

## 19CE4601E – SANITARY ENGINEERING

Course Category:	Program Elective	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	19CE3404- Environmental Engineering 19BS1103- Chemistry of Materials	Continuous Evaluation:	30
		Semester End Evaluation:	70
		Total Marks:	100

### Course Outcomes

Upon successful completion of the course, the student will be able to:

<b>CO1</b>	Understand the different sewerage systems and the types of sewerage appurtenances	K4
<b>CO2</b>	Analyze the characteristics of sewage	K3
<b>CO3</b>	Treat the sewage by using various treatment units before disposal	K4
<b>CO4</b>	Identify the miscellaneous methods for treatment of sewage	K2
<b>CO5</b>	Understand sanitary Installations and disposal techniques of the sewage	K2

### Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	2			2								2	1
<b>CO2</b>	3	2			2								2	1
<b>CO3</b>	3	2	2		1								2	1
<b>CO4</b>	3	2	2		2								2	1
<b>CO5</b>	3	2	2		2			2					2	1

1- Low

2-Medium

3-High

### Course Content

<b>UNIT-1</b>	<p><b>INTRODUCTION TO SANITARY ENGINEERING:</b> Sanitation, conservancy and water carriage system, sewerage systems, relative merits.</p> <p><b>SANITARY SEWAGE AND STORM SEWAGE:</b> Quantity of sanitary sewage, factors affecting sanitary sewage, determination of quantity of sanitary sewage, factors affecting storm water sewage, determination of quantity of storm water sewage, sewers, sewer appurtenances, sewage pumping, types of sewers, design of sewers, construction; testing, sewer appurtenances manholes, drop man holes, lamp holes, flushing tanks, grease and oil traps, inverted siphons, street inlets, catch basins, storm water regulators, sewage pumping, types of pumps.</p>	<b>CO1</b>
<b>UNIT-2</b>	<p><b>QUALITY AND CHARACTERISTICS OF SEWAGE:</b> Characteristics of sewage, decomposition of sewage, BOD, COD, physical and chemical analysis of sewage.</p> <p><b>NATURAL METHODS OF WASTEWATER DISPOSAL:</b> Trickling filters and ASP trickling filters, operational problems and remedies, activated sludge process vs trickling filter process, methods of aeration, diffused air system, mechanical aeration, combined system, sludge bulking, sludge volume index.</p>	<b>CO2</b>
<b>UNIT-3</b>	<p><b>PRIMARY TREATMENT OF SEWAGE:</b> Screens, grit chamber, grease traps, skimming tanks, sedimentation tanks.</p> <p><b>SECONDARY TREATMENT OF SEWAGE:</b> Sanitary requirements and maintenance of the public utility services like schools, hospitals, offices and in other public buildings.</p>	<b>CO3</b>

<b>UNIT-4</b>	<b>MISCELLANEOUS METHODS OF SEWAGE TREATMENT:</b> Septic tank, septic tank effluent disposal, Imhoff tank introduction, oxidation ditch, stabilization pond (oxidation pond) <b>TYPES OF LAGOONS AND RBC:</b> Aerobic lagoons, anaerobic lagoons, facultative ponds, Rotating Biological Contractor. (RBC)	<b>CO4</b>
<b>UNIT-5</b>	<b>SLUDGE TREATMENT AND DISPOSAL:</b> Anaerobic sludge digestion process, factors effecting sludge digestion, sludge digestion tanks, high-rate digestion, sludge thickening, sludge conditioning, methods of dewatering the sludge, methods of sludge disposal <b>SANITARY INSTALLATIONS:</b> Sanitary fittings, plumbing systems, single stack system, one pipe and two pipe systems, design of building drainage, maintenance of sanitary installations	<b>CO5</b>
<b>Learning Resources</b>		
<b>Text Books</b>	1. .K. Garg, Environmental Engineering vol-II Sewage Disposal and Air Pollution Engineering, Khanna Publishers, 2008. 2.K.N. Duggal, Elements of Public Health Engineering,4/e, S Chand, 1988	
<b>Reference Books</b>	1.S.C. Rangwala, Water Supply and Sanitary Engineering,1/e, Charotar, 2005. 2.S.R. Kshirasagar, Sewage and Sewage Treatment, 3/e, Roorkee Publishing House, 1968. 3.Met Calf and Eddy, Wastewater Engineering Treatment, Disposal and Reuse,Tata McGraw Hill, 2010. 4.M.J. Hammer, Water and Wastewater Technology, 2/e,John Wiley and Sons,1996.	
<b>e-Resources&amp; other digital material</b>	<a href="https://nptel.ac.in/syllabus/105105048/">https://nptel.ac.in/syllabus/105105048/</a>	