**17CE4XO6 – BUILDING PLUMBING SERVICES**

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| **Course Category** | Open Elective | **Credits:** | 3 |
| **Course Type** | Theory | **Lecture - Tutorial - Practical:** | 3 - 0 - 0 |
| **Prerequisite** | Environmental Engineering – I & II, Water Resources Engineering and Solid Waste Management. | **Sessional Evaluation**  | 40 |
| **Semester End Exam Evaluation** | 60 |
| **Total Marks:** | 100 |

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| **Course Objectives** | 1. To know the different types of plumbing systems, fixtures, pipe fittings and water treatment methods.
2. To learn the about study of internal and external drainage system of various buildings.
3. To study various disposal techniques and treatment methods for waste water.
4. To study various principles of storm water drainage and rain water harvesting system.
5. To learn how to store, collect and transfer the solid waste from generation place to disposal site.
6. To study the layout design and details of sewage and drainage systems for different building types.
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| **Course Outcomes** | CO1 | Estimate the water requirements for various building types based on Indian Standards. |
| CO2 | Analyze the internal and external drainage system of various buildings. |
| CO3 | Understand disposal systems and modern types of sewage treatment plants. |
| CO4 | Understand the principles of storm water drainage and recycling of water. |
| CO5 | Analyze solid waste management practices and modern renewable energy systems. |
| CO6 | Design sewage and drainage system for different building types. |
| **Course****Content** | **UNIT - I****WATER SUPPLY:** Sources, demand, treatment and distribution of water. Sources of water supply, Plumbing system types for various buildings. Quality of potable water. Calculation of water requirements for various building types based on Indian standards (BIS). Water treatment methods– Screening, Aeration, Sedimentation, Filtration, Disinfection, Softening. Storage and distribution of water. Choice of pipe materials, types of fixtures and fittings.**UNIT - II****SANITATION I:** Sanitary pipes, fittings and fixtures- Layout and design Principles of sanitation, Study of Indian standards and plumbing by-laws (NBC). Introduction to various sanitary Pipes, joints, fittings and fixtures, their function, placement and constructional details. Study of internal & external drainage system of various buildings including small residences, apartments, public buildings etc. Single stack system, one pipe and two pipe systems, testing of house drains, Gradients used in laying drains and sewers, Self-cleaning and non-scoring velocities for drain pipes,**UNIT - III****WASTE WATER TREATMENT AND DISPOSAL METHODS:** Study of Traps, Inspection chambers, Manholes, Septic tanks, Soak pits, and Public sewage line. Study of Disposal systems for domestic effluent from fitting to sewer line. Study of low cost sanitary systems (sulabh complexes) and other CBRI details. Waste water – Sewage disposal, primary treatment, secondary treatment and tertiary treatment. Modern types of Sewage Treatment Plants.**UNIT - IV****STORM WATER DRAINAGE & RAIN WATER HARVESTING:** Principles of storm water drainage. Types of drain pipes. Storm water gutter / Storage sumps. Study of storm water disposal at site and settlement level. Rain water harvesting system. Recycling of water.**UNIT - V****SOLID WASTE MANAGEMENT:** Solid waste, collections, treatments and disposal Prevalent SWM practices and deficiencies: Storage of waste at source, collection, segregation, transportation of waste. Disposal of solid wastes: Sanitary land filling, Composting, Incineration, Pyrolysis – advantages and limitations. Biogas system and Modern renewable energy system.**UNIT - VI****APPLICATIONS:** Layout design and construction Layout design and details of water supply distribution system in a Campus. Layout design and details of sewage and drainage system for different building types. Storm water drainage and rain water harvesting system design for a building project. |

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| **Textbooks****and****References** | **TEXT BOOKS AND REFERENCES:**1. B.C. Punmia, “Waste Water Engineering”, Laxmi Publications. 20092. S.J. Arceivala, “Waste Water Treatment for Pollution Control”, Tata McGraw Hills  Publication.2008.3. K.N. Duggal,”Elements of Environmental Engineering”, Chand & Co. 20104. “Uniform Illustrated Plumbing Code – India (UIPC-I)”, Indian Plumbing  Association 2014.5. Charanjeet S. Shah; Water Supply and Sanitation; Galgotia Publication 20156. H.S. Bhatia; Environmental Services (Plumbing); Galgotia Publication. |