

# SYLLABUS

## Soil Science and Agril. Chemistry

Sr. No.	Semester	Course No.	Credits	Course Title
1	I	SSAC 111	3(2+1)	Fundamentals of Soil Science
2	IV	SSAC 242	2(1+1)	Problematic Soils and their Management
3	V	SSAC 353	3(2+1)	Manures, Fertilizers and Soil Fertility Management
4	VI	ELE SSAC 364	3(2+1)	Agrochemicals
5	VIII	ELM SSAC 485	10(0+10)	Soil, Water, Plant and Fertilizer Analysis
6	VIII	ELM SSAC 486	10(0+10)	Agricultural Waste Management

<b>Course :</b>	SSAC 111		<b>Credit:</b>	3(2+1)	<b>Semester-I</b>
<b>Course title:</b>	Fundamentals of Soil Science				

### Syllabus

#### Teaching schedule

##### a) Theory

Lecture	Topic	Weightage (%)
1 & 2	History and development of soil science, its scope and importance. Soil as natural body, pedological and edaphological concept of soil.	5
3 & 4	Soil genesis: Soil forming rocks and minerals.	6
5 & 6	Weathering of Rocks and Minerals.	6
7 & 8	Processes and factors of soils formation.	5
9	Soil profile, components of soil.	5
10 & 11	Soil physical properties: Soil texture, structure, density and porosity.	5
12	Soil colour, consistency and plasticity.	3
13 ,14	Elementary knowledge of soil survey, soil taxonomy, classification, Land capability classification.	5
15	Soils of India and Maharashtra.	3
16 , 17& 18	Soil water : Soil water classification, soil water retention , soil water potential, soil moisture constants', Hydraulic conductivity, permeability, percolation, movement and availability in soil.	6

19	Soil air : composition, gaseous exchange and effect on plant growth.	6
20	Soil temperature: source, amount and flow of heat in soil and effect on plant growth.	6
21 & 22	Soil reaction: pH, soil acidity and alkalinity, buffering capacity, effect of soil pH on nutrient availability.	6
23 & 24	Soil colloids: soil colloidal properties, inorganic and organic colloids.	4
25, 26 & 27	Silicate clay: constituents and properties, sources of charge, ion exchange, cation and anion exchange capacity, base saturation.	6
28,29 & 30	Soil organic matter: sources, composition, properties, factors affecting SOM, its importance and influence on soil properties.	6
31	Humic substances-nature and properties	5
32 ,33 & 34	Soil organisms : macro and micro organism, their beneficial and harmful effects on soil and plant. soil biological properties (SMBC, soil respiration, DHA etc.)	6
35 & 36	Soil pollution – sources of soil pollution*, behavior of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.	6

<b>Course :</b>	BIOCHEM 231	<b>Credit:</b>	3(2+1)	<b>Semester-III</b>
<b>Course title:</b>	Fundamentals of Plant Biochemistry and Biotechnology			

## Teaching Schedule

### a) Theory

Lecture	Topic	Weightage (%)
1	Importance of Biochemistry	2
2-3	Properties of Water, pH and Buffer	5
4	Biomolecules - Definition, types, structure, properties and its applications	5
5-7	Carbohydrate: Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides, Mutarotation; Structure of Disaccharides and Polysaccharides.	8
8-9	Lipid: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids.	6

10-12	Proteins: Importance of proteins and classification; Structures, titration and zwitterions nature of amino acids; Structural organization of proteins.	8
13-14	Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes.	8
15	Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure.	5
16-18	Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain.	8
19-20	Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids.	5
21	<b>Biochemistry of nitrate assimilation</b>	5
22	Photosynthesis	5
23-24	Introduction to recombinant DNA technology: PCR techniques and its applications.	5
25-26	Organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications;	5
28-29	Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance; somatic hybridization and cybrids	8
30	Somaclonal variation and its use in crop improvement	4
31-32	Physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods	4
33	Marker Assisted Breeding in crop improvement	4
	<b>Total</b>	<b>100</b>

#### b) Practical

Experiment	Topic
1	Preparation of solution, pH & buffers
2-3	Qualitative tests for carbohydrates and amino acids
4	Estimation of reducing sugars by Nelson-Somogyi method
5	Estimation of starch by Anthrone method
6	Determination of soluble protein by folin-lowry method
7	Estimation of free amino acids by Ninhydrin method
8	Determination of total crude fat/oil by Soxhlet method

9	Qualitative tests for oil
10	Determination of alpha amylase activity from germinating seed
11	Determination of invivo nitrate reductase activity from leaf tissue
12	Paper chromatography/ TLC demonstration for separation of amino acids
13	TLC for separation of sugars
14-15	Isolation of genomic DNA from plant. Purification, Quantification and quality determination
16	Amplification of genomic DNA using different primers and resolution of PCR products on agarose gel

