# INSTITUTE OF AERONAUTICAL ENGINEERING
**(AUTONOMOUS)**
Dundigal, Hyderabad - 500 043

**CIVIL ENGINEERING**
**COURSE DESCRIPTION FORM**

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|---|---|---|---|---|
| Course Title | **ENVIRONMENTAL ENGINEERING** | | | |
| Course Code | **A60119** | | | |
| Regulation | **R15-JNTUH** | | | |
| Course Structure | **Lectures** | **Tutorials** | **Practicals** | **Credits** |
| | 4 | - | - | 3 |
| Course Coordinator | Mr. Srinivas Angadi, Assistant Professor, Department of Civil Engineering | | | |
| Team Instructors | Mr. G Anil Kumar, Assistant Professor, Department of Civil Engineering | | | |

## I. COURSE OVERVIEW:

This course will cover the study of various waterborne diseases which are very harmful to human beings, population forecasting for designing distribution systems, Designing of water treatment plant and various considerations, to determine the optimum dosage of coagulant, working of filters and troubles in their operation, various disinfection methods, Design principles of distribution system and analysis by hardy cross & equivalent pipe method, methods of conveying sewage to the treatment plant, various valves which are used in distribution system and also the characteristics of sewage and its estimation, various appurtenances in sewers, sewage disposal and farming. This course also cover the study of construction of oxidation pond, sludge digestion tank, skimming tanks, grit chambers, sedimentation tanks and designing of septic tanks and soak pits.

## II. PREREQUISITES:

| Level | Credits | Periods / Week | Prerequisites |
|---|---|---|---|
| UG | 4 | 5 | Water Resource Engineering-I |

## III. COURSE ASSESSMENT METHODS:

| Session Marks | University End Exam Marks | Total Marks |
|---|---|---|
| **Mid Semester Test**<br>There shall be two midterm examinations.<br>Each midterm examination consists of subjective type and objective type tests.<br>The subjective test is for 10 marks of 60 minutes duration.<br>Subjective test of shall contain 4 questions; the student has to answer 2 questions, each carrying 5 marks.<br>The objective type test is for 10 marks of 20 minutes duration. It consists of 10 Multiple choice and 10 objective type questions, the student has to answer all the questions and each carries half mark.<br>First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion.<br>**Assignment**<br>Five marks are earmarked for assignments.<br>There shall be two assignments in every theory course. Marks shall be awarded considering the average of two assignments in each course. | 75 | 100 |

## IV. EVALUATION SCHEME:

| S. No | Component | Duration | Marks |
|---|---|---|---|
| 1 | I Mid Examination | 80 minutes | 20 |
| 2 | I Assignment | - | 5 |
| 3 | II Mid Examination | 80 minutes | 20 |
| 4 | II Assignment | - | 5 |
| 5 | External Examination | 3 hours | 75 |

## V. COURSE OBJECTIVES:

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

I. Forecast the population for designing of distribution system.
II. Calculate the sufficient quantity of water for fire fighting in a town
III. Design and analysis of distribution system and appurtenances in distribution system
IV. Design skimming tank, grit chambers, sedimentation tank and trickling filters.
V. Design sludge digestion tank, oxidation pond and working principles of septic tanks.

## VI. COURSE OUTCOMES:

1. Ability to design distribution system for future population.
2. An ability to suggest the quantity of water required for fire fighting in a town.
3. Student can be able to identify the quality of water by analyzing with permissible limits.
4. Ability to design intakes and infiltration galleries.
5. Student can determinate the optimum coagulant dose in water treatment.
6. An ability to design sedimentation tanks and clarifiers.
7. Student can be able to design rapid and slow sand filters.
8. Ability to analysis a distribution system
9. Ability to design skimming tank, grit chambers and sedimentation tanks.
10. Student can be able to design septic tank and sludge digestion tank.
11. Student can be able to use properly various appurtenances in distribution system.
12. Ability to analyze, examine the different physical, chemical and biological properties of water.

