

**ZOOLOGY SYLLABUS FOR
CREDIT BASED SEMESTER SYSTEM (BASIC)**

No.	Course Code	Name of the course	Hours	Credits
1	ZOO – 401	Cell Biology	3+1	04
2	ZOO - 402	Biochemistry	3+1	04
3	ZOO – 403	Animal Diversity	3+1	04
4	ZOO – 404	Physiology	3+1	04
5	ZOO – 405PR	Practical – 1	6	04
6	ZOO – 406PR	Practical – 2	6	04
		Total	28	24
1	ZOO – 407	Genetics	3+1	04
2	ZOO - 408	Radiation Biology & Biostatistics	3+1	04
3	ZOO – 409	Immunology & Toxicology	3+1	04
4	ZOO – 410	Animal Behaviour & Evolutionary Biology	3+1	04
5	ZOO – 411PR	Practical – 3	6	04
6	ZOO – 412PR	Practical – 4	6	04
		Total	28	24
1	ZOO – 501	Developmental Biology	3+1	04
2	ZOO - 502	Ecological Sciences	3+1	04
3	ZOO – 503EA	Molecular Cell Biology – I	3+1	04
	ZOO – 503EB	Molecular Endocrinology - I		
4	ZOO – 504EA	Molecular Cell Biology – II	3+1	04
	ZOO – 504EB	Molecular Endocrinology - II		
5	ZOO – 505PR	Practical – 5	6	04
6	ZOO – 506PR	Practical – 6	6	04
		Total	28	24
1	ZOO – 507S	Seminars / Industrial Visits	4	04
2	ZOO - 508A	Assignments / Group Discussions	4	04
3	ZOO – 509PT	Dissertation and Viva	20	16
		Total	28	24
		Grand Total	112	96

ZOOLOGY SEMESTER – I

ZOO-401 : Cell Biology:

UNIT – I : Methods in Cell Biology

Microscopy: Principle and working of light and Electron microscopes; Fluorescence microscope, Phase contrast microscope.
Tissue and Cell Disruption, Cell sonication.
Smears and squash preparations.

UNIT – II : Centrifugation and sedimentation. (Density gradient differential and ultra centrifugation).
Basics in Cell and tissue culture.
Isolation and separation of DNA.

UNIT – III : Structure and Functions of the cell organelles:

Plasma membrane; mitochondria; endoplasmic reticulum; ribosomes; Golgi apparatus; lysosomes, peroxisomes, nucleus, nucleolus and cytoskeleton.

UNIT – IV: Cell division: Molecular basis of mitosis and meiosis and their regulation.
Cell cycle and its regulation.
Characteristics of a cancer cell.

ZOO-402 : Bio-Chemistry:

UNIT – I : Polymorphism in Nucleic Acid Structure.

Biochemical role of Vitamins.
Metabolic reactions and biosynthesis of amino acids.
Levels of organization in protein structure.

UNIT – II : Regulation of enzyme activity, Co-enzymes and Co-factors.

Thermodynamics of cellular reactions
Redox potential and Reactive oxygen species.
Energy rich compounds and ATP synthesis, Chemo-osmotic theory.

UNIT – III : Reactions and regulation of Embden Mayerhoff pathway and TCA cycle.

Glucose transporter molecules.
Metabolism of Lipids- Biosynthesis of fatty acids and triglycerides, oxidation of fatty acids.
Intermediary metabolism.

UNIT – IV: Techniques in analysis of macromolecules

Principle of chromatography.
Principle of Electrophoresis.
Protein fractionation, purification, Sequencing of amino acids.
Spectrophotometry, pH measurement.

ZOO-403 : Animal Diversity:

UNIT – I : Taxonomy:

Newer trends.
Numerical Taxonomy.
Chemotaxonomy.
Taxonomic procedures.
Various types of Taxonomic characters.

UNIT – II : Zoogeography:

Zoogeographic distribution of animals.
Factors influencing animal distribution.
Extinction of species, Introduction of exotic species.
Anthropogenic pressures.

UNIT – III : Diversity of Non- Chordates:

Comparative functional anatomy.
Feeding and digestion movement.
Osmoregulation and neural Co-ordination.
Respiration.

UNIT – IV: Diversity of Chordates:

Comparative functional anatomy of various systems.

ZOO-404 : Physiology:

UNIT – I : Respiratory pigments and respiratory functions of blood.
Physiology of Digestion, absorption, regulation of digestive secretion.
Physiology of respiration, Exchange and transport of respiratory gases.

