

SYLLABUS FOR M.Sc. COURSE IN ZOOLOGY

PG I SEMESTER

SESSION – 2019-20 onwards



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

M.Sc. I Semester

Paper Course Code	Paper Title	Credits
P-I ZOO-CC-121	Principles of Systematic Zoology – Theory	04
ZOO-CC-122	Principles of Systematic Zoology – Practical	01
P-II ZOO-CC-123	Biostatistics and Computational Biology – Theory	04
ZOO-CC-124	Biostatistics and Computational Biology – Practical	01
P-III ZOO-CC-125	Endocrinology – Theory	04
ZOO-CC-126	Endocrinology – Practical	01
P-IV ZOO-CC-127	Animal Physiology – Theory	04
ZOO-CC-128	Animal Physiology – Practical	01
Total Credits		20

M.Sc. COURSE, SESSION – 2019-20
PG FIRST SEMESTER, (CORE COURSE) IN ZOOLOGY
Course Code ZOO CC 121
PRINCIPLES OF SYSTEMATIC ZOOLOGY

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit I

Principles of Systematics

- Definition and basic concepts of biosystematics
Alfa, beta, Gamma Taxonomy
Newer trends in Taxonomy (Molecular taxonomy details)
- Theories of Systematics

Unit II

Species Concept

- Species categories
- Typological, Nominalistic, Biological, Evolutionary, Phylogenetic & Recognition species concept
- Polytypic species
- Intraspecific categories
- Hierarchy of categories

Unit III

Taxonomic collections

- Systematic collections: value and scope of collection
- Curation of collections, housing, cataloging
- Loans and expendable collection materials
- Taxonomic characters, different types:-(Morphological, behavioural, cytological and biochemical) and process of identification

Unit IV

Procedure of classifications

- Qualitative and quantitative analysis of Variations and procedure of classifying
- Non genetic and Genetic Variations
- Individual, social, ecological and traumatic Variation
- Sex associated and non-sex associated variations

Unit V

Principles and application of Zoological nomenclature

- Taxonomic publications
- Rules of Zoological Nomenclature

- Interpretation of Rules of nomenclature
Type specimens and their importance

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, Principles of Systematic Zoology. McGraw-Hill Book Co.
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.
8. Go to: Animal Taxonomy

M.Sc. COURSE, SESSION – 2019-20
PG FIRST SEMESTER, (CORE COURSE) IN ZOOLOGY
Course Code ZOO CC 122
PRINCIPLES OF SYSTEMATIC ZOOLOGY
Practical

L	T	P	C
0	0	2	1

1. Recent classification of animals exemplified by museum specimens.
2. Identification of animal species with the help of taxonomic keys.
 1. Insect fauna up to order
 2. Fish fauna up to families
 3. Identification of earthworm
3. Methods of taxonomic collection and preservations.
4. Collection of local fauna.
5. Morphological variations in animal phyla.
6. Methods of measuring biodiversity.
7. Methods of key preparation
8. Mitochondrial gene diversity, COX gene diversity.

M.Sc. COURSE, SESSION – 2019–20
PG FIRST SEMESTER, (CORE COURSE) IN ZOOLOGY
Course Code ZOO CC 123
BIostatistics AND Computational Biology
Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit I

- Matrices and Vectors
- Exponential functions
- Periodic functions and differential equations
- Mathematical modeling

Unit II

- Sampling, Data collection and recording.
- Central tendency – concept; arithmetic mean, mode, median for ungrouped and grouped data.
- Measures of dispersion: absolute and relative measures; range, standard deviation (grouped and ungrouped data), variance, quartile deviation, coefficient of variability.

Unit III

- Skewness, Kurtosis
- Probability - normal, poisson and binomial
- parametric and non - parametric test.

Unit IV

- Statistical Methods: Hypothesis testing, significance and correlation. Correlation.
- Linear models and regressions. Pearson and other correlation coefficients. Multiple regressions.
- Distribution- Normal, t-test and chi square test
- Analysis of variance

Unit V

- Basic concepts of computer, hardware and operating systems: Windows, Android, iOS
- Use of common application software in biology: word processing, spreadsheets, graphics and data base.
- Introduction to web browsing software and search engines with special reference to online resources.
- Definition, history, scope and applications of bioinformatics, Biological Databases primary & Secondary Databases e.g. GenBank, EMBL, DDBJ, Entrez, OMIM, SWISS-Prot etc. Use of PubMed, BLAST etc.

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, Mac millan, 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.

M.Sc. COURSE, SESSION – 2019–20
PG FIRST SEMESTER, (CORE COURSE) IN ZOOLOGY
Course Code ZOO CC 124
BIOSTATISTICS AND COMPUTATIONAL BIOLOGY
PRACTICAL

L	T	P	C
0	0	2	1

LIST OF PRACTICALS

1. Numerical Based on:
Matrices.
Mean, median and mode.
Mean deviation, variance, standard deviation and standard error.
2. Representation of data: Bar diagrams, π -diagrams, Histograms, Frequency polygons and ogives.
3. t-test
4. F-test
5. Chi square test
6. ANOVA
7. Demonstration of PubMed in searching scientific literature using authors name, fields, limits etc.
8. Demonstration of BLAST in comparing Protein Sequences.
9. Use of Sigma Stat/Prism Software for Statistical analysis.
10. Use of Search engines and online resources.

M.Sc. COURSE, SESSION – 2019–20
PG FIRST SEMESTER, (CORE COURSE) IN ZOOLOGY
Course Code ZOO CC 125
ENDOCRINOLOGY

Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit-I

General Endocrinology, Reproductive hormones and behavior

- Introduction to endocrinology and endocrine system
- Phylogeny and ontogeny of endocrine glands
- Discovery and Classification of hormones
- Overview of reproductive hormones secretion in males and females
- Regulatory mechanism of reproductive hormones in spermatogenesis and oogenesis
- Hormones effects on behavior and immunity
- Biological activities of prostaglandins

Unit II

Biosynthesis of Hormones and Regulation

- Biosynthesis of steroid hormones de novo
- Biosynthesis and amino-acid derived small size hormones
- Biosynthesis and simple peptide hormones – Pre – and Pro- hormones
- Hormones and Homeostasis
- Termination mechanism of hormone action.

Unit-III

Pituitary and Pineal glands

- Pituitary gland: histological structure and function
- Hormones secretion from pituitary gland and mechanism of action
- Autoimmune disorder of pituitary gland
- Pineal gland: histological structure and function
- Hormones secretion from pineal gland and mechanism of action
- Role of pineal gland in stress related diseases

Unit-IV

Thyroid, Parathyroid and Thymus glands

- Thyroid gland: histological structure and function
- Hormones secretion from thyroid gland and mechanism of action
- Imbalance of thyroid hormone and related diseases

- Parathyroid gland: histological structure and function
- Hormones secretion from parathyroid gland and mechanism of action
- Parathyroid gland disease (hyperparathyroidism)
- Structure and function of Thymus

Unit-V

Adrenal gland and hormones of GIT

- Physiology of adrenal gland: structure and function of excretory hormones
- Mechanism of action of adrenal gland secreted hormones
- Endocrine diseases involve dysfunctions of the adrenal gland
- Hormonal control of digestion – from esophagus to intestine (feeding to absorption)
- Hormonal regulation of carbohydrate, protein and lipid metabolism

Suggested Reading

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. W.S. Hoar General and comparative Animal Physiology.
7. Harpers Biochemistry by David A. Bender et al.

M.Sc. COURSE, SESSION – 2019–20
PG FIRST SEMESTER, (CORE COURSE) IN ZOOLOGY
Course Code ZOO CC 126
ENDOCRINOLOGY
Practical

L	T	P	C
0	0	2	1

1. Histological study of different endocrine glands (Pituitary, Thyroid, Parathyroid, Adrenal, Thymus, Gonads and Pancreas).
2. Microtomy to prepare stained, permanent mounts of different endocrine glands
3. Study of estrous cycle of rat
4. Sperm count and mobility assay
5. Eosin-Nigrosin staining of live and dead spermatozoa
6. To detect the presence of human chorionic gonadotropin hormone
7. Preparation of melanophore index of rasbora fish scale due to the effect of adrenalin hormone.

M.Sc. COURSE, SESSION – 2019–20
PG FIRST SEMESTER, (CORE COURSE) IN ZOOLOGY
Course Code ZOO CC 127
ANIMAL PHYSIOLOGY

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit-I

Food, Feeding and Digestion

- Types of food and nutrition: proteins, carbohydrates, fats, vitamins and minerals
- Feeding Mechanisms in general
- Physiology of digestion: structure and function of digestive system
- Role of visceral and glandular organs in digestion
- Absorption and food assimilation

Unit-II

Respiration and Circulation

- Types of respiration and respiratory systems in animals
- Physiology of Respiration: structure and function of respiratory organs
- Mechanism of O₂ & CO₂ transport in blood
- Overview of lymphatic system
- Blood: hemopoiesis, composition, coagulation mechanism, blood pressure
- Blood groups, Rh factor, and blood related diseases

Unit-III

Nervous and Muscular System

- Nerves & Nervous system: types, structure and function
- Synapse: neurotransmitters, mechanism of excitation
- Muscles: types, structure & function
- Muscle biomechanics: contraction and relaxation mechanism

Unit-IV

Excretion and Reproduction

- Physiology of excretion: structure and function of excretory organs
- Types of excretory products in animals
- Mechanism of urea production
- Physiology of reproduction: structure and function of male and female reproductive system
- Fertilization and post-fertilization developments

Unit-V

Physiological Regulations and Ocular Physiology

- Thermoregulation: mechanism and regulation
- Osmoregulation: mechanism and regulation
- Overview of sensory system: eye, ear, mouth, nose & skin
- Ocular Physiology: structure, function and components of eye
- Mechanism of vision development and related diseases

Suggested Readings:

1. W.S. Hoar General and comparative Animal Physiology.
2. Schiemdt-Nielsen Animal Physiology: Adaptation and Environment. Cambridge
3. C.L. Prosser Comparative Animal Physiology W.B. Saunders & Company
4. R. Eckert Animal physiology: Mechanism and Adaptation W.H.Freeman& Company.
5. C.R. Martin, Endocrine Physiology, Oxford University Press.
6. Harpers Biochemistry by David A. Bender et al.

