

SYLLABUS FOR M.Sc. COURSE IN ZOOLOGY

PG FIRST SEMESTER

SESSION – 2013-14



SCHOOL OF BIOLOGICAL SCIENCES (SBS)

**DR. HARI SINGH GOUR UNIVERSITY
SAGAR (M.P.) 470 003**

M.Sc. COURSE, SESSION – 2013–14
PG FIRST SEMESTER, (CORE COURSE) IN ZOOLOGY

Course Code - ZOO C 121

PINCIPLES OF TAXONOMY

L	T	P	C
4	0	0	4

Instructor: Prof. U.S. Gupta

Unit I

Definition and basic concepts of biosystematics
Alfa, beta, Gamma Taxonomy
Newer trends in Taxonomy (Molecular, Cytological taxonomy, etc.)
History of Theories of Taxonomy
Theories of Taxonomy

Unit II

Species categories
Polytypic species
Hierarchy of categories

Unit III

Taxonomic collection and process of classification
Taxonomic characters

Unit IV

Qualitative and quantitative analysis of Variation
Procedure of Classifying

Unit V

Taxonomic publications
Principals and application of Zoological Nomenclature

6 hours/unit

Suggested Reading Material (All latest editions)

1. M.Kato. The Biology of Biodiversity, Springer.
2. J.C. Avise, Molecular Markers, Natural History and Evolution, Chapman & Hall, New York.
3. E.O. Wilson, Biodiversity, Academic Press, Washington.
4. G.G. Simpson, Principle of Animal taxonomy, Oxford IBH Publishing Company.
5. E. Mayer, Elements of Taxonomy.
6. E.O. Wilson, The Diversity of Life (The College Edition), W.W. Northem & Co.
7. B.K. Tikadar, Threatened Animals of India, ZSI Publication, Calcutta.

LIST OF PRACTICALS
M.Sc. COURSE, SESSION – 2013–14
PG FIRST SEMESTER, (CORE COURSE) IN ZOOLOGY
Course Code - ZOO C 122
BIOSYSTEMATICS & TAXONOMY

L	T	P	C
0	0	4	1

1. Recent classification of animals exemplified by museum specimens.
2. Identification of animal species with the help of taxonomic keys.
 - a. Insect fauna up to order
 - b. Fish fauna up to families
 - c. Identification of earth
3. Methods of taxonomic collection and preservations. Collection of local fauna.
4. Morphological variations in animal phyla.
5. Evaluation of biodiversity indices.

M.Sc. COURSE, SESSION – 2013–14
PG FIRST SEMESTER, (CORE COURSE) IN ZOOLOGY

Course Code – ZOO C 123

QUANTITATIVE BIOLOGY

L	T	P	C
4	0	0	4

Instructor : Prof. Smita Banerjee

- | | | |
|----------|-----|---|
| Unit-I | 1.0 | Basic Mathematics for Biologists |
| | 1.1 | Matrices and Vectors |
| | 1.2 | Exponential functions |
| | 1.3 | Periodic functions |
| | 1.4 | Differential equations, Integration |
| Unit-II | 2.0 | Biostatistics |
| | 2.1 | Probability distributions and their properties |
| | 2.2 | Hypothesis testing |
| | 2.3 | Analysis of frequencies |
| | 2.4 | Experimental design and sampling theory |
| Unit-III | 3.0 | Biostatistics |
| | 3.1 | Analysis of Variance |
| | 3.2 | Correlation |
| | 3.3 | Regression |
| | 3.4 | Non-parametric tests |
| | 3.5 | Probability theory |
| Unit-IV | 4.0 | Mathematical Modeling |
| | 4.1 | Types of models-Statistical; Empirical; Mechanistic; Stochastic; Simulation, etc. |
| | 4.2 | Properties of models-generality, precision, realism |
| | 4.3 | Building a model-planning (conceptualisation), implementation, evaluation, sensitivity analysis |
| Unit-V | 5.0 | Detailed treatment of selected specific models from different areas of Biology (examples) |
| | 5.1 | Cycling of nutrients in an ecosystem/eutrophication model |
| | 5.2 | Optimal clutch size in birds |
| | 5.3 | Morphogenesis |
| | 5.4 | Genetic drift |

6 hours/unit

Suggested Reading Material

1. Batschelet, E., Introduction to mathematics for life scientists. Springer-Verlag, Berlin.
2. Jorgensen, S.E., Fundamentals of ecological modeling, Elsevier, New York.
3. Swartzman, G.L., and S.P.O. Kaluzny, Ecological simulation primer, Macmillan, New York.
4. Lendren, D., Modelling in behavioral ecology, Chapman & Hal, London, U.K.
5. Sokal, R.R. and F.J. Rohlf, Biometry, Freeman, San Francisco.
6. Snedecor, G.W. and W.G. Cochran, Statistical methods, Affiliated East-West Press, New Delhi (Indian ed.).
7. Green, R.H., Sampling design and statistical methods for environmental biologists, John Wiley & Sons, New York.
8. Murray, J.D., Mathematical biology, Springer-Verlag, Berlin.
9. Pielou, E.C., The interpretation of ecological data: A primer on classification and ordination.

LIST OF PRACTICALS
M.Sc. COURSE, SESSION – 2013–14
PG FIRST SEMESTER, (CORE COURSE) IN ZOOLOGY
Course Code - ZOO C 124
QUANTITATIVE BIOLOGY

L	T	P	C
0	0	4	1

Numerical Based on:

1. Matrix algebra: arrangement of variables in different types of matrices, matrix addition, subtraction, multiplication, transposes operation.
2. Mathematical modeling.
3. Mean median and mode.
4. Mean deviation, variance, standard deviation and standard error.
5. Representation of data: Bar diagrams, *π -diagrams*, Histograms, Frequency polygons and ogives.
6. t-test
7. F-test
8. Chi square test
9. ANOVA

M.Sc. COURSE, SESSION – 2013–14
PG FIRST SEMESTER, (CORE COURSE) IN ZOOLOGY
Course Code ZOO C 125
GENERAL AND COMPARATIVE ENDOCRINOLOGY

L	T	P	C
4	0	0	4

Instructor : Dr.Payal Mahobiya

- | | | |
|----------------|------------|---|
| Unit-I | 1.0 | Aims and scope of endocrinology |
| | 1.1 | Hormones as messengers |
| | 1.2 | Hormones and eukaryotic metabolic regulation |
| | 1.3 | Classification of hormones |
| | 1.4 | Discovery of hormones |
| | 1.5 | Experimental methods of hormone research |
| | 1.6 | Validity of comparative study of hormones |
| Unit-II | 2.0 | Phylogeny and ontogeny of endocrine system |

- 2.1 Phylogeny of endocrine glands (Pituitary, pancreas, adrenal, thyroid etc.)
- 2.2 Ontogeny of endocrine glands
- 2.3 Neuroendocrine system and neurosecretion
- 2.4 General principles of hormone action : Nature of hormone action
- 2.5 Hormone receptors-physico-chemical preparation
- 2.6 Hormone receptors-signal transduction mechanisms

Unit-III 3.0 Hormones and Regulation of metabolism

- 3.1 Hormones and homeostasis
- 3.2 Hormonal regulation of carbohydrate, nitrogen and lipid metabolism
- 3.3 Termination of hormone action
- 3.4 Hormone structure and evolution : Chemical nature and gross features of hormones
- 3.5 Evolution of protein hormones and their receptors

Unit-IV 4.0 Biosynthesis and secretion of hormones

- 4.1 Hormone levels in circulation and other body fluids
- 4.2 Biosynthesis of steroid hormones *de novo*
- 4.3 Biosynthesis and amino acid derived small size hormones (e.g.-T₄, Epinephrine etc.)
- 4.4 Biosynthesis and simple peptide hormones-Pre and Prohormones
- 4.5 Co-translational and post-translational modifications of hormone structure

Unit-V 5.0 Hormones controlling behaviour and reproduction

- 5.1 Metabolism of hormones
- 5.2 Hormones and Behavior
- 5.3 Hormones, Growth and Development

5.4 Hormones and Reproduction

- a. Seasonal breeders
- b. Continuous breeders

Suggested Reading Material

1. E.J.W. Barrington, General and Comparative Endocrinology, Oxford, Clarendon Press.
2. P.J. Bentley, Comparative Vertebrate Endocrinology, Cambridge University Press.
3. R.H. Williams, Text Book of Endocrinology, W.B. Saunders.
4. C.R. Martin, Endocrine Physiology, Oxford University Press.
5. A. Gorbman et. al. Comparative Endocrinology, John Wiley & Sons.

6 hours/unit

LIST OF PRACTICALS
M.Sc. COURSE, SESSION – 2013–14
PG FIRST SEMESTER, (CORE COURSE) IN ZOOLOGY
Course Code - ZOO C 126
COMPARATIVE ENDOCRINOLOGY

L	T	P	C
0	0	4	1

1. Histological study of different endocrine glands.
(Pituitary, Thyroid, Parathyroid, Adrenal, Thymus, Gonads and Pancreas).
2. Study of estrous cycle of rat.
3. Sperm count and mobility.
4. Eosin - Nigrosin staining of live and dead spermatozoa.
5. Sperm mitochondrial activity index.