<b>Course :</b>	SSAC 242		<b>Credit:</b>	2(1+1)	<b>Semester-IV</b>
<b>Course title:</b>	Problematic Soils and their Management				

### Teaching schedule

#### a) Theory

Lecture	Topic	Weightage (%)
1-2	Soil degradation: Concept, types, factors and processes. Soil quality and soil health: definition and concept, soil quality indicators. Characteristics of healthy soils.	6
3-4	Distribution and extent of waste land and problematic soils in India and Maharashtra. Categorization of problem soils based on properties.	6
5-6	Saline soils, alkali Soils, saline-alkali soils, degraded alkali soils, coastal saline soils: definition, formation, characteristics, effect on plant growth, reclamation and management. Acid and acid sulphate soils: definition, formation, characteristics, effect on plant growth, reclamation and management.	12
7-8	Calcareous Soil: definition, formation, characteristics, effect on plant growth, reclamation and management.	8
9	Eroded soils and compacted soils: definition, formation, characteristics, effect on plant growth, reclamation and management.	6
10	Submerged soils and flooded soils: definition, formation, characteristics, effect on plant growth, reclamation and management.	10
11	Polluted soils: definition, sources and their remediation.	10
12	Water pollution: definition, sources and their remediation.	6
13	Quality of Irrigation water and its suitability for irrigation.	6

<b>Lecture</b>	<b>Topic</b>	<b>Weightage (%)</b>
14	Utilization of saline and sewage water in Agriculture.	6
15	Remote sensing and GIS in diagnosis and management of problem soils.	6
16	Multipurpose tree species and bioremediation of soils.	6
17	Land capability classification and Land suitability classification.	6
18	Problematic soils under different Agro-ecosystem.	6
	<b>Total</b>	<b>100</b>

### b) Practical

<b>Experiment</b>	<b>Topic</b>
1 & 2	Preparation of saturation paste extract.
3	Determination of $pH_e$ and $EC_e$ .
4 & 5	Determination of cations (Ca, Mg, Na and K) and computation of SAR.
6 & 7	Determination of ESP of soils.
8	Determination of gypsum requirement of sodic soil.
9	Determination of calcium carbonate from soil.
10	Determination of lime requirement of acidic soil.
11	Collection of irrigation water and sewage water.
12	Determination pH and EC from irrigation water.
13 & 14	Determination of cations (Ca, Mg, Na and K) from irrigation water.
15 & 16	Determination of anions ( $CO_3$ , $HCO_3$ , Cl and $SO_4$ ) from irrigation water and RSC and SAR.
17	Determination of BOD and COD.
18	Satellite image analysis by visual method .

<b>Course :</b>	SSAC 353		<b>Credit:</b>	3(2+1)	<b>Semester-V</b>
<b>Course title:</b>	Manures, Fertilizers and Soil Fertility Management				

### Teaching schedule

#### a) Theory

<b>Lesson</b>	<b>Topic</b>	<b>Weight age</b>
1 & 2	History of soil fertility and plant nutrition.	3
3 & 4	Soil as a source of plant nutrients, essential and beneficial nutrients and their role. Criteria of essentiality, forms of nutrients in soil.	5
5, & 6	Introduction and importance of organic manures. Sources of organic matter, recycling, composition and C:N ratio.	5
7, 8 & 9	Definition, properties and classification of bulky and concentrated organic manures, their composition and nutrient availability. Preparation of FYM, composts, different methods of composting, decomposition process and nutrient losses during handling and storage.	6
10 & 11	Vermicomposting, green manuring; types, advantages and disadvantages and nutrient availability.	5
12 & 13	Sewage and sludge, Biogas plant slurry; their composition and effect on soil and plant growth.	5
14 & 15	Integrated nutrient management; concept, components and importance.	6
16 & 17	Fertilizer; Definition and their classification; N fertilizers: classification, manufacturing process and properties their fate and reaction in soils.	6
18 & 19	Phosphatic fertilizers, manufacturing process and properties, classification, their fate and reaction in soils.	5
20 & 21	Potassic fertilizers: classification, manufacturing process, properties, their fate and reaction in soils. Complex fertilizers their fate and reaction in the soil. Nano fertilizers.	5
22 & 23	Secondary & micronutrient fertilizers: Types, composition, reaction in soil and effect on crop growth. Soil amendments.	5
24	Handling and storage of fertilizers: Fertilizer control order.	3
25 & 26	Mechanism of nutrient transport to plants: Factors affecting nutrient availability to plants. Measures to overcome deficiencies and toxicities.	6
27,28 & 29,	Chemistry of soil N,P, K, calcium, magnesium, sulphur and micronutrients.	6
30 & 31	Soil fertility evaluation and different approaches.	6
32	Soil Testing (Available nutrients) : Chemical methods and critical levels of different nutrients in soil.	6
33	Plant analysis methods : Critical levels of nutrients, DRIS approach,	6

