WOMEN UNIVERSITY MARDAN

DEPARTMENT OF ZOOLOGY

SEMESTERWISE BREAK DOWN AND CURRICULUM

FOR

M. Phil

WOMEN UNIVERSITY MARDAN

MPhil/MS Program

The Department of Zoology offers MPhil/MS Zoology program with specializations in various disciplines (see our web page). Candidates holding MSc/BS (4 years) degree in relevant areas of Zoology/Biology or equivalent degree are eligible for our MPhil/MS program. The number of open positions depends upon the availability of faculty members and space in a respective lab/research group.

Admission Criterion

- The applicants must have completed 2 year M.Sc with minimum 60 % marks or 4-year BS (Zoology) with at least CGPA 2.5 out of 4.0.
- Admission to MPhil/MS program is based on cumulative merit to be determined from previous academic record (50%), written General and Subject test (40%) conducted by the National Testing Service and interview (10%).
  2. Only the applicants scoring 50% in the written test will be called for interview.

The Program

i) The student must complete 24 CH course work with CGPA ≥2.5.
ii) Having obtained CGPA ≥2.5 in course work, the M. Phil student will complete a 6-credit hour thesis and will successfully defend it in order to qualify for the award of M. Phil degree.
iii) Thesis evaluation and viva voce will be conducted by one external examiner (from a universityin Pakistan other than university of enrollment) and one internal examiner.

1) SCHEME OF STUDIES FOR M.Phil. ZOOLOGY (2 YEAR)

Semester-I

Course Category	Course codes	Course Title	Credits
Core Course-I	ZOOL-711	Advanced Biological Techniques	3
Specialized	ZOOL- 715	Advances in Parasitology	3
Specialized	ZOOL- 713	Wildlife Management and Conservation	3
Specialized	ZOOL-725	Mammology	3
Total			**12**

Semester-II

Course Category	Course codes	Course Title	Credits
Core Course–II	ZOOL-712	Applied Biostatistics	3
Specialized	ZOOL-726	Recombinant DNA Technology	3
Specialized	ZOOL-730	Vector Biology	3
Specialized	ZOOL-729	Advances In Research Methodology	3
			12

Semester-III & IV

Course Category	Course Title	Credits
Compulsory	Research and thesis	6
		6

Course work = 24 credits (compulsory) Core and Special

Research & Thesis = 6 credits (Compulsory)

M.Phil. ZOOLOGY (2 YEAR) PROGRAM COURSES

Core Course-I

Course Code- ZOO-711 ADVANCED BIOLOGICAL TECHNIQUES

Contact Hours:
Theory = 48
Total = 48

Credit Hours:
Theory = **3.0**
Total = 3.0

Course Objectives:
The course aims to:

1. Familiarize the students with advance biological equipments and technique
2. Develop basic understanding of the equipment handling in research.
3. Develop scientific and technical expertise, culture and work habits.

Course Learning Outcomes:

After studying this course students must be able to:

1. Understand advanced biological techniques
2. Apply practical and research skills
3. Operate and use the lab equipment efficiently.

Course Outlines:

UV Spectroscopy/Separations, Flame Atomic Absorption Spectroscopy, Spectrofluorimetry, Thin Layer Chromatography (TLC), Gas Chromatography, High Performance Liquid Chromatography (HPLC), Amino acid sequencing, Blotting techniques, Centrifugation techniques, PCR, DNA Sequencing, Electrophoresis, Isoelectric Focusing Apparatus, Lyophilizer, Microarray Technology, Microscopy, Microtomy, Nuclear Magnetic Resonance Instrument, principles and application, Geographic Information Systems and Remote sensing, ELISA, Cell culture.

Books Recommended:

1. Chemical Analysis: Modern instrumentation, methods and techniques, Francis Rouessac and Annick Rouessac, John Wiley & Sons, 2000, ISBN 0-471-97261-4.
2. Principles of Instrumental Analysis (5th ed), Douglas A. Skoog, F. James Holler and Timothy A. Nieman, Brooks Cole, 1997, ISBN 0-03-002078-6.
3. Spectrometric analysis techniques, M.T.C. de Loos - Vollebregt, Heron reeks - Bohn Stafleu Van Loghum, 2004, ISBN 90-313-4142-8.

Core Course-II

Course Code- ZOOL-712 **Applied Biostatistics**

Contact Hours:		**Credit Hours**
Theory	=32	Theory =2.0
Practicals	=32	Practical =1.0
Total	=64	Total = 3.0

Course Objectives:

1. To provide knowledge about the importance and use of statistics in life sciences.
2. To familiar student with the methods of data analysis pertaining to their research work and to assess the significance of their experimental designs.

Course Outcomes:

Students who successfully complete this course will be able to:

1. **DESCRIBE** the roles biostatistics serves in zoology and biomedical research.
2. **EXPLAIN** general principles of study design and its implications for valid inference.
3. **ASSESS** data sources and data quality for selecting appropriate data for specific research questions.
4. **TRANSLATE** research objectives into clear, testable statistical hypotheses.
5. **DESCRIBE** basic principles and the practical importance of key concepts.

6. **APPLY** numerical, tabular, and graphical descriptive techniques commonly used to characterize and summarize data.

Course Contents:

1. **Introduction:** a. Definition, branches of statistics, b. Scope and importance of statistics. 2. **Data:** a. Population and sample, variable, categorical and non-categorical data, b. Scales of measurements, errors of measurements. 3. **Presentation of data:**

a. Descriptive statistics b. Tabulation of data **c.** Parts of table and construction of table.

d. Diagrams and graphs, pictogram, historigram, line chart, histogram, applications and uses of histogram e. Construction of histogram, comparison of data using histogram,

f. Bar chart, multiple bar chart, pie chart, gantt chart, timeline, infograph, pedigree chart

4. **Frequency distribution:** a. Empirical FD, relative FD, Cumulative FD, class frequency, class limits, class boundaries, class mark, class interval, midpoints. 5. **Measures of Central Tendency:** a. Types of averages, arithmetic mean for grouped and ungrouped data, harmonic mean for grouped and ungrouped data, geometric mean for grouped and ungrouped data, median, quartiles, deciles, percentiles and mode. b. Advantages and disadvantages of arithmetic mean, harmonic mean, geometric mean, median and mode. 6. **Measures of Dispersion:** a. Range, grouped and ungrouped data, coefficient of range b. Mean deviation of grouped and ungrouped data. Coefficient of mean deviation. c. Standard deviation and variance of grouped and ungrouped data, variance and standard deviation of population and sample data. 7. **Probability:** a. Definition, properties, experiment and random experiment, event, outcome, trial, multiplication rule, sample space and sample point, mutually exclusive event, combinations and permutations, probability distribution, binomial experiment 8. **Tests of Significance:**

a. Hypothesis testing b. Steps of hypothesis testing c. Z-test d. t-test, types, e. Chi-square f. ANOVA, its uses and LSD g. Correlation h. Regression

Practicals/Tutorials:

1. Data collection, arrangement and frequency table
2. Data presentation in table, graphs (simple bar chart, multiple bar chart, component bar chart)
3. Construction of timeline, pedigree chart, organogram, Gantt chart, infogram
4. Calculating arithmetic mean, harmonic mean and geometric mean, median and mode from ungrouped and grouped data
5. Calculating mean deviation, standard deviation and variance from ungrouped and grouped data
6. Probability distribution
7. z-test
8. T-test
9. ANOVA

10. Correlation
11. Regression

Text and Reference Books:

1. Field A. (2013) Discovering Statistics with IBM SPSS Statistics. 4th Edition. SAGE Publication Ltd.
2. Belle V. B, Fisher, L.D., Heagerty, P.J., Lumley, T. (2004) Biostatistics – A methodology for the health sciences. 2nd Edition. Wiley-Interscience
3. Quinn, G. (2002) Experimental Design and Data Analysis for Biologists. Cambridge University Press
4. Campbell, M.J., Swinscow, T.D.V. (2009) Statistics at Square One. 11th Edition. BMJ Books.

