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Item no. 4.62

UNIVERSITY OF MUMBAI



Syllabus for Sem V & VI

Program: B.Sc.

Course: Soil Science

(Applied Component)

(Credit Based Semester and Grading System with
effect from the academic year 2013–2014)

T.Y.B.Sc.
Applied Component
Soil Science Including Soil Analysis and Soil Mechanics
Credit Based Semester and Grading System
To be implemented from the Academic year 2013-2014

SEMESTER V
Theory

Course code	Soil- Its Formation and Development			
USACSS501	Units	Topics	Credits	Lectures/ week
	I	Soil and its Function	2	4
	II	Principles of Weathering		
	III	Soil Development		
	IV	Soils of India		

Practicals

USACSS5P1	Practicals based on theory course	2	4
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SEMESTER VI
Theory

Course code	Soil Morphology Structure and Classification			
USACSS601	Units	Topics	Credits	Lectures/ week
	I	Soil Morphology	2	4
	II	Soil structure		
	III	Soil Composition		
	IV	Soil properties		

Practicals

USACSS6P1	Practicals based on Theory course	2	4
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T.Y.B.Sc.
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SEMESTER V

1	<p>Introduction: Agriculture in India, Chemical Aspects of soil fertility; New approach.</p> <p>Earth's Crust: Earth's origins; Present condition of Earth; Atmosphere, Hydrosphere; Lithosphere; Composition of the Earth; Minerals; Rocks- Igneous, Sedimentary and Metamorphic</p> <p>Soil and its function: Definition of Soil, soil components, surface soil and subsoil, functions of soil.</p>
2	<p>Principles of Weathering: Weathering; Effect of Temperature; Effect of Water; Effect of Air; Effect of Plants; Effect of Animals.</p> <p>Weathering of Minerals and Rocks: Introduction, Weathering of minerals; quartz, feldspar, hornblende, augite, mica, olivine, calcite, dolomite, apatite, magnetite and pyrite; Weathering of Rocks- Granite, basalt, sandstone, clay, limestone and laterite.</p> <p>Translocation of Materials: Denudation and Deposition; Sedimentary soils- residual soils and cumulose soils; Transported soils- effects of wind, running water, glacier and gravity.</p>
3	<p>Soil Development: Pedogenic processes; factors of soil development; effects of rainfall, temperature, vegetation and organisms; Development of soil profile; classification of pedogenic processes. Zonal soils, Dessert soils, Grey soils, Chestnut soils, Chernozems, Laterite soil, Podsoles, Brown earths, Tundra soils, Intrazonal soils, Saline and alkaline soils, rendzine soils, bog soils, azonal soils.</p> <p>Soil Classification: Early attempts, Modern systems of soil classification- Physical classification, genetic classification, American system, Other systems.</p>
4	<p>Ion Exchange: Importance, cation exchange- surface reaction, mechanism of cation exchange, nature of exchangeable cations, amount of exchangeable cations, cation as plant nutrients, exchangeable cations in relation to soil fertility. Anion exchange-ionic substitution.</p> <p>Soils of India: Early work, Present position, Red soil, Laterite and lateritic soils, black soils, alluvial soils, forest and hill soils, desert soils, saline and alkaline soils, peaty and marshy soils.</p>

Theory (detailed syllabus)

Practicals

USACSS5P1	<p>Identification and description of the following minerals and rocks with special attention to their weathering characteristics and bearing on soil development:</p> <p>Minerals- Quartz, Chalcedony, Flint, Jasper, Opal, Orthoclase, Microcline, Labradorite, Muscovite, Biotite, Chlorite, Augite, Hornblende, Olivine, Calcite, Dolomite, Apatite, Magnetite, Haematite, Pyrite, Serpentine, Garnet and Kaolin.</p> <p>Rocks- Granite, Gabbro, Dolerite, Basalt, Rhyolite, Trachyte, Conglomerate, Sandstone, Shale, Limestone, Laterite, Slate, Schist, Gneiss, Quartzite, Marble.</p> <p>Examination of Soil types and Determination of their Structure: Lateritic, Sandy, Black soil, Loamy soil, Bog soil, Brown earths.</p> <p>Field Discription of Soil Profiles: Study of cuttings exposing soils in the field.</p>	2	4
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SEMESTER VI