M.Sc. COURSE, SESSION – 2019–20
PG FIRST SEMESTER, (CORE COURSE) IN ZOOLOGY
Course Code ZOO CC 128
ANIMAL PHYSIOLOGY (PRACTICAL)

L	T	P	C
0	0	4	1

List of practical:

1. Histological study of all organs systems
2. Enzymatic activity of human salivary amylase
3. Effect of pH & temperature on amylase activity
4. Measurement of blood pressure.
5. Determination of Blood groups and Rh Factor
6. Counting of blood cells by haemocytometer
7. Determination of bleeding time
8. Test of Ammonia, urea, uric acid and creatinine in urine sample
9. Study of osmotic hemolysis and chemical hemolysis

SYLLABUS FOR M.Sc. COURSE IN ZOOLOGY

PG II SEMESTER

SESSION – 2019-20



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M.Sc. II Semester

Paper Course Code	Paper Title	Credits
P-I ZOO-CC-221	Population Genetics and Evolution – Theory	04
ZOO-CC-222	Population Genetics and Evolution – Practical	01
P-II ZOO- CC -223	Gamete Biology – Theory	04
ZOO- CC -224	Gamete Biology – Practical	01
P-III ZOO- CC -225	Tools and Techniques for Biology – Theory	04
ZOO- CC -226	Tools and Techniques for Biology – Practical	01
P-IV ZOO- CC -227	Biochemistry – Theory	04
ZOO- CC -228	Biochemistry – Practical	01
P-V ZOO-E-229A	Elective Course – Theory	03
ZOO-E-229B	Elective Course – Practical	01
	Total Credits	24
ZOO- OE- 229	OPEN ELECTIVE	02

Elective Courses for M.Sc. II Semester

1. Medical Biochemistry
2. **Genetic Engineering**
3. Environmental Health
4. Cancer Biology & Therapeutics
5. Vermibiotechnology
6. Neurobiology
7. **Biological Methods to Study the Tissue**

P.G. COURSE, SESSION 2019-20
M.Sc. SECOND SEMESTER (CORE COURSE) IN ZOOLOGY
Paper Code ZOO CC 221
POPULATION GENETICS AND EVOLUTION
Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit-I

- Concepts of evolution and theories of organic evolution with an emphasis on Darwinism
- Neo-Darwinism .
- Hardy-Weinberg law of genetic equilibrium
- Natural selection (ii) Mutation (iii) Genetic drift (iv) Migration
- Meiotic drive
- Genetic structure of natural populations
- Factors affecting human disease frequency

Unit-II

- Molecular population genetics
- Patterns of change in nucleotide and amino acid sequences
- Ecological significance of molecular variations
- Analysis of quantitative traits
- Quantitative traits and natural selection
- Estimation of heritability
- Genotype-environment interactions

Unit-III

- Genetics of speciation
- Phylogenetic and biological concept of species
- Patterns and mechanisms of reproductive isolation
- Models of speciation (Allopatric, sympatric, parapatric)
- Evolution of gene families, Molecular drive

Unit-IV

- Origin of higher categories
- Micro-and Macro-evolution
- Molecular phylogenetics
- Phylogenetic inference-Distance methods, parsimony methods, maximum likelihood method
- Amino acid sequences and phylogeny
- Molecular clocks

Unit-V

- Origin and evolution of economically important microbes and animals
- Population genetics and ecology
- Metapopulations
- Monitoring natural populations
- Loss of genetic variations
- Conservation of genetic resources in diverse taxa

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. Strikberger, M.W. Evolution. Jones and Bartlett Publishers, Boston London.

P.G. COURSE, SESSION 2019-20
M.Sc. SECOND SEMESTER (CORE COURSE) IN ZOOLOGY
Paper Code ZOO CC 222
POPULATION GENETICS AND EVOLUTION
Practical

L	T	P	C
0	0	2	1

List of Practical

1. Distribution of gene frequency in a particular population (Brahmins, Saxenas etc.) with reference to:
 - a. Size of index and ring 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.
6. Determination of average Heterozygosity and gene polymorphism

P.G. COURSE, SESSION 2019-20
M.Sc. SECOND SEMESTER (CORE COURSE) IN ZOOLOGY
Paper Code ZOO CC 223
GAMETE BIOLOGY

Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit-I

- Heterogamy in eukaryotes
- Comparative account of differentiation of gonads in a mammal and an invertebrate
- Leydig cells
Morphology
Differentiation
Function and its regulation
- Spermatogenesis
Morphological basis in Rodents
Morphological basis in any Invertebrate
Gamete specific gene-expression and genomics
- Biochemistry of Semen
Semen composition and formation
Assessment of sperm functions
Y-specific probes

Unit-II

- Fertilization
Pre-fertilization events
Biochemistry of fertilization
Post-fertilization events
- Collection and cryopreservation of gametes and embryos
- Ovarian follicular growth and differentiation
Morphology
Endocrinology
Molecular Biology
Oogenesis and vitellogenesis
Ovulation and ovum transport in mammals

Unit-III

- Biology of sex-determination and sex-differentiation a comparative account
- Multiple ovulation and embryo transfer technology (MOET)
In vitro oocyte maturation
Superovulation
In vitro fertilization
- Transgenic animals and knock-outs

Production
Applications
Embryonic stem cells

Unit-IV

- Care and breeding of experimental animals including bioethics
- Assisted reproduction technologies
- Embryo sexing and cloning
- Screening for genetic disorders
- ICSI, GIFT etc.
- Cloning of animals by nuclear transfer

Unit-V

- Teratological effects of Xenobiotics
- Immunocontraception
- Gamete specific antigens
- Antibody mediated fertilization block and termination of gestation
- Other contraceptive technologies
- Surgical methods
- Hormonal methods
- Physical barriers
- IUCD

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 2019-20
M.Sc. SECOND SEMESTER (CORE COURSE) IN ZOOLOGY
Paper Code ZOO CC 224
GAMETE BIOLOGY
Practical

L	T	P	C
0	0	2	1

List of Practical

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 2016-17
M.Sc. SECOND SEMESTER (CORE COURSE) IN ZOOLOGY
Paper Code ZOO C 225
TOOLS AND TECHNIQUES FOR BIOLOGY

Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit-I

- Assay
- Definition and methods for assay
- Chemical assays
- Biological assays-in vivo and in vitro assays
- Principles and uses of analytical instruments - balance, pH meter, spectrophotometer, centrifuge

Unit-II

- Microscopy - Principle of light, phase-contrast, fluorescence, confocal, electron microscopes
- Microbiological techniques
- Media preparation and sterilization
- Inoculation and growth monitoring
- Use of fermentors
- Microbial assays
- Cell culture techniques
- Design and functioning of tissue culture laboratory
- Culture media preparation and cell harvesting methods
- Cell proliferation measurements
- Cell viability testing

Unit-III

- Cryotechniques
- Cryopreservation for cells, tissue, organisms
- Cryotechniques for microscopy
- Freeze-drying for physiologically active substances
- Separation techniques in biology
- Molecular separations by chromatography and electrophoresis
- Organelle separation by centrifugation etc.
- Cell separation by flow cytometry, density gradient centrifugation

Unit-IV

- Computer aided techniques for data presentation, data analyses, statistical techniques, special software for specific tasks
- Radioisotope and mass isotope techniques in biology
- Sample preparation for radioactive counting

- Autoradiography
- Metabolic labeling
- Magnetic Resonance Imaging

Unit-V

- Immunological techniques based on antigen-antibody interactions
- Surgical techniques
- Organ ablations (eg: ovariectomy, adrenalectomy etc.)
- Perfusion techniques
- Indwelling catheters
- Stereotaxy
- Parabiosis
- Biosensors

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 2019-20
M.Sc. SECOND SEMESTER (CORE COURSE) IN ZOOLOGY
Paper Code ZOO CC 226
TOOLS AND TECHNIQUES FOR BIOLOGY
Practical

L	T	P	C
0	0	2	1

List of Practical

1. Procedure of microtomy for animal tissue
2. Demonstration of microscopy: phase-contrast, fluorescence, confocal and electron
3. Isolation of Protein from plant/animal tissues
4. Demonstration of protein precipitation
5. Estimation of proteins by spectrophotometer
6. Separation of proteins by SDS-PAGE
7. Isolation of nucleic acids from plant/animal tissues
8. Estimation of nucleic acids by spectrophotometer
9. Separation of nucleic acids by agarose gel electrophoresis
10. Demonstration of PCR and RT-PCR
11. Demonstration of cell viability assays

P.G. COURSE, SESSION 2019-20
M.Sc. II SEMESTER (CORE COURSE) IN ZOOLOGY
Paper Code ZOO CC 227
BIOCHEMISTRY

Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit I

Amino acids and proteins

- Amino acids
- Acids and bases
- Protein structure
- Myoglobin and hemoglobin
- Collagen
- Protein purification
- Electrophoresis of proteins
- Protein sequencing and peptide synthesis
- Amino acid metabolism

Unit II

Enzymes

- Introduction to enzymes
- Thermodynamics
- Enzyme kinetics
- Enzyme inhibition
- Regulation of enzyme activity

Unit III

Nucleic Acids

- DNA structure
- DNA replication in prokaryotes & eukaryotes
- RNA structure
- Transcription in prokaryotes & eukaryotes
- Regulation of transcription by RNA Pol II
- Processing of eukaryotic pre-mRNA
- Ribosomal RNA
- Transfer RNA

Unit IV

Protein Synthesis

- The genetic code
- Translation in prokaryotes
- Translation in eukaryotes

- Protein targeting
- Protein glycosylation

Unit V

Carbohydrate & Lipid metabolism

- Monosaccharides, disaccharides, Polysaccharides and oligosaccharides
- Glycolysis & Gluconeogenesis
- Pentose phosphate pathway
- Glycogen metabolism & its regulation
- Structures and roles of fatty acids
- Fatty acid breakdown & synthesis
- Triacylglycerols
- Cholesterol
- Lipoproteins

Suggested readings:

1. B.D. Hames. Instant Notes in Biochemistry. Bios Pub. UK.
2. Voet D. and Voet J.G., Biochemistry, John Willey and Sons.
3. Nelson D.L., Cox M.M. Lehninger, Principles of Biochemistry, MacMilan , USA.
4. Metzler D.E. and Metzler C.M. , Biochemistry, Wiley – Liss.
5. Devlin T.M. , Text book of Biochemistry , Willey-Liss.

P.G. COURSE, SESSION 2016-17
M.Sc. II SEMESTER (CORE COURSE) IN ZOOLOGY
Paper Code ZOO CC 228
BIOCHEMISTRY
Practical

L	T	P	C
0	0	2	1

Practical:

1. Preparation of standard graph of protein for quantitative estimation of protein
2. Preparation of standard graph of DNA for quantitative estimation of DNA
3. Preparation of standard graph of RNA for quantitative estimation of RNA
4. Preparation of standard graph of Pi for determining V-max of mitochondrial ATPase Enzyme
5. Effect of substrate concentration, temperature and pH on mitochondrial ATPase enzyme
6. Chromatography ; TLC and Paper chromatography
7. DNA isolation
8. RNA isolation

Suggested readings:

1. Plummer D.T. , Practical Biochemistry , Tata McGraw-Hills.
2. Wilson K. and Walker K. , Principles & Techniques of Practical Biochemistry. Cambrigde Uni.Press.