UNIT – II : Physiology of blood, Haemopoiesis, Coagulation.
Initiation, conduction and regulation of heart beat.
Physiology of Excretion: Vertebrate kidney.
Role in body water regulation.
Nitrogen excretion patterns in vertebrates and its regulation.

UNIT – III : Co-ordination of body functions

Chemical co-ordination.
Hormones, Neuro-hormones, Neuro-humous.
Endocrine organs and hormonal regulation in vertebrates;
Neural integration- Neuron, excitability of membranes, conduction of nerve impulse, synapse.

UNIT – IV: Structure and physiology of vertebrate muscle

Immune system – Basics.
Types of cells.
Lymphoid Organs.

ZOO-405PR: Practical I : Based on topics covered in ZOO 401 and 402

ZOO-406PR : Practical II : Based on topics covered in ZOO 403 and 404

Reference Books For Zoology Semester – I:

1. De Robertis, E. D. P. and De Rebartis, E. M. F. 1987. Cell and Molecular Biology. Eighth Edition. Lea and Febiger, Philadelphia.
2. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, D. 1983. Molecular Biology of The Cell. Garland Publishing, New York.
3. Lodish, H., Baltimore, D., Berk, A., Zipursky, S. L., Matsudaira, P. and Darhell, J. 1995. Molecular Cell Biology. Third Edition. Academic Press, New York.
4. Karp, G. 1999. Cell and Molecular Biology. John Wiley, London.
5. Gasque, C. E. 1990. A Manual of Laboratory Experiences in Cell Biology. Universal Book Stall N. Delhi.
6. Thorpe, N. 1985. Cell Biology.
7. Garrett, R.H. and Grisham, C.M. 1999. Biochemistry. Second Edition. Saunders College Publishing, New York.
8. Lehninger, A. L. 1982. Biochemistry. Second Edition. Kalyani Publishers, New Delhi.
9. Stryer, L. 1986. Biochemistry. Second Edition. CBS Publishers and Distributors, Delhi.
10. Barrington, E. J. W. 1983. Invertebrate Structure and Function. University Press, Cambridge.
11. Barnes, R. D. 1980. Invertebrate Ecology. Saunder's College, Philadelphia.
12. Ganguly, B. B., Sinha, A. K. and Adhikari. 2001. Biology of Animals. Volume I & II. New Central Book Agency, Calcutta.
13. Simpson, G. G. 1961. Principles of Animal Taxonomy. Columbia University Press. New York.
14. Mayr, E. 1969. Principles of Systematic Zoology. McGraw-Hill, New York.
15. Zubay, G.L. 1998. Biochemistry. Fourth Edition. Wm.C. Brawn Publishers, Dubuque.
16. Tortora, G.J. and Grabowski, S. R. 1993. Principles of Anatomy and Physiology. Seventh Edition. HarperCollins College Publishers, New York.
17. Hoar, W. S. 1975. General and Comparative Physiology. Second Edition. Prantice-Hall Inc., London.
18. Prosser, C. L. and Brown, F. A. 1965. Comparative Animal Physiology. Second Edition. W. B. Saunders Co, Philadelphia.
19. Schmidt-Nielsen, K. 1975. Animal Physiology- Adaptation and Environment. First Edition. Cambridge Iniversity Press, London.
20. Best, C. H. and Taylor, N. B. 1955. The physiological Basis of Medical Practice. Sixth Edition. The Williams and Wilkins Company, Baltimore

ZOOLOGY SEMESTER – II

ZOO-407 : Genetics:

UNIT – I : Molecular Basis of Inheritance:

Histone proteins, Nucleosome, Solenoid structure and Organization of DNA in the chromosomes. Heterochromatin and Euchromatin.

Units of inheritance: newer concepts of genome organization.

Split genes, pseudo genes, overlapping genes, unique sequences, repetitive sequences transposons and conserved genes.

UNIT – II : Mechanisms of sex determinations- Human & Mouse.

Y- Specific Genes.

DNA Replication.

Extra- Nuclear Inheritance.

Mutations and mutagenesis.

UNIT – III : Chromosome aberrations

Genetic Disorders: Autosomal and sex chromosomal.

Polygenic and Multifactorial Inheritance.

In-born errors of Metabolism.

Chromosomes and cancer.

UNIT – IV : Gene expression: Details of Operon Models.

Genetic Engineering Basics.

Applications of Genetic Engineering.

ZOO-408 : Radiation Biology and Biostats:

Radiation Biology

UNIT – I : Isotopes: Types, uses, properties, radioactive decay and half life.

Types of radiation: Electromagnetic and particulate.

Dosimetry: Measurement of radiation.

