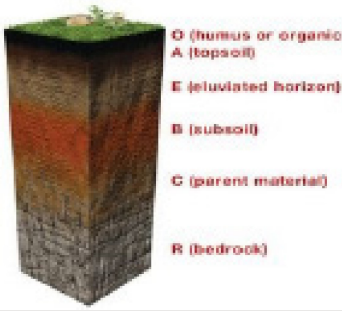
# 21SSAC121 FUNDAMENTALS OF SOIL SCIENCE

Hours Per Week :

| L | T | P | C |
|---|---|---|---|
| 2 | - | 2 | 3 |

Total Hours :

| L | T | P |
|---|---|---|
| 30 | - | 30 |




***Source :***
*http://soilsciences.ukzn.ac.za/Homepage.aspx*

## Course Description and Objectives:

This course makes the student better appreciate the origin, development and classification of soils and understand their physical, chemical and biological properties

## Course Outcomes:

Upon completion of the course, the student will be able to achieve the following outcomes:

| COs | Course Outcomes |
|---|---|
| 1 | Enable to acquaint comprehensive, detailed understanding of genetics, heredity in crop plants to improve and develop the new varieties |
| 2 | Enable to design, execute, and analyze the results of genetic experimentation in plant systems |
| 3 | Can empower the beneficiaries on the role of genetic technologies in industries related to Biotechnology, and other fields |

## SKILLS:

- ✓ *Identify different types of soils; problematic soils and suggest reclamation measures*
- ✓ *Quantification of nutrients availability in soils*
- ✓ *Handling equipments and chemicals used in soil science laboratory*

**ACTIVITIES:**

- *Collection of soil samples, processing and storage*
- *Determination of soil density, moisture content and porosity*
- *Determination of soil texture by feel and Bouyoucos Methods*
- *Draw the figures of different soil profile*
- *Determination of soil pH and electrical conductivity*
- *Determination of cation exchange capacity of soil*
- *Determination of soil colour*
- *Demonstration of heat transfer in soil*
- *Estimation of organic matter content of soil*

**UNIT - 1**

**Soil genesis, morphology and classification** - Spheres of the earth and their characteristics; Origin of soil and its components - Mineral matter, organic matter, water and air; Definition of soil and various concepts of soil; Soil forming rocks and minerals, Classification of rocks based on mode of origin, silica content and weatherability; Weathering and soil formation; Soil forming factors and their role in oil formation; Types of weathering - Physical weathering, Biological weathering and Chemical weathering; Soil profile and horizons; Soil groups of India – Alluvial soils, black soils, red soils, laterite soils and coastal sands; Systems of Soil classification; Soil taxonomy

**UNIT – 2**

**Soil physical properties** – Particle size distribution, Soil texture; Various textural classes; significance of soil texture; Soil structure; Classification, Importance and management of structure; Bulk density and particle density; Factors affecting density parameters; Calculation of porosity; Importance of bulk density; Soil compaction and its importance; Soil strength and its importance; Soil colour and significance of soil colour; Soil consistency; swelling and shrinking; Factors affecting plastic limits; Significance of soil consistency; Soil crusting, Soil aeration

**UNIT – 3**

**Soil, water and air environment** - Soil water content; Soil water potential; Soil moisture characteristic curves; Soil moisture constants and methods for determining soil moisture constants; Water flow in saturated and unsaturated soils; Hydraulic conductivity; Infiltration; Water holding capacity and distribution in different soils; Soil drainage and its importance; Evaporation; Field water balance; Soil plant atmosphere continuum; Soil temperature; Sources of heat, factors influencing soil temperature, Modification of soil thermal regimes, Measurement of soil temperature, Importance of soil temperature on crop growth; Soil air, compositions of atmospheric air and soil air, Gaseous exchange, Influence of soil air on plant growth, Measures to improve soil aeration

**UNIT – 4**

**Soil chemical properties** – Chemical composition of soils, Soil reaction, pH, soil acidity and alkalinity, effect of pH on nutrient availability. Soil colloids, Definition, General properties – Shape, surface area, electrical charge, adsorption, flocculation, deflocculation, Secondary silicate clay minerals of different types, Adsorption and exchange of ions, Factors affecting ion exchange capacity of soils, Importance of Cation Exchange Capacity (CEC) of soils, Calculation of base exchange capacity and exchangeable acidity, Chemistry of acid and salt affected soils, EC, ESP, SAR, Soil management and amendments

**UNIT – 5**

**Soil biological properties** - Soil biology, Biomass, Flora and fauna their important characteristics, Soil organic matter, Various sources, Compounds in plant residues their decomposability Organic matter decomposition, mineralization and immobilization. Nitrogen fixation, denitrification, solubilization of phosphorus, Harmful activities of soil organisms. Humus – Definition, Synthesis and importance of humus. Fractionation of soil humus, Carbon Cycle, Carbon : nitrogen (C:N) ratio of commonly available organic residues, Significance of C:N ratio in soil fertility

## LABORATORY EXPERIMENTS

### LIST OF EXPERIMENTS

1. Methods of chemical analysis, principles, techniques and calculations
2. Study of soil sampling tools, collection of representative soil sample, its Processing and storage
3. Description of soil profile in the field
4. Studies of capillary rise phenomenon of water in soil column and water movement in soil
5. Determination of texture by feel method
6. Determination of mechanical composition of soil using Bouyoucos Hydrometer
7. Determination of bulk density and particle density of soil and porosity
8. Determination of infiltration rate
9. Determination of soil strength by cone penetrometer
10. Aggregate analysis by wet sieving method
11. Determination of soil pH & EC of soil
12. Determination of cation exchange capacity of soil
13. Determination of soil colour& study of soil map
14. Estimation of organic matter content in soil
15. Soil moisture determination

### REFERENCES


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