Specialized Courses

Course Code- ZOOL-713 WILDLIFE MANAGEMENT AND CONSERVATION

Credit Hours: 03 **Theory =03**
Total = 03

Course Objectives:

The objective of this course is

1. To enable the student to understand values and objectives of wildlife conservation
2. To understand the wildlife management rules and regulations in Pakistan
3. To understand how National and International agencies involved in conservation and management of wildlife

Course Learning Outcomes:

Upon successful completion of this course, the student will be able to:

1. Acquire theoretical knowledge about the identification, distribution, status, conservation and management (population estimate technology) of fishes, amphibians, reptiles, birds and mammals of major importance in Pakistan

2. Understand the zoo rules, protected area system Game Reserves, Wildlife Sanctuaries and National Parks,

3. Solve the threats to wildlife by applying the scientific principles and modern technologies.
4. Analyse, interpreting and synthesize data and other information about the population of wildlife
5. Evaluate the conservation management by government department, National and International organizations
6. DEMONSTRATE the ecological assessment, International conventions and importance of wildlife to certain area.

Course Outline:

1. **Wildlife of Pakistan**
   a. Introduction
   b. Important Definitions
   c. Identification
   d. Distribution
   e. Status
   f. Wildlife values
   g. Conservation and Management (population estimate technology) of fishes, amphibians, reptiles, birds and mammals of major importance in Pakistan
2. **Objectives of wildlife conservation**
3. **Problems in wildlife conservation**
4. **Wildlife rules and regulations in Pakistan**
   a. Principles of Reintroduction
   b. IUCN categories of Wildlife
   c. Zoo rules
5. **National and International agencies involved in conservation and management of wildlife**
   a. National Organizations
   b. International Organizations
6. **Protected Areas in Pakistan**
   a. Sanctuaries
   b. Game Reserves
   c. National Parks
7. **Threatened species of Pakistan**
   a. Vulnerable
   b. Endangered
   c. Critically Endangered
8. **Modern Techniques for Control of Environmental Pollution in Wildlife Areas**
9. **Endangered Species Causes and Measures for the Conservation**
10. **International Conventions**

Recommended Books:

1. Mills, S. 2007. Conservation of Wild population. Blackwell Publishing & Co. London, UK.
2. Sinclair, A. R. E., Fryxell, J. M. and Caughley, G. 2006. Wildlife Ecology, Conservation and Management. Blackwell Publishing & Co., London, UK.
3. Sutherlands, W. J. 2000. The Conservation handbook, Blackwell Science.
4. Sexena, M.M., 1990. Applied Environmental Biology, Agro Botanical Publ. India.
5. Rigger. P.G. 1991. Long Term Ecological Research, an International Perspective. John Wiley.
6. Sheehun et. al. P. J. 1984. Effects of Pollution on the Ecosystem. John Wiley.

Course Code- ZOOL-714 **Comparative Endocrinology**

Contact Hours:
Theory = 48
Total = 48

Credit Hours:
Theory =**3.0**
Total= 3.0

Course Objectives:

1. General concepts and principles of chemical coordination.
2. The details of the endocrine mechanisms in relation to various functions such as reproduction and lactation.
3. Recent trends of endocrinology in relation to diversified function.
4. Comparative studies of endocrine mechanisms in various invertebrates and vertebrates.

Course Contents :

An overview of general concepts and principles of endocrinology: The endocrine system; Type of hormones; Endocrine and nervous system relationship; General principles in function, interaction, nature, synthesis, transport of hormones; General concept of feedback, biorhythms, pathology and assessment of endocrine function; Evolution of endocrine system. Hypothalamus and pituitary: Hypothalamic hormones: Origin, chemistry and actions; Anterior pituitary & hormones: Hypothalamic pituitary regulation, General chemistry, Physiological action and metabolism of prolactin-growth hormone family, glycoprotein hormone family, corticotrophins and other pro-opiomelanocortin peptides; posterior pituitary: Release, regulation and actions of vasopressin and oxytocin. Thyroid gland: Anatomy and histology of gland; Formation and secretion of thyroid hormones; Thyroid hormones in peripheral tissues, Regulation and factors affecting thyroid

function. Calciotrophic and Mineral Metabolism Hormones: Chemistry, physiological actions and metabolism of parathyroid hormone, calcitonin and calciferols; Homeostasis of calcium, phosphate and magnesium. Pancreatic Hormones and Regulatory Peptides of the Gut: Anatomy and histology for sources of the hormones; Chemistry, physiological roles and mechanism of action of insulin and glucagon; Physiological roles of gut peptides. Adrenal Medulla and Catecholamines: Chromaffin cell and organization; Structure of adrenal medulla; Biosynthesis, storage, release and metabolism; Adrenergic receptors. Adrenal Cortex: Steroid biochemistry; Physiological actions of corticoid hormones; Regulation and metabolism of glucocorticoids, mineralocorticoids and adrenal sex steroids. Testes: Androgenic tissue: Structure and chemistry; Transport, metabolism and mechanism of action. Ovaries: Ovarian hormones: Steroid biochemistry and biosynthesis; Transport, metabolism and mechanism of action. Endocrinology of Heart, Kidney, Immune system: Growth and pineal gland. Functional diversity of hormones in vertebrates; Overview of endocrine mechanisms in invertebrates.

Text and Reference Books:

1. Greenspan, F.S. and Strewler, G.J. Basic and Clinical Endocrinology, 5 th Edition. 2002. Prentice Hall International Inc., London.
2. Wilson, J.D., Foster, D.W., Kronenberg, H.M. and Larsen, P.R. WILLIAMS Textbook of Endocrinology, W.D. 2008.Saunders Company, Philadelphia.
3. DeGroot, L.J., Jameson, J.L. Endocrinology, 4th Edition. 2001. W.B. Saunders, Philadelphia. 4. Giffin, J.E. and Ojeda, S.R. Textbook of Endocrine Physiology.4th Edition. 2000. Oxford University Press, Oxford.
5. Neal, J.M., Basic Endocrinology: An Interactive Approach. 2000. Blackwell Science Inc., London.

Course Code- ZOOL-715 **Advances in Parasitology**

Contact Hours:	**Credit Hours:**
Theory = 48	Theory =**3.0**
Total = 48	**Total**= 3.0

Course Objectives:

The objectives of this course are to: • enable the students to discuss various types of parasites and hosts. • Educate the students on the similarities and differences between a parasite and a foetus • explain the relationship between a parasite and the host and the effects of parasites on the hosts to the students. • Enhance students understanding of host responses to parasite • give the students' detailed classification of medically important parasites. • Equip the students with the distinguishing features among cestodes, nematodes and trematodes. • Enlighten students on the pathology, clinical symptoms, diagnostic methods, control and prevention of common parasitic infections.

Course Outcomes:

1. Upon completion of this course students will be able to:
    a. Demonstrate an understanding of the diversity of parasites.
    b. Discuss the parasite-host relationship and describe the effects parasites have on their hosts. • Describe the basic biology, physiology, morphology, life history, behavior, phylogeny and ecology of selected parasites.
    c. Recognize significant morphological characteristics for identification of parasites to the taxonomic group and the life history stage.
    d. Communicate effectively in class discussion and on written assignments.