Types and effects of Non-Ionizing radiation: UV, IR, Microwave and radiofrequency radiation.

Sources, Uses and applications of radiation.

- UNIT – II** : Biological effects of radiation: effects on the macromolecules, cells, organs and organ systems.
Radiation syndromes and radiation hormesis.
Radiation induced carcinogenesis.
Radioprotective and radiosensitizing agents.
Radiation safety and precautions.

Biostatistics

- UNIT – III** : Data and data organization and representation.
Measures of central tendency: Mean, Median and Mode.
Variance, Standard Deviation, Standard error.
Probability, Normal distribution and distribution curves.
Skewed distribution.
- UNIT – IV**: Correlation co-efficient, Regression.
Tests of Hypothesis; Null, Alternative Hypothesis.
Tests of Significance: Students 't' test, chi square test.
ANOVA.

ZOO-409: Immunology and Toxicology:

- UNIT – I** : Principles of Immunology.
Types of Immunity TCR's, Immune response, Antigens, Ag-Ab Interactions.
Diversity of Immunoglobulins.
- UNIT – II** : Hypersensitivity, Allergy, Histamines and Anti-histamines, Immunoglobulin IgE, MHC, Auto-immune diseases and other immunological diseases, Tumour Biology.
- UNIT – III: Toxicology:**
General principles and terminology:
Types of toxicity and factors affecting toxicity
Acute, Sub-acute and chronic toxicity
Classification of toxicants
Estimation of toxicity, LD50, LC50
Toxicity testing.
Absorption and Distribution Excretion
Metabolism and Bio-transformation
Xenobiotics and Toxins of animal and plant origin

- UNIT – IV : Toxicology of organs and organ systems and Genotoxicity:**
Toxicology of organs and organ systems:
Toxicology of blood, skin
Digestive, Excretory and Nervous systems
Sense organs
Cardiovascular system
Genotoxicity, Occupational toxicology
Industrial Toxicology and importance in Forensic Science
- ZOO-410 : Animal Behaviour and Evolution:**
- UNIT – I** : Sensory world and behavioural equipments.
Genetic basis of animal behaviour.
Behavioural patterns.
Evolutionary approach to behaviour.
- UNIT – II : Community Ecology:**
Social Organization:
Social Competition, territorial behaviour.
Dominance hierarchies.
Individual-social Interactions:
Animal Communication.
Dance language of honey bees.
Social facilitation.
Learning behaviour:
Forms and mechanisms of learning.
Development, Imprinting.
Human Ethology.
Anomalies in human behaviour, Psychosomatic disorders.
- UNIT – III** : Concept of Evolution, Origin of Life on Earth, Theories and evidences
Molecular phylogeny, Evolution in Action.
Sources of Evolution,
Variations, Role of Mutation, Recombination, Ploidy, Isolation, Species concept, Hardy -Weinberg Law and Genetic Drift. and other evolutionary forces
- UNIT – IV** : Geological time scale and its implication
Adaptations: Various types, Desert, Cursorial, Fossorial, Arboreal, Volant and Aquatic.
Mimicry, Polymorphism.
Macro and Micro-Evolution, Evolution of Man
Trends in Evolution, Evolution- Future prospects.

ZOO-411PR: Practical III : Based on topics covered in ZOO 407 and 408

ZOO-412PR: Practical IV : Based on topics covered in ZOO 409 and 410

Reference Books For Zoology Semester – II:

1. Russel, P. J. 1998. Genetics. Beryamin / Cummaings Publishing Company.
2. Strickberger, M. W. 1985. Genetics. MacMillan Pub. Co., Philadelphia.
3. Gardner, E. J. 1999. Genetics, John wiley & Sons, New York.
4. Benjamin, L. 2000. Genes VII. John Wiley & Sons, New York.
5. Kuby, J. 1994. Immunology. Second Edition . W. H. Freeman & Co. New York.
6. Roitt, I. M. and Delves, P.J. 2001. Essential Immunology. Tenth Edition. Blackwell Science, Oxford.
7. Organic Evolution by Rastogi.
8. Genetics and Origin of Species by Dobzhansky.
9. Evolutionary Biology by P. Arora.
10. The Collins encyclopedia of Animal Evolution by Berry and Hallam.
11. Animal Behaviour : Psychobiology, ethology and evolution. ELBS Publications by David McFarland.
12. The fundamentals of Ethology by Kornard Z. Lorenz.
13. Shah, V. C. 1985. Elements of Radiation Biology. Globe Books and Periodicals, Ahmedabad.
14. Thronburn, C.C. 1972. Isotopes and Radiation in Biology. Butterworth & Co., London.

