

# SOIL SCIENCE

ENAE 152

**Lecture** : 3  
**Tutorial** : 1  
**Practical** : 2

**Year** : I

**Part** : II

## **Course Objectives:**

To develop understanding about soil forming processes and soil as natural body/medium for storage and movement of water, gases, heat, nutrients and physical and chemical properties of soil.

- 1 Concept and Importance of Soil (2 hours)**
  - 1.1 Soil in relation to agricultural production
  - 1.2 Definition and concept of soil science and its branches
  - 1.3 Development of soil science program and research in Nepal
  - 1.4 Introduction to sustainable soil management
  
- 2 Soil Genesis and Classification (10 hours)**
  - 2.1 Soil forming rocks and minerals
  - 2.2 Weathering and soil forming processes
  - 2.3 Factors of soil formation
  - 2.4 Morphological properties
  - 2.5 Soil profile development and horizon designation
  - 2.6 Surface and sub-surface diagnostic horizons
  - 2.7 Soil temperature and moisture regimes
  - 2.8 Soil taxonomy and its application in land use and crop production
  - 2.9 Introduction and history of soil classification
  - 2.10 World reference based (WRB) soil classification system
  
- 3 Soil Survey and Mapping (3 hours)**
  - 3.1 Types of soil survey and scales of soil maps
  - 3.2 Remote sensing and geographic information system (GIS) and their application in soil science
  - 3.3 Digital soil mapping and its development in Nepal
  
- 4 Soil Physical Properties (10 hours)**
  - 4.1 Soil texture
  - 4.2 Soil structure
  - 4.3 Soil consistency
  - 4.4 Bulk density, particle density and porosity

- 4.5 Soil aeration
- 4.6 Soil temperature
- 4.7 Soil moisture
- 4.8 Soil colour
- 4.9 Infiltration, percolation and hydraulic conductivity
- 4.10 Soil water movement (Saturated, unsaturated and diffusion) and classification of soil water
- 4.11 Soil-water-energy and its dynamics
- 4.12 Tillage and structural management of soils
- 4.13 Importance of soil physical properties in land use and crop production management

**5 Soil Chemical Properties (7 hours)**

- 5.1 Soil reaction and its importance in soil fertility
- 5.2 Nature and properties of soil problem: Acidic, saline and sodic soils
- 5.3 Reclamation and management of acidic, saline and sodic soils
- 5.4 Buffering capacity of soil and liming
- 5.5 Soil colloids: Properties and types
- 5.6 Cation and anion exchange phenomenon

**6 Soil Fertility and Plant Nutrition (13 hours)**

- 6.1 Basic concept of soil fertility and plant nutrition
- 6.2 Essential plant nutrients
  - 6.2.1 Available forms
  - 6.2.2 Classification
  - 6.2.3 Mobility in soil and plant system
  - 6.2.4 Major functions
  - 6.2.5 Deficiency symptoms
  - 6.2.6 Uptake mechanisms
- 6.3 Soil fertility evaluation techniques
  - 6.3.1 Soil testing
  - 6.3.2 Plant analysis
  - 6.3.3 Deficiency and toxicity symptoms
  - 6.3.4 Biological tests
- 6.4 Inorganic fertilizers: Composition and their behavior in soil
- 6.5 Fertilizer recommendation for major crops of Nepal
- 6.6 Green manures: Desirable characters and their importance in soil fertility
- 6.7 Bio-fertilizers: Types and importance in soil fertility
- 6.8 Biological nitrogen fixation and its potential uses
- 6.9 Soil organic matter and its influence in soil fertility
- 6.10 Organic manures and its benefits

**Tutorial****(15 hours)**

1. Numerical on bulk density of soil
2. Numerical on particle density of soil
3. Numerical on porosity of soil
4. Soil classification methods
5. Suitability of soil for different purpose
6. Soil survey and mapping from remote sensing data
7. Digital soil mapping
8. Calculation of fertilizer doses
9. Bio-fertilizer application rate determination

**Practical****(30 hours)**

1. Collection and preparation of soil samples for lab analysis
2. Determination of soil texture by feel method
3. Soil particle size analysis by Bouyoucos hydrometer method
4. Identification of soil structure
5. Determination of bulk density, particle density and porosity
6. Identification of important rocks and minerals
7. Study of soil profile and morphological properties
8. Determination of soil wetness by gravimetric and volumetric methods and express in terms of depth of water in the soil
9. Measurement of matric suction by field tensiometer
10. Test of soil pH, nitrogen, phosphorus and potassium by the use of kit box
11. Determination of soil pH by using pH meter
12. Determination of total soil nitrogen by the Kjeldahl method
13. Determination of soil available phosphorus by the modified Olsen's bicarbonate method
14. Estimation of available potassium by the ammonium acetate method using flame photometer
15. Determination of organic carbon

**Final Exam**

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1.	2	2
2.	10	15
3.	3	3
4.	10	15
5.	7	10
6.	13	15
<b>Total</b>	<b>45</b>	<b>60</b>

\* There may be minor deviation in marks distribution.

## References

1. Brady, N.C. (1990). The nature and properties of soils (Latest Edition). Macmillan.
2. Biswas, T.D., Mukherjee, S. K. (1994). Textbook of Soil Science (Latest Edition). Tata McGraw Hill.
3. Oswal, M.C. (1994). Soil Physics (Latest Edition). Oxford & IBH Publishing Co.
4. Gupta, P.K. (2009). Soil, plant, water and fertilizer analysis. India: Agrobios.