Course Contents:
Parasite diversity, life cycles, host defense mechanisms, parasite evasion, host pathology, ecology, evolution, and control. The laboratory component of the course will examine parasites of medical and veterinary importance.
Introduction to parasitology. Relationship to other sciences, parasitology and human welfare. Parasites of domestic and wild animals. Some basic definitions. Basic principles and concepts. Parasite ecology and evolution. Basic principles and concepts. Immunology and pathology. Susceptibility and resistance, innate defence mechanisms. Pathogenesis of parasitic infections. Accommodation and tolerance in the host-parasite relationship. Parasitic protozoa, form, function and classification:. Other flagellated protozoa, order Retortamonadita, order Diplomonadida, order Trichomonadida,. The Amoebas. Order Amoebida, order Schizopyrenida. Phylum Apicomplexa, Gregarines, Coccidia and related organisms. The apical complex, class Gregarinea, class Coccidea. Phylum Apicomplexa, Malaria, organisms, and pyroplasms, Phylum ciliophora, ciliated protistan parasites, class Spirotoichea, class Litostomitea, Phyla Microspora and Myxozoa. Parasites with polar filaments. Phylum Microspora, Phylum Myxozoa. The Mesozoa, pioneers or Degenerates. Phylogenetic position, physiology and Host parasite relationship. Classification of Phylum Mesozoa. Systematics, morphology and biology of Arthropods (Causing or responsible for transmission of disease. Pathology of Helminths: Host parasite relationships and control of parasitic Helminths with particular reference to Helminths of Medical and Veterinary importance.

Books Recommended

1. Roberts, L.S. and Janovy, J. Jr. 2005. Foundations of Parasitology. 7 th Edition. W.M. Brown Publishers, Chicago, London, Tokyo, Toronto.

2. Urquhart, G.M., Hucan, J.L., Dunn, A.M. and Jennings, F.W. 2000. Veterinary Parasitology. Longman Scientific and Technical publications, Longman Group, UK.

3. Roberts, L.S. and Janovy, J. 2000. Foundation of Parasitology, 6th Edition. McGraw Hill Book Co.

4. Hausman, K. and Hulsmann, N. T. 1996. Protozoology, 2nd Edition. Medical Publishers, Inc. New York.

5. Smyth, J.D. Introduction to Animal Parasitology. 1994. Cambridge University Press.

6. Cheesbrough, M. 1987. Medical Laboratory Manual for Tropical Medicine. Vol.I. University Press Cambridge.

7. Noble, E.R. and Noble, G.A. Parasitology. 1982. The Biology of Animal Parasites. 5th Edition. Lea and Febiger Publisher. 8. Beck, J.W. and Davies, J.E. 1981. Medical Parasitology. 3rd Edition. C.V. Mosby Company, Toronto, London.

Course Code- ZOOL -716 **Advances Cell and Molecular Biology**

Contact Hours:		**Credit Hours**
Theory	=48	Theory =3.0
Total	=48	Total = 3.0

Course Objectives:

The course aims to:

1. Impart knowledge about the animal cell and its complex organization of architecture
2. Provide understanding about the unified role of a cell for the ultimate sustainability of the organisms.
3. Enable students to understand various ultra-structural, molecular and functional aspects of the cells will be communicated in this course.

Course Contents:

Introduction to prokaryotic and eukaryotic cells: Plasma membrane, its chemical composition structure and functions of plasma membranes, cell permeability, active transport, endocytosis, phagocytosis. Cytoskeleton: Microfilaments, Microtubules, Intermediate filaments. Cytoplasmic Organelles: Membrane system, structural and functional commonalities. Ultrastructure, chemical composition and functions of Endoplasmic Reticulum and their role in protein synthesis and drug metabolism, Golgi apparatus its role in synthesis of glycoprotein, Mitochondrial respiration and its significance as semi-autonomous organelle; Lysosome, its diverse roles due to hydrolytic activity of enzymes, Peroxisome, its role in metabolism of hydrogen peroxide, Glycoxysome with reference to glyoxylic acid cycle. Nucleus: chromatin, heterochromatin, euchromatin, chromosome structure, coiling and nucleosome during different phases of cell cycle. Replication: mechanism, DNA replication in prokaryotes specially with reference to variety of DNA polymerases and other proteins involved, DNA replication in Eukaryotes with emphasis on DNA polymerases, concept of replicons etc., Transcription: variety of RNA and their characteristics, synthesis of mRNA, rRNA and tRNA with special reference to enzymes involved, RNA splicing, split genes, concept of ribozymes and 43 posttranscriptional processing, RNA transduction, Genetic code, point mutations. Translation: Specific role of Ribosomes, various factors, and posttranslational processing, control of gene expression in Prokaryotes.

Text and Reference Books:

1. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., Watson, J.D.2013. Molecular Biology of the Cell. Garland Publishing Inc., New York.

2. Damell Jr. J., Lodisch, H., Balimore, D. 2013. Molecular Cell Biology, Scientific American Inc. N.Y. 3. Friefelder, D. 2010. Molecular Biology.
4. Geoffrey M.C., Robert E.H. 2007. The cell: A Molecular Approach,. Sinauer Associates, INC.
5. Karp, J. 2005. Cell and Molecular Biology, Concepts and Experiments, Jhon Wiley and Sons, INC.
6. De Robertis, E. D. P., De Robertis Jr. E. N. F. 1987. Cell and Molecular Biology, Lea & Febiger, New York

Course Code- ZOOL-717 **Advances in Animal Physiology**

Contact Hours:
Theory = 48
Total = 48

Credit Hours:
Theory = **3.0**
Total = **3.0**

Course Objectives:
The objectives of the course are:-

1. To impart knowledge about membrane irritability and generation of nerve impulse.
2. To develop critical thinking about the mechanisms of integration in the different functional systems of the animals.
3. To develop analytical approach about the physiology of neural and hormonal control systems.

Course Learning Outcomes:
Upon successful completion of the course, the student will be able to:

1. **ACQUIRE** the basic knowledge of membrane irritability, physiology of receptors and membrane potentials.
2. **UNDERSTAND** the concepts of basic mechanism of action potential and its propagation.
3. **ANALYZE** the physiological changes due to stress, hormonal problem, respiratory arrest and cardiovascular problems.
4. **DEMONSTRATE** individually ECG and various cardiovascular problems.

Course Outline:

1. **Membrane Potentials**
   a. Membrane channels
   b. Mechanisms in resting membrane potentials
   c. Electrogenic ion pump.
   d. Diffusional potentials. Nernst equation
   e. Ionic mechanisms in action potentials
   f. Properties of action potential.

g. Propagation of action potential in neurons.

2. **Synaptic transmission**
   a. Structure and function of electrical synapse structure and function of chemical synapse .
   b. Non synaptic Chemical transmission.
   c. Neurotransmitters; Synaptic receptors; excitatory postsynaptic potentials.
   d. Inhibitory postsynaptic potentials.
   e. Presynaptic inhibitions; Integration at synapses.
   f. Facilitation, Posttetanic Potentiation.
3. **Receptor Physiolgy**
   a. Mechanoreception and hair cell mechanism.
   b. Pain receptors and ascending and descending pathways for pain signal.
   c. Ultra structure of photo receptors, photochemistry, color vision. Structure and physiology of taste receptors and olfactoryreceptors
4. **Hormones**
   a. Mechanism of hormone action.
   b. Steroid hormones and their action.
   c. Non steroid hormones and their action
   d. Negative feedback mechanism of hormonal control (Insulin, Glucagon, regulation of blood calcium level)
   e. Insect hormones.
   f. Cyclic AMP as secondary messenger.
5. **Respiration**
   a. Neural and chemical control of respiration.
   b. Bohr's effect and Haldane effect
   c. Oxygen –hemoglobin dissociation curve and factors affecting this curve
   d. Respiratory responses in extreme conditions as hypoxia.
   e. Hypercapnia in air breathing divers.
   f. Anaesthesia and periodic breathing. Shunt pathways
6. **Osmoregulation and Excretion**
   a. Osmoregulation in aquatic and terrestrial environment.
   b. Vertebrate nephron as osmoregulatory organ.
   c. Physiological anatomy.
   d. Glomerular filtration, Tubular absorption and secretion.
   e. Nitrogenous waste products.
   f. Patterns of nitrogenous excretion and their phylogenetic development.
   g. Renal lesions
7. **Muscle contraction**
   a. Structural basis of muscle contraction.