Zoology Semester – III

ZOO – 501: Developmental Biology

- UNIT 1** : Cytophysiology of gametes.
Fertilization - Natural and Artificial.
Cleavage patterns, Gastrulation.
Embryological development of Amphioxus, Frog, Chick and Mammal.
- UNIT 2** : Fate maps and their significance.
Embryonic Induction, Inductors, chemical nature of induction.
Gradients.
Formation of rudimentary organs.
- UNIT 3** : Organogenesis
Differentiation and development: Cytological, genetical and chemical basis of differentiation and its regulation
Epithelial - mesenchymal interaction
- UNIT 4** : Growth patterns; Dynamics of growth; Types of growth; Physiological mechanisms of growth.
Regeneration in non-chordates and chordates; Factors affecting regeneration; Regeneration fields; Physiological gradients and polarity concerned with regeneration.

ZOO-502 : Ecological Sciences:

- UNIT – I** : Productivity in ecosystems.
Indian Biomes: Types.
Rocky, Sandy Shores, Mangroves, Estuaries and Coral reefs.
- UNIT – II : Community Ecology:**
Community structure and organization.
Analytical and synthetic characters, Species diversity.
Ecological dominants and indicators.
Stratification, Niche theory.
Ecological succession and community stability.

UNIT – III : Population Ecology:

Population density - Absolute and Relative density and its measurements.
Demographic units; Life Tables and Survivorship curves.
Age distribution
Population growth - Exponential and Logistic growth.
Population dispersion, dispersal and fluctuations.
Population selection - Life history strategies r and K selection. Clutch size and sex ratios in populations.

UNIT – IV: Biotic Interactions – Positive and Negative interactions.
Biogeochemical cycles – Carbon, Phosphorous and Nitrogen. Environmental degradation and Pollution
Reduction of carbon footprints.

ZOO – 503EA: Molecular Biology, Cytogenetics and Biotechnology - I

- UNIT 1** : RFLP analysis and restriction mapping.
DNA fingerprinting.
DNA footprinting.
DNA sequencing.
Southern, Northern blotting and Western Blotting.
In-situ hybridization technique.
Bioinformatics: Introduction and applications.
- UNIT 2** : Cell, tissue and organ culture, suspension and monolayer cultures. Study of cell using tracer techniques with Radioactive isotopes and antibodies.
Autoradiography.
FISH
Flow cytometry.
- UNIT 3** : Cell - Cell interactions; Cell adhesions, and cell junctions.
Cell transformation.
Characteristics of cancer cell, alteration in cell cycle related to cancer.
Cytogenetics and molecular genetics of cancer; Oncogenes, retroviruses.
Effects of radiations, Chemicals, mutagens, pollutants, drugs and toxins on the cell.
- UNIT 4** : Cell ageing (senescence), Cell death
Cellular communication
Intra cellular interactions.
Receptor ligand interaction, Recycling and metabolism.
Signal transduction, role of second messengers and G-proteins. Ion, Calcium channels.

ZOO-503EB : Molecular Endocrinology and Reproductive Technology - I:

UNIT – I : Endocrine system:

Origin, Evolution and Classification of Endocrine system.
Feedback Mechanisms, Nerves' metabolites, Hormones
Mechanism of action, receptors mechanism and metabolism.

UNIT – II : Endocrine glands – Hormone synthesis, release, regulation and its pathology.
Hormones of extra endocrine sites – GI tract, Kidney, Liver, Heart, Lungs and their role in metabolism of carbohydrates, lipids, water, minerals, electrolytes and osmoregulation.

UNIT – III : Hormonal Control Of:

Migration, Aestivation, Hibernation, Pigmentation, Reproductive behaviour and its control, Endocrine basis of communication in reproduction and aggression, Pheromones.

UNIT – IV: Reproduction and Toxicology:

Reproductive toxicity testing, Toxicants and Reproduction, Embryotoxicity, Teratogenicity and Mutagenicity.

ZOO – 504EA: Molecular Biology, Cytogenetics and Biotechnology – II

- UNIT 1** : Types and structure of chromosomes. Chromosome identification.
Banding techniques and karyotyping.
Chromosomal aberrations and variation.
Chromosomes and disease; Genetic disorders.
Prenatal Diagnosis
Chromosomes and evolution.
- UNIT 2** : DNA modification and restriction.
DNA repair mechanism.
DNA synthesis
Isolation of gene.
Transfer of information from DNA.
Gene expression and regulation of gene expression in eukaryotes.
Human genome Project
Gene therapy Microarrays.
- UNIT 3** : Recombinant DNA Technology and Gene cloning.
Molecular probes.
Construction and screening of gene libraries: genome library, DNA library.