M.Sc. COURSE, SESSION – 2013–14
PG FIRST SEMESTER, (CORE COURSE) IN ZOOLOGY

Course Code – ZOO C 127

MOLECULAR CELL BIOLOGY

L	T	P	C
4	0	0	4

Instructor : Dr. Subodh Jain

- | | | |
|----------|-----|---|
| Unit-I | 1.1 | Introduction-experimental systems in Cell Biology |
| | 1.2 | Biomembranes |
| | 1.3 | Molecular composition and arrangement functional consequences. |
| | 1.4 | Transport across cell membrane-Diffusion, active transport and pumps, uniports, symports and antiports. |
| | 1.5 | Membrane potential |
| | 1.6 | Co-transport by symports or antiports |
| | 1.7 | Trnsnsport across ephthelia |
| Unit-II | 2.1 | Cytoskeleton |
| | 2.2 | Microfilaments and microtubulos-structure and dynamics |
| | 2.3 | Microtubules and mitosis |
| | 2.4 | Cell movements-intracellular transport, role and kinesin and dynein, signal transduction mechanism |
| | 2.5 | Cilia and Flagella |
| | 2.6 | Cell-Cell signalling |
| | a. | Cell surface receptors |
| | b. | Second messenger system |
| | c. | MDP kinase pathways |
| | d. | Signalling from plasma membrane to nucleus |
| Unit-III | 3.1 | Cell-Cell ahesion and communication |
| | 3.2 | Ca++ dependent homophillic cell-cell ahension |
| | 3.3 | Ca++ independent homophilic cell-cell ahension |
| | 3.4 | Gap junctions and connexins |
| | 3.5 | Cell matrix adhesion |
| | a. | Integrins |
| | b. | Collagen |

- c. Non-collagen components
 - d. Auxin & Cell expansion
 - e. Cellulose fibril synthesis and orientation
- Unit-IV
 - 4.1 Cell cycle
 - 4.2 Cyclins and cyclin dependent kinases
 - 4.3 Regulation of CDK-cyclin activity
 - 4.4 Genome organization
 - 4.5 Hierarchy in organization
 - 4.6 Chromosomal organization of genes and non-coding DNA
 - 4.7 Mobile DNA
 - 4.8 Morphological and functional elements of eukaryotic chromosomes
- Unit-V
 - 5.1 Genetic analysis in Cell Biology
 - 5.2 Intracellular protein traffic
 - a. Protein synthesis on free and bound polysomes
 - b. Uptake into ER
 - c. Membrane proteins, Golgi sorting, post-translational modifications
 - d. Biogenesis of mitochondria and nuclei
 - e. Trafficking mechanisms
 - 5.3 Biology of cancer
 - 5.4 Biology of aging
 - 5.5 Apoptosis-definition, mechanism and significance

Suggested Reading Material

1. Molecular Cell Biology, J. Darnell, H. Lodish and D. Baltimore Scientific American Book, Inc., USA.
2. Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson, Garland Publishing Inc., New York.

6 hours/unit

LIST OF PRACTICALS
M.Sc. COURSE, SESSION – 2013–14
PG FIRST SEMESTER, (CORE COURSE) IN ZOOLOGY
Course Code - ZOO C 128
MOLECULAR CELL BIOLOGY

L	T	P	C
0	0	4	1

1. Experiments showing osmosis.
2. Separation of proteins by electrophoresis.
3. Antigen-antibody reaction.
4. Apoptosis-Chick embryo (4/6 days limb formation)
5. Histochemistry-Carbohydrate/Cholesterol
6. Staining of Golgi bodies and mitochondria
7. Study of mutants in *Drosophila melanogaster*
8. Squash preparation of salivary gland chromosomes

M.Sc. COURSE, SESSION – 2013–14
PG FIRST SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
Course Code – ZOO E 129

Biological methods to study the tissue

L	T	P	C
0	0	4	2

Instructor : Prof. Mangla Bhide

Unit-I Preparation of material for microtomy :

- 1.1 Rearing of animals.
- 1.2 Selection of tissue.
- 1.3 Tissue fixation : Preparation of different fixatives for fixation of different tissue.
- 1.4 Processing for paraffin wax block preparation of different tissue.

Unit-II Microtomy

- 2.1 Principle and about the microtome.
- 2.2 Sharpening of razor.
- 2.3 Cutting of paraffin wax blocks.
- 2.4 Preparation of dehydration rack.
- 2.5 Preparation of different stains.

Unit-III Detection of protein, carbohydrate and lipid in different tissue while applying the following staining methods :

- 3.1 Mercuric Bromophenol Blue Stain : For protein detection.
- 3.2 Periodic acid Schiff's reagent for carbohydrate detection.
- 3.3 Sudan Black B : For lipid detection.

Unit-IV Detection of DNA & RNA in different tissue :

- 4.1 Methyl Green : Pyronin method : to detect DNA & RNA.
- 4.2 Double staining method e.g. Haematoxylin – Eosin.

Unit-V Microscopic observations :

- 5.1 By simple microscope.
- 5.2 By compound microscope.
- 5.3 By Phase – Contrast microscope.

6 hours/unit

LIST OF PRACTICALS
M.Sc. COURSE, SESSION – 2013–14
PG FIRST SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
Course Code - ZOO E 129

1. Preparation of different types of fixatives.
2. Preparation of different stains.
3. Paraffin blocks preparation of different tissue.
4. Microtomy.
5. Preparation of sections of different tissues.
6. Dehydration and staining to detect.
 - (i) Protein in the tissue.
 - (ii) Lipid in fat-bodies.
 - (iii) Carbohydrate in the tissue.
 - (iv) DNA & RNA in the tissue.
7. Microscopy :
 - (i) Dissecting and
 - (ii) Compound microscope.

L	T	P	C
2	0	1	3

M.Sc. COURSE, SESSION - 2013-14
PG FIRST SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
COURSE CODE – ZOO E 122
Cancer Biology & Therapeutics
(Instructor: Dr. Pradyumna Kumar Mishra)

Unit I: Origin, progress and dissemination of the disease, common forms and their diagnosis.

Unit II: Genetic and epigenetic association

- 1.1 Heritable traits
- 1.2 histone modifications and DNA methylation
- 1.3 micro RNAs and their role

Unit III: Radio-protectors, immuno-modulators and chemo-prevention

- 3.1 Anti-carcinogenicity of novel drug prototypes isolated from herbal/plant sources

Unit IV: Cellular therapy

- 4.1 Basic introduction to cellular engineering methods including Dendritic cell based nano-therapeutics

Unit V: Translational oncology

- 5.1 Basic understanding to epithelial-mesenchymal transition
- 5.2 Stem cell therapeutics
- 5.3 Pharmaco-surveillance and nano-medicine

Practical Course:

- 1. Cancer cell culture
- 2. Dendritic cell culture
- 3. Immunophenotyping
- 4. Isolation and characterization of active principles from herbal sources
- 5. Preparation of molecular vectors and characterization

6 hours/unit

L	T	P	C
2	0	1	3

M.Sc. COURSE, SESSION - 2013-14
PG FIRST SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
COURSE CODE – ZOO E 123
Vermibiotechnology
(Instructor: Dr. Shweta Yadav)

Unit 1.0: Earthworms

- 1.1 Basic structure
- 1.2 Life cycle
- 1.3 Life span

Unit 2.0: Ecological Groups of Earthworms

- 2.1 Ecological requirements of earthworms
- 2.2 Earthworm species used in vermiculture

Unit 3.0: Vermicompost

- 3.1 Vermicompost materials
- 3.2 Preliminary treatment of composting materials
- 3.3 Method of vermicompost production
- 3.4 Benefits of vermicompost
- 3.5 Nutrient profile of vermicompost
- 3.6 Problems and their solutions

Unit 4.0: Vermiwash

- 4.1 Composition of vermiwash
- 4.2 Method of preparation
- 4.3 Method of application
- 4.4 Benefits of vermiwash

Unit 5.0: Wormery

- 5.1 Methods to establishment of wormery unit
- 5.2 Harvesting of earthworms
- 5.3 Grading and counting of earthworms
- 5.4 Transportation of live worms and cocoons
- 5.5 Precautions and requirements of wormery
- 5.6 Factors effecting the worm production
- 5.7 Vermi -entrepneurship

Practical Course:

Experiment 1: Collection and Identification of the epigeic earthworm species suitable for vermicomposting.

Experiment 2: Different techniques for developing small and high scale vermireactors.

Experiment 3: Grading and counting of Coccons and their method of transportation.

Experiment 4: Preparation of Vermiwash and Vermimeal.

6 hours/unit

L	T	P	C
2	0	1	3

M.Sc. COURSE, SESSION - 2013-14
PG FIRST SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY

COURSE CODE – ZOO E 124

Neurobiology

(Instructor: Dr. Raj Kumar Koiri)

Unit-I Plasticity of brain and neurogenesis

Unit-II Organization of nervous system

- 2.1 Brain structure
- 2.2 Neurons and glia
- 2.3 Cerebrospinal fluid
- 2.4 Neural network
- 2.5 Blood brain barrier
- 2.6 Autonomic nervous system

Unit-III Axonal and synaptic transmission

- 3.1 Types of neurons
- 3.2 Membrane potential and action potential
- 3.3 Types of synapses
- 3.4 Excitatory and inhibitory post-synaptic potential
- 3.5 Chemical transmission, neurotransmitters (acetylcholine, catecholamines, serotonin and GABA), neuropeptides

Unit-IV 4.1 Molecular basis of learning and memory

- 4.2 Brain and behavior
- 4.3 Brain imaging using CAT, PET and MRI

Unit-V 5.1 Brain aging

- 5.2 Neuropathology
 - 5.2.1 Strokes
 - 5.2.2 Epilepsy
 - 5.2.3 Alzheimer disease
 - 5.2.4 Huntington disease
 - 5.2.5 Parkinson disease
 - 5.2.6 Hepatic Encephalopathy

List of practical:

1. Studies on learning and memory in rat/mouse model by Morris-Water-Maze Test or by using a zigzag or T-shaped maze in an animal model of Hepatic Encephalopathy
2. Behavioural analysis through motor function tests (catalepsy test, footprinting test, rotarod test).
3. a). Isolation of neurons and glia by differential centrifugation
 b). Characterization of isolated cells types using specific marker