## VII. HOW PROGRAM OUTCOMES ARE ASSESSED:

| Program Outcomes | | Level | Proficiency assessed by |
|---|---|---|---|
| PO1 | **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. | H | Assignments, Tutorials, Exams |
| PO2 | **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. | - | -- |
| PO3 | **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. | H | Assignments, Tutorials, Exams |

| | | | |
|---|---|---|---|
| PO4 | **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. | S | Assignments |
| PO5 | **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. | H | Assignments, Tutorials, Exams |
| PO6 | **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. | - | -- |
| PO7 | **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. | H | Assignments |
| PO8 | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. | S | Assignments |
| PO9 | **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. | S | Assignments |
| PO10 | **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. | - | -- |
| PO11 | **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. | - | -- |
| Po12 | **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. | - | -- |
| PO13 | An ability to recognize the importance of civil Engineering professional development by pursuing post graduate studies or face competitive examinations that offer challenging and rewarding careers in computing. | - | -- |

**N - None** **S – Supportive** **H - Highly Related**

## VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

| Program specific outcomes | | Level | Proficiency Assessed by |
|---|---|---|---|
| PSO 1 | **ENGINEERING KNOWLEDGE:** Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good foundation in mathematics, basic sciences and technical communication. | H | Lectures, Exercises and Assignments |
| PSO 2 | **BROADNESS AND DIVERSITY:** Graduates will have a broad understanding of economical, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within multidisciplinary teams with competence in modern tool usage. | H | Project |
| PSO 3 | **SELF-LEARNING AND SERVICE:** Graduates will be motivated for continuous self-learning in engineering practice and/ or pursue research in advanced areas of civil engineering in order to offer engineering services to the society, ethically and responsibly. | S | Guest lectures |

**N - None** **S – Supportive** **H - Highly Related**

## IX. SYLLABUS:

**Unit –I:**

**Protected Water Supply** - Population Forecasts, Design Period - Water Demand - Types Of Demand - Factors Affecting Fluctuations - Fire Demand - Storage Capacity - Water Quality And Testing - Drinking Water Standards. Comparison from Quality and Quantity and Other Considerations – Intakes - Infiltration Galleries, Confined and Unconfined Aquifers, Distribution Systems - Requirements - Methods and Layouts.

**Unit –II:**

**Layout and general outline of water treatment units** - sedimentation, uniform settling velocity – principles - design factors - surface loading - Jar test- optimum dosage of coagulant – coagulation - flocculation, clarifier design - coagulants - feeding arrangements. Filtration – theory - working of slow and rapid gravity filters - multimedia filters - design of filters - troubles in operation comparison of filters - disinfection - Types of disinfection - theory of chlorination- chlorine demand and other disinfection treatment methods. Distribution systems - types of layouts of distribution systems - Design of distribution systems - Hardy Cross and equivalent pipe methods, Service reservoirs – joints, valves such as sluice valves, air valves, scour valves and check valves water meters - laying and testing of pipe lines- pump house.

**Unit –III:**

**Conservancy and water carriage systems** - sewage and storm water estimation - type of concentration - storm water over flows combined flow - characteristics of sewage, cycles of decay - decomposition of sewage, examination of sewage, B.O.D. and C.O.D. equations - design of sewers - shapes and materials - sewer appurtenances manhole - inverted siphon - catch basins - flushing tanks - ejectors, pumps and pump houses- house drainage - components requirements - sanitary fittings - traps- one pipe and two pipe systems of plumbing – ultimate disposal of sewage – sewage farming – dilution

**Unit –IV:**

**Lay out and general outline of various units in a waste water treatment plant** –primary treatment design of screens –grit chambers –skimming tanks-sedimentation tanks-principles and design of biological treatment – trickling filters- standard and high rate.

**Unit –V:**

**Construction and design of oxidation ponds** –sludge digestion tanks –factors effecting –design of digestion tank – sludge disposal by drying –septic tanks working principles and design-soak pits. Ultimate disposal of waste water-self purification of rivers- sewage farming.

**TEXTBOOKS:**

1. Water Supply And Sanitary Engineering By G .S. Birdi, Dhanpat Rai & Sons Publishers
2. Water Supply Engineering , Vol 1 , Waste Water Engineering , Vol II , B. C Punmia, Ashok Jain & Arun Jain, Laxmi Publications Pvt. Ltd .
3. Elements of Environmental Engineering by K .N. Duggal, S. Chand Publishers.

