



Syllabus
Gyanmanjari Science College
Semester-7 (B.Sc)

Subject: Water & Soil Analysis and Treatment -BSCCM17403

Type of course: Major

Prerequisite: Students should have basic knowledge of environmental science, chemistry, and biology. Understanding of water, soil, and environmental pollution concepts will help in learning this course.

Rationale: This course provides knowledge of advanced water and soil analysis, treatment technologies, and sustainable management practices. It helps students understand environmental pollution control, resource conservation, and modern remediation techniques used in industrial and agricultural applications.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P		C	SEE		CCE		
			Theory		Practical	MSE	LWA/V	ALA	
3	0	2	4	75	25	30	20	50	200

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; SEE - Semester End Evaluation; MSE- Mid Semester Examination; LWA - Lab Work Assessment; V – Viva voce; CCE- Continuous and Comprehensive Evaluation; ALA- Active Learning Activities.

3 Credits * 25 Marks = 75 Marks (each credit carries 25 Marks) Theory
 1 Credits * 25 Marks = 25 Marks (each credit carries 25 Marks) Practical
 SEE 100 Marks will be converted in to 50 Marks
 CCE 100 Marks will be converted in to 50 Marks
 It is compulsory to pass in each individual component.



Course Content:

Unit No	Course Content	Hrs	% Weightage
1	<p>(A) Advanced Water Analysis Sources and quality requirements of water (drinking & industrial), Advanced water sampling and preservation techniques , Physical analysis: turbidity, conductivity, TDS, Chemical analysis: pH, alkalinity, hardness ,Chlorides, sulphates, nitrates, fluorides ,Biological analysis: coliform bacteria , Oxygen-related parameters: DO, BOD, COD and their environmental significance</p> <p>(B) Water Quality Monitoring & Standards Water quality criteria (drinking, irrigation, industrial use) , National & international standards (BIS, WHO) ,Water quality index (WQI) concept.</p>	13	25%
2	<p>Modern Water Treatment Technologies Principles and design of water treatment plants , Coagulation and flocculation mechanisms , Conventional vs modern treatment systems , Membrane technologies: Reverse Osmosis (RO), Ultra filtration (UF) , Adsorption techniques (activated carbon) , Advanced oxidation processes (AOP), Desalination methods , Industrial effluent treatment and recycling, Zero Liquid Discharge (ZLD) concept</p>	12	25%
3	<p>Soil Analysis and Fertility Evaluation Soil formation and classification , Soil health indicators and soil quality index , Advanced soil sampling and preparation , Physical properties: texture, structure, bulk density, porosity , Chemical properties: pH, EC (electrical conductivity) , Cation exchange capacity (CEC) , Nutrient analysis: macronutrients (N, P, K) and micronutrients , Soil fertility evaluation methods .</p>	10	25%
4	<p>Soil Treatment, Remediation and Sustainable Management Soil reclamation techniques: Acidic soil treatment (liming), Alkaline soil treatment (gypsum method) , Use of organic manure, compost and biofertilizers Bioremediation (use of microorganisms) , Phytoremediation (use of plants) , Integrated nutrient management (INM) , Organic farming and sustainable agriculture practices , Soil health monitoring and sustainability practices , Effects of soil pollution on environment and human health .</p>	10	25%



Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	Water Source Identification Activity :- Students collect information about drinking water, groundwater, river water, and industrial water sources, from their local area and prepare a comparison chart based on quality parameters and upload them on the GMIU web portal	10
2	ZLD Case Study Presentation:- Students study industrial ZLD systems and present case studies with process flow diagrams and upload them on the GMIU web portal and upload them on the GMIU web portal	10
3	Integrated Nutrient Management (INM) Planning :- Students prepare nutrient management plans combining organic and inorganic fertilizers for different crops and upload them on the GMIU web portal	10
4	Organic Farming Survey:- Students conduct surveys of nearby organic farms and prepare reports on farming methods and upload them on the GMIU web portal	10
5	Attendance	10
Total		50

List of Practical:

Sr.no	Description	Unit no.	Hrs
1	1: Electrical Conductivity (EC) & Total Dissolved Solids (TDS) To determine Electrical Conductivity (EC) and Total Dissolved Solids (TDS) of water.	1	3
2	pH Determination :-To determine the pH of the water sample.	1	3
3	Alkalinity :-To determine alkalinity of water sample.	1	3
4	Total Hardness (EDTA Method) :-To determine total hardness of water.	2	3
5	Chloride (Argentometric Method):-To determine chloride content in water.	2	3
6	Soil Sampling & Preparation:-To collect and prepare soil samples for analysis.	3	3



7	Soil Structure & Color :-To study soil structure and color.	3	3
8	Bulk Density & Porosity:-To determine bulk density and porosity of soil.	3	3
9	Soil pH & EC:-To determine soil pH and EC.	4	3
10	Organic Carbon (Walkley-Black Method) :-To determine organic carbon in soil.	4	3
Total			30

Suggested Specification table with Marks (Theory):75

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	20%	20%	40%	20%	-	-

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.

Course Outcome:

After learning the course the students should be able to:	
CO1	Analyze and evaluate water quality using standard analytical techniques and guidelines.
CO2	Understand and apply modern water treatment technologies for wastewater treatment and recycling.
CO3	Assess soil properties and determine soil fertility using physical and chemical methods.
CO4	Demonstrate soil treatment, remediation, and sustainable management practices for environmental protection and soil health improvement.

Instructional Method:



The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

- (1) *Standard Methods for the Examination of Water and Wastewater– American Public Health Association*
- (2) *Water Quality Engineering in Natural Systems – David A. Chin*
- (3) *Introduction to Environmental Engineering – Mackenzie L. Davis*
- (4) *Soil Fertility and Fertilizers – John Havlin*
- (5) *Principles of Soil Conservation and Management – Humberto Blanco*

