**19CE3202 – ENVIRONMENTAL ENGINEERING-I**

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| **Course Category** | Professional Core | **Credits** | 3 |
| **Course Type** | Theory | **Lecture - Tutorial - Practical** | 2 - 1 - 0 |
| **Prerequisite** | None | **Sessional Evaluation** | 40 |
| **Semester End Exam Evaluation** | 60 |
| **Total Marks** | 100 |

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| **Course Objectives** | 1. To classify different sources of water and to understand the principles of water demand. 2. To categorize water characteristics and conventional treatment of water. 3. To assess the suitability of different types of filters. 4. To examine the suitability of various disinfection methods. 5. To assess the various types of advanced water treatment methods. 6. To illustrate different types of water distribution networks. | |
| **Course Outcomes** | CO1 | Identify the sources of water and intake works for collection. Be able to forecast and calculate water demand. |
| CO2 | Determine the water quality and understand the conventional methods of water treatment. |
| CO3 | Design of filtration units. |
| CO4 | Apply the concepts of disinfection. |
| CO5 | Demonstrate the advanced water treatment methods. |
| CO6 | Apply water distribution principles and design pipe-networks by hardy-cross method. |
| **Course Content** | **UNIT – I**  **SOURCES, DEMAND AND COLLECTION OF WATER:** Sources of water – Source Selection – Water demand – Types – Factors affecting water demand – Fluctuations in water demand – Design period – Population forecasting methods and their suitability – Intake structures – Site selection.  **UNIT – II**  **WATER QUALITY:** Need for protected water supply –Water quality – Characterization – Water quality standards – Water-borne diseases.  **CONVENTIONAL TREATMENT OF WATER:** General outline of conventional water treatment units and their functions – Theory of aeration – Aeration methods –Principles and design of sedimentation – Coagulation, flocculation and clarification.  **UNIT – III**  **FILTRATION:** Theory of filtration – Types of filters – Working and design of slow and rapid sand filters – Operational troubles in filters.  **UNIT – IV**  **DISINFECTION:** Disinfection–Types of disinfectants – Theory of chlorination – Types of chlorination – Forms of application – Break point chlorination.  **UNIT – V**  **ADVANCED TREATMENT METHODS:** Removal of salinity – Adsorption technique – Removal of arsenic–Ion exchange process – Removal of hardness – Chemical oxidation and precipitation – Removal of Iron, manganese and fluorides – Membrane process.  **UNIT – VI**  **CONVEYANCE SYSTEM:** Systems of conveyance of water – Pipe materials Hydraulics of flow in pipes.  **WATER DISTRIBUTION:** Requirements of water distribution–Components–Service reservoirs– Layout of distribution networks–Design of pipe networks–Hardy cross and equivalent pipe method–Pipe joints–Valves–House service connections. | |
| **Textbooks**  **and**  **References** | **TEXTBOOKS:**   1. S.K. Garg, *Water supply engineering*, Khanna publishers, 33rd edition, 2019. 2. B.C. Punmia, *Water supply engineering*, Laxmi publications, 2nd edition, 2016. 3. G. S. Birdie & J. S. Birdie, *Water Supply and Sanitary Engineering*, Dhanpat Rai publishing company, 9th edition, 2018.   **REFERENCE BOOKS:**  1. Dr. P.N. Modi, *Water Supply Engineering*, Standard book house, 5th edition, 2018  2. H. S. Peavy, Donald Rowe, George Tchobanoglous, *Environmental Engineering*, McGraw Hill Education,1stedition, 2017. | |

**CO-PO Mapping:** 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

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|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 3 | 3 | 1 | - | 2 | 1 | - | - | - | - | 2 | 2 |
| **CO2** | 3 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | - | 3 | 1 |
| **CO3** | 2 | 1 | 3 | 2 | 2 | - | 1 | - | - | - | 2 | 3 |
| **CO4** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | - | 2 | 3 |
| **CO5** | 2 | 1 | 2 | - | 1 | 2 | 1 | - | - | - | 3 | 2 |
| **CO6** | 3 | 2 | 2 | - | 1 | - | - | - | 1 | - | 2 | 2 |