



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**

**Subject Code: 3160513**

**Semester – VI**

**Subject Name: Wastewater Engineering**

**Type of course:** Open elective course

**Prerequisite:** None

### **Rationale:**

To provide an idea on the challenges in the field of water management with a perspective on wastewater management. Students will learn about the problems and its solution perspective on waste water treatment methods, sewage and sludge disposal. Different types of primary, secondary and advances treatment methods should be known by the student. This subject will guide students in the same direction. The objectives of this course are to help the students develop the ability to apply the basic understanding of physical, chemical and biological phenomena for successful design, operation and maintenance of sewage treatment plants.

### **Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

### **Content:**

Sr. No.	Content	Total Hrs	% weightage
1	<b>Characterization and treatment of wastewater</b> Introduction: Wastewater flow and its characteristics, Wastewater collection systems, Estimation and variation of wastewater flows. Problems of industrial wastewaters, sampling protocol, equalization, neutralization, proportioning processes, volume and strength reduction. Preliminary, primary, secondary and tertiary wastewater treatment processes. Theory and design of screens, grit chambers, sedimentation, coagulation, flocculation	07	15
2	<b>Activated sludge treatment for wastewater</b> Physico-chemical and biological treatment strategies and their evaluation, Theory of activated sludge process (ASP), extended aeration systems, trickling filters (TF), aerated lagoons, stabilization ponds, oxidation ditches, sequential batch reactor, rotating biological contactor, etc., Mass balancing in ASP and TF and their design.	10	25
3	<b>Anaerobic treatment of wastewater</b> Anaerobic treatment process, Effects of pH, temperature and other parameters on anaerobic treatment, Concept of anaerobic contact process, anaerobic filter, anaerobic fixed film reactor, fluidized bed and expanded bed reactors and up flow anaerobic sludge blanket (UASB) reactor.	08	15



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4	<b>Planning for wastewater treatment and its reclamation</b> Indian standards for disposal of treated wastewaters on land and in natural streams, Agricultural irrigation, Ground water recharge, Treated wastewater reclamation and reuse, Introduction to duckweed pond, vermiculture and root zone technology for wastewater treatment, Special treatments, Recent technologies of treatment.	10	20
5	<b>Industrial wastewater treatment</b> Study on wastewater generation points, wastewater characteristics, process flow sheets, wastewater treatment scheme for sugar, textile, steel, paper/pulp, oil refinery, pharmaceutical, dyes and intermediates industries.	10	25

**Suggested Specification table with Marks (Theory): (For BE only)**

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	15	15	5	5	0

**Legends: R: Remembrance; U: Understanding; A: Application; N: Analyze; E: Evaluate; C: Create and above Levels (Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### Reference:

#### Text Books

1. Economics of Water Resources Planning, James L.D. and Lee R.R., McGraw-Hill, Newyork, 1971.
2. Water Resources Handbook, Mays L.W., McGraw-Hill 1996.
3. Design of Water-Resource Systems, Maass A., Hufschmidt M.M., Dorfman R., Jr. Thomas H.A., Marglin, S.A., Fair G.M., Harvard University Press, 1962.
4. Environmental Engineering (Vol. I) Water Supply Engineering, Garg S.K., Khanna Publishers, 1977.
5. Water Supply and Wastewater Engineering, Raju B.S.N., Tata McGraw-Hill, New Delhi, 1995.
6. Water Supply and Sanitary Engineering, Birdie G.S. and Birdie J.S. Dhanpat Rai Publishing Company Private Ltd. New Delhi, 2014.
7. Wastewater Engineering: Treatment Disposal Reuse, Metcalf & Eddy, McGraw-Hill, 1979
8. Water & Wastewater Engineering Volume II, Fair G.M., Geyer J.C., Okun D.A., John Wiley & Sons Ltd. Newyork, 1968.

#### Other References:

1. Water Resources Systems Planning and Management, Chaturvedi M.C., Tata McGraw-Hill, India, 1992.
2. Introduction to Hydrology, Viessman W., Thomas Y. Crowell, Harper and Row, NY, 1972.



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3. Handbook of Applied Hydrology, Chow V.T., McGraw Hill Book Company, New York, 1964.
4. Engineering Hydrology, Subramanya K., Tata McGraw Hill Company Ltd., New Delhi, 1994.
5. Hydrology and Water Resources Engineering, Patra. K.C., Narosa Publishing House, New Delhi, 2008.

List of Open Source Software/learning website: [www.nptel.iitm.ac.in/courses/](http://www.nptel.iitm.ac.in/courses/)

### Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	To understand the basic knowledge about the wastewater and its treatment processes	15
CO-2	To understand the activated sludge process for the treatment of wastewater	20
CO-3	To understand the anaerobic process for the treatment of wastewater	15
CO4	To understand the standards for wastewater treatment, disposal and its reclamation	15
CO-5	To study the wastewater treatment scheme for various industries	20

**List of Tutorials:** Students can select any type of wastewater treatment. Each group of students are expected to create a way to utilize wastewater treatment method and sludge disposal process in innovative way and prepare report of project assigned to his/her group. In addition, each group is expected to give a power point presentation during the semester. The presenter will be selected randomly just prior to the presentation.

**List of Open Source Software/learning website:** Students can refer to video lectures available on various websites including NPTEL. Students can refer to the CDs which are available with some reference books for the solutions of problems using softwares. Students can develop their own programs for the solutions using excel, ChemCAD and other simulation softwares.