b. Molecular structures of contractile components and their interaction.
c. Sarcoplasmic reticulum
d. Cross bridge chemistry and sliding filament model

8. **Temperature relations**
   a. Temperature relations of ectotherms
   b. Temperature relations of endotherms
   c. Stages of sleep
   d. Torpor, hibernation and winter sleep
9. **Rhythmicity of heart**
   a. Excitatory and conductive system of heart.
   b. Control of blood flow and blood pressure.
   c. Sick sinus syndrome.
   d. ECG and hemodynamics.
10. **Physiology of Digestion**
   a. Movements in GIT.
   b. Absorption of water and nutrients in GIT.
   c. Regulation of digestive secretions.
   d. Neural control of GIT potential

Text and Reference Books:

1. Guyton, A.C. and Hall, J.E. 2010: Text book of Medical Physiology, 11th Edition. W.B. SaundersCompany,Philadelphia
2. Hill, R.W., Wyse, G.A. and Anderson, M., 2016: Animal Physiology. 4th Ed. Sinauer Associates, Inc. New York
3. John E. Hall., 2015: Guyton and Hall textbook of Medical Physiology. 13th Ed. Elesvier
4. Moyes, C.D. and Schulte,P.M. 2015: Principles of Animal Physiology. 3rd Ed. Pearson New York
5. Randall, D., Burggren, W., French, K. and Fernald, R. Eckert. 2002: Animal Physiology. 5th Edition. W.H. Freeman and Company, New York
6. Widmaier, E., Raff, H. and Strang , K. 2013: Vander's Human Physiology: The Mechanisms of Body Function. 13th Ed. McGraw-Hill Education
7. Withers, P.C. 1992: Comparative Animal Physiology. Saunders College Publishing, Philadelphia.

Course Code- ZOOL-721 **Advances Developmental Biology** Credit Hour = **3.0**

Course Objectives:
This course aims to:
1. Provide information on transmission of traits from the parents in their gametes, the formation of

zygote and its development
2. Impart detailed knowledge about cellular basis of morphogenesis, mechanisms of cellular differentiation and induction.
3. Provide understanding of the mechanisms of organogenesis, factors controlling growth and oncogenesis.

Course Contents:

Introduction: Principal features of development, origin of sexual reproduction, developmental patterns; Spermatogenesis; Oogenesis. Fertilization: Recognition of sperm and egg, fusion of gametes, activation of egg metabolism, rearrangement of egg cytoplasm**.** Cleavage: Patterns of embryonic cleavage, mechanism of cleavage. Gastrulation: Fate maps, gastrulation in sea urchin, amphibians, birds and mammals. Early Vertebrate Development: Neurulation, ectoderm, mesoderm and endoderm. Cellular Basis of Morphogenesis: Differential cell affinity, cell adhesion molecules. Mechanism of Cellular Differentiation: RNA processing, translational regulation of developmental process, cell-fate by progressive determinants, autonomous cell specification by cytoplasmic determinants, establishment of body axes and mechanism of teratogenesis; Secondary Induction. Organogenesis: A brief account; Origin and migration of germ cells in vertebrates. Factors controlling growth and oncogenesis. Post embryonic Development and metamorphosis Hormones as mediators of development; Regeneration in vertebrates

Text and Reference Books:

1. Gilbert, S. F. 2012. Developmental Biology, Sinauer Associates, Sunderland, MA.
2. Klaus, K. 2001. Biological Development. 2nd Ed., McGraw Hill.
3. Balinsky, B. I. 1985. An Introduction to Embryology, Saunders.
4. Oppenheimer, S.S. 1984. Introduction to Embryonic Development, Allen and Bacon.
5. Saunders, J. W. 1982. Developmental Biology, McMillan and company.
6. Ham, R. G., Veomett, M. J. 1980. Mechanism of Development. C. V. Mosby Co.

Course Code- ZOO 722 ANIMAL BIOTECHNOLOGY 3(2 + 1)

COURSE OBJECTIVES:

To acquaint the students with techniques to produce transgenic animal and embryonic micromanipulations.

COURSE CONTENTS:

Introduction and history of transgenic animals, Role of synthetic peptides/protein in animal health, Use of monoclonal antibodies as a diagnostic/therapeutic agents, Cytokines and their potential

therapeutic value, Application to diagnosis of microbial infection and to genotype analysis, The micromanipulations of farm animal embryos, The incorporation of biotechnological techniques in animal breeding strategies, Gene transfer through embryo microinjection, Ethical and social issues in animal biotechnology.

Practicals:

Aquaculture

techniques, various DNA recombinant techniques useful for animal biotechnologies.

RECOMMENDED TEXT BOOKS:

1. Freshney, II., .2000. Culture of animal cells: A manual of basic techniques Wiley, John and Sons
2. Masters, J. R., 2000. Animal cell culture. Oxford University Press.
3. Lanza, R.P., Lanza, B., Atala, A., 2001. Methods of tissue engineering Academic Press Inc.
4. Doyle, A., Griffiths, J. B., 1998. Cells and tissue culture: Laboratory. procedures in biotechnology. Wiley, John and Sons.
5. Barnum, S., 2004. Biotechnology: An Introduction (with Infotrac) Brooks /Cole.
6. Tourte, Y., and Catherine, T. C., 2005. Genetic Engineering and Biotechnology: Concepts, Methods, and Agronomic Applications. Science Publishers.
7. Houdebine, L-M., 2003. Animal Transgenesis and Cloning. John Wiley and Sons Limited.

Course Code- ZOO 723 INTEGRATED BIOLOGICAL RESOURCE MANAGEMENT 3(3-0)

Course Objectives:

This course aims at providing student with the basic understanding of principles and concepts of Natural Resource. Course is designed to provide student with the basic understanding of role performed by these natural resources, threats that are associated with them and approaches used for their management. Course will also emphasize on the issues and constraints involved in the management of these resources. Course is designed to provide student with a general overview keeping in view its undergraduate level however special focus will be on Pakistan's perspective. Other objectives are: • To provide students with the basic understanding of biological resources we are blessed with and what functions they perform in our lives; • To investigate the major issues involved in Biological

Resource Management in both the global and Pakistani context; • To develop an integrated approach to the analysis and management of Natural Resources and issues associated with their management;

Course Outline:

Introduction: Biological resources, classification of natural resources, basic definitions and concepts (tragedy of the commons, resource degradation, 48 carrying capacity, ecological footprints), human demands on natural resources, existing situation in world in general while in Pakistan particularly, brief history of natural resource management, sustainable management of natural resources, different approaches to natural resource management, conservation, preservation, Community based natural resource management, development of natural resource management plan: needs, requirement, process and contents of the management plan. Forest management: forest types and its existing management, watershed management: Importance basic principles, methodologies, national example, wetland management: existing situation, importance, key threats, National wetland policy and brief introduction to Ramsar convention, rangeland management: existing status, importance, threats, causes and methods for its improvement. Rotational grazing, seasonal grazing, National Rangeland policy of Pakistan, livestock management, wildlife management: Management existing situation at national level, wildlife census, reasons for its decline and its possible remedies, existing management approaches, sustainable/trophy hunting projects and its role in local and national development, national and provincial legislation. Agriculture resource management: Existing situation of agriculture sector in Pakistan, agriculture products and their share in GDP, problem in agriculture, agriculture chemicals, their pros and cons, national agriculture policy, management options., Energy (coal, hydrocarbon, hydel) and Mineral Resource (Metallic and non-metallic deposits) Management, Land use Planning and Management: evolution of land use planning, review of land use plans developed by the various organizations, field visit to develop a land use plan for selected area. Water Resource Management: water conservation at domestic, industrial and agricultural sectors. Flood control, drought management, channelization, desalinization, cloud seeding, rain water harvesting and recharge wells. Technologies for watercourse improvement and Farm layout improvement, Laser land leveling, Improve cropping pattern, groundwater zoning and skimming wells. Fisheries Management: Types of fishes in Pakistan, existing situation reason for decline and its potential in the national economy, management options.