Books Recommended

1. Ganong: Review of Medical Physiology (22nd ed 2005, Lang Medical Publications)
2. Guyton and Hall: Text Book of Medical Physiology (11th ed 2006, W.B. Saunders)
3. Keel et al: Samson Wright's Applied Physiology (13th ed 1989, Oxford Press)
4. West: Best and Taylor's Physiological Basis of Medical Practice (11th ed 1981, Williams and Wilkins)
5. Longstaff: Neuroscience (2002, Viva Books)
6. Shepherd: Neurobiology (1994, Oxford Univ Press)
7. Squire et al: Fundamental Neuroscience (2003, Academic Press)
8. Eric Kandel: Principles of Neural Science (2000, Mc Graw Hill)

6 hours/unit

SYLLABUS FOR PG COURSE IN ZOOLOGY

M.Sc. SECOND SEMESTER

SESSION: 2013-14



**DEPARTMENT OF ZOOLOGY
SCHOOL OF BIOLOGICAL SCIENCES (SBS)
DR. HARI SINGH GOUR UNIVERSITY
(A CENTRAL UNIVERSITY)
SAGAR (M.P.) 470 003**

P.G. COURSE, SESSION 2013-14
M.Sc. SECOND SEMESTER (CORE COURSE) IN ZOOLOGY
Paper Code - ZOO C 221
POPULATION GENETICS AND EVOLUTION

L	T	P	C
3	0	0	3

Instructor: Prof. D.K.Saraf

Unit-I

- 1.0 Concepts of evolution and theories of organic evolution with an emphasis on Darwinism
- 2.0 Neo-Darwinism .
 - 2.1 Hardy-Weinberg law of genetic equilibrium
 - 2.2 A detailed account of destabilizing forces:
(i) Natural selection (ii) Mutation (iii) Genetic drift
(iv) Migration (v) Meiotic drive
- 3.0 Quantifying genetic variability
 - 3.1 Genetic structure of natural populations
 - 3.2 Phenotypic variation
 - 3.3 Models explaining changes in genetic structure of populations
 - 3.4 Factors affecting human disease frequency.

Unit-I I

- 4.0 Molecular population genetics
 - 4.1 Patterns of change in nucleotide and amino acid sequences
 - 4.2 Ecological significance of molecular variations
 - 4.3 Emergence of Non-Darwinism-Neutral Hypothesis
- 5.0 Genetics of quantitative traits in populations
 - 5.1 Analysis of quantitative traits
 - 5.2 Quantitative traits and natural selection
 - 5.3 Estimation of heritability
 - 5.4 Genotype-environment interactions

	5.5	Inbreeding depression and heterosis
	5.6	Molecular analysis of quantitative traits
	5.7	Phenotypic plasticity
Unit-III	6.0	Genetics of speciation
	6.1	Phylogenetic and biological concept of species
	6.2	Patterns and mechanisms of reproductive isolation
	6.3	Models of speciation (Allopatric, sympatric, parapatric)
	7.0	Molecular Evolution
	7.1	Gene Evolution
	7.2	Evolution of gene families, Molecular drive
	7.3	Assessment of molecular variation
Unit-IV	8.0	Origin of higher categories
	8.1	Phylogenetic gradualism and punctuated equilibrium
	8.2	Major trends in the origin of higher categories
	8.3	Micro-and Macro-evolution
	9.0	Molecular phylogenetics
	9.1	How to construct phylogenetic trees?
	9.2	Phylogenetic inference-Distance methods, parsimony methods, maximum likelihood method.
	9.3	Immunological techniques
	9.4	Amino acid sequences and phylogeny
	9.5	Nucleic acid phylogeny-DNA-DNA hybridizations, Restriction Enzyme sites,

		Nucleotide sequence comparisons and homologies
	9.6	Molecular clocks
Unit-V	10.0	Origin and evolution of economically important microbes and animals
	11.0	Population genetics and ecology
	11.1	Metapopulations
	11.2	Monitoring natural populations
	11.3	Why small populations become extinct?
	11.4	Loss of genetic variations
	11.5	Conservation of genetic resources in diverse taxa

6 hours/unit

Suggested- Reading Material

1. Dobzhansky, Th. Genetics and Origin of Species. Columbia University Press.
2. Dobzhansky, Th., F.J. Ayala, G.L. Stebbins and J.M. Valentine. Evolution. Surjeet Publication, Delhi.
3. Futuyama, D.J. Evolutionary Biology, Sinauer Associates, INC Publishers, Sunderland.
4. Hartl, D.L. A Primer of Population Genetics. Sinauer Associates, Inc, Massachusetts.
5. Jha, A.P. Genes and Evolution. John Publication, New Delhi.
6. King, M. Species Evolution-The role of chromosomal change. The Cambridge University Press, Cambridge.
7. Merrel, D.J. Evolution and Genetics. Holt, Rinehart and Winston, Inc.
8. Smith, J.M. Evolutionary Genetics. Oxford University Press, New York.
9. Strickberger, M.W. Evolution. Jones and Bartlett Publishers, Boston London.

P.G. COURSE, SESSION 2013-14
M.Sc. SECOND SEMESTER (CORE COURSE) IN ZOOLOGY
Paper Code - ZOO C 222
POPULATION GENETICS AND EVOLUTION

L	T	P	C
0	0	3	1

List of Practicals

1. Distribution of gene frequency in a particular population (Brahmins, Saxenas etc.) with reference to:
 - a. Size of second finger.
 - b. Freeness ear lobes.
 - c. Blood groups, A,B, AB, O, Rh, MNS etc.
2. Phenotypic plasticity in
 - a. Butterfly
 - b. Rasbora
 - c. Ophiocephalus or Notopterus
3. Electrophoretic pattern of DNA fragments belonging to Horse, Man, Monkey, Cow etc after treatment with particular restriction endonuclease.
4. Distribution of frequency of serum isozymes like, LDH & DH, Glutamate dehydrogenase, glucose-6-phosphate dehydrogenase etc in a population.
5. Some numerical problems on Hardy Weinberg's law.

P.G. COURSE, SESSION 2013-14
M.Sc. SECOND SEMESTER (CORE COURSE) IN ZOOLOGY
Paper Code - ZOO C 223
GAMETE BIOLOGY

L	T	P	C
3	0	0	3

Instructor: Prof. Mangla Bhide

Unit-I	1.0	Heterogamy in eukaryotes
	2.0	Comparative account of differentiation of gonads in a mammal and an invertebrate
	3.0	Leydig cells
	3.1	Morphology
	3.2	Differentiation
	3.3	Function and its regulation
	4.0	Spermatogenesis
	4.1	Morphological basis in Rodents
	4.2	Morphological basis in any Invertebrate
	4.3	Gamete specific gene-expression and genomics
	5.0	Biochemistry of Semen
	5.1	Semen composition and formation
	5.2	Assessment of sperm functions
	5.3	Y-specific probes
Unit-II	6.0	Fertilization
	6.1	Pre-fertilization events
	6.2	Biochemistry of fertilization
	6.3	Post-fertilization events
	7.0	Collection and cryopreservation of gametes and embryos
	8.0	Ovarian follicular growth and differentiation
	8.1	Morphology
	8.2	Endocrinology
	8.3	Molecular Biology
	8.4	Oogenesis and vitellogenesis
Unit-III	8.5	Ovulation and ovum transport in mammals
	9.0	Biology of sex-determination and sex-differentiation a comparative account
	10.0	Multiple ovulation and embryo transfer technology (MOET)
	10.1	<i>In vitro</i> oocyte maturation
	10.2	Superovulation
	10.3	In vitro fertilization
	11.0	Transgenic animals and knock-outs
	11.1	Production
	11.2	Applications
	11.3	Embryonic stem cells
Unit-IV	12.0	Care and breeding of experimental animals including bioethics
	13.0	Assisted reproduction technologies

Unit-V	13.1	Embryo sexing and cloning	
	13.2	Screening for genetic disorders	
	13.3	ICSI, GIFT etc.	
	13.4	Cloning of animals by nuclear transfer	
	14.0	Teratological effects of Xenobiotics.	
	15.0	Immunocontraception	
	15.1	Gamete specific antigens	
	15.2	Antibody mediated fertilization	block and
		termination of gestation.	
	15.3	Other contraceptive technologies	
	15.1	Surgical methods	
	15.2	Hormonal methods	
	15.3	Physical barriers	
	15.4	IUCD	

6 hours/unit

Suggested Reading Material

1. Austen, C.R and Short, RV. Reproduction in animals.
2. Schatten and Schatten. Molecular biology of fertilization.
3. F.T. Longo. Fertilization, Chapman & Hall.
4. R.G. Edwards. Human Reproduction.

P.G. COURSE, SESSION 2013-14
M.Sc. SECOND SEMESTER (CORE COURSE) IN ZOOLOGY
Paper Code - ZOO C 224
GAMETE BIOLOGY

L	T	P	C
0	0	3	1

List of Practicals

1. Demonstration of different types of Ovarioles in insects. e.g. in (i)
Cockroach/Grasshopper (Panoistic type) (ii)
Dysdercus/Bagrada/Sphaerodema (Acrotrophic type) and (iii)
Musca/Drosophila (polytrophic type).
2. Squash preparation of testes of male insects to demonstrate spermatogenesis.
3. Section of ovaries of mammals showing oogenesis, development of graafian follicles and corpus luteum.
4. Section of testes of a mammal (rat/rabbit) showing spermatogenesis.
5. Effect of xenobiotics on teratogenesis using snail egg masses as model material.
6. Development of chick showing morphogenesis & organogenesis by using 2,4,6,8,10 days incubated hen's eggs.

