ST. JOSEPH’S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

B.SC.(HONORS) AGRICULTURE AND RURAL DEVELOPMENT WITH SINGLE MAJOR

# II SEMESTER AGRICULTURE AND RURAL DEVELOPMENT Time: 15hrs/week

AGRD121 (1)  **FUNDAMENTALS OF SOIL SCIENCE** Marks:100

w.e.f AK 2023-2024 (Admitted batch) **SYLLABUS**

**OBJECTIVES:**

* To identify the different types of soils and its properties
* To know about the weathering and its types
* To identify the role of nitrogen fixation, phosphorous and organic matter in enhancing the soil fertility.

**COURSE OUTCOMES**

At the end of the course, students will be able to

**CO1:** Classify rocks, minerals and soils and explain various aspects of soil.

**CO2**: Discuss about the soil profile, structure, density and its properties.

**CO3:** Discuss the importance of nitrogen fixation, role of phosphorous and organic matter in enhancing soil fertility.

**CO4**: Discuss on soil colloids and its general properties in detail.

**CO5:** Learn classification of soils, soil taxonomy and groups of soils in India.

**UNIT – I:                                                                                                       (3Hrs.)**

1. Introduction - Spheres of the earth atmosphere, hydrosphere and lithosphere –

Their characteristics – Origin of soil – Soil and soil components – Mineral matter,

organic matter, water and air – Definition of soil and various concepts of soil –

Branches of soil science.

2. Rocks – Classification of rocks based on mode of origin –Iigneous rocks, sedimentary rocks and metamorphic rocks – Classification of rocks based on silica content –Weatherability of rocks.

3. Minerals – Primary, secondary, essential and accessory minerals – Primary minerals– Quartz, feldspar, micas, pyroxenes, amphiboles and olivines – Weatherability of primary minerals.

4. Non-silicate minerals – P, Ca, Mg, S and micronutrient containing minerals –Secondary silicate minerals – Basic structural units.

5. Weathering – Types of weathering – Physical weathering of rocks – Agents of physical weathering and their role- Biological weathering – Role of flora and fauna in weathering process.

6. Chemical weathering – Solution, hydration, hydrolysis, carbonation, oxidation and

reduction.

**UNIT – II:                                                                                                       (3Hrs.)**

1. Parent material – Classification of parent materials based on their mode of transport by different agents - Soil formation – Soil forming factors – Classification and their role in soil formation – Catena – Definition.

2. Pedogenic processes – Eluviation, illuviation, humification, calcification, laterization, podzolisation, melanisation, salinization and alkalization.

3. Soil profile –Detailed description of a theoretical soil profile – Differences between

surface soil and sub soil.

4. Soil physical properties – Soil texture – Definition – Various inorganic components

in soil and their properties – Various textural classes in soil and their properties.

5. Particle size analysis –Stoke’s Law – Assumptions and limitations – significance of

soil texture.

6. Soil consistence – Consistence of wet and dry soils – Soil crusting – Soil plasticity –Atterberg’s plastic limits – Factors affecting plastic limits – Significance of soil consistence.

7. Soil structure – Classification – Types, classes and grades of soil structure –

Importance of soil structure and its management.

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**UNIT – III:                                                                                                       (3Hrs.)**

1. Soil density – Bulk density and particle density – Factors affecting density

parameters – Importance of bulk density of soil – Soil compaction –Iits importance

– Calculation of porosity.

2. Soil strength and its importance – Soil colour – Components – Significance of soil

colour.

3. Soil water – Forces of soil water retention – pF concept – Soil moisture characteristic curves – Importance of soil water.

4. Soil water potential – Components of water potentials – Soil moisture constants –

Field capacity, wilting coefficient, hygroscopic water and saturation – Available water

and methods for determining soil moisture constants – Pressure plate and pressure

membrane apparatus.

5. Soil water content – Soil water movement – Darcy’s Law – Saturated, unsaturated and vapour flows – Infiltration, percolation and permeability – Distribution of waterin profile in different soils – Soil drainage and its importance.

6. Soil temperature – Sources of heat – Heat capacity and conductivity –factors

influencing soil temperature – Modification of soil thermal regimes – Measurement

of soil temperature – Importance of soil temperature on crop growth –Management

of soil temperature and importance.

7. Soil air – Compositions of atmospheric air and soil air – Gaseous exchange –Influence of soil air on plant growth, soil properties and nutrient availability – Measurement of oxygen diffusion rate – Measures to improve soil aeration.

8. Soil reaction, pH, soil acidity and alkalinity, buffering, effect of pH on nutrient

availability.

**UNIT – IV:                                                                                                       (3Hrs.)**

1. Soil colloids – Definition – General properties – Shape, surface area, electrical charge, adsorption, flocculation, deflocculation, plasticity, cohesion, swelling, shrinkage, Tyndall effect and Brownian movement.

2. Secondary silicate clay minerals of different types – Kaolinite, illite, montmorillonite

and chlorite – Properties – Allophones.

3. Origin of charge in organic and inorganic colloids – Negative and positive charges– Differences between organic and inorganic soil colloids.

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4. Adsorption of ions – Types of ion exchange – Cation and anion exchange – Cation

and anion exchange capacities of soil – Base saturation – Factors affecting ion

exchange capacity of soils – Importance of Cation Exchange Capacity (CEC) of soils

– Calculation of base exchange capacity and exchangeable acidity.

5. Soil biology – Biomass – Flora and fauna – Their important characteristics – Role of beneficial organisms – Organic matter decomposition, mineralization and immobilization.

6. Nitrogen fixation, denitrification , solubilization of phosphorus and biological control of plant diseases – Promotion of plant growth promoting substances –Harmful activities of soil organisms.

**UNIT – V:                                                                                                           (3Hrs.)**

1. Soil organic matter – Various sources – Composition – Compounds in plant residues– Their decomposability – Humus – Definition – Synthesis of humus.

2. Soil organic matter and humus – Importance - Fractionation of soil humus – Carbon cycle – Carbon : nitrogen (C:N) ratio of commonly available organic residues –Significance of C:N ratio in soil fertility.

3. Soil classification – Early system of soil classification – Diagnostic horizons.

4. Soil taxonomy – Order, sub order, great group and family series – Nomenclature

according to soil taxonomy.

5. Soil groups of India – Alluvial soils, black soils, red soils, laterite soils and coastal sands.

**REFERENCE TEXT BOOKS:**

1. Indian Society of Soil Science. 2012. Fundamentals of Soil Science, IARI, New Delhi.

2. Das, D. K .2015. Introductory Soil Science, 4th Edition, Kalyani Publishers, New Delhi

3. Sehgal,J. 2015. A Text Book of Pedology – Concepts and Applications, Kalyani

Publishers, New Delhi.

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