<b>Lesson</b>	<b>Topic</b>	<b>Weight age</b>
	rapid tissue test, indicator plants. Soil test based fertilizer recommendations to crops.	
34 & 35	Methods and scheduling of nutrient applications for different soils and crops grown under rain fed and irrigated conditions.	6
36	Factors influencing nutrients use efficiency (NUE) in respect of N, P, K, S, Fe and Zn fertilizers.	5
	<b>Total</b>	<b>100</b>

<b>Course :</b>	ELE SSAC 364		<b>Credit:</b>	3(2+1)	<b>Semester-VI</b>
<b>Course title:</b>	Agrochemicals				

### Teaching schedule

#### a) Theory

<b>Lesson</b>	<b>Topic</b>	<b>Weightage (%)</b>
1	Introduction to agrochemicals, their type and role in agriculture,	2
2	Effect of agrochemicals on environment, soil, human and animal health. Merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture.	4
3	Fertilizers and their classification;	3
4 & 5	N fertilizers : classification, manufacturing process and properties, their fate and reaction	4
6 & 7	Phosphatic fertilizers, manufacturing process and properties	4
8	Potassic fertilizers and complex fertilizers, their fate and reaction in soils.	3
9 & 10	Secondary nutrients and fertilizers, their type, composition, reaction in soils and effect on crop growth.	4
11	Micronutrient fertilizers, their type, composition, reaction in soils and effect on crop growth.	4
12	Liquid fertilizers	3
13	Handling and storage of fertilizers	3
14	Biofertilizers and their role in crop production	4

<b>Lesson</b>	<b>Topic</b>	<b>Weightage (%)</b>
15	Fertilizer control order and insecticide Act	2
16	Introduction and classification of insecticides: Different types of Classification of insecticides. (Based on toxicity, mode of entry, mode of action, chemical nature)	4
17 & 18	Inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals.	5
19	Insecticide Act and rules. Insecticides banned, withdrawn and restricted use,	2
20	IGRs and Biopesticides. Reduced risk insecticides	2
21	Botanicals, plant and animal systemic insecticides their characteristics and uses.	3
22	Mode of action of insecticides (Pyrethroids, organophosphates, Carbamates and Chitin synthesis inhibitor)	4
23	Fate of insecticides in soil & plant.	3
24	Insecticide resistance and its management	3
25	Pesticide residue- Definition, steps involved in determination of residue.	3
26 & 27	Copper fungicides, formulation of Bordeaux mixture and Bordeaux paste. Chemical reaction involved merits and demerits of Bordeaux mixture. Mode of action of copper fungicides	5
28	Sulfur fungicides: Organic and inorganic sulfur fungicides their classification and mode of action. Preparation of lime sulfur mixture and chemical reaction involved.	4
29	Benzimidazole fungicides, their chemical nature, mode of action and their use	3
30	Introduction to new generation fungicides. VizMetalaxyl, fosetyl Al, Triazoles and shawbilirin fungicides	4
31	Herbicide- Classification, Formulations, Methods of application.	3
32	Mode of action of herbicide- Translocation and absorption	3
33	Persistence and fate of herbicides, Residual effect of herbicides	3
34	Introduction to selectivity of herbicide	2



<b>Lesson</b>	<b>Topic</b>	<b>Weightage (%)</b>
35	Compatibility of herbicides with other Agrochemicals	2
36	Introduction to adjuvants and their use in herbicides	2

### **B) Practical**

<b>Experiment</b>	<b>Topic</b>
1	Fertilizer Adulteration test / Identification of Adulteration in fertilizer / Detection of adulteration in fertilizers (Rapid test)
2	Determination of (Amide nitrogen) from urea.
3	Determination of ammoniacal nitrogen content and nitrate nitrogen content from nitrogenous fertilizer
4	Determination of water soluble phosphorus in superphosphate (Pumberton method)
5	Determination of acid soluble phosphorus from rock phosphate
6	Determination of total potassium content of muriate of potash (by flame photometer).
7	Determination of sulphur content from fertilizer (Gravimetric Method)
8	Determination of Zinc content from micronutrient fertilizer (EDTA Method)
9	Study of plant protection appliances
10	Calculation of doses of insecticides
11	Study of formulations of pesticides
12	Study of pesticide application techniques.
13	Herbicide label information and computation of herbicide doses.
14	Equipments used for herbicide application and calibration. Demonstration of methods of herbicide application.
15	Study of phytotoxicity symptoms of herbicides in different crops.
16	Handling and storage of fungicides and Agrochemicals
17	Preparation of Bordeaux mixture and Bordeaux paste and fungicides solutions.
18	Methods of application of fungicides.