P.G. COURSE, SESSION 2013-14

M.Sc. SECOND SEMESTER (CORE COURSE) IN ZOOLOGY

Paper Code - ZOO C 225

TOOLS AND TECHNIQUES FOR BIOLOGY

L	T	P	C
4	0	0	3

Instructor: Prof. Smita Banerjee

- Unit-I
- 1.0 Assay
 - 1.1 Definition and criteria of reliability
 - 1.2 Chemical assays
 - 1.3 Biological assays-*in vivo* and *in vitro* assays
 - 2.0 Principles and uses of analytical instruments-
Balances, pH meter, colorimeter, spectrophotometer,
ultracentrifuge, densitometric scanner,
spectrofluorometer, chemiluminometers, radioactivity
counters, differential scanning colorimeter, ESR and
NMR spectrometres
- Unit-II
- 3.0 Microscopy-Principle of light transmission, electron,
phase-contrast, fluorescence, electron cryo, confocal,
scanning electron microscopes . Microphotography.
Image analysers
 - 4.0 Microbiological techniques
 - 4.1 Media preparation and sterilization
 - 4.2 Inoculation and growth monitoring
 - 4.3 Use of fermentors
 - 4.4 Biochemical mutants and their use
 - 4.5 Microbial assays
 - 5.0 Cell culture techniques
 - 5.1 Design and functioning of tissue culture
laboratory

	5.2	Cell proliferation measurements
	5.3	Cell viability testing
	5.4	Culture media preparation and cell harvesting methods
Unit-III	6.0	Cryotechniques
	6.1	Cryopreservation for cells, tissue, organisms
	6.2	Cryotechniques for microscopy
	6.3	Freeze-drying for physiologically active substances
	7.0	Separation techniques in biology
	7.1	Molecular separations by chromatography, electrophoresis, precipitation etc.
	7.2	Organelle separation by centrifugation etc.
	7.3	Cell separation by flowcytometry, density gradient centrifugation, unit gravity centrifugation, affinity adsorption, anchorage based techniques etc.
Unit-IV	8.0	Computer aided techniques for data presentation, data analyses, statistical techniques, special softwares for specific tasks.
	9.0	Radioisotope and mass isotope techniques in biology
	9.1	Sample preparation for radioactive counting .
	9.2	Autoradiography
	9.3	Metabolic labelling
	9.4	Magnetic Resonance Imaging
Unit-V	10.	Immunological techniques based on antigen-antibody interactions
	11.	Surgical techniques
	11.1	Organ ablations (eg: ovariectomy, adrenalectomy etc.)

- 11.2 Perfusion techniques
- 11.3 Indwelling catheters
- 11.4 Stereotaxy
- 11.5 Parabiosis
- 12. Biosensors

6 hours/unit

Suggested Reading Material (All latest Editions)

1. Animal Cell Culture - A practical approach, Ed. John R.W. Masters, IRL Press.
2. Introduction to Instrumental analysis, Robert Braun. McGraw Hill International Editions.
3. A Biologists Guide to Principles and Techniques of Practical Biochemistry, K. Wilson & K.H. Goulding, ELBS Edn.

P.G. COURSE, SESSION 2013-14
M.Sc. SECOND SEMESTER (CORE COURSE) IN ZOOLOGY
Paper Code - ZOO C 226
TOOLS AND TECHNIQUES FOR BIOLOGY

L	T	P	C
0	0	3	1

List of Practicals

1. Procedure of microtomy for animal tissue.
2. Morphometric measurements.
3. Separation technique.
(Chromatography, thin layer, column and paper chromatography).
4. Electrophoresis: separation by paper and gel electrophoresis.
5. Quantitative analysis by colorimeter and spectrophotometer.
6. To sketch diagram of any tissue with the help of use of camera lucida.
7. Demonstration of electron microscope, phase contrast and polarized light microscope.
8. Colorimetric estimation of glucose, protein RNA, DNA.
9. Absorption spectrum of any coloured solution of a substance.
10. Light microscopic examination and preparation of tissue sections.
11. Separation of protein son SDS-PAGE..
12. Comparison of RBS and WBC in different groups of vertebrates.
13. Oxygen consumption in aquatic animals under stress.
14. Toxicity test-LC₅₀

P.G. COURSE, SESSION 2013-14
M.Sc. SECOND SEMESTER (CORE COURSE) IN ZOOLOGY
Paper Code - ZOO C 227
ENVIRONMENTAL PHYSIOLOGY (PHYSIOLOGICAL ECOLOGY)

L	T	P	C
3	0	0	3

Instructor: Prof. Smita Banerjee

Unit-I	1.0	Adaptation
	1.1	Levels of adaptation
	1.2	Mechanisms of adaptation
	1.3	Significance of body size
Unit-II	2.0	Physiological adaptations to different environments
	2.1	Marine
	2.2	Shores and Estuaries
	2.3	Freshwater
	2.4	Extreme aquatic environments
Unit-III	2.5	Terrestrial Life
	2.6	Extreme terrestrial environments
	2.7	Parasitic habitats
Unit-IV	3.0	Stress Physiology
	3.1	Basic concept of environmental stress and strain; concept of elastic and plastic strain; stress resistance, stress avoidance and stress tolerance.
	3.2	Adaptation, acclimation and acclimatization
	3.3	Concept of homeostasis
	3.4	Endothermy and physiological mechanism of regulation of body temperature
Unit-V	3.5	Physiological adaptation to osmotic and ionic stress; mechanism of cell volume regulation

- 3.6 Osmoregulation in aqueous and terrestrial environments
- 3.7 Physiological response to oxygen deficient *stress*
- 3.8 Physiological response to body exercise
- 3.9 Meditation, Yoga and their effects.

6 hours/unit

Suggested Reading Material

1. Eckert, R. Animal Physiology: Mechanisms and Adaptation. W.H. Freeman and Company, New York.
2. Hochachka, P.W. and Somero, G.N. Biochemical Adaptation. Princeton, New Jersey.
3. Hoar, W.S. General and Comparative Animal Physiology, Prentice Hall of India.
4. Schiemdt Nielsen. Animal Physiology: Adaptation and Environment. Cambridge.
5. Strand, F.L. Physiology: A regulatory Systems Approach. Macmillan Publishing Co., New York.
6. Pummer, L. Practical Biochemistry, Tata McGraw-Hill.
7. Prosser, C.L. Environmental and Metabolic Animal Physiology. Wiley-Liss Inc., New York.
8. Wilson K. and Walker, J. Practical Biochemistry.
9. Willmer, P.G. Stone, and I. Johnston. Environmental Physiology. Blackwell Sci. Oxford, UK, 644pp.
10. Newell, R.C. (ed.) 1976. Adaptation to environment. Essays on the physiology of marine animals. Butterworths, London, UK, 539pp.
11. Townsend, C.R and P. Calow. Physiological Ecology: An evolutionary approach to resource use. Blackwell Sci. Publ., Oxford, UK.

12. Alexander, R.M.N. Optima for animals. Princeton Univ. Press, Princeton, NJ.
13. Dejours, P., L. Bolis, C.R Taylor and E.R Weibel (eds.), Comparative Physiology: Life in Water and on Land. Liviana Press, Padova, Italy.
14. Johnston, L.A., & A.F. Bennett (eds.). Animals and Temperature: Phenotypic and evolutionary adaptation. Cambridge Univ. Press, Cambridge, UK.
15. Louw, G.N. Physiological animal ecology. Longman Harlow, UK.

P.G. COURSE, SESSION 2013-14
M.Sc. SECOND SEMESTER (CORE COURSE) IN ZOOLOGY
Paper Code - ZOO C 228
ENVIRONMENTAL PHYSIOLOGY (PHYSIOLOGICAL ECOLOGY)

L	T	P	C
0	0	3	1

List of Practicals

1. Study of special characteristics of different animals specific to their habitat.
2. Adaptations to habitats like - aquatic, terrestrial and parasitic.
3. Models for different habitats.
4. Experiment to demonstrate osmosis.
5. Experiment related to stress
6. Acclimation and acclimatization experiments.
7. Water sampling.
8. Appearance of Heat shock proteins-demonstration using elctrophoresis.
9. Oxygen consumption in aquatic animals under stress.
10. To study the effect of temperature on plasma protein : appearance of new protein bands to be studied with gel electrophorsis under temperature stress.
11. Comparison of RBC and WBC number in different groups of vertebrates under different environmental conditions.
12. To study the rate of oxygen consumption by aquatic animals under various environmental stresses.

