

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

**SOIL AND WATER CONSERVATION ENGINEERING
(Code: 3336305)**

Diploma Programme in which this course is offered	Semester in which offered
Agricultural Engineering	3rd

1. RATIONALE.

Soil and its Engineering Properties are highly important in order to make Civil Engineering Structure safe and serviceable. In , INDIA , from region to region ,Soil has varying properties and characteristics and is subjected to various stresses and problems like the water logging, liquefaction of soil , seepage through soil and settlement of Soil. Students have to study these phenomena of Soil and will have to apply this knowledge to Construction of Structures on soil according to Soil available on the field.

2. COMPETENCY (Programme Outcomes (POs) According to NBA terminology)

The course content should be taught and implemented with the aim to develop required theoretical knowledge & associated practical significance so that they acquire following competencies activities.

1. Comprehend Engineering Properties / characteristics of Soil with respect to Construction and Engineering Applications
2. Determine various properties & parameters of different Soil
3. Evaluate Engineering Properties / characteristics of Soil for their suitability for Engineering Structures.
4. Define soil erosion and how to control soil erosion by various methods.
5. Water logging methods and drainage control.

2. TEACHING AND EXAMINATION SCHEME.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
2	0	2	4	70	30	20	30	

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical;
C – Credit, ESE -End Semester Examination; PA - Progressive Assessment

3. COURSE DETAILS.

Unit	Outcomes (in cognitive domain)	Major Learning Topics and Sub-topics
Unit – I Soil and its properties	1.1 Type of crop suitable for the soil 1.2 Major soils of INDIA	1.1 An introduction to the soil as a natural body, definitions and functions of soil. 1.2 Various constituents of soil and their importance. 1.3 Soil as a medium of plant growth, major soils of India.
Unit– II Properties of soil in relation to plant growth	2.1 Crop water requirement 2.2 Soil moisture holding capacity 2.3 Wilting point of plant 2.4 Chemical properties of soil	2.1 Physical Properties 2.1.1. Soil separates; their physical nature and their classifications (I. S. S. S. & U. S. D. A.). 2.1.2. Soil texture; definition and textural classification of soil (U. S. D. A.). 2.1.3. Soil structure; definition, types and factors affecting soil structure. Bulk density and particle density of soils. Soil consistency. Porosity & void ratio. Degree of saturation. 2.1.4. Soil moisture content (dry basis & wet basis). Method of soil moisture determination viz. gravimetric method. 2.1.5. Retention of soil moisture; maximum retentive capacity, field capacity, permanent wilting percentage, hygroscopic coefficient. 2.1.6 Soil moisture classifications i.e. physical & biological. Available water holding capacity of soil. Soil permeability; definition and importance. 2.1.7. Darcy's law, Coefficient of permeability. Infiltration & Infiltration rate. Soil air & aeration. Soil temperature. Soil tilth & its importance. 2.2 Chemical Properties Soil reaction (PH), Electrical Conductivity

Unit	Outcomes (in cognitive domain)	Major Learning Topics and Sub-topics
		(EC), cation exchange, Sodium adsorption ratio (SAR), Exchangeable sodium percentage (ESP), salt concentration in the soils.
Unit-III Erosion	3.1 Types and effects of erosion 3.2 Classification of erosion	Definition, Classification of erosion viz. Geological & accelerated. agents causing erosion 3.1 Mechanics of Water Erosion 3.1.1 Raindrop erosion, Sheet erosion, Rill erosion, Gully erosion and principle of gully erosion and Classification of gullies. Stream channel erosion 3.1.2 Effects of water erosion, Factors affecting erosion by water. 3.2 Mechanics Of Wind Erosion Processes of saltation, suspension, surface creep. Factors affecting erosion by wind.
Unit-IV Erosion control	4.1 Increase in soil quality 4.2 Increase crop productivity 4.3 Reduces water wastage 4.4 Reuse of surface water in ground water recharge	4.1. Principles of erosion control 4.2. Agronomic and field practices to control erosion by wind & water i.e. Contour farming, strip cropping, tillage etc. 4.3. Terracing to control erosion by water. Types of terraces. Terrace design parameters and planning a terrace system. Bench terraces, types and design parameters. 4.4. Use of bunds to control erosion and design parameters of bunds. Contour bunding. 4.5. Vegetated water ways for the control of erosion. 4.6. Temporary structures for the control of gully erosion, their types and adaptability 4.7. Permanent soil conservation structures viz. Drop spillway, Chute spillway, Drop inlet spillway for the control of erosion; their principles, adaptability, constructional features and material of construction. 4.8. Introduction to the farm ponds, earthen embankments and water harvesting in relation to soil and water conservation, soil conservation through tree and grass cultivation 4.9. Concept of ground water recharge, watershed management