**Reference Books:**

1. Water and waste water technology by Mark J Hammar
2. Water and waste water technology by steel
3. Water and waste water engineering by Fair Geyer and Okun
4. Waste water treatment- concepts and design approach by G. L. Karia and R. A .Christian, PHI
5. Waste water engineering by Metcalf and eddy
6. Unit operations in environmental engineering by R. Elangovan and M.K Saseetharan , New age international.

## X. COURSE PLAN:

**At the end of the course, the students are able to achieve the following course learning outcomes:**

| Lecture No. | Learning Objective | Topics to be covered | References |
|---|---|---|---|
| 1 | Water borne diseases | To learn various water borne diseases | **T2:24.6** |
| 2 | Protected water supply | To learn about protected water supply | **T2:24.8** |
| 3-4 | Population forecasting | To forecast the population by various methods | **T2:24.7** |
| 5-6 | Design period, water demand , types of demand | To know the design period and water demand, types of demand | **T7:12.14** |
| 7 | Factors affecting fluctuations | To understand the fluctuations | **T4:3.10** |
| 8-9 | Fire demand, storage capacity | To determine the amount of water required for fire fighting | **T2:24.6** |
| 10 | Water quality and testing, and drinking water standards. | To learn about water quality and testing | **T7:12.14** |
| 11 | Drinking water standards | To know about drinking water standards | **T4:3.10** |
| 12 | Sources of water | To know about sources of water | **T1:16.2** |
| 13-14 | Comparison from quality and quantity of water standards | To know about Comparison from quality and quantity standards and other considerations | **T1:16.5** |
| 15 | Intakes | To know about intakes | **T1:16.6.2** |
| 16 | Infiltration galleries | To know about infiltration galleries | **T2:26.9** |
| 17 | Confined and unconfined aquifers | To know about confined and unconfined aquifers | **T2:26.11** |
| 18-19 | Distribution systems , requirements | To know about distribution systems , requirements , | **T1:16.7** |
| 20 | Methods and layouts. | To know about methods and lay outs of water distribution system | **T2:26** |
| 21 | Lay out and general outline of water treatment units | To know about Lay out and general outline of water treatment units | **T2:20.4** |
| 22 | Sedimentation | To know about the sedimentation | **T2:23.4** |
| 23 | Uniform settling velocity | To know about uniform settling velocity | **T2:20.9** |
| 24-25 | principles , design factors , jar test , optimum dosage of | To know about principles , design factors , jar test , optimum dosage of coagulant | **T2:20.10** |