P.G. COURSE, SESSION 2013-14
M.Sc. SECOND SEMESTER (ELECTIVE COURSE) IN ZOOLOGY
Paper Code - ZOO E 229 A
APPLIED BIOLOGY

L	T	P	C
4	0	0	2

Instructor: Dr. Varsha Sharma

Unit-I

Cell Biology

1. Cancer
2. AIDS
3. Free Radicals in Biology
4. Cell & Tissue Culture

Unit-II

Entomology

1. Pests, stored grain, vegetable pests, crop pests
2. IPM
3. Forensic Entomology
4. Apiculture, Sericulture

Unit -III

Fishes

1. Aquaculture : Prawn Culture, Pearl Culture
2. Induced breeding
3. Aquarium
4. Fish Disease
5. Fish byproduct

Unit-IV

Environment

1. Waste water treatment
2. Global warming & Green House Effect
3. Disaster Management

Unit-V

Toxicology

1. Solid Waste Management
2. Toxicology

6 hours/unit

PG COURSE, SESSION 2013-14
M.Sc. SECOND SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
Paper Code - ZOO E 229 B
Practicals Elective Course
APPLIED BIOLOGY (Practicals)

L	T	P	C
0	0	6	1

1. Demonstration of Cell & tissue culture.
2. Pests & their management
3. Apiculture
4. Sericulture
5. Maintenance of Aquarium
6. Induced breeding
7. Fish- by products
8. Water analysis
9. Waste water Analysis
10. Solid waste management :
 - a. Biogas Plant
 - b. Vermicomposting
 - c. Vermiculture

SYLLABUS FOR PG COURSE IN ZOOLOGY

M.Sc. THIRD SEMESTER

SESSION: 2013-14



**DEPARTMENT OF ZOOLOGY
SCHOOL OF BIOLOGICAL SCIENCES (SBS)
DR. HARI SINGH GOUR UNIVERSITY
(A CENTRAL UNIVERSITY)
SAGAR (M.P.) 470 003**

M. Sc. III Semester
General Paper – I
STRUCTURE & FUNCTION IN INVERTEBRATES
Course code ZOO C 321

L	T	P	C
3	0	0	3

Instructor: Prof. U. S. Gupta

Unit – I

Principles of Animal taxonomy

- Special concept: International code of zoological nomenclature
- Taxonomic procedures: New trends in taxonomy
- Animal collection, handling and preservation

Organization of coelom

- Acoelomates
- Pseudocoelomates
- Coelomates: Protostomia and Deuterostomia

Unit – II

Locomotion

- Flagella and ciliary movement in Protozoa
- Hydrostatic movement in Coelenterate, Annelid and Echinoderm

Nutrition and digestion

- Patterns of feeding and digestion in lower metazoan
- Filter feeding in Polychaeta, Mollusca and Echinodermata

Unit – III

Respiration

- Organs of respiration: Gills, lungs and trachea
- Respiratory pigments
- Mechanism of respiration

Excretion

- Organs of excretion: coelom, coelomoducts, Nephridia and Malpighian tubules
- Mechanisms of excretion
- Excretion and osmoregulation

Unit – IV

Nervous System

- Primitive nervous system: Coelenterata and Echinodermata
- Advanced nervous system: Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda).
- Trends in neural evolution

Unit – V

Invertebrate Larvae

- Larval forms of free living invertebrates
- Larval forms of parasites
- Strategies and Evolutionary significance of larval forms

Minor Phyla

- Concept and significance
- Organization and general characters

9 hours/unit

M. Sc. III Semester
General Paper – I, Practical
STRUCTURE & FUNCTION IN INVERTEBRATES
Course code ZOO C 322

L	T	P	C
0	0	3	1

List of practicals

1. Nervous System: Crab; Sepia/Loligo
2. Mounting: Nephridia and Spermatheca in Earthworm
3. Respiratory System: Mounting of Gills, Trachea and Book lungs
PROTOZOA – Gregarines, Monocystis, Ceratium, Euplotes, Didinium, Noctiluca, Radiolaria, Stentor, Opalina
PORIFERA – Sectional view of Sycon (T.S., L.S.), Grantia (T.S.)
CNIDARIA – Slides of Obelia polyp and Medusa, Pennaria, Aurelia – Tentaculocysts
Museum Specimens of Virgularia, Spongodus, Zoanthus, Favia
HELMINTHES – Slides of Temnocephala
Museum Specimens of ascaris lumbricoides, Taenia solium, Planaria
ANNELIDA – Slide of Ozobranchus, Glossiphonia
Museum Specimens of Eunice, Chloea flava, Polynoe, Terebella, Eurythoe
ARTHROPODA – Slides of Cyclops, Daphnia, Chelifer, Section of Peripatus
Museum Specimens of Balanus, Lepas, Palinurus, Uca, Pycna, Hippa, Gongylus, Belostoma, Limulus, Squilla, Eupagurus
MOLLUSCA -
Museum Specimens of Dolabella, Pteria, Nerita, Sanguinolaria, Chicoreus, Ficus, Lambis, tridacna Onchidium, Olvia, Murex, Turritella, Bulla, Cardium, Arca
ECHINODERMATA –
Museum Specimens of Linckia, Echinodiscus, Holothuria, Antedon
MINOR PHYLA – Slides of Bugula, Plumatella, Cristatella, Pectinella
Museum Specimens of phoronis, Dendrostoma

SPECIMENS – Aurelia – Planula, Redia, Cercaria, Filiform of strongyloides, Trochophore, Nauplius, Zoea, Mysis, Phyllosoma, Trilobite larvae of limulus, Antlion, Veliger, Bipinnaria, Ophio and Echinopluteus, Auricularia, tornaria.

Suggested Reading Material

1. Hyman, L.H. The invertebrates Vol. I Protozoa through Ctenophora, McGraw Hill Co. New York.
2. Barrington, E.J.W. Invertebrate structure and function. Thomas Nelson and Sons Ltd., London.
3. Jagerstein, G. Evolution of Metazoan life cycle, Academic Press, New York & London.
4. Hyman, L.H. The Invertebrates Vol. 2 McGraw Hill Co. New York.
5. Hyman, L.H. The Invertebrates Vol. 8 McGraw Hill Co. New York 7 London
6. Barnes, R.D. Invertebrate Zoology, III edition. W.B. Saunders Co. Philadelphia.
7. Russel – Hunter, W.D. A biology of higher invertibrates, the Macmilan Co. Ltd. London
8. Hyman, L.H. The Invertebrates smaller coelomate groups, Vol 5 McGraw Hill Co. New York
9. Read C.P. Animal Parasitism. Prentice Hall Inc. New Jersey

M. Sc. III Semester
General Paper – II
BIOLOGY OF IMMUNE SYSTEM
Course code ZOO C 323

L	T	P	C
3	0	0	3

Instructor: Prof. Smita
Banerjee

Unit – I

Innate and Acquired Immunity

Phylogeny and Ontogeny of immune system

- Organization and structure of lymphoid organs
- Cells of the immune system and their differentiation
- Lymphocyte traffic

Nature of immune response

Nature of antigens and super antigens

- Antigenicity and immunogenicity
- Factors influencing immunogenicity
- Epitopes and haptens

Unit – II

Structure and Functions of Antibodies

- Classes and subclasses
- Gross and Fine structure
- Antibody mediated effector functions

Antigen – Ab interactions *in vitro* and *in vivo*

Complement System

Major Histocompatibility Complex in mouse and HLA system in human

- MHC haplotypes
- Class I and Class II molecules
- Cellular distribution
- Peptide binding
- Expression and diversity
- Disease susceptibility and MHC/HLA

Unit – III

Organization and expression of Ig genes

- Models for Ig gene structure
- Mutagen organization of Ig genes
- DNA rearrangements and mechanisms
- Generation of antibody diversity
- Differential expression of Ig genes

T – Cell receptors

- Isolation, molecular components and structure
- T – Cell maturation and thymus
- Th – cell activation mechanism
- T –cell differentiation
- Cell death and T – cell population

Unit – IV

B – Cell generation, activation and differentiation

- B – Cell receptor
- Selection of immature self – reactive B – cells
- B – cell activation and proliferation
- Th – B – cell interactions
- Humoral immune response – kinetics

Cytokines

- Structures and functions
- Cytokine receptors
- Cytokines and immune response

Unit – V

Cell – mediated effector functions

- Cell adhesion molecules
- Effector cells and molecules
- CTL and NK cells mechanisms of action
- Delayed type hypersensitivity

Immunological tolerance and Anti-immunity

Hypersensitivity and immune responses to infection agents especially intracellular parasites.

9 hours/unit

M. Sc. III Semester
General Paper – II, Practical
BIOLOGY OF IMMUNE SYSTEM
Course code ZOO C 324

L	T	P	C
0	0	3	1

List of Practical

- Antigen – antibody interaction in vitro
- Radioimmunoassay and ELISA
- Isolation of B – lymphocytes
- Phagocytosis in vitro
- Separation of gamma globulins from serum
- Blood film preparation and identification of cells
- Histology of lymphoid organs
- Immunological diagnosis of pregnancy/infection/cancer

Suggested Reading Material

1. Kuby Immunology, W.H. Freeman, USA.
2. W. Paul Fundamentals of Immunology
3. I.M. Roitt. Essential Immunology, ELBS Edition

M. Sc. III Semester
CELL BIOLOGY (SPECIAL PAPER) III
CELL ARCHITECTURE
Course code ZOO C 325

L	T	P	C
4	0	0	4

Instructor: Dr. Rashmi Srivastava

Unit – I

Prokaryotic and eukaryotic cell organization

Various types of microscopy to study cell architecture

Sorting cells and their parts: flow cytometry, fractionation, centrifugation

Unit – II

Cytoskeleton: microtubules, microfilaments and related proteins

Microtubule polymerization, dynamic instability and treadmilling

Actin polymerization dynamics, cell crawling

Unit – III

Architecture of lipid and protein in cellular membrane: protein lipid interaction.