Unit	Outcomes (in cognitive domain)	Major Learning Topics and Sub-topics
Unit-V Salt affected soil and its reclamation	5.1 Identify how much percentage of soil is alkaline/saline 5.2 Factors affecting soil alkalinity and salinity 5.3 Effect of saline and alkaline soil on crop production 5.4 Reclamation methods like leaching and crop rotation are adopted	5.1 Saline, alkaline and acid soils, Reasons and factors of their formation. 5.2 Effect of salinity, alkalinity and acidity on plant growth. Reclamation of these soils and their management.
Unit-VI Water logged soil and their drainage	6.1 water logging causes and effects 6.2 Determines the quantity of water used for plant growth 6.3 Determines the quantity of water wasted in drain 6.4 Proper drainage system is provided	6.1 Water logging , causes of water logging and its effects. Drainage. Types of drainage systems viz. surface and subsurface drainage. Introduction to drainage investigation. Benefits of drainage. Drainage properties of soil. Drainage coefficient. 6.2 Surface drainage -functional components, types (random drain, parallel field drain, parallel open ditch and bedding system used in flat areas and cross slope ditch system used in sloping areas). Introduction to design criteria and design parameters of open ditches. 6.3 Benefits of subsurface drainage. Introduction to investigations for subsurface drainage, different method of subsurface drainage viz. tile drains, mole drains, deep open drains and combination of tile and opened drains.

4. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Soil and its properties	02	02	02	02	06
2	Properties of soil in relation to plant growth	06	02	04	08	14
3	Erosion	02	02	03	00	05
4	Erosion control	04	03	04	04	11
5	Salt affected soil and its reclamation	06	04	03	07	14
6	Water logged soil and its drainage	08	04	06	10	20
	Total	28	17	22	31	70

Legends: R = Remember U= Understand; A= Apply and above levels (Bloom's revised 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.

General Notes:

1. If midsem test is part of continuous evaluation, unit numbers I and II are to be considered.
2. Ask the questions from each topic as per marks weightage. Numerical questions are to be asked only if it is specified. Optional questions must be asked from the same topic.
3. In examination, example of same chapter is to be asked in place of example.

5. SUGGESTED LIST OF EXERCISES/PRACTICALS.

The exercises/practical/experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency. Following is the list of exercises/practical/experiments for guidance.

Sr. No.	Unit No.	Practical Exercises (outcomes in Psychomotor Domain)	Teaching Hours
1	1	To study the various methods to determine soil moisture content	06
2	2	To determine the bulk density using various methods	06
3	3	To study the various types of soil erosion and their control	04
4	4	To study the terracing and bunds for soil erosion control	04
5	4	To study the soil erosion control structures	02
6	4	To study the vegetative water ways for the control of erosion and safe disposal of water	06
		Total	28

7. LIST OF STUDENT ACTIVITIES:

1. Identify the quality of soil: colour, type, grain size
2. Soil investigation and soil exploration

8 SUGGESTED LEARNING RESOURCES**A. List of Books**

Sr No.	Title Of Book	Author	Publication
1	Soil & Water Conservation Engineering	1. Glenni O.Schwav, Richard K. Frevert, Talcott W. Edminster, Kenneth K.Barnes	John Wiley & Sons New York
2	Manual of Soil & Water Conservation Practice	Gurmail Singh	Oxford & IBH Publication co.
3	Soil & Water Conservation Engineering	Suresh R.	Standard Publication
4	Principle of Agricultural Engineering Volume-II	A.M. Michael & T.P. Ojha	Jain brothers.

B. List of Major Equipment/ Instrument

- Hot air oven
- Weighing balance(100kg)
- Pycnometer bottle

C. List of Software/Learning Websites

- <http://www.agricoop.nic.in/dacdivision/mmsoil280311.pdf>
- http://www.nrcs.usda.gov/internet/FSE_DOCUMENTS/stelprdb1044820.pdf
- <http://nptel.ac.in/courses/105101084/>