



Programme	BSSed	Course Code	SE-311	Credit Hours	3
Course Title	BOTANY IV-Theory (Plant Physiology and Ecology)				
Course Introduction					
The course is organized to cover physiological processes involved in plant interaction with the environment, including water relations, gas exchange, photosynthesis, respiration, energy balance, mineral nutrition, responses to the environment and plant hormones. It is generally aimed to familiarize students with the ecological concepts focusing on biotic and abiotic factors involved in establishing plant communities.					
Learning Outcomes					
On the completion of the course, the students will: The aim is to give the students increased knowledge of metabolism, physiology and structure of plants together with a better understanding of regulation of growth and development and influence of environment.					
Course Content			Assignments/Readings		
Week 1	Plants physiology Unit-1: Water Relations 1.1 Water Potential 1.2 Osmotic Potential		Quiz/ Salisbury, F.B. and Ross, C.B. (2002). Plant Physiology		
	1.3 Pressure Potential 1.4 Matric Potential; Absorption 1.5 Translocation of Water		Long Question Test/ Salisbury, F.B. and Ross, C.B. (2002). Plant Physiology		
Week 2	Unit-2: Mineral Nutrition 2.1 Soil as a Source of Minerals 2.2 Passive and Active Transport of Nutrients 2.3 Essential Mineral Elements 2.4 Role and Deficiency Symptoms of Macronutrients		Written Assignment/ Salisbury, F.B. and Ross, C.B. (2002). Plant Physiology		

	Unit-3: Photosynthesis 3.1 Introduction 3.2 Mechanism of Oxygenic and Non-Oxygenic Photosynthesis: Light Reactions (Electron Transport and Photophosphorylation) and Dark Reactions (Calvin Cycle), Differences between C2 and C3 Plants	Preparation of notes/ Salisbury, F.B. and Ross, C.B. (2002). Plant Physiology
Week 3	3.3 Factors affecting Photosynthesis Unit-4: Respiration 4.1 Definition and Respiratory Substrates 4.2 Mechanism of Glycolysis, Krebs Cycle	Long Question Test/ Salisbury, F.B. and Ross, C.B. (2002). Plant Physiology
	4.3 Electron Transport and Oxidative Phosphorylation 4.4 Anaerobic Respiration 4.5 Energy Balance in Aerobic and Anaerobic Respiration	Preparation of notes/ Salisbury, F.B. and Ross, C.B. (2002). Plant Physiology
Week 4	Unit-5: Growth 5.1: Definition 5.2: Role of Auxins 5.3: Cytokinins,	Long Question Test/ Salisbury, F.B. and Ross, C.B. (2002). Plant Physiology
	5.4 Gibberellins 5.5 Absciscic Acid 5.6 Ethylene in controlling Growth	Written Assignment/ Salisbury, F.B. and Ross, C.B. (2002). Plant Physiology
Week 5	Unit-6: Photoperiodism 6.1 Definition 6.2 Historical Background 6.3 Classification of Plants based on Photoperiodic Response 6.4 Role of Phytochromes	Preparation of notes/ Salisbury, F.B. and Ross, C.B. (2002). Plant Physiology Long Question Test/ Salisbury, F.B. and Ross, C.B. (2002). Plant Physiology

Week 6	6.5 Hormones and Metabolites in photoperiodism	Written Assignment/ Salisbury, F.B. and Ross, C.B. (2002). Plant Physiology
	Unit-7: Dormancy 7.1 Definition and Causes of Seed and Bud Dormancy	Quiz/ Salisbury, F.B. and Ross, C.B. (2002). Plant Physiology
Week 7	7.2 Methods of breaking Seed Dormancy 7.3 Physiological processes during Seed Germination	Quiz/ Salisbury, F.B. and Ross, C.B. (2002). Plant Physiology
	Unit-8: Movements 8.1 Classification 8.2 Phototropism	Written Assignment/ Salisbury, F.B. and Ross, C.B. (2002). Plant Physiology
Week 8	8.3 Nastic Movements 8.4 Gravitropism and their Mechanisms	Quiz/ Salisbury, F.B. and Ross, C.B. (2002). Plant Physiology
	ECOLOGY Unit-1: 1.2 Introduction, 1.3 aims and applications of Ecology.	Quiz/ Schultz, E. (2005). Plant Ecology
Week 9	Unit-2: Soil 2.1 Physical and Chemical Properties of Soil (Soil Formation, Soil Texture, pH, EC, Soil Organisms, Soil Organic Matter) and their relationship to plants.	Quiz/ Schultz, E. (2005). Plant Ecology
	Unit-3: Light and Temperature 3.1 Quality of Light, Diurnal and Seasonal Variations 3.2 Ecophysiological Responses	Quiz/ Schultz, E. (2005). Plant Ecology
Week 10	Unit-4: Water 4.1 Field Capacity and Soil Water Holding Capacity 4.2 Characteristics of Xerophytes and Hydrophytes	Written Assignment/ Hussain, F. (1999). Field and Laboratory Manual of Plant Ecology

