

GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: Environmental Science & Technology
SUBJECT NAME: Design of Soil Pollution Control System

SUBJECT CODE: 2173511
B.E. Semester: VII

Type of course: Environmental Science & Technology

Prerequisite: A good fundamental knowledge of soil, its characteristic & use, causes of soil pollution, physico-chemical and biological treatment process along with basic design consideration.

Rationale: This subject is intended to make students aware about the basic fundamentals of soil, causes of its pollution and various treatment methods with their basic design aspects.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	1	3	7	70	20	10	20	10	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning;

Content:

Sr. No.	Topic	Teaching Hours	Module Weightage (%)
1.	Basic concept related to Soil Pollution: The soil and its constitution. Functions and land uses. Main causes and the processes that contribute to the degradation of soil quality (erosion, chemical degradation and physical degradation). Sources of pollution (<i>e.g.</i> urban areas, industrial areas, agriculture and livestock, landfills, sewage sludge, municipal solid waste dumps and hazardous waste), Soil quality	10	10
2.	Organic residues as soils fertilizers : Application of sewage sludge to soil: Origins and treatment. Characterization. Assessing the risks associated with its application to soil. Determination of heavy metals in sludge. Adsorption / desorption of	15	25

1	Basic concept related to Soil Pollution	6	3	1	0	0	10
2	Organic residues as soils fertilizers :	6	9	5	2	3	25
3	Heavy metals in soils, Application of pesticides aspects of pollution related to their use, Industrial activity as a source of contamination of soil:	6	9	5	2	3	25
4	Soil remediation technique for removal of inorganic and organic pollutants:	8	10	8	8	6	40

Legends: R : Remembrance ; U = Understanding; A = Application; N= Analyze; E= Evaluate 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:

- Pierzynski, G.M., Sims, J.T., and Vance, G.F. (1994). Soils and Environmental Quality. Lewis Publishers. Florida.
- Alloway, B.J. (Editor) (1995). Heavy Metals in Soils. 2nd Edition. Blackie Academic and Professional. London.
- Schepart, B.S. (Editor) (1995). Bioremediation of Pollutants in Soil and Water, ASTM. Philadelphia.
- McBride, M.B. (1994). Environmental Chemistry of Soils. Oxford University Press. International Edition.
- Kearney, P.C., Roberts, T. (Editors) (1998). Pesticide Remediation in Soils and Water. John Wiley and Sons. International Edition.
- Wise, D.L., Trantolo, D.J., Cichon, E.J., Inyang, H.I., Stottmeister (Editors) (2000). Remediation Engineering of Contaminated Soils. Marcel Dekker, Inc. New York.
- Leschber, R., Davis, R.D., L'Hermite, P. (Editors) (1985). Chemical Methods for Assessing Bio-Available Metals in Sludges and Soils. Elsevier Applied Science Publishers. London.

- Pinto, P.S.S. (Editor) (1998). Environmental Geotechnics. Volume II – Remediation of Polluted Land and Abandoned Landfills. A.A. Balkema/Rotterdam/Brookfield.
- Calvin Rose, An Introduction to the Environmental Physics of Soil, Water and Water Sheds, Cambridge University Press, 2004.
- Paul Nathanail C. and Paul Bardos R., Reclamation of Contaminated Land, John Wiley & Sons Limited, 2004.
- Hari D. Sharma and Krishna R. Reddy, Geo-Environmental Engineering : Site Remediation, Water Contaminant and Emerging Water Management Technologies, John Wiley & Sons Limited, 2004.
- Marcel Vander Perk, Soil and Water Contamination from Molecular to Catchment Scale, Taylor & Francis, 2006.
- William J. Deutsch, Groundwater Geochemistry : Fundamentals and Applications to Contamination, Lewis Publishers, 1997.

Course Outcome: On successful completion of this course unit, the student should be able to:

1. Have knowledge on the different sources of soil pollution as well as the different types of pollutants generated by them.
2. To identify the different types of soil decontamination/remediation methods, their application fundamentals and their major advantages and constraints:
 - I. Constructive techniques versus treatment techniques; In situ versus ex situ techniques;
 - II. Physical, chemical, solidification/stabilization/immobilization, thermal, and biological techniques.

List of Experiments:

Minimum 5 practical to be performed and remaining time should be allotted to open-ended projects/study reports/latest outcomes in technology study:-

PRACTICALS (ANYFIVE):

1	Determination of moisture content
2	Determination of specific gravity
3	Determination of permeability
4	Determination of porosity
5	Grain size analysis: Sieve analysis
6	Determination of Bulk density
7	Determination of soil reaction (pH)
8	Determination of Electrical conductivity
9	Determination of Soil Texture – International Pipette Method (Mechanical
10	Determination of Organic carbon in soil
11	Determination of Calcium carbonate (free lime) in soil
12	Determination of Nitrogen in soil
13	Determination of Phosphorous in soil

Equipment: Glass wares, Weighing balance, Sieve analysis apparatus, Hot air Oven, Ammonical-nitrogen assembly, pH meter, Conductivity meter etc.

Open ended Projects:

- Sampling of Soil
- Physical analysis of Soil
- Chemical analysis of sludge generated from industries

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.