Recommended Books:

1. Environmental Science: working with Earth. 2013. Miller, T.G. 9thEdition. Jack Cary Publisher London.

2. Basics of forestry and Applied Sciences, Concepts and Theory. Masood A.A Qureshi, 3 rd Ed Vol-1, A-one Publishers 2005.

3. Environment: Problems and Solutions. Asthana, D. K & Asthana, M, 5th Ed, S. Chand & company LTD 2006.

4. Environmental Science: Earth as Living Planet. Botkin, D., & Keller, E, 8th Ed. John Wiley and Sons 2000.

5. Environmental Science: working with Earth. Miller. T. G, 9th Edition, Jack Cary publisher 2003.

WOMEN UNIVERSITY MARDAN
DEPARTMENT OF ZOOLOGY

Course Code- ZOO 724 **ORNITHOLOGY** **Credit hours 3(2+1)**

Objectives :

The course will

1. Provide knowledge about bird diversity
2. Avian anatomy, physiology and adaptations
3. Bird behavior and socioeconomic and ecological importance

Course Contents:

Introduction to ornithology, class Aves, taxonomy of birds up to orders, families and major species; evolution of birds; biology of fossil birds; archaeopteryx, archaeornithes, neoornithes; morphology and surface anatomy of bird, and development structure of feathers, plumage; structure of bones; basic embryology of birds; internal anatomy of birds; systems physiology; blood circulatory, cardiovascular physiology, heart, blood cells and hemodynamics; respiratory system, air sacs, ventilation of lungs, metabolic rates, oxygen consumption; urinary system, kidney physiology and production of solid or semisolid excreta, brain physiology and anatomy, special senses, olfaction, vision, taste; digestive system, anatomy, guts and feeding strategies; morphological and physiological adaptations of birds to flying, kinds of flight; reproductive organs anatomy and physiology, egg laying and breeding seasons; bird migration, song production, bird behavior, courtship, mating, egg incubation strategies, brood parasitisim; predator-prey relationship; homing behavior; learning, imprinting; nest building; bird parasite; endangered species of birds; bird conservation and sanctuaries. Introduction, evolution, geographical distribution. Classification Characteristics of birds, external features, identification of sex and age, reproduction and development, behaviour (migration, territoriality), populations and their regulation.

Books Recommended:

1. Howell, S. N. G. 2010. Peterson Reference Guide to Molt in North American Birds (Peterson Reference Guides. Amazon Co.
2. Kaiser, G. W. 2008. The Inner Bird: Anatomy and Evolution. Amazon Co. Richarcd
3. A J Urfi 2009. Birds of India: A Literary Companion, OUP.
4. Frank B. Gill. 2004. Ornithology. 2nd Ed. W. H. Freeman & Co.
5. Handbook of Bird Biology by Cornell Lab of Ornithology. Princeton University Press. New Jersey. 2004
6. Rank B. Gill. 2004. Ornithology: Ecology and Evolution of Darwin's Finches. 99 ed. (rev). Princeton. W. H. Freeman
7. David Allen Sibley and Alfred A. Knopf 2003.The Sibley Field Guide to Birds of Eastern North America. New York Press
8. Salim Ali and S. Dillon Ripley 2001. Handbook of the Birds of India and Pakistan: Together with Those of Bangladesh, Nepal, Bhutan and Sri Lanka/. Reprint. New Delhi, Oxford University Press, 10 Vols.
9. . Noble S. Proctor, Patrick Lynch, Patrick J. Lynch, Patrick J. Lynch 1998. Manual of Ornithology: Avian Structure and Function. Yale University Press.
10. Audubon Handbook: How to identify birds? 88th ed. McGraw-Hill Publishing Company.

Course Code- ZOO 725 Mammalogy Credit Hours: 3(2+1)

Objectives:

1. To teach the students about phylogenetic relationships of the primitive and present mammals, based on taxonomic and modern approaches
2. To study the feeding and foraging periodicities of different mammalian groups and impact of environment on feeding behavior
3. To ascertain different mammalian population patterns viz. concept of natality, mortality, modeling signaling and effective communication in various mammals

Course Contents :

Introduction to mammalogy. History of mammalogy. Mammalian phylogeny. Dental and cranial characteristics. Evolution of viviparity. Biogeography: Mammalian radiation, biogeography of mammals of Pakistan. Food and 95 feeding: Stenophagy and euryphagy. Population regulation: Natality, mortality, immigration, emigration, population size, mean crowding, population modeling, Signaling: Types and evolution, communication and social organization. Mammalian Adaptations: Molecular basis of torpor, aestivation, hibernation, acoustic orientation (echolocation). Home range and territoriality. Predation: Predator-prey co-evolutionary race.

Practicals

1. General survey of mammalian species (Visits to zoological museums and zoos and field study)
2. Study of techniques for the collection of mammals, their identification and systematic relationships
3. Comparative study of mammalian skeleton
4. Dissection of a rabbit or rat to expose its different systems

Books Recomended

1. Vaghuan, T. A., J. M. Ryan and N. J. Czaplewski. 2010. Mammalogy. 5 th Ed. The John Hopkins University Press, New York, USA.
2. Feldhamer, G. A., L. C. Drickamer, S. H. Vessey, J. F. Merritt and C. Krajewski. 2007. Mammalogy: Adaptation, Diversity, Ecology. 3rd Ed. The John Hopkins University Press, New York, USA.
3. Genoways, H.H., 2000. Current Mammalogy. Plennium Press, New

Course Code- ZOO-726 RECOMBINANT DNA TECHNOLOGY

Contact Hours:

Theory = 48
Total = 48

Credit Hours

Theory = 2.0
Practical = 1.0
Total = 3.0

Course Contents

An outline of DNA cloning experiment, cloning vectors including plasmids, bacteriophages, cosmids, YAC vectors, shuttle and expression n vectors; tumor inducing (Ti) plasmids; restriction enzymes; gene splicing, genomic and cDNA libraries, screening methods for gene libraries; Southern and Northern blotting; chromosome walking; site specific mutagenesis; potentials of recombinant DNA technology; PCR; production of proteins; tissue culture techniques; transgenic organisms and gene therapies; restriction fragment length polymorphisms and disease detection (e.g. cystic fibrosis); human genome project; stem cells and therapeutic cloning; social

considerations.

Practicals

Plasmid isolation, Transformation techniques, PCR, Southern and Northern blotting; RFLP.

Books Recommended

1. Basic Biotechnology. C. R. Attedge, and B. Kristiansen, 2001.\

Cambridge University Press, U.K.
2. A Manual of Basic Technique. Freshney, R. Ian. 2000. Alan R. Liss,

Inc., New York.