SYLLABUS FOR M.Sc. COURSE IN ZOOLOGY

PG III SEMESTER

SESSION – 2019-20



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M. Sc. III Semester			
Core Course Code		Paper Title	Credits
P- I ZOO CC 321	Theory	Structure & Function of Invertebrates	04
ZOO CC 322	Practical	Structure & Function of Invertebrates	01
P –II ZOO CC 323	Theory	Immunology	04
ZOO CC 324	Practical	Immunology	01
P- III Special Paper			
ZOO CC 325	Theory	Cell Architecture	04
ZOO CC 326	Practical	Cell Architecture	01
ZOO CC 325	Theory	Structure and Function of Insects	04
ZOO CC 326	Practical	Structure and Function of Insects	01
ZOO CC 325	Theory	Fish Structure and Function	04
ZOO CC 326	Practical	Fish Structure and Function	01
ZOO CC 325	Theory	Principles of Environmental Biology	04
ZOO CC 326	Practical	Principles of Environmental Biology	01
P-IV Special Paper			
ZOO CC 327	Theory	Cell Physiology	04
ZOO CC 328	Practical	Cell Physiology	01
ZOO CC 327	Theory	Insect Taxonomy	04
ZOO CC 328	Practical	Insect Taxonomy	01
ZOO CC 327	Theory	Fish Anatomy & Physiology	04
ZOO CC 328	Practical	Fish Anatomy & Physiology	01
ZOO CC 327	Theory	Composition of Biosphere	04
ZOO CC 328	Practical	Composition of Biosphere	01
ZOO E 329 A	Theory	Elective	03
ZOO E 329 B	Practical	Elective	01
Total Credits			24
ZOO-OE-329	Theory	OPEN ELECTIVE	02

Elective Courses for M.Sc. III Semester (any one)

1. Molecular Medicine,
2. **Methods in Molecular Biology,**
3. Bioinformatics,
4. Molecular Reproduction & Development,
5. Molecular Taxonomy and DNA Barcoding
6. **Free Radicals, Oxidative Stress and Antioxidants**

M.Sc. COURSE, SESSION – 2019–20
M. Sc. III Semester
General Paper – I
STRUCTURE & FUNCTION IN INVERTEBRATES
Course code ZOO - CC- 321
Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit – I

Organization

- Symmetry in animal organization – Asymmetry, radial, biradial and bilateral symmetry – Significance.
- Coelom – Evolution of coelom. Acoelomate, pseudocoelomate, coelomate groups: Protostomia and Deuterostomia – Significance.
- Metamerism – Evolution of metamerism – Pseudometamerism, cyclo metamerism. Coelom theory. Embryological theory – Significance, Organization of coelom Enterocoelic, Schizocoelic and gonocoelic.

Unit – II

Locomotion, Nutrition and Digestion

- Flagellar and ciliary movements in Protozoa
- Hydrostatic movement in Coelenterate, Annelid and Echinoderm
- Patterns of feeding and digestion in lower metazoan
- Filter feeding in Polychaeta, Mollusca and Echinodermata

Unit – III

Respiration, Circulation and Excretion

- Different types of respiratory organs – Gills, lungs and trachea
- Respiratory pigments
- Mechanism of respiration
- Different types of excretory organs- coelomoducts, Nephridia and Malpighian tubules.
- Mechanisms of excretion and osmoregulation.

Unit – IV

Nervous System and Chemical Co-ordination

- Primitive nervous system: Coelenterata and Echinodermata
- Advanced nervous system: Annelida, (Polychaeta and Oligochaets), Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda).
- Endocrine glands in crustaceans and Insects – Pheromones and allelochemicals.

Unit – V

Reproduction and Minor Phyla

- Pattern of sexual and asexual reproduction.
- Larval forms of free living invertebrates, larval forms of parasites and their phylogenetic significance.
- General Characters and affinities of Minor phyla: Rotifera, Chaetognatha, Phoronida and Sipunculida.

M.Sc. COURSE, SESSION – 2019–20
M. Sc. III Semester
General Paper – I, Practical
STRUCTURE & FUNCTION IN INVERTEBRATES
Course code ZOO CC 322

L	T	P	C
0	0	2	1

List of practical

- 1. Nervous System:** Prawn/Squilla and Pila/Sepia/Mytilus
- 2. Mounting:** Gill, Statocyst, Nephridia and Spermatheca in Earthworm
- 3. Specimens and slides :**

PROTOZOA – *Monocystis*, *Noctiluca*, *Opalina*, *Euglena*, *Paramecium*

PORIFERA – *Sycon* (T.S., L.S.), *Grantia* (T.S)
Museum Specimens of *Leucosolenia*, *Hyalonema*, *Spongilla euspongia*,

CNIDARIA : Slides of *Obelia* polyp and Medusa, *Pennaria*, *Aurelia* – Tentaculocysts Museum
Specimens of *Hydra*, *Physalia*, *Porpita*, *Gorgonia*, *Metridium*, *Aurelia*, *Corallium*, *Pennatula*,
Metridium, *Virgularia*, *Zoanthus*, *Favia*.

HELMINTHES – Slides of mature segment, Gravid segment of *Tenia*,
Museum Specimens of *Ascaris*, *Taenia*, *Planaria*, *Faciola*

ANNELIDA – Slide of Setae, ovary, septal nephridia of earthworm, parapodia of *Nereis* and
Heteronereis, Male and Female *Culex*, Male and Female *Anopheles*
Museum Specimens of Hirudinaria, Patella, Eunice, Chloea, Polynoe, Terebella Eurythoe.

MOLLUSCA - Museum Specimens of *Chiton*, *Patella*, *Aplysia*, *Helix*, *Limax*, *Nautilus*, *Octopus*.

ECHINODERMATA – Museum Specimens of *Echinodiscus*, *Holothuria*, *Antedon*

SPECIMEN OF MINOR PHYLA

Larval Form: Parasitic and free swimming larval forms.

M.Sc. COURSE, SESSION – 2019–20

M. Sc. III Semester

General Paper – II, Theory

IMMUNOLOGY

Course code ZOO CC 323

Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit - I:

Components of the Immune System

- Introduction to the Immune System
- Cells, Tissues, and Organs of the Immune System
- Antibodies
- Complement

Unit - II:

Modes of Immune Response

- T Cell receptors, B cell receptor, VDJ recombination and MHC Molecules
- Mechanisms of Innate Immunity
- Antigen Presentation
- Cell-mediated Cytotoxicity

Unit - III:

Defense against Infectious Agents

- Immunity to Viruses
- Immunity To Bacteria
- Immunity to Protozoans
- Immunity to Worms

Unit - IV:

Immunomodulation

- Primary and Secondary Immunodeficiencies
- Immunosuppression
- Hypersensitivity (Type I,II, III, IV)
- Vaccination

Unit - V:

Immune Responses against Tissues

- Immunological Tolerance
- Autoimmunity and Autoimmune Disease
- Transplantation and Rejection
- Immunity to Cancers

M.Sc. COURSE, SESSION – 2019–20
M. Sc. III Semester
General Paper - II, Practical
IMMUNOLOGY
Course code ZOO CC 324

L	T	P	C
0	0	2	1

List of Practical

2. Handling of laboratory animals
- 2 Immune system and organs in a mammalian animal model
3. Routes of inoculation in mammalian model
4. Blood film preparation and identification of cells.
5. Isolation of mouse spleenocytes by density gradient centrifugation
6. ELISA
7. Radial immune-diffusion
8. Immunological diagnosis (Blood group)
9. extraction and purification of lymphocyte and its genomic DNA.
- 10 Immunocytochemistry/Immunohistochemistry
11. Western Blot: diagnosis of viral disease/cancer/pregnancy
12. RT-PCR and its applications in immunology
13. Flow cytometry (acquisition and analysis of immune cells)

Suggested Reading Material

1. Kuby Immunology, International Edition (2013) by Judy Owen, Jenni Punt and haron Stranford.
2. Fundamentals of Immunology, VII Edition (2012) by William E. Paul.
3. Immunology , VIII Edition (2013) by David Male, Jonathan Brostoff , David Roth and Ivan Roitt.

M.Sc. COURSE, SESSION – 2019–20

M. Sc. III Semester

SPECIAL PAPER - III

Principles of Environmental Biology

Course code ZOO CC 325

Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit – I

- Definition, principles and scope of Environmental Science.
- Earth, Man and Environment. Ecosystems, Pathways in Ecosystems.
- Physico-chemical and Biological factors in the Environment.

Unit – II

- Geographical classification and zones.
- Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere.
- Natural resources, conservation and sustainable development.

Unit – III

- **Chemical composition of Air** : Classification of elements, chemical speciation. Particles, ions and radicals in the atmosphere. Chemical processes for formation of inorganic and organic particulate matter. Thermochemical and photochemical reactions in the atmosphere. Oxygen and ozone chemistry, Chemistry of air pollutants, Photochemical smog.
- **Water Chemistry** : Chemistry of water, concept of DO, BOD, COD, sedimentation, coagulation, filtration, Redox potential.
- **Soil Chemistry** : Inorganic and organic components of soil, Nitrogen pathways and NPK in soils.

Unit – IV

- **Toxic Chemicals in the environment – Air, Water** : Pesticides in water.
- Biochemical aspects of Arsenic, Cadmium, Lead, Mercury, Carbon Monoxide, Os and PAN Pesticides, Insecticides, MIC
- Carcinogens in the air, water and soil.

Unit – V

- **Principles of Analytical Methods**: Titrimetry, Gravimetry, Colourimetry, Spectrophotometry
- Chromatography, Gas Chromatography, Atomic Absorption Spectrophotometer, GLC, HPLC.
- Electrophoresis X – ray fluorescence, X-ray diffraction. Flame photometry.

M.Sc. COURSE, SESSION – 2019–20
M. Sc. III Semester
(SPECIAL PAPER) IV
Principles of Environmental Biology
PRACTICAL
Course code ZOO CC 326

L	T	P	C
0	0	2	1

List of Practicals

1. Social organization.
2. Methods for calculation of population density.
3. Different types of ecological pyramids.
4. Experiment of demonstrate green house effect.
5. Resources & their conservation.
6. Estimation of alkali metals in various samples by flame-photometry.
7. Water analysis for physic-chemical characteristics.

