

**Department of Entomology
Faculty of Agricultural Sciences
University of the Punjab, Lahore
Course Outline**



Programme	B.Sc. (Hons) Agriculture (Major: Entomology)	Course Code	ENT-304	Credit Hours	3 (2-1)
Course Title	INSECT CLASSIFICATION AND BIODIVERSITY				
Course Introduction					
<p>Study of insect biodiversity and evolution are integral part of entomological sciences. Adult insect individuals represent the most astonishing biodiversity features as they manifest the distinct features of different species. This course aims to introduce the students about the basics of insect classification and biodiversity of different insect orders up to family level. Students will get familiarized with the concepts of insect classification, biodiversity and their different types. They will learn to study adaptation strategies of adult insects in different geographical areas and about their adaptive and phylogenetic affinities. They will study the available insect fauna diversity in Pakistan and their classification among different hierarchical categories i.e. orders, families, genera etc.</p>					
Learning Outcomes					
<p>On the completion of the course, the students will have gained the ability to:</p> <ol style="list-style-type: none"> 1. Identify hexapods to order and the majority of common insects to family by sight 2. Identify adult insects to order and family using dichotomous keys 3. Collect insects and field data in different habitats using a variety of techniques. 4. Curate insect specimens properly, including labeling, pinning, point mounting, and preserving in ethanol. 5. Describe the taxonomic process: how species are described, named and classified. 6. Explain how key innovations in the life history of insects led to their incredible diversity. 7. Interpret phylogenetic trees depicting the evolutionary relationships among insects 					
Course Content (Theory)					Assignments/Readings
Week 1	Unit-I 1.1. Introduction 1.1.1. Introduction to Course Outline, Weekly scheme of work, lecture break-up of whole semester. Scope of Insect Biodiversity & Evolution				Suhail, A. 2002. A notebook of classification of adult insects. Department of Agri. Entomology, University of Agriculture, Faisalabad.
	1.2. Division of Phylum Arthropoda 1.2.1. Sub-Class Ametabola, 1.2.2. Sub-Class Metabola				

		Gillott, C., 2005. Entomology. 3rd Edi. Springer Publishers
Week 2	Unit-II 2.1. Systematics 2.1.1. Hemimetabola 2.1.2. Holometabola 2.1.3. Endopterygota 2.1.4. Exopterygota	Suhail, A. 2002. A notebook of classification of adult insects. Department of Agri. Entomology, University of Agriculture, Faisalabad.
	2.2. Division Ametabola 2.2.1. Morphological and key identification characteristics and habitats of insect order Thysanura and Diplura, their sub-orders and important families.	Gillott, C., 2005. Entomology. 3rd Edi. Springer Publishers
Week 3	Unit-III 3.1. Division Ametabola 3.1.1. Morphological and key identification characteristics and habitats of insect order Protura, Collembola, their sub-orders and important families.	Suhail, A. 2002. A notebook of classification of adult insects. Department of Agri. Entomology, University of Agriculture, Faisalabad.
	3.2. Division Hemimetabola 3.2.1. Morphological and key identification characteristics and habitats of insect order Ephemeroptera, its sub-orders and important families.	Gillott, C., 2005. Entomology. 3rd Edi. Springer Publishers
Week 4	Unit-IV 4.1. Division Hemimetabola 4.1.1. Morphological and key identification characteristics and habitats of insect order Odonata, its sub-orders and important families.	Suhail, A. 2002. A notebook of classification of adult insects. Department of Agri. Entomology, University of Agriculture, Faisalabad.
	4.2. Division Hemimetabola 4.2.1. Morphological and key identification characteristics and habitats of insect order Plecoptera and Grylloblattodea, their sub-orders and important families.	Gillott, C., 2005. Entomology. 3rd Edi. Springer Publishers
Week 5	Unit-V 5.1. Division Hemimetabola 5.1.1. Morphological and key identification characteristics and habitats of insect order Orthoptera, its sub-orders and important families.	Suhail, A. 2002. A notebook of classification of adult insects. Department of Agri. Entomology, University of Agriculture, Faisalabad.
	5.2. Division Hemimetabola 5.2.1. Morphological and key identification characteristics and habitats of insect order	