3. Application of Microbes in Biotechnology. Lee, Y.K. & C.L. Poh and H.

M. Tan.1999. Springer-verlag.

Course Code- ZOO-727 ADVANCES IN WILDLIFE Credits hour 3

Objectives

Provide a foundation of modern concepts in wildlife science

To elicit public support for conservation of wildlife & habitats through

conservation awareness programmes and ecotourism

Course Contents

Wildlife of Pakistan, Identification, distribution, status, life cycle, conservation and management of reptiles, birds and mammals of major importance in Pakistan. Philosophy of wildlife conservation.

Protected Areas in Pakistan a. Sanctuaries b. Game Reserves c. National Parks Ramsar convention a. Wetlands b. Ramsar Criteria c. Ramsar Sites ,Biodiversity and sustainability of wildlife. Wildlife rules and regulations in Pakistan & AJ&K National and international agencies involved in conservation and management of wildlife. Sanctuaries, Game Reserves and National Parks in Pakistan. .

Practicals

1. Demonstration of distribution Birds & mammals of Pakistan (blank

maps may be provided)

2. Study of Wildlife habitates.

3. Measurements of Animal Diversity.

Books Recommended

1. Roberts, T.J., (1991) Mammals of Pakistan Ernest benon Ltd, London

2. Birds Mammals, Reptiles Amphibians population censing Techniques. 142

3. 3. Southwick, C.H (1976). Ecology and quality of our environment, D.vannostrand Co. New York.

Course Code- ZOO-728 HUMAN GENETICS Credits hour 3

Contact Hours:
Theory = 48
Total = 48

Credit Hours
Theory = 2.0
Practical = 1.0
Total = 3.0

Objectives

The concepts and mechanisms of inheritance pattern, chromosome

and gene linkage and molecular basics of genetics.

Extend provision in knowledge of human genome

To study impact of human genes on health

Course Contents

Human genome map. Impact of human genes on health. Somatic cell Karyotyping. Human Karyotyping. Single gene traits inheritance: Study of Pedigree analysis for identification of various modes of inheritance. Genetic defects in prenatal development; oncogenes and cancer, normal chromosomes, congenital malformations.

Metabolic variation and diseases: In-born errors of metabolism, Errors in transport system, Inherited variations.

Genetic linkage: family method, somatic cell hybridization, deletion mapping and duplication mapping. Eugenics. Twin studies. Human genome project objectives and goals.

Practicals

1. Study of different qualitative and quantitative traits.

2. Pedigree analysis.

3. Analysis of sex chromosomes in Inter-phase nuclei.

4. Karyotyping of normal and abnormal human chromosomes.

5. Screening of metabolic and other disorders.

6. Dermatology of normal and mentally retorted individuals.

7. Problems solving on genetic counseling.

Books Recommended

1. Strachan, T., A. P. Read, Human Molecular Genetics, 3rd edition,Garland Science/Taylor & Francis. 2003.

2. Ehrlich P.R., Human Natures: Genes, Cultures, and the Human Prospect, 1st edition, Penguin USA Paper, 2002.

3. Relethford J. H., Genetics and the Search for Modern Human Origins, Wiley-Liss 2001. 4. Annual Review of Genomics and Human Genetics (Annual Review of Genomics and Human Genetics, Vol 2, AnnualReviews, 2001.

WOMEN UNIVERSITY MARDAN
DEPARTMENT OF ZOOLOGY

Course Code- ZOO-729 **ADVANCES IN RESEARCH METHODOLOGY**

Contact Hours:		**Credit Hours**	
Theory	= 48	Theory	= 3.0
Practicals	= 0	Practical	= 0.0
Total	= 48	Total	= 3.0

Course Objectives:

The course is aims to:

4. Develop research skills Provide understanding how to design scientific research, to collect data and its interpretation
5. Emphasize the importance of ethics in scientific research
6. Enable students to write a research proposal

Course Outcomes:

On completion of this course, the students should be able to:

1. **UNDERSTAND** a general definition of research design.
2. **IDENTIFY** the overall process of designing a research study from its inception to its report.
3. Become **FAMILIAR** with ethical issues in educational research, including those issues that arise in using quantitative and qualitative research.
4. **KNOW** the primary characteristics of quantitative research and qualitative research.
5. **IDENTIFY** a research problem stated in a study.
6. Become **FAMILIAR** with how to write a good introduction to an educational research study.
7. To **DISTINGUISH** a purpose statement, a research question or hypothesis, and a research objective.

Course Contents:

1. **Introduction:**
   b. Objectives of Research, Motivations
2. **Research Process:**
   a. Research methods vs. research methodology, scientific method
   b. Types of research, general steps involved in research
   c. Problems of research in Pakistan
3. **Topic Selection:**
   a. Problem identification for research, criteria and evaluation
4. **Literature Review:**
   a. Importance and sources
   b. Referencing and citation and bibliography
   c. Plagiarism

5. Know and use library reference sources and services
6. **Research Design:**
   b. Parts, important features, important concepts in research design,
7. **Aims and Objectives:**
   a. Research objectives, qualities of research objectives
8. **Material and Methods:**
   a. Bioethics, sampling, sampling designs, data collection and data analysis, sampling requirements, scales of measurement, error of measurement and its sources
9. **Data Analysis:**
   a. Advanced statistical analysis will focus on the different types of descriptive statistics, important statistical concepts such as normal distribution, sampling error, standard error, confidence intervals, and the use of significance tests, error, p-values, and 1- and 2-sided t-tests. The course will also focus on tests to compare means, transforming data, correlating data, running regressions, and interpreting survival data.
10. **Statistical Software**
    a. SPSS, SAS, SATA, Python and R etc.
11. **Data Presentation**
    a. Tabulation, graphical presentation
    b. Presentation software
12. **Scientific Writing:**
    a. Difference between thesis/report/synopsis/research proposal
    b. Parts of synopsis/project proposal, parts of thesis/report
13. **Reference management software**
    a. Endnote, Reference Manager, Mendeley etc.
14. **Budgeting:**

a. Cost estimates for a research project, funding sources e.g. USAID, HEC, MOST, HED, PMRC, WWF, PSF etc.

Text and Reference Books:

1. Paul Leedy, 2004, Practical Research: Planning and Design (8th Edition), Jeanne Ellis Ormrod
2. Creswell, J. W. (2013). Research Design Quantitative Qualitative and Mixed Methods Approaches. Sage.
3. Hess-Biber, S. N. and P. Leavy. (2004). Approaches to Qualitative Research, A Reader on Theory and Practice. New York, Oxford University Press.
4. Khan, J.A. (2008). Research Methodology. New Delhi: APH Publishing.
5. Kothari, C.R., & Gaurav, G. (2014). Research Methodology: Methods and Techniques. New Delhi: New Age International.
6. Kumar, R. (2011). Research Methodology: A Step By Step Guide for Beginners. Cornwall: SAGE Publications, Inc.
7. Laurel, B. (2003). Design Research, Methods and Perspectives. London England, The MIT Press.
8. Walliman, N. (2005).Your Research Project, 2nd Edition, A step by step guide for the

first-time researcher. New Delhi, Vistaar Publications

Course Code- ZOO-730 **VECTOR BIOLOGY**

Contact Hours:		**Credit Hours**	
Theory	= 48	Theory	= 3.0
Practicals	= 0	Practical	= 0.0
Total	= 48	Total	= 3.0

Objectives:

The objectives of the course are:-

1. To provide in-depth appreciation of diseases transmitted by invertebrate vectors

2. To impart knowledge about control of vector-borne disease

Course Learning Outcomes: Upon successful completion of the course, the student will be able to:

1. Discoverthe basic knowledge of vector biology

2. Illustrate the concepts of disease transmission by invertebrate vectors. 3. Analyze knowledge for control of vector-borne disease

Course Outline: 1. Vector Biology and Control a. Key aspects of vector taxonomy b. Evolution c. Biology and Behavior. 2. An introduction to the life-cycles of vectors a. Ecology b. Role in transmission of various diseases 3. Major groups of arthropod-borne pathogens and vectors a. Basic components of arbopathogen disease cycles b. Principles of pathogen transmission dynamics 4. Emergent pathogens a. Vector genetics b. Vaccines for vector-borne disease c. Traditional and modern disease control strategies d. Venomous Arthropods. 5. Biology and Ecology of some vectors of medical importance (order Diptera) a. Mosquitoes (Anopheles culicine), Black flies sand flies, biting midges, horse flies, deer flies and clegs, tsetse flies, house flies, myiasia producing flies (blow flies, blue bottles, green bottles, flesh flies, warable flies and bot flies). b. Morphology, anatomy, distribution, breeding habits, life-cycle and seasonal prevalence of the species c. Brief account of diseases spread by these vectors d. Methods of control e. Modern trends in their biological and chemical control.