M.Sc. COURSE, SESSION – 2019–20

M. Sc. III Semester

(SPECIAL PAPER) IV

Composition of Biosphere

Course code ZOO CC 327

Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit I

- Structure and functions, Abiotic and Biotic components, energy flows, Food chains, Food web, Ecological pyramids, types and diversity.
- Ecological Succession, Population, Community ecology and Parasitism, Prey – predator relationships.

Unit II

- Common flora and fauna in India
- Aquatic : Phytoplankton, Zooplankton and Macrophytes.
- Terrestrial : Forests
- Endangered and Threatened Species

Unit III

- Biodiversity and its conservation : Definition, 'Hotspot's of Biodiversity, Strategies for Biodiversity conservation. National Parks and Sanctuaries. Gene pool.
- Microflora of Atmosphere : Air Sampling techniques. Identification of aeroallergens. Air – borne diseases and allergies.
- Environmental Biotechnology : Fermentation Technology, Vermiculture technology, Biofertilizer technology.

Unit IV

- Sun as source of energy; solar radiation and its spectral characteristics.
- Fossil fuels-classification, composition, physico-chemical characteristics and energy content of coal, petroleum and natural gas.
- Principles of generation of hydroelectric power, tidal, Ocean Thermal Energy Conversion, wind, geothermal energy; solar collectors, photovoltaics, solar ponds.
- Nuclear energy-fission and fusion; magnetohydrodynamic power.
- Bioenergy-energy from biomass and biogas, anaerobic digestion.
- Energy use pattern in different parts of the world.

Unit V

- Environmental implication of energy use.
- CO₂ emissions, global warming.
- Air and thermal pollution.
- Radioactive waste and radioactivity from nuclear reactors.
- Impact of large-scale exploitation of Solar, Wind, Hydro and Ocean energy.

M.Sc. COURSE, SESSION – 2019–20
M. Sc. III Semester
(SPECIAL PAPER) IV
COMPOSITION OF BIOSPHERE
PRACTICAL
Course code: ZOO CC 328

L	T	P	C
0	0	2	1

List of Practicals

- A visit to aquatic ecosystem and methods for water and plankton collection
- Plankton identification and quantification from river / lake water samples. 2
- Vegetation studies by line, quadrates and belt transect methods and their analysis
- Studies on different types of eco-system models.
- Food chains and food webs in different eco systems.
- Light as limiting factor in photosynthesis.
- Different biogeochemical cycles.
- Interspecies relationships : prey-predator relation, mutualism, commensalisms & parasitism etc.

M.Sc. COURSE, SESSION – 2019-20

M. Sc. III Semester

(SPECIAL PAPER) III

CELL ARCHITECHTURE

Course code: ZOO CC 325

Theory

L	T	P	C
4	0	0	4

12 hrs/unit (Total : 60 hrs)

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

- Cell wall architecture: 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

Unit – IV

- Integrins, Collagen and non – collagen components
- Nucleus
- Interphase nucleus
- Biogenesis of nucleus

Unit – V

- Endoplasmic reticulum,
- Golgi complex,
- Mitochondria,
- Lysosomes, Vacoules, peroxisomes

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 Ind., New York.
3. Lehninger, Principles of Biochemistry, Fifth Edition.
4. Genetics : Principles and Analysis : Daniel L. Hartl, Elizabeth W. Jones.

M.Sc. COURSE, SESSION – 2019-20

M. Sc. III Semester

(SPECIAL PAPER) III

CELL ARCHITECHTURE

PRACTICAL

Course code: ZOO CC 326

L	T	P	C
0	0	2	1

List of Practicals

1. Visualization methods for cells and sub-cellular components : light microscopy, phase contrast microscopy, scanning and transmission microscopes. Laser scanning confocal microscope and atomic force microscope.
2. Demonstration of cell sorting by flow cytometry
3. Use of different types of centrifuge.

M.Sc. COURSE, SESSION – 2019–20

M. Sc. III Semester

(SPECIAL PAPER) IV

CELL PHYSIOLOGY

Course Code ZOO CC 327

Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

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: ion channels, active transport and ion pumps

Unit – III

- Cell signaling: Hormones and their receptors, cell surface receptor, signaling through G protein coupled receptors, signal transduction pathways
- Second messengers and regulation of signaling pathways: phosphatidylinositol, inositol trisphosphate, 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
- Bioenergetics and Oxidative phosphorylation.

Unit – V

- Action potential of cells and conduction of electrical impulse
- Coupled reaction, Group transfer, Biological energy transducers
- Development, propagation and transmission of action potential
- Synapses and impulse transmission, Neurotransmitter receptors

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,
3. Lehninger, Principles of Biochemistry, Fifth Edition.
4. Genetics : Principles and Analysis : Daniel L. Hartl, Elizabeth W. Jones.

M.Sc. COURSE, SESSION – 2019–20
M. Sc. III Semester
(SPECIAL PAPER) IV
CELL PHYSIOLOGY
PRACTICAL
Course Code : ZOO CC 328

L	T	P	C
0	0	2	1

List of Practicals

1. Staining of Golgi complex, mitochondria, peroxisomes etc
2. Experiment on osmosis
3. Study of hemolysis
4. Introduction to nucleic acid and protein sequence databases: data mining methods for sequence analysis, web-based tools for sequence searches, motif analysis and presentation.

M.Sc. COURSE, SESSION – 2019–20
M. Sc. III Semester
(SPECIAL PAPER) III
STRUCTURE & FUNCTION OF INSECTS
Course Code ZOO CC 325
Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

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 hemocytes
- 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

M.Sc. COURSE, SESSION – 2019–20
M. Sc. III Semester
(SPECIAL PAPER) III
STRUCTURE & FUNCTION OF INSECTS
PRACTICAL
Course Code ZOO CC 326

L	T	P	C
0	0	2	1

List of Practicals

1. Types of antenna and mouth parts
2. Different types of wings, tegmina, hemelytra, 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. COURSE, SESSION – 2019–20
M. Sc. III Semester
(SPECIAL PAPER) IV
INSECT TAXONOMY AND ECOLOGY
Course Code ZOO CC 327

Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

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

- 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

M.Sc. COURSE, SESSION – 2019–20
M. Sc. III Semester
(SPECIAL PAPER) IV
INSECT TAXONOMY AND ECOLOGY
PRACTICAL
Course Code ZOO CC 328

L	T	P	C
0	0	2	1

List of Practicals

1. Collection and Identification of Insect
2. 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
3. Practical on molecular taxonomy
4. Effects of abiotic factors like temperature, humidity and light on insects.

M.Sc. COURSE, SESSION – 2019–20
M. Sc. III Semester
(SPECIAL PAPER) III
FISH STRUCTURE AND FUNCTION
Course Code ZOO CC 325

Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit I:

Skin and skeleton

- Structure. Types of scale and fins
- Colour change mechanism.
- Vertebral column, Trunk vertebra, complex vertebra and caudal vertebra
- Skull, Visceral skeleton, opercular series
- Branchial arches, pectoral and pelvic girdles

Unit II :

Respiratory system

- Respiratory organ
- Structure of a gill, gill epithelium and branchial glands
- Accessory respiratory organ
- Blood vascular system, structure of heart

Unit III :

Nervous System

- Functional organization of Brain.
- Evolution of cerebrum. Functional association of CNS and information processing
- **Sense organs:** Sensory receptors and classification.
- Organs of olfaction and taste, electroreception in fish. Sound producing organ

Unit IV

Excretory system

- Evolution of uro-genital system in vertebrate series.
- Ultrastructure of kidney and its role in homeostasis.
- Structure of kidney in fish
- Osmoregulation

Unit V

Reproductive and endocrine system

- Male reproductive organ
- Female reproductive organ
- Embryonic and larval development

- Endocrine glands

Sexual dimorphism and parental care प्रेक्टिकल भी जोड़ना है। **Course Code ZOO CC 326**

M.Sc. COURSE, SESSION – 2019–20
M. Sc. III Semester
FISH (SPECIAL PAPER) PRACTICAL
Course Code ZOO CC 328

L	T	P	C
0	0	2	1

List of Practical

1. Anatomy of Teleosts from dissections of organ systems
2. Estimation of maturity and fecundity of fish specimens
3. Study of skeletal system of fish
4. Field study and case analysis
5. microtomy of various tissues
6. Viva voce

SYLLABUS FOR M.Sc. COURSE IN ZOOLOGY

PG IV SEMESTER

SESSION – 2019-20



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

M. Sc. IV Semester			
Core Course Code		Paper Title	Credits
P – I ZOO CC 421	Theory	Structure & Function of Vertebrates	04
ZOO CC 422	Practical	Structure & Function of Vertebrates	01
P- II ZOO CC 423	Theory	Environmental Biology and Ethology	04
ZOO CC 424	Practical	Environmental Biology and Ethology	01
P- III Special Paper			
ZOO CC 425	Theory	Insect Physiology and Biochemistry	04
ZOO CC 426	Practical	Insect Physiology and Biochemistry	01
ZOO CC 425	Theory	Cytogenetics	04
ZOO CC 426	Practical	Cytogenetics	01
ZOO CC 425	Theory	Fish Taxonomy and Ecology	04
ZOO CC 426	Practical	Fish Taxonomy and Ecology	01
ZOO CC 425	Theory	Environmental Pollution	04
ZOO CC 426	Practical	Environmental Pollution	01
P-IV Special Paper			
ZOO CC 427	Theory	Applied Entomology	04
ZOO CC 428	Practical	Applied Entomology	01
ZOO CC 427	Theory	Molecular Cell Biology	04
ZOO CC 428	Practical	Molecular Cell Biology	01
ZOO CC 427	Theory	Pisciculture and Applied Fisheries	04
ZOO CC 428	Practical	Pisciculture and Applied Fisheries	01
ZOO CC 427	Theory	Environmental Management	04
ZOO CC 428	Practical	Environmental Management	01
Total Credits			20

M.Sc. COURSE, SESSION - 2019-20
M. Sc. IV Semester
General Paper – I
STRUCTURE AND FUNCTION IN VERTEBRATES
Course code ZOO CC 421
Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit – I

- Origin of Vertebrates
- Comparative account of Petromyzontia and Myxinoidea
- Characters and Classification of Placodermi
- General organization and Classification of Elasmobranchii
- General organization and Classification of Osteichthyes
- Brief account of Dipnoi, Holocephali

Unit – II

- General organization and Classification of Amphibians, Limbless Amphibian
- Origin of Amphibia
- General organization and Classification of Reptilians
- Brief account of Chelonia, Dinosaurs, Crocodiles, Lizards and snakes

Unit – III

- General organization and Classification of Birds
- Origin of Birds
- Flight adaptation in Birds
- Brief account of Archaeopteryx and Flightless Birds