	Phasmida and Dermaptera, their sub-orders and important families.	Gillott, C., 2005. Entomology. 3rd Edi. Springer Publishers
Week 6	Unit-VI 6.1. Division Hemimetabola 6.1.1. Morphological and key identification characteristics and habitats of insect order Embioptera and Dictyoptera, their sub-orders and important families	Suhail, A. 2002. A notebook of classification of adult insects. Department of Agri. Entomology, University of Agriculture, Faisalabad.
	6.2. Division Hemimetabola 6.2.1. Morphological and key identification characteristics and habitats of insect order Isoptera and Zoraptera, their sub-orders and important families	Gillott, C., 2005. Entomology. 3rd Edi. Springer Publishers
Week 7	Unit-VII 7.1. Division Hemimetabola 7.1.1. Morphological and key identification characteristics and habitats of insect order Psocoptera and Mallophaga, their sub-orders and important families	Suhail, A. 2002. A notebook of classification of adult insects. Department of Agri. Entomology, University of Agriculture, Faisalabad.
	7.2. Division Hemimetabola 7.2.1. Morphological and key identification characteristics and habitats of insect order Siphunculata and Hemiptera, their sub-orders and important families	Gillott, C., 2005. Entomology. 3rd Edi. Springer Publishers
Week 8	Unit-VIII 8.1. Division Hemimetabola 8.1.1. Morphological and key identification characteristics and habitats of insect order Hemiptera, its sub-orders and important families	Suhail, A. 2002. A notebook of classification of adult insects. Department of Agri. Entomology, University of Agriculture, Faisalabad.
	8.2. Division Hemimetabola 8.2.1. Morphological and key identification characteristics and habitats of insect order Homoptera, its sub-orders and important families	Gillott, C., 2005. Entomology. 3rd Edi. Springer Publishers
Week 9	MIDTERM EXAM	
Week 10	Unit-IX 9.1. Division Hemimetabola 9.1.1. Morphological and key identification characteristics and habitats of insect order Thysanoptera, its sub-orders and important families	Suhail, A. 2002. A notebook of classification of adult insects. Department of Agri. Entomology, University of Agriculture, Faisalabad.
	9.2. Division Holometabola	

	9.2.1. Morphological and key identification characteristics and habitats of insect order Neuroptera, its sub-orders and important families	Gillott, C., 2005. Entomology. 3rd Edi. Springer Publishers
Week 11	Unit-X 10.1. Division Holometabola 10.1.1. Morphological and key identification characteristics and habitats of insect order Coleoptera, its sub-orders and important families	Suhail, A. 2002. A notebook of classification of adult insects. Department of Agri. Entomology, University of Agriculture, Faisalabad. Gillott, C., 2005. Entomology. 3rd Edi. Springer Publishers
	10.2. Division Holometabola 10.2.1. Morphological and key identification characteristics and habitats of insect order Strepsiptera and Mecoptera, their sub-orders and important families	Suhail, A. 2002. A notebook of classification of adult insects. Department of Agri. Entomology, University of Agriculture, Faisalabad. Gillott, C., 2005. Entomology. 3rd Edi. Springer Publishers
Week 12	Unit-XI 11.1. Division Holometabola 11.1. Morphological and key identification characteristics and habitats of insect order Siphonaptera and Diptera, their sub-orders and important families	Suhail, A. 2002. A notebook of classification of adult insects. Department of Agri. Entomology, University of Agriculture, Faisalabad. Gillott, C., 2005. Entomology. 3rd Edi. Springer Publishers
	11.2. Division Holometabola 11.2.1. Morphological and key identification characteristics and habitats of insect order Lepidoptera, their sub-orders and important families	
Week 13	Unit-XII 12.1. Division Holometabola 12.1. Morphological and key identification characteristics and habitats of insect order Trichoptera and Hymenoptera, their sub-orders and important families	Suhail, A. 2002. A notebook of classification of adult insects. Department of Agri. Entomology, University of Agriculture, Faisalabad. Gillott, C., 2005. Entomology. 3rd Edi. Springer Publishers
	12.2. Division Holometabola	
	12.2. Morphological and key identification characteristics and habitats of insect order Hymenoptera, its sub-orders and important families	
Week 14	Unit-XIII 13.1. Biodiversity Exploration	Gupta, R.K., 2004. Advancement of Insect