Reference Books:

1. Handler, A. M. James, A.A. (Eds.). 2004. Insect Transgenesis: Methods and Applications, Comprehensive review of insect gene transfer, its methodologies, applications and risk assessment and regulatory issues. CRC Press.

2. Hoy, M.A.2000. Insect Transgenesis: Methods and Application. CRC Press.

3. Pedigo, L. P. 2003. Entomology and Pest Management. 4 th ed. Pearson Education, Singapore, Pvt. Ltd.

4. Roy, D. N. and Brown, A.W.A .2004. Entomology. Biotech .Books, New Delhi.

5. Peter, W. Atkinson., 2010. Vector Biology, Ecology and Control.Springer Dordrecht Heidelberg, London, New York.

6. William, H. Marquardt, et al., 2004. Biology of Disease Vectors.2nd Edition.

7. William Charles Marquardt, Richard S. Demaree, Jr., Robert Burton Grieve., 2000. Parasitology & Vector Biology.2nd Edition.

Course Code- ZOO-731 **ADVANCED INSECT ECOLOGY**

Contact Hours:
Theory = 48
Total = 48

Credit Hours
Theory = 3.0
Total = 3.0

Objectives:

The objectives of the course are:-

1. To provide a synthesis of ecological principles with an applied interpretation.

2. To explore the roles of insects in delivery of ecosystem services and applications topest management and conservation.

3. To demonstrate the intra and inter specific interactions of insects thus highlighting their ecological niche.

Course Learning Outcomes: Upon successful completion of the course, the student will be able to:

1. UNDERSTAND how insects engineer our global ecosystem as well as how they respond to environmental changes.

2. DESCRIBE the reasons of insect abundance and diversity in any ecosystem.

3. APPRAISE the principles of ecology at four levels of integration i.e. populations, communities, ecosystems, and landscapes.

4. EXPLORE AND ESTABLISH the links between different levels of integration.

Course Outline: Scope of Insect ecology.

a. Introduction to insect ecology: Insects in ecosystems, Adaptations of Insects, Life history strategies. b. Responses to abiotic conditions. c. Resource acquisition. d. Insects and Landscape: affects of landscape modification on insects. e. Insects and Climate: affects of climate change on insect species, Insect invasions & climate change. 236 f. Biodiversity: Insect conservation, Insect extinctions. g. Insect populations: Population Dynamics, Population sampling methods. h. Insect communities: Community Interactions: (1) Insect-plant interactions, Plant defenses and insect counter-defenses, Insect herbivores, Natural Enemies of insect herbivores with emphasis on Ichneuomonidae and Braconidae, Insect defenses against enemies (2) Predator-prey interactions (3) host-parasite interactions (4) Mutualisms (5) Pollinators-plant interactions: co-evolution of plants & pollinators (6) Insect and pathogens (7) Ecology based Insect pest management. i. Behavioral ecology: Social organization in insects, Insect communication, Insect societies (with emphasis on societies of ants, termites and bees).

Reference Books:

1. Schowalter, T.D., 2017. Insect Ecology: An Ecosystem Approach. Academic Press.633pp.

2. Price, P.W., Denno, R.F., Eubanks, M.D., Finke, D.L., and Kaplan, I., 2011. Insect Ecology: Behavior, Populations, and Communities. Cambridge University Press.

3. Speight, M.R., Hunter, M.D., & Watt, A.D. (2008). Ecology of Insects: Concepts and Applications. Wiley-Blackwell. 237

4. Denno, R. F. and Eubanks, M. D. 2011. Insect Ecology: Behavior, Populations and Communities. Cambridge University Press, New York.USA.

5. Gullan, P. J. and Cranstan, P. S., 2014. The Insects: An Outline of Entomology. 4th edition. Wiley-Blackwell. A John Wiley & Sons, Ltd., Publication, UK.

6. Ambrose, D.P., 2015. The Insects: Structure Functions and Biodiversity. Kalyani publishers, Ludhiana, India.

7. Rockwood, L.L. 2006. Introduction to Population Ecology. Wiley, John and Sons.

8. Bourtzis, K. and Miller, T. 2003. Insects Symbiosis. CRC Press.

9. Vandermeer, J.H. and Goldberg, D.E. 2003. Population Ecology: First Principles, Princeton University Press.

10. Southwood, T.R.E. and Henderson, P.A. 2000. Ecological Methods. 3rd Ed. Blackwell Science.

11. Grimaldi, D. and Engel, M.S. 2005. Evolution of Insects. Cambridge University Press.

Course Code- ZOO-732 ADVANCED MOLECULAR GENETICS

Contact Hours:		Credit Hours	
Theory	= 48	Theory	= 3.0
Total	= 48	Total	= 3.0

Course Objectives: The objectives of the course are:-

1. To understand the organization of human nuclear genome and mitochondrial genome.

2. To develop understanding of different types gene families and superfamilies'

3. To equip the student with different modern molecular Techniques.

Course Learning Outcomes: Upon successful completion of the course, the student will be able to:

1. Acquire the basic knowledge of human nuclear genome and mitochondrial genome.

2. Illustrate the key features of human genome and certain gene families.

3. Discover the role of certain RNA coding genes along with protein coding genes.

4. Investigate certain molecular problems with the help of modern molecular techniques.

Course Outline:

1. Genome structure a. Human mitochondrial genome b. Human Nuclear genome c. Protein Coding gene d. RNA genes 2. Gene Families a. Solitary gene and gene family b. Gene superfamily. c. Pseudogens d. Retrogenes e. Cluster gene families f. Interspersed gene families 3. Transposable Genetic Elements a. LINES b. SINES c. Fossil Transposons 249 2. Repeat Instability and Genetic Disorders a. TRED1 b. TRED2 c. Fragile X- Syndroem d. Mytonic Dystrophy 3. DNA Methylation and Cancer a. Differential methylation and cancer b. Imprinting c. Epigenetics and its implications in the genome d. ,Telomere and Telomerase and their role in cancer and aging e. RNA interference f. RNAi mediated pathways in nucleus 4. Study of Molecular Techniques a. Southern blotting b. Western blotting c. Northern blotting d. RFLP e. RAPDS f. Microsatellite DNA

Text and Reference Books:

1. Alberts, B., A. Johnson, J. Lewis, M. Raff, K .Roberts, and P. Walter. Molecular Biology of the Cell, 4th Ed. Garland Publishing Inc.New York.2002.