Specialized regions of the plasma membrane: pancreatic acinus, plasma membrane of intestinal epithelial cell, microvilli

Cell junction: tight junction, gap junction, plasmodesmata

Unit – IV

Integrins, Collagen and non – collagen components

Auxins, cell expansions

Interphase nucleus

Biogenesis of nucleus

Unit – V

Endoplasmic reticulum, Golgi complex

Lysosomes, Vacuoles, peroxisomes

Chloroplast

Mitochondria

12 hours/unit

M. Sc. III Semester
CELL BIOLOGY (SPECIAL PAPER) IV
CELL PHYSIOLOGY
Course code ZOO C 327

L	T	P	C
4	0	0	4

Instructor: Prof. Smita Banerjee

Unit – I

Transport across prokaryotic cells

Osmosis: movement of water and regulation of cell volume in animal cells

Internalization of macromolecules and particles: endocytosis, exocytosis, pinocytosis, phagocytosis

Unit – II

Concept of receptors, receptor ligand binding, endocrine, paracrine and autocrine signaling

Receptor mediated endocytosis

Extracellular receptors and their coupling to different signals transducing machinery: G – proteins, ion channels

Unit – III

Intracellular receptors: structure & function of steroid receptors

Second messengers: inositol phosphoinositides, 1,4,5 – triphosphate, DAG, cAMP, cGMP, prostaglandins

Receptor regulation

Unit – IV

Oxygen consumption of cells: aerobic oxidation

Glycolysis and fermentation: anaerobic oxidation

Cell oxidation with emission of light: luminescence

Photosynthesis

Unit – V

Action potential of cells and conduction of electrical impulse

Development, propagation and transmission of action potential

Synapses and impulse transmission, Neurotransmitter receptors

12 hours/unit

M. Sc. III Semester
CELL BIOLOGY (SPECIAL PAPER) PRACTICAL
Course code ZOO C 326 & ZOO C 328

L	T	P	C
0	0	12	4

List of Practical

1. Demonstration of working of Light, Phase Contrast, interference, dark field and electron (transmission and scanning) microscope
2. Demonstration of cell sorting by flow cytometry
3. Use of different types of centrifuge
4. Staining of Golgi complex, mitochondria, peroxisomes etc
5. Experiment on osmosis
6. Study of hemolysis
7. Determination of oxygen consumption in a laboratory animal
8. Estimation of dissolved oxygen in a laboratory animal

M. Sc. III Semester
ENVIRONMENTAL BIOLOGY (SPECIAL PAPER) III
PRINCIPLES OF ECOLOGY
Course Code ZOO C 325

L	T	P	C
4	0	0	4

Instructor: Prof. U. S. Gupta

Unit – I

Biosphere – Composition, Atmosphere, Hydrosphere, Lithosphere

Ecosystem – Structure & Composition

Unit – II

Energy flow in ecosystem

Hydrological cycle

Biogeochemical cycle

Unit – III

Community

Development & evolution of Ecosystem

Unit – IV

Population ecology

Characteristics of population

Population control theory

Unit – V

System ecology

Mathematical models in ecology

12 hours/unit

M. Sc. III Semester

ENVIRONMENTAL BIOLOGY (SPECIAL PAPER) PRACTICAL

Course Code ZOO C 326 & ZOO C 328

L	T	P	C
0	0	12	4

1. Studies on different types of eco system models.
2. Food chains and food webs in different eco systems.
3. Light as limiting factor in photosynthesis.
4. Different biogeochemical cycles.
5. Interspecies relationships: prey – predator relation, mutualism, commensalisms & parasitism etc.
6. Social organization.
7. Methods for calculation of population density.
8. Different types of ecological pyramids.
9. Experiment to demonstrate green house effect.
10. Recourses & their conservation.
11. Tools & Techniques for the study in ecology
12. Mathematical models in ecology

M. Sc. III Semester
ENVIRONMENTAL BIOLOGY (SPECIAL PAPER) IV
ECOSYSTEM ECOLOGY
Course Code ZOO C 327

L	T	P	C
4	0	0	4

Instructor: Prof. Mangla Bhide

Unit – I

Fresh water ecology – properties & Composition of fresh water, lake, River,
Eutrophication, Fresh water Biota

Unit – II

Marine ecology

Marine environment, Marine Biota, Estuarine environment and Biota

Unit – III

Terrestrial ecology

Terrestrial environment, Communities, Soil, Biomes & Biota

Unit – IV

Resources

Radiation ecology

Unit – V

Tools & Techniques for the study in ecology

12 hours/unit

M. Sc. III Semester
ENTOMOLOGY (SPECIAL PAPER) III
STRUCTURE & FUNCTION OF INSECTS
Course Code ZOO C 325

L	T	P	C
4	0	0	4

Instructor: Prof. Janak Ahi

Unit – I

Head: Segmentation, structure, endoskeleton, antenna

Mouth: Structure and mechanism of feeding, Types of mouth parts

Thorax: Structure, endoskeleton, structure and modification of legs

Wings: Origin, structure, modification and function of wings

Unit – II

Integument: Structure and chemistry

Abdomen: Structure, pregenital appendages, cerci and external genitalia

Digestive system: Structure and anatomy of the alimentary canal

Unit – III

Respiratory system: Structure in aquatic and terrestrial insects

Circulatory system: Circulatory organs, types and functions of haemocytes

Excretory system: Structure of excretory organs.

Unit – IV

Nervous system

Neuron endocrine system: Structure of neuroendocrine glands, structure and role of hormones, Endocrine control of metamorphosis and reproduction

Sense organs: photoreception, mechanoreceptor and chemoreception, sound production in insects

Unit – V

Reproductive System: structure of male and female reproductive system

Embryology: Pre and post embryonic development. Types of larvae and pupae, type of metamorphosis, diapauses

12 hours/unit

M. Sc. III Semester
ENTOMOLOGY (SPECIAL PAPER) IV
TAXONOMY
Course Code ZOO C 327

L	T	P	C
4	0	0	4

Instructor: Dr. Varsha Sharma

Unit – I

Origin and evolution of insects

Molecular markers in insects: Classes of molecular marker

Classification of insects up to orders following Imms revised by Richards and Davis Vol. I & II

Unit – II

Classification up to super families following Imms revised by Richards and Davis Vol. I & II

Apterygota: *Thysanura, Diplura, Protura, Collembola*

Pterygota: Palaeoptera, Odonata

Orthopteroid: *Orthoptera*

Unit – III

Classification up to superfamilies:

Orthopteroid: Dictyoptera, Isoptera

Hemipteroid: Hemiptera (Homoptera, Heteroptera)

Neuropteran: Coleoptera

Panorgod insects: Diptera, Lepidoptera, Hymenoptera

Unit – IV

Biology and Control of insect pests of:

Cash crop: soybean, sugar cane

Oil seeds: cotton, sunflower, mustard

Cereal: pea, arhar, masoor, moong

Unit – V

Stores grain pests wheat, gram and rice

Vegetable: cabbage, bhindi, brinjal, tomato, potato

Fruits: mango, citrus, papaya

12 hours/unit

M. Sc. III Semester
ENTOMOLOGY (SPECIAL PAPER) PRACTICAL
Course Code ZOO C 326

L	T	P	C
0	0	6	2

List of practical

1. Types of antenna and mouth parts
2. Different types of wings, tegmina, hemielytra, different types of wings venation.
Male genitalia: Grasshopper and coleoptera
Female genitalia: Grasshopper, Gryllus, Coleoptera
3. Sting of honey bee and wasp
4. Preparation of pericardial cells, oenocytes and nephrocytes
5. Different types of spiracles, opening and closing mechanism respiratory organs in aquatic insects
6. Auditory and sound producing organs
7. Neuroendocrine system of cockroach, grasshopper and bugs
8. Sympathetic and central nervous system of the above mentioned insects
9. reproductive system of male and female insects

M. Sc. III Semester
ENTOMOLOGY (SPECIAL PAPER) PRACTICAL
Course Code ZOO C 328

L	T	P	C
0	0	6	2

List of practical

1. Collection
2. Identification
3. Classification of insects belonging to the different orders as follows:

Apterygota: *Thysanura, Diplura, Protura, Collembola*

Pterygota: Palaeptera, Odonata

Orthopteroid: Orthoptera

Orthopteroid: Dictyoptera, Isoptera

Hemipteroid: Hemiptera, Isoptera

Neuropteran: Coleoptera

Panorgod insects: Diptera, Lepidoptera, Hymenoptera

M. Sc. III Semester
FISH (SPECIAL PAPER) III
FISH STRUCTURE AND FUNCTION
Course Code ZOO C 325

L	T	P	C
4	0	0	4

Instructor: Prof. D. K. Saraf

Unit – I

Structure & Function of fish

Structure and function of scales, determination of growth and age

Origin and evolution of paired fins and their specific modifications

Unit – II

Skeleton in fishes

Locomotion in fish

Structure and function of swim bladder

Accessory respiratory organs with special reference to Indian fishes

Unit – III

Special reference to Indian fishes

Different type of food, feeding habits of fish

Structure function and homologies of weberian ossicles

Hill stream adaptation in fish

Deep sea fishes

Unit – IV

Migration in fishes

Structure & functions of electric organs and electro receptors

Structure and function of sound producing organs and sound reception

Unit – V

Poisonous & venomous fish

Sense organs in fishes

Chemical composition of fishes

12 hours/unit

M. Sc. III Semester
FISH (SPECIAL PAPER) IV
FISH MORPHOLOGY ANATOMY & PHYSIOLOGY
Course Code ZOO C 327

L	T	P	C
4	0	0	4

Instructor: Dr. Deepali Jat

Unit – I

Chromatophores, classification, ultra structure and functional significance
Color changes, Types neural endocrine control mechanism
Respiratory organs – Kinds and physiology of aqueous breathing
Digestive system – Anatomy and Physiology of alimentary canal

Unit – II

Nervous System – Brain its functional organization with ecological bearing
Nervous System – Nerves and their supply
Lateral line system – structure, modification and significance
Circulatory system in fish, heart venous and arterial system

Unit – III

Neuroendocrine integration in fish
Anatomy and Physiology of pituitary gland
Anatomy and Physiology of thyroid gland
Pineal organ, internal tissue and caudate neurosecretory system

Unit – IV

Environmental and hormonal control of reproduction
Parental care
Early development of a teleost
Osmoregulatory organs mechanisms

Unit – V

Seasonal cycles of gonads in Indian fish
Hormonal and Endocrines control of reproduction in fish
Biochemical composition of fishes

12 hours/unit

M. Sc. III Semester
FISH (SPECIAL PAPER) PRACTICAL
Course Code ZOO C 326 & ZOO C 328

L	T	P	C
0	0	12	4

List of Practical

1. Dissections:
 - a. Major Dissection:
 - i. Cranial nerves of Wallago and Scoliodon
 - ii. Internal ear, air bladder connection in Mystus and Wallago
 - b. Minor Dissection:
 - i. Afferent arteries of Scoliodon
 - ii. Cranial nerves of Torpedo and Trygon
 - iii. Weberian ossicles of Clarias
2. Age determination in Fish
3. Sexual dimorphism in Fish
4. Modification in digestive system as per the feeding behavior in Fish
5. Experiments on induced breeding
6. Mounting (Permanent): ctenoid and cycloid scales
7. Study of histological slides of various tissues of Fish
8. **Microtomy:**
 - a. Section cutting of various tissues of fish
 - b. Serial T. S. of fish embryo
 - c. Alizarin preparation of fish

M. Sc. III Semester
PAPER V (ELECTIVE COURSE) THEORY.
Course Code ZOO E 329 A

L	T	P	C
4	0	0	2

Instructor: Dr. Subodh Jain

1. Seminar / project / Excursion / Review article writing on any topic of significance.
2. Power point preparation of the same.