	13.1.1. Insect Biodiversity: Tools and Approaches 13.1.2.Exploring Biodiversity	Biodiversity. Agrobios (India). ISBN: 81-7754-208-7.
	13.2. Diversity Indices 13.2.1. Popular Estimates of Biodiversity value using species richness	
Week 15	Unit-XIV	Gupta, R.K., 2004. Advancement of Insect Biodiversity. Agrobios (India). ISBN: 81-7754-208-7.
	14.1. Benefits of Biodiversity	
	14.1.1 Benefits of biodiversity: What has biodiversity ever done for us? 14.1.2. Biodiversity loss and Humanity	
	14.2. Ecosystem and structure 14.3. Community Structure	
Week 16	Unit-XV 15.1. Population Abundance 15.1.1. Richness of various lineages and guilds	Gupta, R.K., 2004. Advancement of Insect Biodiversity. Agrobios (India). ISBN: 81-7754-208-7.
	15.2. Species Diversity	Gupta, R.K., 2004. Advancement of Insect Biodiversity. Agrobios (India). ISBN: 81-7754-208-7.
Course Content (Practical)		Assignments/Readings
Week 1	Introduction and uses of diversity indices	
Week 2	Calculation of Biodiversity by Simpson's diversity index	
Week 3	Calculation of Biodiversity by Sorenson's diversity index	
Week 4	Calculation of Biodiversity by species evenness	
Week 5	Calculation of Biodiversity by species richness	
Week 6	Calculation of Biodiversity by Shannon's diversity index	
Week 7	Calculation of Biodiversity by Menhinick's diversity index	
Week 8	Calculation of Biodiversity by Berger-Parker's diversity index	
Week 9	MIDTERM EXAM	
Week 10	Calculation of Biodiversity by Brillouin's diversity index	

Week 11	Calculation of Biodiversity by Q index	
Week 12	Calculation of Biodiversity by S index	
Week 13	Calculation of Biodiversity by Log α index	
Week 14	Calculation of Biodiversity by Log Normal Lambda λ Index	
Week 15	Calculation of Biodiversity by Gini index	
Week 16	Calculation of Biodiversity by Margalef Index	

Textbooks and Reading Material		Calculation of
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<ol style="list-style-type: none"> 1. Afzal, M. and Mufti, S.A. 1998. Natural History Research. Pakistan Scientific and Technological Information Center, Islamabad. 2. Daly, H.V. Doyen, J.T. Purcell, A.H. and Daly B.B. 1998. Introduction to Insect Biology and Diversity. Oxford University Press. 3. Foottit, R.G. and Adler, P.T. 2009. Insect Biodiversity Science and Society. Wiley – Blackwell Publication UK. 4. Gupta, R.K. 2003. Advances in Insect Biodiversity. Agrobios, New Delhi, India. 5. Richards, O.W. and Davies, R.G. 1984. Imm's General Text Book of Entomology. Vol. II. 10th Ed. (Revised), Chapman and Hall, London. 6. Wheeler, W.M. 2006. Insects: their origin and evolution. Discovery Publishing House, New Delhi <p>Note:</p> <ol style="list-style-type: none"> 1. It is preferable to use latest available editions of books. Mention the publisher & year of publication. 2. The References/ bibliography may be in accordance with the typing manual of the concerned faculty/subject. Preferably follow APA 7th Edition publication manual. 		
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Teaching Learning Strategies	
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| <ol style="list-style-type: none"> 1. Multimedia 2. White Board 3. Group discussion 4. Quiz/Assignments 5. Demonstration/Activity |
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Assignments: Types and Number with Calendar	
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Assessment	
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Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.