Unit – IV

- Characters and Classification of Mammals
- Brief account of Prototheria , Metatheria, and Eutheria

Unit – V

- Brief account of-
- Primate, Chiropterans, Cetacean, Carnivores, Proboscidea, Rudentia
- Aquatic Mammals, Stomach in Ruminants

M.Sc. COURSE, SESSION - 2019-20
M. Sc. IV Semester
General Paper – I, PRACTICAL
STRUCTURE AND FUNCTION IN VERTEBRATES
Course code ZOO CC 422

L	T	P	C
0	0	2	1

List of Practical

Dissections: Rat/Mice/Frog/Bony or cartilaginous fishes – Digestive, Reproductive, Arterial, Venous systems, cranial nerves and sense organs

Museum specimens and slides

- Protochordates – Salpa-sexual, Salpa-asexual, Botryllus, Herdmania, Amphioxus
- Museum Specimens (Protochordates to mammals)
- Slides: sections of skin, alimentary canal, lungs, gills, kidney, ovaries and testes of different groups of vertebrates.
- General anatomy of Herdmania/ Frog
- Preparation of permanent slides of test and pharyngeal wall of Herdmania, different types of scales in fishes, ampulla of Lorenzini
- Microtomy to prepare stained, permanent mounts of different organs e.g. skin, liver, lung, kidney and gonads etc.
- Skeletal system: fish, amphibian, reptilian, aves and mammal.
- Accessory respiratory organs in fishes.
- Blood supply to air tube in *Heteropneustes*

M.Sc. COURSE, SESSION - 2019-20
M. Sc. IV Semester
General Paper – II, Theory
ENVIRONMENTAL BIOLOGY AND ETHOLOGY
Course code ZOO CC 423

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit I:

Environmental health and toxicology

- Introduction to Toxicology
- Kinds of Toxic Substances
- Toxicity-Influencing Factors
- Exposure to Toxic Substances
- Dose–Response Relationships
- Xenobiotic and Endogenous Substances
- Toxicification and Detoxification
- Synergism, Potentiation, and Antagonism
- Behavioral and Physiological Responses
- Reproductive and Developmental Effects

Unit II :

Conservation and management of natural resources

- Natural resources conservation and Management
- Biodiversity: Need for conservation of biodiversity
- Benefits and threats to biodiversity
- Endangered species management and biodiversity protection
- Alternative sources of Energy

Unit III :

Global Environmental Issues

- Global Warming and Global Cooling
- Green House Effect
- Ozone Depletion
- Acid Rain
- Sea level rise
- Antarctica: Environmental politics & resource development regimes

Unit IV :

Environmental Protection and Impact Assessment

- The Environmental protection Act, 1986
- Air Pollution Act, 1981 and Motor Vehicle Act, 1988
- Water Protection Act, 1974
- The Wildlife Protection Act, 1972
- Introduction to environmental impact analysis.

- Environmental impact Statement and Environmental Management Plan.
- EIA guidelines 1994, Notification of Government of India.
- Impact Assessment Methodologies.
- Procedure for reviewing Environmental impact analysis and statement.
- Guidelines for Environmental audit.

Unit V :

Ethology

- Introduction to animal behaviour
- Genetic and neural basis of behavior
- Habitat selection and foraging behaviour
- Animal signals and communication
- Sexual conflict: Parental care, Sexual selection
- Social organization: Theories of social behavior, Altruism

M.Sc. COURSE, SESSION - 2019-20
M. Sc. IV Semester
ENVIRONMENTAL BIOLOGY AND ETHOLOGY
Course Code ZOO CC 424
Practical

L	T	P	C
0	0	2	1

List of Practicals:

1. Field visit to river/lake and water and wastewater treatment plants.
2. Water analysis of municipal and industrial wastes for the detection of DO, BOD, COD, Alkalinity, pH, turbidity, and temperature.
3. Soil analysis for the detection of N, P, & K.
4. Waste water treatment methods.
5. Measurement of sounds by DB meter in silent, industrial, residential and commercial zones.
6. Biodegradation of pesticides.
7. Models of non-conventional energy resources
8. Wild life: endangered and frightened species
9. Experiment to demonstrate green house effect.
10. Resources & their conservation.
11. Biosphere reserves, National parks and wildlife sanctuaries in India.
12. Demonstration of reflexes in man
13. Study of learning behaviour.
14. Display of electric organ of an electric ray.
15. Demonstration of parental care / nest building / sexual dimorphism.
16. Study of learning behaviour in mice by using a zigzag or T-shaped maze
17. Study of wall-seeking behaviour in mice
18. A field study of play behaviour or parent-young interactions in a troop of rhesus monkeys
19. A field study of foraging or trail making behaviour in a seed harvester or predatory ant species

Suggested Reading Material

1. Alcock : Animal Behaviour: An Evolutionary Approach (7th ed 2005, Sinaur).
2. Bolhuis & Giraldeau: The Behavior of Animals: mechanisms, function, and evolution (2005, Blackwell)
3. Drickamer, Vessey & Jakob: Animal Behavior: Mechanisms, Ecology, Evolution (2007, McGraw-Hill)
4. Krebs & Davis: Behavioural Ecology. (3rd ed 1993, Blackwell)
5. Lehner: Hand Book of Ethological Methods.(2nd ed 1996, Garland)
6. Manning & Dawkins: An introduction to Animal Behaviour (5th ed 1998, Cambridge Univ. Press)

M.Sc. COURSE, SESSION - 2019-20

**M. Sc. IV Semester
(SPECIAL PAPER) III
CYTOGENETICS**

Course code ZOO CC 425

Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit – I

- Structure of eukaryotic chromosome
- Euchromatin and Heterochromatin
- Organization of genes and chromosomes

Unit – II

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

Unit – III

- 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
Types of bacteriophages
- Conformations of nucleic acids (A-, B-, Z-DNA, t-RNA, micro-RNA) and their stability, Cvalue Paradox
- Mobile DNA, transposons and repetitive DNA

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

M.Sc. COURSE, SESSION - 2019-20

M. Sc. IV Semester

(SPECIAL PAPER) III

CYTOGENETICS

Course code ZOO CC 426

PRACTICAL

L	T	P	C
0	0	2	1

List of Practicals

1. UV Spectrophotometer estimation of DNA, RNA and protein
2. Isolation and purification of genomic DNA & RNA and plasmid
3. Isolation and separation methods for analysis of proteins
4. Separation of proteins by SDS-PAGE
5. Separation of DNA by agarose gel electrophoreses

M.Sc. COURSE, SESSION - 2019-20
M. Sc. IV Semester
(SPECIAL PAPER) III
PHYSIOLOGY AND BIOCHEMISTRY OF INSECTS
Course code ZOO CC 425
Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

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

M.Sc. COURSE, SESSION - 2019-20
M. Sc. IV Semester
(SPECIAL PAPER) III
PHYSIOLOGY AND BIOCHEMISTRY OF INSECTS
Course code ZOO CC 426
PRACTICAL

L	T	P	C
0	0	2	1

List of Practicals

1. Salivary glands of *Drosophila* larvae and *Chironomus* larvae.
2. Physiology experiments to show: (i) functions of malpighian tubules (ii) insects produce moisture from the spiracles during flight
3. Study of histochemical techniques in insect tissues
4. Study of protein, carbohydrate and lipid estimation in insect tissues
5. Determination of haemocyte count of a given insect
6. Identification of different types of haemocytes

M.Sc. COURSE, SESSION - 2019-20
M. Sc. IV Semester
(SPECIAL PAPER) III
TAXONOMY, AND ECOLOGY OF FISHES
Course code ZOO CC 425
Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit – I

Taxonomy

Classification of fishes upto families.

Phylogenetic analysis of bony fish : morphological analysis: mtDNA polymorphisms; comparison of protein sequences and construction of phylogenetic tree.

Unit – II

Riverine fisheries-

Important river systems and their hydrological conditions flora and fauna with and fauna with special reference to fisheries, dams and their impact on riverine fisheries, fish ladders, interlinking of rivers and likely impact on fisheries, Cold water fisheries – ecology of hill streams, biology of important cold water fishes of India, recreational fishing.

Unit – III

Lacustrine fisheries

Origin of lakes and lake morphology, light, temperature and density relationship in the lacustrine ecosystems, heat energy and water movements, oxygen and other dissolved gases in lakes, pH and redox potential, fisheries profile and potential of major Indian lakes.

Unit – IV

Estuarine fisheries-

Major estuarine systems of India, hydrograph, flora and fauna with special reference to fisheries Marine fisheries- coastal and deep sea fisheries, permanent and seasonal stratification, upwelling, the photic zone, control of primary production by light and nutrients availability, chemical properties of sea water, biology of important fishes (sardine, mackerel, tuna), marine protected areas.

Unit –V

Aquatic pollution-

Types and sources, impact of pollution on aquatic organisms, ecosystem analysis bio-indicators, biomonitoring environmental factors and fish health, xenobiotics. Waste management national and international standards.. Extension services – basic principles and emerging issues of extension, role of information and communication technology in fisheries extension.

Suggested Literature:

1. Computers in Fisheries Research, Megrey, B.A. and Mokshess, E. (2009), Springer, USA
2. Biological Invasions in Marine Exosystems Ecological, Management and Geographic Perspectives, Rilov, G. and Jeffrey, A.C. (2009), Springer-Verlag, GERMANY
3. Handbook of Fisheries and Aquaculture, Indian Council of Agricultural Research, ICAR, (2006), DIPA.

M.Sc. COURSE, SESSION - 2019-20
M. Sc. IV Semester
(SPECIAL PAPER) III
TAXONOMY, AND ECOLOGY OF FISHES
Course code ZOO CC 426
PRACTICAL

L	T	P	C
0	0	2	1

List of Practicals

Aquatic Resources and Their Conservation

1. Identification of Indian common fish faunal resources from cold water, warm water, marine water and ornamental fishes.
2. Physic-chemical parameters of freshwater bodies.
3. Biological analysis of water and estimation of primary productivity.
4. Collection of phytoplankton and zooplankton from natural resources and their identification.
5. Study of benthic macro invertebrates in natural water bodies.
6. Study of fishing gears and nets with the help of models.
7. Simulated experiments on population.
8. Salinity tolerance in select fishes.
9. Determination of age and growth; gonadosomatic index
10. Length-weight relationship and condition factor determination.
11. Experiments on chemoreception using different attractants and repellents.
12. Toxicity testing with zooplankton/fish.
13. Visit to a coastal/ mariculture farm and study the socio-economic status of the fisherman community.