| | | | |
|---|---|---|---|
| | coagulant | | |
| 26-27 | Coagulation ,Flocculation , clarifier design | To know about coagulation, flocculation , clarifier design | **T4:5.13** |
| 28 | Coagulants and feeding arrangements. | To know about coagulants , feeding arrangements | **T2:34.2** |
| 29-30 | Theory of filtration , working of slow and rapid gravity filters, multi media filters | To know about theory of filtration , working of slow and rapid gravity filters, multi media filters | **T2:21.1-21.2** |
| 31 | Design of filters | To know about design of filters | **T:21.3-** |
| 32-33 | Troubles in operation , comparison of filters | To know about troubles in operation , comparison of filters | **T:21.4** |
| 34 | The process of disinfection ,types of disinfection | To know about the process of disinfection ,types of disinfection | **T2:21.5-21.6** |
| 35-36 | Theory of chlorination, chlorine demand , disinfection treatment methods | To know about theory of chlorination, chlorine demand, disinfection treatment methods. | **T4:7.1-7.3** |
| 37 | Distribution systems | To know about distribution systems and types | **T3:27.2** |
| 38 | Design of distribution system | To know about design of distribution system | **T3:27.9** |
| 39-40 | Hardy cross, equivalent pipe method | To know about the methods of distribution system | **T3:27.9** |
| 41 | Service reservoirs | To know about service reservoirs | **T3:27.10** |
| 42 | Sluice, air, scour, check valves | To know about types of valves | **T3:27.11** |
| 43 | about laying and testing of pipe lines, pump house | To know about laying and testing of pipe lines, pump house | **T4:10.6** |
| 44 | Conservancy and water carriage systems | To know about conservancy and water carriage systems | **T5:11.2** |
| 45 | Estimation of sewage and storm water | To know about estimation of sewage and storm water | **T5:11.3** |
| 46 | Time of concentration , storm water flows and combined flow | To know about time of concentration , storm water ,over flows | **T5:11.4** |
| 47 | Characteristics of sewage , cycles of sewage , decomposition of sewage | To know about characteristics of sewage , cycles of sewage , decomposition of sewage | **T5:11.5** |
| 48 | BOD , COD equations | To learn about examination of sewage – BOD , COD equations | **T5:11.1** |
| 49 | Design of sewers ,shapes and materials | To know about design of sewers , shapes and materials | **T5:11.2** |
| 50 | Man holes | To know sewer appurtenances , man holes | **T5:11.3** |
| 51 | Inverted siphon , catch basins , flushing tanks , ejectors | To know about inverted siphon, catch basins, flushing tanks, ejectors. | **T5:11.5** |
| 52 | Pumps , pump houses , house drainage | To know about pumps , pump houses , house drainage and component requirements | **T5:11.7** |
| 53 | Sanitary fittings , traps | To know about sanitary fittings , traps ,one pipe and two pipe systems of plumbing | **T5:11.8** |
| 54 | Ultimate disposal of sewage , sewage farming , dilution | To know about ultimate disposal of sewage , sewage farming , dilution | **T5:11.10** |
| 55 | Lay out of various units in a waste water treatment plant | To know about lay out and general outline of various units in a waste water treatment plant | **T5:11.11** |
| 56 | Primary treatment , design of screens | To know about primary treatment ,design of screens | **T5:11.15** |
| 57 | Grit chambers | To know about grit chambers | **T5:11.19** |
| 58 | Skimming tanks , sedimentation tanks | To know about skimming tanks , sedimentation tanks , | **T5:11.22** |

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|---|---|---|---|
| 59 | Trickling filters | To know about principles and design of biological treatment units – trickling filters | **T5:11.3** |
| 60 | Oxidation ponds | To know about construction and design of oxidation ponds | **T5:11.5** |
| 61 | Sludge digestion tanks | To know about sludge digestion tanks | **T5:11.7** |
| 62 | Digestion tanks | To know about design of digestion tanks | **T5:11.8** |
| 63 | Sludge disposal | To know about sludge disposal by drying | **T5:11.10** |
| 64 | Septic tanks | To know about septic tanks | **T5:11.11** |
| 65 | Soak pits. | To know about working principles and design of soak pits | **T5:11.15** |

## XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES:

| Course Objectives | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **I** | H | | | | | | | | | | | | H | S | |
| **II** | H | | S | | | | H | | | | | | H | S | |
| **III** | H | | S | S | | | | | H | | | | S | H | |
| **IV** | H | | | | | | | H | | | | | H | S | |
| **V** | | | | | S | | | | | | | | H | | |

**S= Supportive** **H = Highly Related**

## XII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | H | | H | | H | | H | | | | | | H | | |
| 2 | | | H | S | | | | H | S | | | | | H | |
| 3 | | | H | | H | | | | S | | | | | H | S |
| 4 | | | | S | | | H | H | S | | | | H | H | S |
| 5 | H | | | | H | | | | S | | | | H | | |
| 6 | | | | S | H | | | H | S | | | | H | H | S |
| 7 | H | | H | | H | | H | | S | | | | | | |
| 8 | H | | H | | | | | S | | | | | | H | |
| 9 | H | | | S | H | | H | S | | | | | H | | |
| 10 | | | | | | | | S | | | | | H | | S |
| 11 | H | | H | S | H | | H | S | | | | | H | | |
| 12 | | | | S | H | | H | | | | | | H | | |

**S= Supportive** **H = Highly Related**

**Prepared By:** Srinivas Angadi, Assistant Professor **HOD CIVIL ENGINEERING**