DEPARTMENT OF AGRONOMY
Faculty of Agricultural Sciences
University of the Punjab, Lahore

Course Outline

Programme	B. Sc. (Hons.) Agriculture (Agronomy)	**Course Code**	**SS-304**	**Credit Hours**	3 (2-1)
Course Title	**SOIL FERTILITY AND FERTILIZER USE (Interdisciplinary)**				

Course Introduction

This course discusses plant nutrients' availability, replenishment, retention, and the use and behavior of fertilizers in soil. Students will learn to diagnose nutrient deficiency and toxicity symptoms and determine the fertilizer requirements for optimum plant growth.

Learning Outcomes

Upon completion of the course, students will:

1. Understand the functions of essential plant nutrients and their deficiency and toxicity symptoms.
2. Analyze the movement, acquisition, and uptake of nutrients by plants.
3. Comprehend the behavior of various fertilizers and their fate in the soil.
4. Diagnose nutrient deficiencies and calculate fertilizer requirements for optimal plant growth.
5. Implement integrated plant nutrient management practices.
6. Recognize the role of nutrients in human and plant health.
7. Evaluate nutrient behavior in different soil conditions, including submerged soils.

Course Content (Theory)

Week	**Unit**	**Topics**	**Assignments/Readings**
1	Unit 1	Crop growth, factors affecting, and growth expressions	Read chapter on plant growth factors from recommended textbooks.
2	Unit 2	Essential plant nutrients: functions, deficiency, and toxicity	Review case studies of nutrient deficiencies and toxicities.
3	Unit 3	Movement of nutrients to roots, acquisition, and uptake	Assignment on nutrient uptake mechanisms.
4	Unit 4	Nitrogen gains and losses in soil	
5		Nitrogen fertilizers and their fate in soil	Analysis of nitrogen fertilizer application in different soil types.
6	Unit 5	Phosphorus forms and P-fertilizers behavior in soil	

7		Phosphorus cycle in soil and its environmental impact	Group discussion on phosphorus management.
8	Unit 6	Potassium forms, amount, and exchange equilibrium in soil	
9		Role of potassium in plant health and soil fertility	Field visit to observe potassium management practices.
10	Unit 7	Calcium, magnesium, and sulfur forms and amount in soil	
11		Soil amendments and their effects on calcium and magnesium availability	Presentation on sulfur deficiency symptoms.
12	Unit 8	Crop responses; factors affecting and residual effects	
13		Integrated plant nutrient management	Case study on integrated nutrient management practices.
14	Unit 9	Nutrients behavior in submerged soil	
15		Nutrient role in human and plant health	Research paper review on nutrient roles in human health.
16	Unit 10	Micro nutrients role and deficiency symptoms	Summary report on micronutrient deficiencies in local crops.

Course Content (Practical)			
Week	**Unit**	**Topics**	**Assignments/Readings**
1	Unit 1	Fertilizers identification and composition	Practical notebook completion.
2		Fertilizer requirement calculation	Assignment on calculating fertilizer needs for different crops.
3	Unit 2	Fertilizer analyses (urea, CAN, DAP, and SOP)	
4		Determination of available P and K in soil	
5		Practical analysis report writing	
6	Unit 3	Plant analysis for N, P, and K sufficiency and uptake	
7		Analysis of plant samples for nutrient content	
8	Unit 4	Field visits for identification of nutrients deficiency and toxicity symptoms	Practical notebook completion.
9		Field visit to local farms	Observation report on nutrient deficiencies.

10	Unit 5	Visit to fertilizer factories, soil fertility institutes, and demonstration trials	
11		Industry visit report writing	
12	Unit 6	Soil sampling and preparation for nutrient analysis	
13		Laboratory analysis of soil samples for nutrient content	
14	Unit 7	Analysis of soil texture and structure	
15		Practical demonstration of soil testing kits	
16	Unit 8	Final practical examination and project presentation	

Textbooks and Reading Material

1. Ahmad, N. and M. Rashid. 2003. *Fertilizer and Their Use in Pakistan: An Extension Guide*. Planning Commission, National Fertilizer Development Centre, Islamabad, Pakistan.
2. Elsworth, L. and W.O. Relay (eds.). 2009. *Fertilizers: Properties, Applications and Effects*. Nova Science Publ. Inc., NY, USA.
3. Havlin, J.L., S.L. Tisdale, W.L. Nelson and J.D. Beaton. 2013. *Soil Fertility and Fertilizers: An Introduction to Nutrient Management*. 8th ed. Pearson Education, Prentice Hall, Upper Saddle River, NJ, USA.
4. Mengel, K. and E.A. Kirkby. 2001. *Principles of Plant Nutrition*. 5th Ed. International Potash Inst., Bern, Switzerland.
5. Russell, E.J. 2011. *The Fertility of the Soil*. 1st Ed. Cambridge Univ. Press, UK.