M.Sc. COURSE, SESSION - 2019-20

M. Sc. IV Semester

(SPECIAL PAPER) III

ENVIRONMENTAL POLLUTION

Course code ZOO CC 425

Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit-I

- Air : Natural and anthropogenic sources of pollution. Primary and Secondary pollutants.
- Transport and diffusion of pollutants. Gas laws governing the behaviour of pollutants in the atmosphere. Methods of monitoring and control of air pollution SO₂, NO_x, CO, SPM.
- Effects of pollutants on human beings, plants, animals, materials and on climate. Acid Rain.
- Air Quality Standards.
- Water : Types, sources and consequences of water pollution. Physico-chemical and Bacteriological sampling and analysis of water quality. Standards, sewage and waste water treatment and recycling. Water quality standard.
- Soil : Physico-chemical as bacteriological sampling as analysis of soil quality. Soil Pollution Control. Industrial waste effluents and heavy metals, their interactions with soil components.
- Soil micro-organisms and their functions, degradation of different insecticides, fungicides and weedicides in soil. Different kinds of synthetic fertilizers (NP & K) and their interactions with different components of soil.

Unit-II

- Noise : Sources of noise pollution, measurement of noise and Indices, effect of meteorological parameters on noise propagation. Noise exposure levels and standards. Noise control and abatement measures. Impact of noise on human health.
- Marine : Sources of marine pollution and control. Criteria employed for disposal of pollutants in marine system-coastal management.
- Radioactive and Thermal Pollution.

Unit-III

- Introduction to environmental impact analysis.
- Environmental impact Statement and Environmental Management Plan.
- EIA guidelines 1994, Notification of Government of India.
- Impact Assessment Methodologies.
- Procedure for reviewing Environmental impact analysis and statement.
- Guidelines for Environmental audit.

Unit-IV

- Introduction to Environmental planning.
- Base line information and predictions (land, water, atmosphere, energy, etc.).
- Restoration and rehabilitation technologies.
- Landuse policy for India.

- Urban planning for India.
- Rural planning and landuse pattern.

Unit-V

- Concept and strategies of sustainable development.
- Cost-Benefit analysis.
- Environmental priorities in India and sustainable development.

M.Sc. COURSE, SESSION - 2019-20
M. Sc. IV Semester
(SPECIAL PAPER) III
ENVIRONMENTAL POLLUTION
Course code ZOO CC 425
Practical

L	T	P	C
0	0	2	1

List of Practicals :

1. Comparative analysis of air sampling from clean and polluted area using key parameters.
2. Collection and Interpretation of Weather data.
3. Field visit to river/lake and water and wastewater treatment plants.
4. Water analysis of municipal and industrial wastes for the detection of Do, BOD, COD, CO₃, HCO₃, Cl₂, Alkalinity pH, turbidity and temperature.
5. Soil analysis for the detection of N, P, K, NO₃, SO₄, Cl₂, CO₃ etc.
6. Waste water treatment methods.
7. Detection of heavy metals in water samples.

M.Sc. COURSE, SESSION - 2019-20

M. Sc. IV Semester

(SPECIAL PAPER) IV

MOLECULAR CELL BIOLOGY

Course code ZOO CC 427

Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit – I

- DNA replication: unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons
- DNA damage and repair mechanisms
- Transcription (gene expression): mechanism and regulation, transcription factors and machinery
- RNA processing, RNA editing and splicing
- Post transcriptional modifications

Unit – II

- Translation: mechanism and regulation
- Post translational modifications
- Control of gene expression at transcription and translation levels
- Regulation of gene expression by non-coding RNAs
- Antisense molecules in regulation of gene expression and gene silencing, CRISPR-CAS

SYSTEM

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

M.Sc. COURSE, SESSION - 2019-20
M. Sc. IV Semester
(SPECIAL PAPER) IV
MOLECULAR CELL BIOLOGY
Course code ZOO CC 428
Practical

L	T	P	C
0	0	2	1

List of Practicals

1. Study of normal human karyotype
2. Study of chromatin by Feulgen staining
3. Demonstration of PCR
4. Primer and siRNA designing
5. Cloning using bacterial plasmids

M.Sc. COURSE, SESSION - 2019-20

**M. Sc. IV Semester
(SPECIAL PAPER) IV
APPLIED ENTOMOLOGY
Course code ZOO C 427**

Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

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

- 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

M.Sc. COURSE, SESSION - 2019-20
M. Sc. IV Semester
(SPECIAL PAPER) IV
APPLIED ENTOMOLOGY
Course code ZOO C 428
PRACTICAL

L	T	P	C
0	0	2	1

List of practical:

1. Collection, identification and classification of insects belonging to the different orders
2. Collections of insects of medical importance and their life cycle
3. Collection of polymorphic forms of honey bee and termites
4. Effect of an insecticides on a household pest

M.Sc. COURSE, SESSION - 2019-20
M. Sc. IV Semester
(SPECIAL PAPER) IV
PISCICULTURE AND APPLIED FISHERIES
Course code ZOO CC 427
Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit - I

Fish reproduction Development and Growth

- Male and female reproductive organs
- Hormonal actions for fish breeding.
- Developmental traits and pattern of fish eggs and larvae.
- Ageing and growth of fish

Unit II

Fish pathology and diseases

- General principles of diseases in aquaculture.
- Major diseases in aquaculture, control and management.
- Immune protection in fish systems and Stress response.
- Transformation of infection into diseases. Selection of site and species for aquaculture.
- Qualities of culturable indigenous and exotic species

Unit III

Aquaculture Techniques

- Site selection and construction of farms for carp and prawn culture.
- Aquaculture of carps. Concepts and economic principles of farm management.
- Culture system, preparation and management of ponds for culture
- Modern hatcheries and management.
- Non-conventional aquaculture system.
- Waste water recycling through aquaculture
- Bioinformatics and statistics of aquaculture data

Unit IV

Transgenesis

- Fish as a model organism, methods of gene transfer
- strategies for gene targeting (homologous sites/ recombination system)
- specialized vectors for high efficiency transgenesis – eukaryotic transposon vectors, retroviral vectors, etc., Transgene: integration and detection techniques, an overview of transgenics developed in fisheries sector – food/or ornamental
- Fish as biosensors and biofactories.

Unit V

Composite fish culture

- Integration of aquaculture. Rationale of integrated farming of fish and livestock
- Rice field aquaculture
- Techniques of stock improvement.
- Induced breeding and bundh breeding.
- Cryopreservation, hybridization, polyploidy

Suggested readings

1. Fish Genetics and Biotechnology – Ayappan et al. ICAR publication
2. Fisheries Biotechnology – W.S. Lakra
3. Gene IX – Benjamin Lewin.
4. Concepts in biochemistry – Rodney Boyer
5. Molecular Cloning: A laboratory Manual- J. Sambrook et al.
6. Genomes – T.A. Brown

M.Sc. COURSE, SESSION - 2019-20
M. Sc. IV Semester
(SPECIAL PAPER) IV
PISCICULTURE AND APPLIED FISHERIES
Course code ZOO CC 428
Practical

L	T	P	C
0	0	2	1

List of Practicals

Aquaculture Laboratory Course

1. Studies on fish diversity- Documentation of endangered fish fauna and morphometric analysis
2. Fish pathology- Study of fish parasites and diseases, pathological experiments
3. Induced breeding of carps, spirulina culture, identification of selected algae
5. PAGE analysis for recombinant proteins
6. Demonstration of research methods & Field study
7. Sessional (Internal evaluation)
8. Viva voce

M.Sc. COURSE, SESSION - 2019-20
M. Sc. IV Semester
(SPECIALPAPER) IV
ENVIRONMENTAL MANAGEMENT
Course code ZOO CC 427
Theory

L	T	P	C
4	0	0	4

12hrs/unit (Total : 60 hrs)

Unit I

- Sources and generation of solid wastes, their characterization, chemical composition and classification.
- Different methods of disposal and management of solid wastes (Hospital Wastes and Hazardous Wastes)
- Recycling of waste material.
- Waste minimization technologies.
- Hazardous Wastes Management and Handling Rules, 1989.

Unit II

- Resource Management, Disaster Management and Risk analysis.
- Environment protection-issues and problems.
- International and National efforts for Environment Protection.
- Provision of Constitution of India regarding Environment (Article 48A and 58A).
- Environmental Policy Resolution, Legislation, Public Policy Strategies in Pollution Control.

Unit III

- Wildlife Protection Act, 1972 amended 1991.
- Forest Conservation Act, 1980.
- Indian Forests Act (Revised) 1982.
- Air (Prevention and Control of Pollution) Act, 1981 as amended by Amendment Act, 1987 and Rule 1982, Motor Vehicle Act, 1988.
- The Water (Prevention and Control of Pollution) Act, 1974 as amended up to 1988 and Rules 1975.
- The Environment (Protection) Act, 1986 and Rules 1986.
- Scheme of labelling of environmentally friendly products (Ecomark), Public Liability Insurance Act, 1991 and Rules 1991.

Unit IV

- Environmental Education and Awareness. Environmental Ethics and Global imperatives.
- Global Environmental problems-ozone depletion, global warming and climatic change.
- Current Environmental issue in India. In context to Narmada Dam and Tehri Dam etc.
- Soil Erosion, Formation and reclamation of Usar, Alkaline and Saline Soil.
- Waste lands and their reclamation.
- Desertification and its control.

- Vehicular pollution and urban air quality.

Unit V

- Depletion of Nature resources.
- Biodiversity conservation and Agenda – 21.
- Waste disposal, recycling and power generation, Fly ash utilization. Water Crises- Conservation of water.
- Environmental Hazards.
- Eutrophication and restoration of Indian lakes. Rain water harvesting. Wet lands conservation.
- Epidemiological issues (e.g., Goitre, Fluorosis, Arsenic).

M.Sc. COURSE, SESSION - 2019-20
M. Sc. IV Semester
(SPECIALPAPER) IV
ENVIRONMENTAL MANAGEMENT
Course code ZOO CC 428
PRACTICAL

L	T	P	C
0	0	2	1

List of Practicals

1. Detection of pesticide residues by TLC.
2. Calculation of LC₁₀₀, LC₅₀, LC₀, sub-lethal concentration, LD₁₀₀, LD₅₀, LD₀ and sub-lethal doses.
3. Measurement of sounds by DB meter in silent, industrial, residential and commercial zones.
4. Biodegradation of pesticides.
5. Models of non-conventional energy resources
6. Vermiculture and composting.
7. Wild life: endangered and frightened species
8. Biosphere reserves, National parks and wildlife sanctuaries in India.