	4.3 Effects of Precipitation on Distribution of Plants	Long Question Test/ Odum, E.P. (1970). Basic Ecology
Week 11	Unit-5: Wind 5.1 Wind as an Ecological Factor and its Importance	Quiz/ Rick, R.E. (2000). Ecology
	Unit-6: Population Ecology 6.1 Introduction to Population Ecology	Quiz/ Schultz, E. (2005). Plant Ecology
Week 12	Unit-7: Community Ecology 7.1 Ecological Characteristics of Plant Community	Quiz/ Rick, R.E. (2000). Ecology
	7.2 Methods of Sampling Vegetation (Quadrat and Line Intercept)	Long Question Test/ Odum, E.P. (1970). Basic Ecology
Week 13	7.3 Succession	Long Question Test/ Odum, E.P. (1970). Basic Ecology
	7.4 Major Vegetation Types of the Local Area	Quiz/ Schultz, E. (2005). Plant Ecology
Week 14	Unit-8:Ecosystem Ecology 8.1 Definition and Components of Ecosystem	Quiz/ Rick, R.E. (2000). Ecology
	8.2 Food Chain and Food Web	Long Question Test/ Odum, E.P. (1970). Basic Ecology
Week 15	8.3 Biogeochemical Cycles, Definition, Types with emphasis on Nitrogen and Hydrological Cycles	Long Question Test/ Odum, E.P. (1970). Basic Ecology
	Revision	
Week 16	Revision	
	Revision	

Textbooks and Reading Material	
1. Taiz, L. and Zeiger, E. (2010). Plant Physiology. 5th Edition. Sinauers Publishing, Company. Inc. California. 2. Illahi, I. (2009). Plant Physiology. Biochemical Processes in Plants. UGC Press. 3. Witham, F.W, Devlin, A., Blaydes, D.F. and Devline, R.M (1986) Exercises in Plant Physiology. Prindle, Weber and Schmidt, Boston. 4. Schultz, E. (2005). Plant Ecology. (2nd Ed.) Springer-Verlag, Berlin. 5. Smith, R. L. (2002). Ecology and Field Biology. Harper and Row Publishers, New York. 6. Salisbury, F.B. and Ross, C.B. (2002). Plant Physiology. (7th Ed.), Wordsworth Publishing Co. Belmont CA. 7. Ricklefs, R.E. (2001). The Economy of Nature. W.H. Freeman and Company .UK. 8. Hopkins, W.B. (2000). Introduction to Plant Physiology. (2nd Ed.), John Wiley and Sons. New York. 9. Rick, R.E. (2000). Ecology. (1st Ed.). W.H. Freeman and Company, U.K. 10. Smith, R. L. (2000). Elements of Ecology. Harper and Row Publishers, New York. 11. Subrahmanyam, N.S. and Sambamurthy. A.V.S.S. (2000). Ecology. Narosa Publishing House, New Delhi. 12. Townsend, C.R., Harper, J.L. and Begon, M.E. (2000). Essentials of Ecology. Blackwell Scientific Publications, U.K. 13. Barbour, M.O., Burke, H.J. and Pitts, D.W. (1999). Terrestrial Plant Ecology. The Benjamin, Cumming Publishing Co. California, USA. 14. Hussain, F. (1999). Field and Laboratory Manual of Plant Ecology. National Academy of Higher Education, Islamabad. 15. Krebs, C. J. (1997). Ecology and Field Biology. Addison Wesley Longman Inc, New York. 16. Chapman, J.L. and Reiss, M.J. (1995). Ecology; Principles and Applications. Cambridge University Press. U.K. 17. Odum, E.P. (1970). Basic Ecology. V/B. Saunders. Phiadelphia.	
Teaching Learning Strategies	
1. Lecture Method 2. Inquiry Method 3. Demonstration Method 4. Project Method	
Assignments: Types and Number with Calendar	
1. Quiz 2. Presentation 3. Written Test 4. Class discussion	

