**20CE3203 – ENVIRONMENTAL ENGINEERING**

**(Civil Engineering)**

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| **Course Category** | Professional Core | **Credits:** | 3 |
| **Course Type** | Theory | **Lecture - Tutorial - Practical** | 3 - 0 - 0 |
| **Prerequisite** | Engineering Chemistry and Fluid Mechanics | **Sessional Evaluation** | 40 |
| **Semester End Exam Evaluation** | 60 |
| **Total Marks** | 100 |

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| **Course Outcomes** | CO1 | Identify the sources of water and wastewater and determine the quality. Forecast the population for water demand and estimate the wastewater flows. |
| CO2 | Identify the intake structures; Analyze and design pipe network system. |
| CO3 | Design circular sewers; Select materials and appurtenances for sewers. |
| CO4 | Understand the methods of water treatment |
| CO5 | Understand conventional wastewater treatment methods. |
| CO6 | Understand the sludge treatment methods; Select proper effluent disposal method and design a septic tank. |
| **Course**  **Content** | **UNIT I**  **SOURCES, QUALITY AND QUANTITY PERSPECTIVES OF WATER AND WASTEWATER:** Sources, Characteristics - physical, chemical and biological, water demands – types and factors affecting water demand, fluctuations in rate of water demand, design period, population forecasting methods, estimation of dry weather flow and wet weather flow.    **UNIT II**  **COLLECTION AND CONVEYANCE OF WATER:**Intakes, types of Intakes, factors governing selection of location for intakes.  **DISTRIBUTION SYSTEM:**Requirements of a good distribution system, methods of distribution, systems of supply of water, Distribution reservoirs, layout of distribution system, design and analysis of pipe networks of distribution system – Hardy cross method.  **UNIT III**  **HYDRAULIC DESIGN OF SEWERS:**Hydraulic formulae for design of circular sewers, minimum and maximum velocity of flow in sewers.  **SEWER MATERIALS AND APPURTENANCES:**Factors affecting the selection of material, materials for sewers, shapes of sewers, valves and joints, sewer appurtenances.  **UNIT IV**  **WATER TREATMENT METHODS:**General layout of water treatment plant, Aeration, Sedimentation, Sedimentation aided with Coagulation, Filtration – Rapid sand filters, Disinfection – methods, Chlorination – types and forms, Membrane processes, Ion exchange process.  **UNIT V**  **CONVENTIONAL WASTEWATER TREATMENT:**General layout of wastewater treatment plant,**Primary treatment of sewage:**Screening, Grit Chambers, Sedimentation, Sedimentation aided with coagulation.  **SECONDARY TREATMENT OF WASTEWATER:**Activated sludge process, Trickling filters, Oxidation Pond.  **UNIT VI**  **SLUDGE MANAGEMENT:**Sludge - Types, Sludge treatment – Thickening, Stabilization/Digestion, Conditioning, Dewatering – Drying/Incineration, Sludge disposal methods.  **EFFLUENT DISPOSAL:**Methods – Dilution, Marine disposal, Land disposal, Self-purification of water bodies, Oxygen Sag Curve, Sewage Sickness.  Design of septic tank, Septic tank effluent disposal methods. | | |
| **Textbooks**  **and**  **References** | **TEXTBOOKS:**  1. S.K. Garg, *Water supply engineering – Environmental Engineering I),* Khanna Publishers,33rd edition, 2019.  2. B.C. Punmia, *Wastewater engineering – environmental engineering II*, laxmi publications, 2nd edition, 2016.  3. S.K. Garg, *Sewage Disposal and Air Pollution Engineering* – Environmental Engineering (Vol.II), Khanna Publishers, 37th edition, 2019.  **REFERENCES:**  1. Metcalf & Eddy, Inc., *Waste water Engineering Treatment and Reuse*, McGraw Hill education, 4rth edition, 2017.  2. Ruth F. Weiner and Robin A. Matthews, *Environmental Engineering*, Butterworth- Heineman. Publishers, 4th edition 2003.  3. B.C. Punmia, *Water supply engineering - Environmental engineering I*, laxmi publications, 2nd edition, 2016. | | |

**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** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 2 | 2 | - | 1 | - | - | 1 | 2 | 1 | 2 | - | 1 | - | 1 | 2 |
| **CO2** | 2 | 2 | 2 | 1 | - | - | - | 1 | 2 | 1 | 1 | 1 | 1 | 1 | - |
| **CO3** | 2 | 2 | 2 | - | - | 1 | 1 | 1 | 1 | 1 | - | 1 | - | 1 | - |
| **CO4** | 1 | 1 | 1 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | - | 1 | - | 1 | - |
| **CO5** | 1 | 1 | 1 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | - | 1 | - | 1 | - |
| **CO6** | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 3 | 1 | 1 | - | 1 | - | 1 | - |