6 hours/unit

M. Sc. III Semester
PAPER V (ELECTIVE COURSE) PRACTICAL
Course Code ZOO E 329 B

L	T	P	C
0	0	6	1

1. Presentation of data with power point.
2. Discussion.
3. Viva voce.

SYLLABUS FOR PG COURSE IN ZOOLOGY

M.Sc. FOURTH SEMESTER

SESSION: 2013-14



**DEPARTMENT OF ZOOLOGY
SCHOOL OF BIOLOGICAL SCIENCES (SBS)
DR. HARI SINGH GOUR UNIVERSITY
(A CENTRAL UNIVERSITY)
SAGAR (M.P.) 470 003**

M. Sc. IV Semester
General Paper – I
Comparative Anatomy of Vertebrates
Course code ZOO C 421

L	T	P	C
3	0	0	3

Instructor: Prof. Mangla Bhide

Unit – I

Digestive System

- Food & feeding
- Change in alimentary canal with respect to mode of feeding
- Ciliary mode of feeding in Urochordates, Cephalochordates & cetaces

Unit – II

Vertebrate integument and its derivatives

Development, general structure and functions of skin and its derivatives

Glands, scales, horns, claws, nails, hoofs, feathers and hairs

General plan of circulation in various groups

Blood

Evolution of heart

Evolution of aortic arches and portal systems

Unit – III

Respiratory system

Characters of respiratory tissue

Internal and external Respiration

Comparative account of respiratory organs

Skeletal system

Form, function, body size and skeletal elements of the body

Comparative account of jaw suspensorium, vertebral column

Limbs and girdles

Unit – IV

Nervous system

Comparative anatomy of the brain in relation to its functions

Comparative anatomy of spinal cord

Nerves-Cranial, Peripheral and Autonomous nervous systems

Unit – V

Evolution of Urinogenital system in vertebrate series

Sense organs

Simple receptors

Organs of olfaction and taste

Lateral line system

Electroreception

9 hours/unit

M. Sc. IV Semester

General Paper – I, PRACTICAL
Comparative Anatomy of Vertebrates
Course code ZOO C 422

L	T	P	C
0	0	3	1

List of Practical

1. Dissections: Rat/mouse/Scoliodon – Digestive, Reproductive, Arterial, Venous systems, neck nerves.
2. Museum specimens and slides
Protochordates – Salpa-sexual, Salpa-asexual, Botryllus, Herdmania, Fishers

Museum Specimens (Protochordates to mammals)

Slides: sections of skin, alimentary canal, lungs, gills, kidney, ovaries and testes of different groups of vertebrates.

Dissection: (major and minor in Scoliodon/electric ray)

- Fish a) afferent blood vessels
 - b) Efferent blood vessels
 - Frog c) Cranial Nerves
 - d) Spinal nerves
 - e) Digestive system
 - f) Urinogenital system
 - g) Sense organs e.g. Eye, Internal ear, Lateral line
4. General anatomy of Herdmania
 5. Preparation of permanent slides of test and pharyngeal wall of Herdmania, Amphioxus: anterior region: w.m., different types of scales in fishes in fishes, ampulla of Lorenzini.
 6. Microtomy to prepare stained, permanent mounts of different organs e.g. skin, liver, lung, kidney and gonads etc.
 7. Skeletal system: fish, amphibian, reptilian, aves and mammal.
 8. Accessory respiratory organs in fishes.
 9. Blood supply to air tube in *Heteropneustes*.

M. Sc. IV Semester
General Paper – II
Comparative Physiology
Course code ZOO C 423

L	T	P	C
3	0	0	3

Instructor: Prof. Smita Banerjee

Unit – I

Aims and scope of comparative physiology

General physiological functions and principles

Validity of comparative approach

Organismic and cell physiology

Respiratory organs and respiratory pigments through different phylogenetic groups

Unit – II

Feeding mechanisms and regulation

Comparative physiology of digestion

Patterns of nitrogen excretion among different animal groups

Osmoregulation in different animal groups

Unit – III

Thermoregulation

Homeothermic animals

Poikilotherms

Hibernation

Circulation of body fluids and their regulation

Unit – IV

Receptor physiology – a comparative study

Mechanoreception

Photoreception

Phonoreception

Chemoreception

Equilibrium reception

Communication among animals

Biohuminescence

Pheromones and other semiochemicals

Audio signals

Unit – V

Metabolic pathways and variations in different phylogenetic groups of animals

Contractile elements, cells and tissues among different phylogenetic groups

Muscle structure and function-correlation

Movements-amoeboid, ciliary and flagellar

Specialized organs (eg: electric organs and tissues)

Chromatophores and regulation of their function

Suggested Reading Material

1. C.L. Prosser Comparative Animal Physiology W.B. Saunders & Company
2. R. Eckert Animal physiology: Mechanism and Adaptation W.H.Freeman & Company.
3. W.S. Hoar General and comparative Animal Physiology.
4. Schiemdt-Nielsen Animal Physiology: Adaptation and Environment. Cambridge
5. C.L.Prosser Environment and Metabolic Physiology Wiley-Liss, New York.

9 hours/unit

M. Sc. IV Semester
General Paper-II, PRACTICAL
Comparative Physiology
Course code ZOO C 424

L	T	P	C
0	0	3	1

List of Practical:

Enzymatic activity of human salivary amylase.
Effect of PH & temperature on amylase activity.
Effect of substrate concentration on rate of reaction.
Demonstration of oxygen consumption of a laboratory animal.
Demonstration of respiratory rate by estimation of dissolved oxygen (DO).
Study of capillary circulation in the web of frog.
Measurement of blood pressure by Sphygmomanometer.
Counting of blood cells in an insect / vertebrate by haemocytometer.
Determination of bleeding time.
Demonstration of role of Malpighian tubules in insect excretion.
Test of Ammonia, urea, uric acid and creatinine in urine sample.
Study of color change mechanism in fish & frog.
Study of osmotic haemolysis and chemical haemolysis.
Demonstration of reflexes in man:
Study of learning behaviour.
Display of electric organ of an electric ray.
Demonstration of parental care / nest building / sexual dimorphism.

M. Sc. IV Semester
CELL BIOLOGY (SPECIAL PAPER) III
Cytogenetics
Course code ZOO C 425

L	T	P	C
4	0	0	4

Instructor: Prof. Smita Banerjee

Unit – I

Structure of prokaryotic chromosome: chromosome of *Escherichia coli*
Mitochondrial and chloroplast DNA organization
Structure of eukaryotic chromosome
Euchromatin and Heterochromatin

Unit – II

Normal human karyotype, G – banding
Human sex chromosomes and determination of sex
Human chromosomal abnormalities: Sex chromosomal anomalies, autosomal anomalies

Unit – III

Major classes of eukaryotic DNA
Genetic map of the human chromosome
Somatic cell genetics, hybrid and their applications, heterokaryon
Cytogenetic effect of ionizing and non – ionizing radiation

Unit – IV

Genetic transfer in bacteria (bacterial recombination): conjugation, transduction, transformation
Mobile DNA with reference to transposons in bacteria
Types of bacteriophages
Genetic material: structure of DNA, the concept of gene and its synthesis, C – value paradox

Unit – V

The genetic code, codon – anticodon recognition
Structure and types of RNA
Properties of t – RNA for pairing and proof reading
Concept of gene therapy

12 hours/unit

M. Sc. IV Semester
CELL BIOLOGY (SPECIAL PAPER) IV
Molecular Biology
Course code ZOO C 427

L	T	P	C
4	0	0	4

Instructor: Dr. Subodh Jain

Unit – I

Prokaryotic and eukaryotic DNA replication
DNA repair and recombination
Transcription (gene expression): mechanism and regulatory factors in prokaryotes and eukaryotes
Post transcriptional modification in prokaryotes and eukaryotes

Unit – II

Translation: mechanism and regulation in prokaryotes and eukaryotes
Post translational modifications
Antisense molecules and their role in regulation

Unit – III

Molecular markers: RFLPs, RAPDs, Minisatellites, Microsatellites
Genetic maps of mouse & fruitfly using molecular markers
Cytogenetics maps using molecular markers: flow sorting, PFGE, microdissection, radiation hybrids
Physical maps using molecular markers: deletions ISH, YAC

Unit – IV

Gene cloning techniques, Enzymes used in genetic engineering
Cloning vectors: plasmids, phages, cosmids, phagemids, viruses, transposons, YAC, MAC
PCR: working mechanism and applications

Unit – V

DNA fingerprinting, DNA foot printing
DNA isolation and sequencing
Southern, northern and western blotting, Dot blots and Slot blots
Gene transfer methods in animals: transgenic animals

12 hours/unit

M. Sc. IV Semester
CELL BIOLOGY (SPECIAL PAPER) PRACTICAL
Course code ZOO C 426 & ZOO C 428

L	T	P	C
0	0	12	4

List of Practical

Study of chromosomes: mitosis and meiosis

Study of polytene chromosomes

Study of normal human karyotype

Study of chromatin by Feulgen staining

UV Spectrophotometer estimation of DNA, RNA and protein

Extraction of DNA from living tissues

Isolation of Plasmid

Isolation of genomic DNA

Separation of proteins by SDS – PAGE

Separation of DNA by agarose – gel electrophoreses

M. Sc. IV Semester
ENVIRONMENTAL BIOLOGY (SPECIAL PAPER) III
Environmental conservation and management
Course code ZOO C 425

L	T	P	C
4	0	0	4

Instructor: Prof. Mangla Bhide

Unit – I

Wildlife conservation
Forest conservation and management
Wildlife (protection) act 1972.