PCR system and gene amplification.
Chromosome walking
Chromosome jumping.
Biotechnology in Medicine and Biology.
Transfection methods and transgenic animals.
Production of hormones, Vaccines.

- UNIT 4 :** Immunotechnology: Types of Immunity; Types, Fine structure, Generation and Functional properties of Immunoglobulins.
Cellular diversity in immune response.
Role of Lymphoid tissues.
Immunogenetics and genetic basis of Clonal selection.
Immuno techniques.
Hybridoma technology.

ZOO-504EB : Molecular Endocrinology and Reproductive Technology - II:

UNIT – I : Embryology of Gonads and Genital Ducts:

Development, factors affecting sex determination, Genetic Control of sex determination, Endocrinology of the foetal gonads, Prenatal diagnostic techniques.

UNIT – II : Female Reproductive System:

Structure and functions of Female reproductive organs.
Folliculogenesis, Ovulation, Corpus luteum, atrecia, Implantation, Placenta, Pregnancy and its control
Foetoplacental unit as an endocrine entity.
Menopause, reproductive cycles, non-steroidal regulators of ovarian function.
Gamete and zygote transport.
Mammary glands, Lactation and its hormonal control.

UNIT – III : Male Reproductive System:

Structure and function of the Male Reproductive Organs.
Spermatogenesis and its hormonal control.
Functions of the Sertoli cells and Leydig Cells.
Semen formation and its biochemistry.
Sperm structure and function.
Testis Anomalies, Senescence, Puberty.

UNIT – IV: Fertility Regulation:

Principles of Fertility Regulation in males and females.
In-Vitro Fertilization, ET and AR technologies.
Collection and preservation of Gametes.
Research methodologies; RIA, PCR, EIA, IRMA, Radioreceptors, Chemiluminescence, Polyclonal and Monoclonal antibodies.

ZOO-505PR: Practical III : Based on topics covered in ZOO 501 and 502

ZOO-506PR: Practical IV : Based on topics covered in ZOO 503 and 504

Reference Books For Zoology Semester – III:

1. Developmental Biology by Gilbert.
2. An introduction to Embryology by Balinsky.
3. Development Biology by Vasudev Rao.
4. Odum, E. P., 1990. Fundamentals of Ecology. W. B. Saunders Company.
5. Krebs, C. J. 1985, *Ecology*, 3rd Edition, Harper & Row, New York.
6. Sharma, P. D. 1996. *Ecology and Environment*. Seventh Edition. Rastogi Publication. Meerut.
7. Kormondy, E. J. 1996. *Concepts of Ecology*. Fourth Edition. Prantice Hall of India Pvt. Ltd., New Delhi.
8. *Molecular Cell Biology*. Second Edition. Darnell, Lodish, Baltimore. Scientific American Books, New Delhi.
9. *Molecular Biology of the Cell*. Second Edition. Alberts, Bray, Lewis, Raff, Roberts, Waston, 1989.
10. *Cell Biology – Structure and Function* David E. Sadava, 1993. Jones and Bartlett Publishers, IND.
11. *Endocrinology*, Volumes 1, 2, 3 by Degroot.
12. *Molecular Endocrinology* by Bolander.
13. *Basic and Clinical Endocrinology* by Greeuspan and Forham.
14. *Vertebrate Endocrinology* by Norris.
15. *Genes VI*, Benjamin Lewin, 1997, Oxford University Press, New Delhi.
16. *Modern Genetic Analysis*, Griffithus, Gelbert, Miller, Lewontin, 1999, W.H. Freeman and Company, New York.
17. *Genetics*, P. K. Gupta, 1997, Rastogi Publications, Meerut, India.
18. *Marshall's Physiology of Reproduction Vol 1& 2* Lamming.
19. *The physiology*

Zoology Semester – IV

ZOO-507S : Seminars and Industrial Visits during the Semester.

ZOO-508 : Assignments / Group Discussions.

ZOO-509PT: Project Dissertation and Viva-voce

TIME TABLE BIO-MEDICAL TECHNOLOGY (SEMESTER –) YEAR 201 -201 .

BMT-I	TIME	MON	TUE	WED	THUR	FRI	SAT
THEORY (11.30 TO 01:30)	11:30 12:30						
	12:30 01:30						
01:30 02:00	R E C E S S						
PRACTICAL (02:00 TO 05:00)	02:00 03:00						
	03:00 04:00						
	04:00 05:00						
THEORY	05:00 06:00						