SYLLABUS FOR ELECTIVE COURSES IN ZOOLOGY

PG II & III SEMESTER

SESSION – 2019-20



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

**M.Sc. COURSE, SESSION - 2019-20
PG SECOND SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY**

COURSE CODE ZOO E 229 A

Medical Biochemistry

L T P C

3 0 0 3

09 hrs/unit (Total : 45 hrs)

Unit-I 1.1 Biochemical basis of diseases/disorders, diagnosis and treatment

1.2 Molecular deficiency disorders

1.2.1 Enzyme deficiency: inborn errors of metabolism

1.2.1.1 Alkaptonuria

1.2.1.2 Phenylketonuria

1.2.1.3 Lesh-Nyhan syndrome

1.2.2 Protein defects/ deficiency

1.2.2.1 Cystic fibrosis

1.2.2.2 Sickel cell anaemia

1.2.2.3 Thalassemia

Unit-II Transport/storage associated disorders

2.1 Hypercholesterolemia and atherosclerosis

2.2 A-Beta-lipoproteinemia

2.3 Tay-Sachs disease

2.4 Gout

Unit-III Apoptosis and its implications in health and disease

3.1 Process of apoptosis

3.1.1 Induction and biochemical changes

3.1.2 Execution

3.1.3 Phagocytosis of apoptotic bodies

3.2 Regulation of apoptosis

3.3 Implications

3.3.1 Programmed cell death and development

3.3.2 Development of immunological tolerance

3.3.3 Neurological disorders

Unit-IV Cancer

4.1. Biochemical alterations during carcinogenesis

4.2. Regulatory mechanisms as targets for cancer therapy

Univ-V 5.1 Drug action, abuse and catabolism

5.1.1 Mechanisms

5.1.2 Drug addiction, alcohol toxicity

5.1.3 Catabolism of drugs

5.2. Recent trends in therapy

5.2.1 Biomolecules as diagnostic markers and therapeutic agents

5.2.2 Gene technology and gene therapy

5.2.3 Drug delivery and targeting

5.3. Medical gerontology

Books Recommended

1. Murray et al: Harper's Illustrated Biochemistry (27th ed 2006, McGraw Hill)
2. Ganong: Review of Medical Physiology (21st ed 2003, Lange Medical Publications)
3. Alberts et al: Molecular Biology of the Cell (4th ed 2002, Garland)
4. Goldsby et al: Immunology (5th ed 2003, Freeman)
5. Bhagvan: Medical Biochemistry (4th ed 2004, Hap)
6. Goodman et al: The Pharmacological Basis of Therapeutics (7th ed 1991, Macmillan Publishers)
7. Smith & Marks: Basic Medical Biochemistry (2nd ed 2005, LWW Lippincott's)
8. Chatterjea & Shinde: Medical Biochemistry (6th ed 2005, Jaypee brothers)
9. Bennett & Brown: Clinical Pharmacology (9th ed 2005, Elsevier)
10. Saini & Kaur: Clinical Biochemistry (1st ed 2001, CBS Publ)

LIST OF PRACTICALS
M.Sc. COURSE, SESSION –2019-20
PG SECOND SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
Medical Biochemistry
Course Code ZOO E 229 B

1. Study of pathological condition in rat/mouse model: liver cirrhosis, diabetes and ascites tumor
2. Analysis of enzymatic/biochemical markers from serum/tissues of rat/mouse model
 - 2.1 Studies on the anti-oxidant enzymes (SOD, catalase and GPx) in normal and diseased rats
 - 2.2 Native-PAGE analysis of LDH isoforms
 - 2.3 Spectrophotometric assay of SGOT (AST) and SGPT (ALT)
 - 2.4 Estimation of bilirubin concentration
3. Study of apoptosis in liver cirrhotic/tumor model
 - 3.1 Analysis of DNA-degradation pattern using agarose gel electrophoresis
 - 3.2 Western blot analysis of release of cytochrome C from mitochondria
 - 3.3 Expression analysis of Bcl2, Bax and pro-apoptotic factors (Caspase3 and 9)
4. Demonstration of expression of a gene/protein during aging

M.Sc. COURSE, SESSION - 2019-20
PG SECOND SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
COURSE CODE ZOO E 229 A

Genetic Engineering

Theory

L T P C

3 0 0 3

09 hrs/unit (Total : 45 hrs)

Unit-I Tools

- 1.1 Recombinant DNA technology
- 1.2 Restriction enzymes and other enzymes for DNA manipulation
- 1.3 Vector types: cloning & expression
- 1.4 Probes

Unit-II Cloning strategies

- 2.1 Genomic libraries
- 2.2 cDNA library
- 2.3 Bacteriophages: Lambda phage, M13
- 2.4 Polymerase Chain Reaction

Unit-III Screening of clones

- 3.1 Preparation of probes
- 3.2 Southern hybridization
- 3.3 Northern Blotting
- 3.4 Immuno-screening

Unit-IV Characterization of clones

- 4.1 Sequencing of DNA
- 4.2 Microarray types
- 4.3 Applications of microarray
- 4.4 DNA chip fabrication technology

Unit-V Applications:

- 5.1 Transgenic organism and genetically modified organisms
- 5.2 Site-directed mutagenesis
- 5.3 Generation of knock out animals
- 5.4 Gene therapy

Books Recommended

- 1. Brown: Gene Cloning & DNA analysis (2001, Blackwell)
- 2. Lewin: Genes IX (2008, Jones & Bartlett)
- 3. Lodish et al : Molecular cell biology (6th edition 2007, Freeman)
- 4. Asubel et al : Current protocol in molecular biology (1944, Wiley)
- 5. Sambrook & Russell : Molecular cloning (2001, Cold Spring Harbour)

M.Sc. COURSE, SESSION – 2019–20
PG SECOND SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
Course Code ZOO E 229 B
Genetic Engineering
Practical
L T P C
0 0 2 1

LIST OF PRACTICALS

1. Demonstration of DNA gel electrophoresis
2. Demonstration of northern, southern hybridization
3. Structure, function & working of instruments: PCR & DNA sequencer.
4. Preparation of models of nucleotides.

M.Sc. COURSE, SESSION - 2019-20
PG SECOND SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
COURSE CODE ZOO E 229 A
Environmental Health
L T P C
3 0 0 3

09 hrs/unit (Total : 45 hrs)

Unit I: Molecular toxicology

1.1 Basic understanding of environmental health impact

Unit II: Epigenetic traits and determinants

2.1 Basic understanding of tools and techniques used for pragmatic analysis of human Exposome

Unit III: Impact assessment of technological advancements

- 3.1 Synthetic pesticides
- 3.2 radiation and nuclear technology
- 3.3 cell phones
- 3.4 genetically modified products.

Unit IV: Occupational medicine

- 4.1 Detection and control of environmentally transmitted microbial hazards
- 4.2 industrial hygiene
- 4.3 occupational safety management

Unit V: Environmental law, regulation and policy

- 5.1 Articulate the implications of human-environmental interactions for social decision making
- 5.2 environmental regulation and allocation of public health resources

M.Sc. COURSE, SESSION – 2019-20
PG SECOND SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
Course Code ZOO E 229 B
L T P C
0 0 2 1

LIST OF PRACTICAL

1. Histone modifications and DNA methylation
2. Hands-on-experience to exposome analytics (HPLC, GC etc.) used for evaluating dose-response and exposure-response relationship
3. Basic toxicogenomic profiling through software-user interface

M.Sc. COURSE, SESSION - 2019-20
PG SECOND SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
COURSE CODE ZOO E 229 A
Cancer Biology & Therapeutics
Theory
L T P C
3 0 0 3

09 hrs/unit (Total : 45 hrs)

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

5.3Pharmaco-surveillance and nano-medicine

M.Sc. COURSE, SESSION – 2019–20
PG SECOND SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
Course Code ZOO E 229 B
Cancer Biology & Therapeutics
Practical
L T P C
0 0 2 1

LIST OF PRACTICALS

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

M.Sc. COURSE, SESSION - 2019-20
PG SECOND SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
COURSE CODE ZOO E 229 A

Vermibiotechnology

Theory

L T P C

3 0 0 3

09 hrs/unit (Total : 45 hrs)

Unit 1.0 : Earthworms

- 1.1 Basic structure
- 1.2 Life cycle
- 1.3 Life span
- 1.4 Identification of earthworm

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

M.Sc. COURSE, SESSION – 2019–20
PG SECOND SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
Course Code ZOO E 229 B
Vermibiotechnology
Practical
L T P C
0 0 2 1

LIST OF PRACTICALS

- 1: Collection and Identification of the epigeic earthworm species suitable for vermicomposting.
- 2: Different techniques for developing small and high scale vermireactors.
- 3: Grading and counting of Coccons and their method of transportation.
- 4: Preparation of Vermiwash and Vermimeal.

M.Sc. COURSE, SESSION - 2019-20
PG SECOND SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
COURSE CODE ZOO E 229 A

Neurobiology

Theory

L T P C

3 0 0 3

09 hrs/unit (Total : 45 hrs)

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 and physiology
 - 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

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 (14th 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)

M.Sc. COURSE, SESSION – 2019–20

PG SECOND SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY

Course Code ZOO E 229 B

L T P C

0 0 2 1

LIST OF PRACTICALS

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

M.Sc. COURSE, SESSION - 2019-20
PG SECOND SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
COURSE CODE ZOO E 229 A

Biological Methods to Study the Tissue

Theory

L T P C

3 0 0 3

09 hrs/unit (Total : 45 hrs)

M.Sc. COURSE, SESSION – 2019–20

PG SECOND SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY

Course Code ZOO E 229 B

L T P C

0 0 2 1

M.Sc. COURSE, SESSION - 2019-20
PG THIRD SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
COURSE CODE ZOO E 329 A

Molecular Medicine

Theory

L T P C

3 0 0 3

09 hrs/unit (Total : 45 hrs)

Unit I: Technology & Society

- 1.1 Historical perspectives
- 1.2 evolution & dynamics of modern biology

Unit II: Biomedical basis of disease: From Gene to Protein to Disease

- 2.1 Cause and molecular/cellular progression of key diseases including infectious
- 2.2 inherited diseases
- 2.3 emphasising specially on cancer

Unit III: Analytical Technology

- 3.1 Basic principles of DNA sequencing
- 3.2 flow cytometry
- 3.3 laser scanning confocal microscopy
- 3.4 Real Time PCR

Unit IV: Genetic & Molecular Epidemiology

- 4.1 Basic principles
- 4.2 Bioinformatic tools
- 4.3 key tests and data interpretation using cutting-edge platforms

Unit V: Translational Research

- 5.1 Integrating pharmacogenetic approaches to health-care systems

M.Sc. COURSE, SESSION - 2019-20
M. Sc. II Semester
ELECTIVE COURSE PRACTICAL
Course Code ZOO E 329 B
L T P C
0 0 2 1

