**19CE4104 – ENVIRONMENTAL ENGINEERING-II**

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| **Course Category** | Professional Core | **Credits** | 3 |
| **Course Type** | Theory | **Lecture - Tutorial - Practical** | 2 - 1 - 0 |
| **Prerequisite** | Environmental Engineering-I | **Sessional Evaluation** | 40 |
| **Semester End Exam Evaluation** | 60 |
| **Total Marks** | 100 |

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| **Course Objectives** | 1. To explain the sources of wastewater and to design sewers depending upon the hydraulic elements 2. To classify the characteristics of wastewater mainly about BOD and its importance in wastewater analysis. 3. To interpret the functions and design of each unit in the primary sewage treatment plant. 4. To demonstrate the principles and design of secondary sewage treatment plant. 5. To explain different tertiary treatment methods and sludge management. 6. To classify different effluent disposal methods and design of septic tank. | |
| **Course Outcomes** | CO1 | Identify the sources of wastewater and materials for sewer design. |
| CO2 | Determine the characteristics of domestic wastewater. |
| CO3 | Apply the principles and design of preliminary, primary treatment of domestic wastewater. |
| CO4 | Apply the principles and design of secondary treatment of domestic wastewater. |
| CO5 | Demonstrate the sludge processing and management and importance of the tertiary sewage treatment. |
| CO6 | Identify various effluent disposal methods and design a septic tank. |
| **Course**  **Content** | **UNIT – I**  **WASTEWATER COLLECTION AND ESTIMATION:** Sanitation **–** Systems of sanitation Sewerage – Systems of sewerage – Sources of wastewater – Sewage and storm water estimation **–** Hydraulic design of sewers – Different materials used for sewers – Shapes of sewer – Sewer appurtenances.  **UNIT – II**  **CHARACTERISTICS OF DOMESTIC WASTEWATER:** Characteristics of sewage –Physical, chemical and biological –BOD equation –Factors affecting the BOD - Population equivalent – Relative stability.  **UNIT – III**  **PRIMARY SEWAGE TREATMENT:** Layout and general outline of wastewater treatment plant – Function of each unit –Principles and design of screens – Grit chambers – Primary settling tanks.  **UNIT – IV**  **SECONDARY SEWAGE TREATMENT:** Principles and nutritional requirement of biological treatment system – Factors affecting biological treatment – Working principles and constructional details of High rate Trickling filter – Activated sludge process – Oxidation/Stabilization pond – Oxidation ditch.  **UNIT – V**  **SLUDGE MANAGEMENT:** Sludge – Characteristics and types – Sludge treatment –Thickening **–**Stabilization –Conditioning – Dewatering –Drying/Incineration – Sludge utilization and disposal.  **TERTIARY SEWAGE TREATMENT:** Removal of nitrogen and phosphorus – Refractory organic – Heavy metals – Suspended solids and pathogenic bacteria.  **UNIT – VI**  **EFFLUENT DISPOSAL:** Methods – Dilution – Self-purification of surface water bodies – Oxygen sag curve – Marine disposal – Land disposal – Sewage farming  Working principle and design of septic tank – Septic tank effluent disposal system –Disposal standards. | |

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| **Textbooks**  **and**  **References** | **TEXTBOOKS:**   * + - 1. S.K. Garg, *Sewage Disposal and Air Pollution Engineering – Environmental Engineering,* Khanna Publishers, Vol. II, 37th edition, 2019.       2. B.C. Punmia, *Wastewater Engineering – Environmental Engineering II*, Laxmi publications, 2nd edition, 2016.       3. Metcalf and Eddy, *Waste water Engineering Treatment and Reuse*, McGraw Hill education, 4th edition, 2017.   **REFERENCE BOOKS:**  G.S Birdie and J.S Birdie, *Water supply & Sanitary engineering*, Dhanpat rai publishing company, 2010.   * + - 1. H.S. Peavy, Donald Rowe and George Tchobanoglous, Environmental *Engineering*, McGraw Hill Education,1st edition, July 2017.       2. P. N Modi, *Sewage Treatment & Disposal & Waste Water Engg. Vol. II,* Standard Book House publication, 15th edition, 2015. |

**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** | 1 | - | - | 2 | - | 2 | 1 | - | - | - | - | 2 |
| **CO2** | 2 | 2 | 1 | 2 | - | - | - | - | - | - | 1 | 1 |
| **CO3** | 3 | 1 | 2 | 1 | 1 | - | - | - | - | - | 1 | 1 |
| **CO4** | 3 | 1 | 2 | 1 | 1 | - | - | - | - | - | 1 | - |
| **CO5** | 2 | 1 | 2 | 1 | 1 | - | - | - | - | - | 1 | 1 |
| **CO6** | 3 | - | 2 | 1 | 1 | - | - | - | - | - | 1 | 1 |