**Department of Science Education
Institute of Education & Research
University of the Punjab, Lahore
Course Outline**



Programme	BS Science Education	Course Code	SE-311A	Credit Hours	04
Course Title	Mathematics B-IV (Metric Spaces & Group Theory)				
Course Introduction					
Mathematics B-IV (Metric Spaces & Group Theory) is an advanced mathematics course that introduces students to two fundamental branches of modern mathematics: metric spaces and abstract algebra. The metric spaces component focuses on the concept of distance, convergence, continuity, compactness, and completeness, providing a rigorous foundation for mathematical analysis. The group theory component explores algebraic structures known as groups, including their properties, subgroups, cyclic groups, permutations, homomorphisms, and applications. Together, these topics strengthen logical reasoning, analytical thinking, and proof-writing skills, while laying the groundwork for higher studies in mathematics and its applications in science, engineering, computer science, and cryptography.					
Learning Outcomes					
On the completion of the course, the students will: 1. Define and explain the fundamental concepts of metric spaces and group theory. 2. Analyze the properties of metric spaces, including convergence, continuity, compactness, and completeness. Construct and evaluate rigorous mathematical proofs using logical reasoning. 3. Identify and classify different types of groups, subgroups, cyclic groups, and permutation groups. 4. Apply group homomorphisms, isomorphisms, and related theorems to solve algebraic problems. 5. Use mathematical techniques to solve theoretical and practical problems involving metric spaces and algebraic structures. 6. Demonstrate critical thinking and problem-solving skills through abstract mathematical reasoning. 7. Develop a strong foundation for advanced studies in analysis, abstract algebra, topology, computer science, and related fields.					
Course Content					
Week 1	Unit -1: Metric Spaces				
	1.1	Definition and various examples of metric spaces			
Week 2	1.2	Holder’s inequality, Cauchy-schwarz and minkowski’s inequality			
	1.3	Open and closed balls			
Week 3	1.4	Neighborhoods			
	1.5	Open and closed sets			
Week 4	1.6	Interior, Exterior and boundary points			
	1.7	Limit points, Closure of a set			
Week 5	QUIZZ				
	QUIZZ				
	1.8	Convergence in metric spaces, Cauchy sequences			
Week 6	1.9	Continuity in metric spaces			

	1.10	Inner product and norm
Week 7	1.11	Orthonormal sets and basis
Week 8	1.12	The Gram-Schmidt process
Week 9	MID- TERM EXAM	
Week 10	PRESENTATIONS	
Week 11	Unit-2: Group Theory	
	2.1	Binary operations
Week 12	2.2	Definition, Examples and formation of groups
	2.3	Subgroups
Week 13	2.4	Order of group, Order of an element
	2.5	Abelian groups
Week 14	2.6	Cyclic groups, Cosets, Lagrange’s theorem
	2.7	Permutation, Even and odd permutations
Week 15	2.8	Symmetric groups
	2.9	Introduction to rings and fields
Week 16	FINAL- TERM EXAM	
Textbooks and Reading Material		
1. Micheal, O. Searcoid, Metric Spaces, Springer, 2007 2. E. Kreyszig, Introduction to Functional Analysis with Applications, John Wiley and Sons, 1978 3. W.A. Sutherland, Introduction to Metric and Topological Spaces, Clarendon Press Oxford, 1975 4. E.T. Copson, Metric Spaces, Cambridge University, Press, 1968 5. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw Hill Company, 1963 6. N. Herstein, Topics in Algebra, Xerox Publishing Company, 1964. 7. Vivek Sahai and Vikas Bist, Algebra, Narosa Publishing House, 1999 8. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra, C.U.P., 1986		
Teaching Learning Strategies		
- Lecture Method - Collaborative Method - Problem-Solving Approaches - Demonstration Method - Project Method - Connecting mathematics to real world context - Discussion		
Assignments: Types and Number with Calendar		
- Class presentation, Quizzes. - Ist assignment before mid-term exam. 2nd assignment after mid-term exam		