2. Watson, J,D., T.A. Baker, S.P. Bell, A. Gann, M. Levine, and R. Losick. 250

3. Molecular biology of the gene.Pearson Education. 2004.

4. Snyder, L. and W. Chapness. Molecular Genetics of bacteria. ASM, Press, 2003.

5. Lewin, B. Gene-VIII. Oxford University Press, Oxford, UK. 2004

WOMEN UNIVERSITY MARDAN
DEPARTMENT OF ZOOLOGY

Course Code- ZOO-734 **Faunal Biodiversity of Pakistan** **Credit Hours 3(2-1)**

Contact Hours:

Theory	= 48
Practicals	= 16
Total	= 64

Credit Hours

Theory	= 2.0
Practical	= 1.0
Total	= 3.0

Theory

Definition: genetics, species, ecosystem, principles of biological richness; paleohistory of Pakistan; present day faunal pattern and species advances of Pakistan. Zoogeography of Pakistan; species of south Asia; original species of Asian origin; species of African origin; bird migration from northern high mountains to Central Asian desert birds; of wetlands; other species including east-west migrants from south; freshwater fish zoo of Pakistan; faunal of eco-zone of Pakistan. Endemic species, species of managerial occurrence; hot spots of species; threatended and vulnerable species; habits and habitats Riparian zones; edge, snags, dead and down woods material; cliffs. Fallen and cover; marine biodiversity.

Practical

Methods and approaches data collection: mammals, birds, reptiles, amphibian, fish. Invertebrate data analysis: vertebrate, insects and other invertebrates; collection of ecological data; methods of estimating species richness; population studies and census of wildlife animal; method of estimating ecological rich areas and hot spots of species; methods of preparing faunal inventories.

Books Recommended

1. Mirza, ZB. 1998. Illustrated handbook of animal biodiversity of Pakistan. Center of environmental research and conservation, Islamabad.
2. Dobson, A. 1998. Conservation and Biodiversity. Scientific American Library. NY. USA.
3. Daniel, JC. 1992. The book of Indian reptiles. Bombay Natural History Society, India
4. Roberts, T.J. 1992. The Birds of Pakistan. Vol-II. Oxford Univ. Press. UK.
5. Roberts, T.J. 1992. The Birds of Pakistan. Vol-I. Oxford U
6. Bailey, J.A. 1986. Principles of Wildlife Management. John Wiley. USA.
7. Robinson, W.L. and Bolen, E.G. 1984. Wildlife Ecology and Management. MacMillan, Cambridge. UK.
8. Roberts, T.J. 1977. Mammals of Pakistan. Ernest Benon Ltd. London.

9. Ali, S. and Ripley, S.D. 1973. A handbook of birds of India and Pakistan. Oxford Univ. Press. London

Annexure E

Other M.phil /Ph. D Specialized Courses offered by HEC

They can be offered depending on the availability of staff specialized in these fields of Specialization

1. Animal Diversity and Zoogeography
2. Principles of Genetics
3. Comparative Animal Physiology
4. Aquaculture and Fisheries
5. Principles of Animal Systematics
6. Advance insect ecology
7. Clinical Endocrinology
8. Clinical Bacteriology
9. Medical Virology
10. Faunal Biodiversity of Pakistan
11. Museology
12. Reproductive Physiology
13. Applied Reproductive Physiology
14. Helminthology and Protozoology
15. Aquaculture System Management
16. Fish Nutrition and Health
17. Advance Mammaalogy
18. Advanced Biochemistry
19. Advanced Cancer biology
20. Advanced Enzymology
21. Advanced Herpetology
22. Advanced insect ecology
23. Advanced instrumental techniques
24. **Advanced Molecular Biology**
25. Advanced molecular genetic
26. Advanced ornithology
27. Advanced physiology
28. Advances in Aquaculture
29. Advances in Biochemistary
30. Advances in bioinformetic
31. Advances in Cell Biology
32. Advances in Ecology

33. Advances In Forensic Biology
34. Advances in Helminthology
35. advances in Immunology
36. Advances in Protozoology
37. **Advances in Research Methodology**
38. Advances In Wildlife*
39. Aerosol and environmental health
40. Air Pollution Monitoring
41. Animal physiology
42. Applied entomology
43. Applied Genetics
44. **Applied Microbiology**
45. Applied Parasitology
46. Apiculture
47. Aquaculture
48. AquaCulture Biotechnology
49. Biological Toxicology
50. Biology of Birds and Mammals In Pakistan
51. Biology of ornamental fish and aquaria management
52. Cancer Genetics
53. Cell and tissue culture
54. Cellular and Molecular Physiology
55. Chemical Oceanography
56. Classification of Insects and Pest Management
57. Climate Change, Ecosystem Resilience And Stability
58. **Clinical Endocrinology**
59. **Clinical Immunology**
60. linical Teratology
61. Conservation Biology
62. Conservation Biology of Wildlife
63. Dersert Zoology
64. Ecosystem Engineering
65. Ecotourium Planning and management
66. Endocrine Toxicology
67. **Environmental Biotechnology**
68. Environmental health policy and law
69. Environmental Toxicology
70. Fish and Aquatic Toxicology
71. Fish Breeding and hatchery management
72. Fish Nutrition and Health
73. Fish parasitology

74. Fish Processing and value addition
75. Fish Requirements
76. Fisheires extension education
77. Fishing Gear Technology
78. Forensic entomology
79. Freshwater Biology
80. Gene therapy
81. Genomics and proteomics
82. Herpetology
83. Insect toxicology
84. Industrial biotechnology
85. Lab and Biosafety*
86. Lac Insects
87. Mangroove ecology
88. Medical and Veterinary Parasitology
89. Medical Biotechnology*
90. Medical Entomology
91. Medical Virology
92. Mericulture technology
93. Molecular Endocrinology
94. Molecular Evolution
95. Molecular immunology
96. Natural Photograph
97. Ornamental fish aquaria management
98. Physical Oceanography
99. Principles of aquaculture
100. Principles of Wildlife Management*
101. Recombinant DNA Technology
102. Reproductive Physiology
103. Research Methods in Entomology
104. Sea Food Processsing
105. Sericulture
106. Toxicology
107. Vaccinology
108. Wetlands Management
109. Wildlife of Pakistan
110. Wildlife Techniques and Data Analysis

Other related courses offered by other Departments

Scholar may opt relevant courses from related Departments (Biotechnology, Botany, Pharmacy and Chemistry) subject to the recommendation of supervisor & chairperson

List of MPhil & PhD Biochemistry Courses

Course Code	Name of Subject	Credits
BCH 750	Advances in Molecular Genetics	3+0
BCH 751	Advances in Biochemistry	3+0
BCH 752	Advances in Clinical Biochemistry	3+0
BCH 753	Advances in Molecular Biology	3+0
BCH 754	Advances in Endocrinology	3+0
BCH 755	Advances in Biotechnology	3+0
BCH 756	Advanced Biostatistics	3+0
BCH 757	Advanced Bioinformatics	3+0
BCH 758	Recent Trends in Immunology	3+0
BCH 812	Advances in Enzymology	3+0
BCH 813	Advances in Cell Biology	3+0
BCH 814	DNA Techniques and Clinical Applications	3+0
BCH 850	Good Laboratory Practices and Quality Control	3+0
BCH 941	Biochemistry of Drugs and Their Resistance	3+0

Department of Biotechnology

Course Code	Course Title	Credits
BT-834	Advances in Animal Biotechnology	3
BT-839	Medicinal Plant Biotechnology	3

Department of Chemistry

Course Code	Course Title	Credits
CHEM-763	Biosynthesis and Natural Products Synthesis	3
CHEM-790	Chemistry of Biominerals	3
CHEM-960	Medicinal Chemistry	3
CHEM-965	Biotransformation	3
CHEM-978	Nanomaterials and their applications	3