Theory

Unit 1	<p>Soil Morphology: Soil colour, soil texture, soil structure, soil constitution, new growth, inclusion.</p> <p>Soil Texture: Importance of soil texture, mechanical analysis- Sieve method, Air elutriator method, Water elutriation method, sedimentation method, Decantation method, Centrifugal method, Pipette method, Hydrometer method. Soil separates- Nomenclature, Textural composition, Significance of mechanical analysis.</p> <p>Physical Properties of Soil: Specific gravity, Weight of soil, pore space, soil porosity, packing of soil particles, size of soil pores, surface area.</p>
2	<p>Soil Structure: Importance of soil structure, Aggregation, Mechanism of aggregate</p>

	<p>formation- colloidal clay, iron and aluminum hydroxides, organic matter. Types of soil structure; Classification, stability of soil structure; evaluation of soil structure-permeability method, porosity method, aggregate analysis.</p> <p>Soil Mineral Matter: Introduction, Gravel, Sand, Silt, Clay- properties, composition of clay components, Constitution and nature, Silica Sequioxide ratio. Clay minerals- Type, structure, properties, occurrence, size and shape.</p>
3	<p>Soil Colloids: Nature of soil colloids, Constitution, Properties of soil colloids- Brownian movement, Non- permeability, electric charge, adsorption, flocculation, swelling, heat of wetting, cohesion, adhesion and plasticity.</p> <p>Soil Water: Importance, Relation of water by soil, hygroscopic water- Nature and amount, hygroscopic coefficient; Capillary water- amount of capillary water, maximum capillary capacity, water holding capacity, movement of capillary water; Soil moisture constants- Field capacity, wilting coefficient available and unavailable water; Wetting and Drying.</p>
4	<p>Three Phase Soil Model, Weight- Volume Relationships, Porosity, Void Ratio, Water content, Degree of saturation, Unit weights, Specific Gravity, Relative density, Grain size distribution and its determination by sieve analysis and hydrometer analysis, Effective size, Uniformity Coefficient.</p> <p>Soil Water, Consistency, Consistency limits and their Determination.</p> <p>Engineering Classification of soils- UNIFIED, ASSHTO and I.S Systems.</p> <p>Introduction to Compaction and Consolidation Phenomena, Proctro Compaction Test, Consolidation Test</p>

Practicals

USACSS6P1	<p>Textural Analysis of Soils: Mechanical analysis of soils by sieving, dispersion and fractionation (decantation and pipette methods); Plotting of results on triangular graph and textural classification.</p> <p>Determination of Organic Content of Soils.</p> <p>Determination of the following properties of soils:</p> <ol style="list-style-type: none"> a. True and apparent specific gravity. b. Porosity c. Moisture Content 	2	4
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	d. Hygroscopic coefficient		
	e. pH		

Books Recommended For Study and Reference:

BIS Bulletins

Daji J. A; A text book of soil science. Media Promoters and Publishers Pvt. Ltd. Bombay.

Gopal Ranjan and Rao, A.S.R; (2000) Basic and Applied Soil Mechanics. New Age International (P) Ltd, New Delhi. ISBN :81-224-1223-8.

Narayanan and Shah; (1966) Physical Properties of Soils, Nanaktalas Pub. Ltd. Bombay

Purnima, B. C; (2003) Soil Mechanics and Foundations; Laxmi Publishing Co. Ltd. New Delhi.

Tamhane, R. V; Motiramani, D. P; Bali, Y.P; and Donahue R.L ; (1964) Soils- Their Chemistry and Fertility in Tropical Asia. Pretice Hall India Ltd.