Unit –II

Non conventional energy sources: Biogas, Wind energy,
Solar energy, Hydro-electric Power

Unit – III

Mycotoxins
Algal toxin and its effect on biota
Environmental biosensors
Vermiculture and biocomposting

Unit – IV

Environmental protection act
Degradation of xenobiotics and bioremediation

Unit – V

Environmental impact, assessment and conservation

12 hours/unit

M. Sc. IV Semester
ENVIRONMENTAL BIOLOGY (SPECIAL PAPER) IV

Applied Aspects of Environmental Biology – Pollution

Course code ZOO C 427

L	T	P	C
4	0	0	4

Instructor: Prof. U.S.Gupta

Unit – I

Air pollution

Sources and effects

Air Pollution: Sampling and measurement

Air Pollution: Control method and equipments

Unit – II

Water pollution

Sources, classification of water pollution and effects

Water sampling and analysis of polluted water

Unit – III

Soil pollution

Sources, sampling and analysis of soil pollutant

Pesticides as pollutant

Heavy metal pollution and its effects

Unit – IV

Green house effect, Global warming, Ozone depletion

Photodynamic action and its medical importance

Air pollution act

Unit – V

Waste water treatment processes

Water pollution act

Water born diseases

Noise pollution and its control

Solid waste management

12hours/unit

M. Sc. IV Semester

ENVIRONMENTAL BIOLOGY (SPECIAL PAPER)
PRACTICAL

Course code ZOO C 426 & ZOO C 428

L	T	P	C
0	0	12	4

Water analysis of municipal and industrial wastes for the detection of DO, BOD, COD,

CO₃, HCO₃, Cl₂, Alkalinity, pH, turbidity, temperature.

Soil analysis for the detection of N, P, K, NO₃, SO₄, Cl₂, CO₃ etc.

Waste water treatment.

Detection of heavy metals.

Detection of pesticide residues by TLC

Calculation of LC₁₀₀, LC₅₀, LC₀, sub-lethal concentration, LD₁₀₀, LD₅₀, LD₀ and sub-lethal doses.

Biodegradation of pesticides.

Models of non – conventional energy resources

Vermiculture and composting

Wild life: endangered and frightened species

National parks and sanctuaries.

M. Sc. IV Semester
FISH (SPECIAL PAPER) III
Taxonomy, systematic and ecology of Fishes
Course code ZOO C 425

L	T	P	C
4	0	0	4

Instructor: Prof. D.K.Saraf

Unit – I

Outline classification of fishes as proposed by Berg.
Classification of Elasmobranches
Classification of Crossopterygii
Classification Actinopterygii

Unit – II

Systematic survey of fish with particular reference to inland fishes of M.P.
Fish nets and gears and methods of fishing
Fish diseases, symptoms and treatment
Common needs of fish Ponds and their control.

Unit – III

Working and maintenance of fish aquarium
Fish nets and gears and methods of fishing
Fish diseases, symptoms and treatment
Common needs of fish Ponds and their control

Unit – IV

Fish parasites and their control
Physics – chemical characteristics of fish pond
Biological characteristics of fish pond
Culturable species of fishes of inland water and basis of their selection

Unit – V

Plankton and their significance in fish culture
Primary productivity of fish ponds and its significance
Ecology of managed fish ponds and its significance
Ecology of fresh water marshes

12 hours/unit

M. Sc. IV Semester
FISH (SPECIAL PAPER) IV
Pisciculture and Economic importance of fishes
Course code ZOO C 427

L	T	P	C
4	0	0	4

Instructor: Dr.Payal Mahobiya

Unit – I

Collection of fish seed from natural resources
Dry bundh breeding of camps
Wet bundh breeding of camps
Hypophysation and breeding of Indian major camps

Unit – II

Drugs useful in induced breeding of fish
Types of ponds, required for fish culture farms
Management of hatcheries, nurseries and reany ponds
Management of stocking ponds

Unit – III

Composite fish culture
Prawn culture and pearl industry in India
Fisheries resource of M.P.
Riverine fisheries

Unit – IV

Coastal fisheries in India
Offshore and deep sea fisher's in India
Role of fisheries in rural development
Sewage fisheries

Unit – V

Methods of fish Preservation
Marketing of fish in India
Economic importance and by products of fishes
Shark liver oil industry in India
Transport of live fish & fish seed

12 hours/unit

M. Sc. IV Semester
FISH (SPECIAL PAPER) PRACTICAL
Course code ZOO C 426 & ZOO C 428

L	T	P	C
0	0	12	4

List of Practical

Systematic

Collection and Identification of fishes (local fauna) with the help of fish fauna

Identification of various weeds of fish pond

fish

Study of endoskeleton of Labeo/Catla and Wallago/Mystus

Study of kidney and single nephron in a local fish

Experimentation:

Experiment of colour change mechanism in fish

Schooling behaviour of fish

Gonadectomy and spinalectomy in fish

Effect of respiratory depressant in a fish

Determination of oxygen consumption in fish

Dissections:

Major Dissection:

Cranial nerves of *Mystus*

Lateral line system of *Scoliodon*

Internal ear of *Scoliodon*

Minor Dissection:

Air tube and its blood supply in *Heteropneustes*

Mounting:

Placoid scale of *Scoliodon*

Ampulla of Lorenzini of *Scoliodon*

Microtomy: serial T.S. of fish embryo

M. Sc. IV Semester
ENTOMOLOGY (SPECIAL PAPER) III
Physiology and Biochemistry
Course code ZOO C 425

L	T	P	C
4	0	0	4

Instructor: Prof. Janak Ahi

Unit – I

Integument: Moulting and sclerotization

Physiology of digestion and assimilation of nutrients

Unit – II

Physiology of circulation and biochemistry of haemolymph

Physiology of respiration in terrestrial and aquatic insects

Unit – III

Physiology of excretion

Physiology of reproductive system

Physiology of nervous system

Unit – IV

Insect immunity: Cellular and humoral

Coloration in insects

Bioluminescence: Structure of bioluminescent organs and physiology of bioluminescence.

Unit – V

Carbohydrate, protein and lipid metabolism

Detoxification mechanism in insects

Physiology and biochemistry of ageing

12 hours/unit

M. Sc. IV Semester
ENTOMOLOGY (SPECIAL PAPER) PRACTICAL
Physiology and Biochemistry
Course code ZOO C 426

L	T	P	C
0	0	6	2

List of practical

Salivary glands of *Drosophila* larvae and *Chironomus* larvae.

Physiology experiments to show: (i) functions of malpighian tubules (ii) insects produce moisture from the spiracles during flight

Study of histochemical techniques in insect tissues

Study of protein, carbohydrate and lipid estimation in insect tissues

Determination of haemocyte count of a given insect

Identification of different types of haemocytes

M. Sc. IV Semester
ENTOMOLOGY (SPECIAL PAPER) IV
Applied Entomology & Insect Ecology
Course code ZOO C 427

L	T	P	C
4	0	0	4

Instructor: Dr. Varsha Sharma

Unit – I

Basic principles of insect control

Chemical control: insecticides, their classification and mode of action

Insect resistance to insecticides, 3rd generation pesticides, chemosterilants and radiations

Unit – II

Insect pest control: role of hormones, pheromones, antifeedents, attractants, repellents, plant products

Biological control: Principle, procedure, success and limitation

Unit – III

Beneficial insects: Life cycle & Polymorphic forms of Honey Bee & Termite

Importance of beneficial insects: apiculture, sericulture, lac culture

Integrated pest management (IPM)

Unit – IV

Insects in medical, veterinary sciences: Common vector insects, their mode of transmission, life cycle, diseases & control

Insect in forensic and forest sciences: Common insects & their life cycle

Unit – V

Principles of insect ecology

Effect of temperature, humidity and light on the biology of insects

Social behaviour of insects: migration, adaptation and distribution

12 hours/unit

M. Sc. IV Semester
ENTOMOLOGY (SPECIAL PAPER) PRACTICAL
Applied Entomology & Insect Ecology
Course code ZOO C 428

L	T	P	C
0	0	6	2

List of practical:

Collection, identification and classification of insects belonging to the different orders

Collections of insects of medical importance and their life cycle

Collection of polymorphic forms of honey bee and termites

Effect of an insecticides on a household pest

Effects of abiotic factors like temperature, humidity and light on insects.

Elective Course
Basic Research Methods
Zoo E 429 A (Theory)

L	T	P	C
0	0	6	2

Instructor: Prof. Janak Ahi

1. Project or Review & its report
2. To learn computer:
 - a. Microsoft word
 - b. Excel
 - c. Power-point
 - d. Paint/brush
3. How to write synopsis of a project
4. How to write review article
5. How to write Bibliography

6 hours/unit

Elective Course
Basic Research Methods
Zoo E 429 B (Practical)

L	T	P	C
0	0	6	1

1. Electrophoresis
2. Spectrophotometry
3. Chromatography
4. Power-point Presentation