Practical Course:

1. Hands on experience to basic molecular tools and techniques
2. Medline database search and basic bioinformatics.

M.Sc. COURSE, SESSION - 2019-20
PG THIRD SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
COURSE CODE ZOO E 329 A
Methods in Molecular Biology

Theory

L T P C

3 0 0 3

09 hrs/unit (Total : 45 hrs)

Unit-I: Methods in Protein Biochemistry

- 1.1 Protein purification and separation methods
- 1.2 Application of centrifugation techniques
- 1.3 Chromatographic separation techniques
- 1.4 Electrophoresis – principle and methods

Unit-II: Protein Purification and Characterization

- 2.1 Protein isolation from plants and animal tissues, and cell cultures
- 2.2 Protein quantification
- 2.3 Catalytic identification of enzymes on electrophoresis

Unit-III: Methods in Nucleic Acids - DNA

- 3.1 DNA isolation from plants and animal tissues, and cell cultures
- 3.2 DNA purification methods
- 3.3 DNA quantification
- 3.4 Agarose gel electrophoresis – principle and methods (DNA and RNA)

Unit-IV: Methods in Nucleic Acids - RNA

- 4.1 Total RNA isolation from plants and animal tissues, and cell cultures
- 4.2 RNA purification and quantification
- 4.3 Agarose gel electrophoresis for RNA

Unit-V: Basics of gene expression analysis

- 5.1 Polymerase chain reaction – principles and methods
- 5.2 Real-Time PCR
- 5.3 Application of RNA for PCR amplification in analysis of gene expression

Suggested Reading Material

- 1. Principles and Techniques of Biochemistry and Molecular Biology, Keith Wilson, John M. Walker.
- 2. Molecular Cell Biology, J. Darnell, H. Lodish and D. Baltimore Scientific American Book, Inc., USA.

M.Sc. COURSE, SESSION - 2016-17

M. Sc. III Semester

ELECTIVE COURSE PRACTICAL

Course Code ZOO E 329 B

L T P C

0 0 2 1

List of Practical:

1. Demonstration of spectrophotometry
2. Demonstration of chromatographic techniques
3. Isolation of Protein from plant/animal tissues
4. Demonstration of protein precipitation
5. Estimation of protein by spectrophotometer
6. Separation of proteins by SDS-PAGE
7. Isolation of nucleic acids from plant/animal tissues
8. Estimation of nucleic acids by spectrophotometer
9. Separation of nucleic acids by agarose gel electrophoresis
10. Demonstration of PCR and RT-PCR

M.Sc. COURSE, SESSION – 2019-20
PG THIRD SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
COURSE CODE ZOO E 329 A

Bioinformatics

Theory

L T P C

3 0 0 3

09 hrs/unit (Total : 45 hrs)

Unit 01: Introduction

- 1.1 History and Scope of Bioinformatics
- 1.2 Definitions of Bioinformatics
- 1.3 Importance of Bioinformatics

Unit 02: Computers, Internet, World Wide Web and NCBI

- 2.1 Computers and Programs
- 2.2 Internet
- 2.3 World Wide Web & Browsers
- 2.4 EMBnet& NCBI

Unit 03: DNA, RNA and Proteins

- 3.1 Principles of DNA sequencing
- 3.2 Principles of RNA sequencing
- 3.3 Principles of Protein sequencing
- 3.4 Gene & Protein Expression Analysis
- 3.5 DNA microarray
- 3.6 Human Genome Project

Unit 04: Databases, Tools and their Uses

- 4.1 Importance of databases
- 4.2 Nucleic acid sequence databases
- 4.3 Protein sequence databases
- 4.4 Primary sequence databases- GenBank; NCBI; EMBL; ODBI
- 4.5 Subsidiary sequence databases-SWISS-PROT; TrEMBL; UniProt
- 4.6 Organism specific resources-OMIM; Unigene
- 4.7 Database Formats; Medline; PubMed; Web of Science
- 4.8 Uses of databases

Unit 05: Analyzing and Retrieving Databases

- 5.1 Sequence alignment methods
- 5.2 Pairwise and Multiple sequence alignment
- 5.3 Analyzing Protein sequences
- 5.4 Analyzing DNA sequences
- 5.5 Analyzing RNA sequences

5.6 BLAST; ClustalW

5.7 Phlogenetic Trees-Phylip

Suggested Readings:

1. “Understanding Bioinformatics” by Marketa J. Zvelbil; Publisher-Garland Science; ISBN-10:0815340249.
2. “Introduction to Bioinformatics” by Arthur M. Lesk; Publisher-Oxford University Press; ISBN-10:0199208042.
3. “Basic Bioinformatics” by S. Iganacimuthu; Publisher-Narosa; ISBN-978-81-7319-540-9.
4. “Bioinformatics for Dummies” by Jean-Michel Claverie, Publisher-For Dummies; ISBN-10:0470089857.

M.Sc. COURSE, SESSION – 2019-20
M. Sc. III Semester
ELECTIVE COURSE PRACTICAL
Course Code ZOO E 329 B
L T P C
0 0 2 1

List of Practical:

1. Demonstration of PubMed in searching scientific literature using authors name, fields, limits etc.
2. Demonstration of BLAST in comparing Protein Sequences.
3. Demonstration of ClustalW in Multiple sequence alignment.
4. Demonstration of Rasmol in Protein structure visualisation.
5. Designing PCR primers.

M.Sc. COURSE, SESSION - 2019-20
PG THIRD SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
COURSE CODE ZOO E 329 A

Molecular Reproduction & Development

Theory

L T P C

3 0 0 3

09 hrs/unit (Total : 45 hrs)

Unit I:

Male reproductive physiology

- Overview of spermatogenesis and male infertility factors

Unit II:

Female reproductive physiology

- Overview of oogenesis and factors affecting female fertility regulation

Unit III:

Development

- Principles of animal development
- Maternal information
- Induction and regulation of gene expression during development

Unit IV:

Developmental genetics

- Organization of human genome
- Pattern of mendelian inheritance
- Genomic imprinting

Unit V:

Biochemical basis of genetic diseases

- Human genetic disorders
- Genetics of childhood cancer
- Genetic counselling and prenatal diagnostics

M.Sc. COURSE, SESSION - 2019-20
M. Sc. III Semester
PAPER V (ELECTIVE COURSE) PRACTICAL
Course Code ZOO E 329 B

L	T	P	C
0	0	2	1

1. Basic evaluation of male and female reproductive tract in a mammalian model
2. Introduction to human genome mapping
3. Chromosomal analysis using software interface

M.Sc. COURSE, SESSION - 2019-20
PG THIRD SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
COURSE CODE ZOO E 329 A

Molecular Taxonomy and DNA Barcoding
Theory

L T P C
3 0 0 3

09 hrs/unit (Total : 45 hrs)

Unit 1.

Basics of Molecular Taxonomy

- Description, Illustration and communicating molecular biodiversity
- DNA barcode for Tree of Life

Unit 2.

Molecular Taxonomy tools and Protocols

- Introduction of mitochondrial DNA for molecular taxonomy
- Techniques of extraction of mDNA.
- Amplification technique of markers
- Quantification and documentation of DNA and PCR product

Unit 3.

Barcode analysis Software

- Introduction of alignment of sequence
- Phylogenetic analysis of ecological communities using DNA barcode

Unit 4.0: Laboratory Information Management System (LIMS) for DNA Barcoding

Unit 5.0: Introduction of Barcode of Life Data Base (BOLD)

M.Sc. COURSE, SESSION - 2019-20
M. Sc. III Semester
PAPER V (ELECTIVE COURSE) PRACTICAL
Molecular Taxonomy and DNA Barcoding
Course Code ZOO E 329 B

L	T	P	C
0	0	2	1

- 1 Collection and preservation of biological Specimens for Molecular studies.
- 2 Extraction and Quantification of mDNA of preserved speccimen
- 3 Amplification of *coi* gene.
- 4 Bioinformatics based sequence assembly, alignment and analysis.

M.Sc. COURSE, SESSION – 2019-20
PG THIRD SEMESTER, (ELECTIVE COURSE) IN ZOOLOGY
COURSE CODE ZOO E 329 A

Free Radicals, Oxidative Stress and Antioxidants

Theory

L T P C

3 0 0 3

09 hrs/unit (Total : 45 hrs)

Unit 01 :

Introduction

- General aspects of Oxidative stress;
- Types of free radicals and their formation;
- Reactive oxygen species (ROS)/ Reactive Nitrogen species (RNS);
- Interaction with biological molecules.

Unit 02 :

Antioxidant Mechanisms

- Mechanisms of antioxidant action;
- Repair systems and inducible defenses against oxidant stress;
- Vitamins and antioxidant enzymes.

Unit 03:

Oxidative Stress: Molecular mechanisms and biological effects

- Free radical mediated damage to biomolecules
- Mitochondrial biology and oxidative stress
- Oxidative stress in Cancer Biology.

Unit 04 :

Techniques to Analyse Free Radicals

- Electron spin resonance (ESR) or electron paramagnetic resonance (EPR)
- spectroscopy;
- Dichlorofluorescein diacetate (DCF-DA), Diaminofluorescein diacetate (DAF-2DA),
- Dihydroethidium (DHE) dyes
- Assays of antioxidant enzymes.

Unit 05 :

Free Radicals in Health and Disease

- Toxicity of oxygen;
- Pathological systems and toxic responses;
- Pathological and Physiological Significance.

Suggested Readings:

- An introduction to Free Radical Chemistry by A. F. Parsons, 2000.
- Free Radicals: An Introduction by A. F. Trotman-Dickenson, 1959.
- Cellular antioxidant defence mechanisms by Ching Kuang Chow, 1988.
- Free Radicals, oxidative stress and antioxidants. Pathological and physiological significance. Edited by Tomris Ozben. NATO ASI Series, Series A: Life Sciences Vol. 296.

- Laboratory Techniques in biochemistry and molecular biology by C.A. Rice-Evans, A.T. Diplock, M.C.R. Symons.

M.Sc. COURSE, SESSION - 2019-20
M. Sc. III Semester
PAPER V (ELECTIVE COURSE) PRACTICAL
Course Code ZOO E 329 B

L	T	P	C
0	0	2	1

Practical Course:

- 1 Detection of mitochondria free radical production.
- 2 Estimation of lipid peroxidation in the cells
- 3 Detection of protein bound carbonyls in the cells
- 4 Detection of free radical (OH, NO) by fluorescence microscopy.
- 5 Antioxidant enzyme assay
- 6 Model preparation to study the mechanisms of action of free radicals and antioxidants.