SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology
Civil Engineering

B.Tech. III Semester VI

Subject Name : Water and Wastewater Treatment Technologies **Subject Code:** BTCL13602

Type of course : PCC
Prerequisite : Environmental Engineering (BTCL13503)
Rationale : Students will understand principal and operations for water and wastewater Treatment options.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
3	0	2	4	60	25	15	30	20	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2**: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE**: Term End Examination **TEP**: Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/ viva on practical skills learned in course.

Content:

Sr. No.	Content	Total Hrs	Module Weightage
1.	**Introduction to water treatment:** Water Demand, Population forecasting, need of water treatment, Estimation of raw water discharge for treatment plant, Design period, and factors considered for selection of design period. Treatment plant site selection, factors considered, future stages of expansion, Hydraulic Flow Diagram	8	15%
2.	**Collection and Conveyance:** Collection and conveyance of raw water from source: Intakes, types of intakes, conveyance of water, design of pumps and gravity and rising mains	7	10%

PCC: Professional Core course

3.	**Water Treatment Plant:** Water treatment processes and treatment units: Plain sedimentation, aeration, sedimentation tank & its design, sedimentation with coagulation, types of coagulants, optimum dose of coagulants, mixing devices, design of flocculation unit. theory of filtration, types of filters and their comparison, design of rapid sand filter, washing of filter, methods of disinfection, methods of removing hardness, Computation of dose of chemicals for removal of hardness	10	25%
4.	**Distribution System:** Layout of distribution networks, methods of water distribution, storage capacity of ESR and underground service reservoir.	5	10%
5.	**Introduction to wastewater treatment:** Unit Operations and processes for Sewerage System: Physical unit operation-Screening, flow equalization, mixing, flocculation, sedimentation. Chemical unit processes-Chemical precipitation. Biological unit processes: classification-Aerobic, anaerobic and anoxic, attached and suspended growth treatment processes, Nutrient removal, Sludge treatment.	10	25%
6.	**Wastewater Treatment Plant:** Design of Facilities for Physical and Biological Treatment of Waste Water: Design of racks, screens, grit chamber, aeration units, sedimentation tanks, activated sludge and trickling filter processes, rotating biological contactors, sludge digesters and drying beds	5	15%

Suggested Specification table with Marks (Theory):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
15	15	20	20	15	15

Legends: R: Remembrance**; U:** Understanding**; A:** Application**, N:** Analyze and **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 Books:

PCC: Professional Core course

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Water Supply and Sanitary Engineering	G.S. Birdie and J.S. Birdie	Dhanpat Rai Publishing Co.- NewDelhi	2018	--
2	Wastewater Engineering, Treatment and Reuse,	Metcalf and Eddy	Tata McGraw-Hill	2002	4th
3	Water & Waste Water Engineering by Water Treatment Plants	Fair and Gayer. C.A. Sastry,	Narosa Publishing House,	2010	3rd
4	Water Treatment Unit Processes – Physical and Chemical'	Hendricks. D	CRC Press	2006	1st
5	Environmental Engineering volume 1 and 2	B.C. Punamia	laxmi publication	--	2nd
6	Wastewater Treatment: Concepts And Design Approach	R. A. Christian	Prentice-Hall Of India Pvt. Limited	2013	2nd

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Identify pertinent forcing criteria and principle of physical and chemical characteristics and standards. *(U,R - Cognitive Level)*	20
CO-2	Analyze the basics principle and design of various physical, chemical processes. *(U,N - Cognitive Level)*	20
CO-3	Design the water supply and water treatment systems. *(E, A, C - Cognitive Level).*	30
CO-4	Design the wastewater treatment systems and sludge treatment. *(E,A,C - Cognitive Level)*	30

Mapping with POs:

PCC: Professional Core course

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	1	2	1	3	2	3	1	1	1	1	2	2	1	1	2
CO-2	2	2	2	3	3	2	1	1	1	1	2	1	1	2	3
CO-3	1	2	1	3	2	3	1	1	1	1	2	2	1	1	2
CO-4	2	2	2	3	3	2	1	1	1	1	2	1	1	2	3
Rationale*	**6**	**8**	**6**	**12**	**10**	**10**	**4**	**4**	**4**	**4**	**8**	**6**	**4**	**6**	**10**

Rationale*: Students will be able to learn principle and design of water and wastewater treatment technologies

FOR LAB SESSIONS
List of Experiments:

- Introduction to Standards, collection and preservation of samples, sampling techniques and laboratory equipment
- Determination of Turbidity and Jar test.
- Determination of dissolved oxygen and BOD.
- Determination of COD of given sample.
- Treatability studies of domestic wastewater (Aeration for 24, 48, 72 hrs. Finding influent and effluent COD, SVI, MLSS conc.)
- Design of Water treatment units also prepares working/non working models.
- Designs of Wastewater treatment units (Primary and Secondary units) also prepare a working/non working model.

Major Equipment:

- Jar Test Apparatus
- Titration Apparatus
- pH meter
- Conductivity Meter
- Hot Air Oven
- BOD Incubator
- Dissolved Oxygen Meter

PCC: Professional Core course

- Turbidity meter
- Microscope
- Spectrophotometer

List of Open learning website: https://nptel.ac.in/courses/105/107/105107207/

https://nptel.ac.in/courses/105/106/105106119/

PCC: Professional Core course