating and Costing in Civil Engineering by B.N. Dutta
2. Estimating, Costing and Valuation by Rangwala
3. Construction Management and Accounts by S.C. Sharma
4. Construction Planning, Equipment and Methods by Peurifoy
5. CPHEEO Manual on Water Supply and Sewerage
6. Project Planning and Control with PERT and CPM by Punmia & Jain
7. IS Codes and Standard Specifications for Civil and Environmental Engineering Works

**Major Accessories required :**

1. Quantity estimation sheets and software
2. Project management software
3. Drawing and drafting tools
4. Standard Schedule of Rates (SOR) documents

**List of Open-Source Software/learning website:**

1. CPHEEO Manuals
2. National Programme on Technology Enhanced Learning (NPTEL)
3. Central Public Works Department (CPWD) Specifications
4. Bureau of Indian Standards (BIS)

5. MS Project Learning Resources

**List of suggested activities for Term Work:**

**PART [A]: ASSIGNMENT:**

1. Assignment on sustainable construction materials.
2. Assignment on technical specifications for environmental engineering works.
3. Assignment on contracts and tendering procedures.
4. Assignment on green project management practices.
5. Assignment on smart environmental infrastructure and SCADA systems
6. Drafting of technical specifications for environmental engineering works.
7. Preparation of tender notice

**PART [B]: TUTORIALS:**

1. Numerical problems on long wall-short wall method.
2. Numerical problems on centre line method.
3. Rate analysis of excavation and RCC works
4. Estimation of septic tank and soak pit
5. Estimation of Retaining Wall
6. Estimation of Underground tank
7. Estimation of Water Storage Tank
8. CPM and PERT numerical problems.
9. Preparation of bar chart and milestone chart for environmental engineering project.
10. Rate analysis of RCC work.
11. Rate analysis of Brick work.

**PART [C] Problem based Learning Activities:**

| Sr. No. | PBL Category | Name of the Activity | No. of Hours | Evaluation Criteria |
|---|---|---|---|---|
| 1 | Mini Project | • Preparation of estimate for rainwater harvesting system<br>• Scheduling of STP/WTP project using CPM and PERT | Duration = 10 hrs | • Based on quantity calculations, technical correctness and report<br>• Based on network development and analysis |
| 2 | Micro Project | Estimation of sewer line for small residential colony | Duration = 5 hrs | Based on estimation accuracy and presentation |
| 3 | Seminar | Seminar on modern project management software and sustainable infrastructure / based on technical topics beyond syllabus | Duration = 10 hrs | Based on technical content and presentation |
| 4 | Concept Mapping Activity | Prepare concept map on estimation, specifications, contracts and project management | Duration = 5 hrs | Based on logical connections and technical clarity |
| 5 | Field Observation Study | Visit nearby construction/environmental engineering project and prepare | Duration = 5 hrs | Based on observations and technical understanding |

| | | | | |
|---|---|---|---|---|
| | | report | | |
| 6 | Case Study | Comparative study of conventional and green construction materials | Duration = 5 hrs | Based on technical comparison and sustainability aspects |
| 7 | Video Based Learning | NPTEL video learning on estimation and project management | Duration = 10 hrs | Based on MCQ test |
| 8 | Poster / PPT Development | Poster/PPT on environmental engineering infrastructure projects | Duration = 5 hrs | Based on technical content and presentation quality |

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