Dept. of Zoology, Palamuru University

CBCS SYLLABUS

(w.e.f.ACADEMIC YEAR 2023-24)

FOR
POST-GRADUATE DEGREE PROGRAMME

Master ofScience
in Zoology

Itoll Semester

OF
PALAMURU UNIVERSITY

Chairperson,
BoSinZoology

PROFESSOR & HEAD
Department of Zoology, UCS
Osmania University

CHAIRMAN
Board of Studies in Zoology
Palamuru University
Mahabubnagar-509 001

palamuru University
Mahabubnagar - 509202
Telangana State

Department of Zoology, Osmania University
Two Year M.Sc. (Zoology) Programme w.e.f. AY 2023–2024 onwards

Proposed Scheme for Choice Based Credit System

Semester I					Semester II				
	Course	Hrs /Wk	Credits	Marks		Course	Hrs /Wk	Credits	Marks
1	Core (SB) (Zoo_101T)	4	4	100	1	Core(TTB) (Zoo_201T)	4	4	100
2	Core (ECB) (Zoo_102T)	4	4	100	2	Core (AP) (Zoo_202T)	4	4	100
3	Core(IMM) (Zoo_103T)	4	4	100	3	Core (MGDB) (Zoo_203T)	4	4	100
4	Core (ATFAI) (Zoo_104T)	4	4	100	4	Core (EFAV) (Zoo_204T)	4	4	100
5	Practical (SB&(ECB)) (Zoo_101P)	4	2	100	5	Practical (TTB) (Zoo_201P)	4	2	50
6	Practical (IMM&BSFAI) (Zoo_102P)	4	2	100	6	Practical (AP) (Zoo_202P)	4	2	50
Total		32	20	600	Total		32	20	600

* 2 hr will be given for each paper for continuous Evaluation of Student progress.

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Scheme of Examination

Semester – I

S.N.	Subject Code	Subject (Title)	Instruction Hrs/week	Duration of (hrs) Exam.	Max. Marks		Total Marks	Credits
					Internal Assessment	Semester Exam.		
	THEORY							
1.	Zoo_101T	Structural Biology	4	3	40	60	100	4
2.	Zoo_102T	Environmental and Conservation Biology	4	3	40	60	100	4
3.	Zoo_103T	Immunology	4	3	40	60	100	4
4.	Zoo_104T	Advances in Taxonomy and Functional Anatomy of Invertebrates	4	3	40	60	100	4
	PRACTICALS							
5.	Zoo_101P	Structural Biology & Environmental and Conservation Biology	4	3	-	100	100	2
6.	Zoo_102P	Immunology&BIOSYSTEMATICS, STRUCTURE & FUNCTIONS OF INVERTEBRATES (BSFI)	4	3	-	100	100	2
Total:			**24**		**160**	**440**	**600**	**20**

* 2 hr will be given for each paper for continuous evaluation process. Periodically.

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Scheme of Examination

Semester – II

S.N.	Subject Code	Subject (Title)	Instruction Hrs/week	Duration of (hrs) Exam.	Max. Marks		Total Marks	Credits
	THEORY				Internal Assessment	Semester Exam.		
1.	Zoo_201T	Tools, Techniques and Biostatistics	4	3	40	60	100	4
2.	Zoo_202T	Animal Physiology	4	3	40	60	100	4
3.	Zoo_203T	Molecular Genetics and Developmental Biology	4	3	40	60	100	4
4.	Zoo_204T	Evolution and Functional Anatomy of Vertebrates	4	3	40	60	100	4
	PRACTICALS							
5.	Zoo_201P	Tools, Techniques and Biostatistics & Animal Physiology	4	3	-	100	100	2
6.	Zoo_202P	Molecular Genetics and Developmental Biology&Evolution and Functional Anatomy of Vertebrates	4	3	-	100	100	2
Total:			**24**		**160**	**440**	**600**	**20**

1 hr will be given for each paper per week for continuous evaluation process

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Semester – I

CORE PAPER

Paper I: Structural Biology [SB]

UNIT I – Basic concepts of Biomolecules and Structural Biology **15 Hrs**

1.1 Biomolecules and their significance – carbohydrates, proteins, amino acids, nucleic acids and lipids.

1.2 Chemistry and structure of mono, oligo and polysaccharides; Deoxy sugars, amino sugars and glycosides.

1.3 Classification and structures of proteins – primary, secondary, tertiary and quaternary.

1.4 Classification, structure and function of lipids, fatty acids, triglycerides; phospholipids, cerebrosides, steroids.

1.5 Nucleic acids – Structure of DNA and RNA, DNA polymorphism, RNA types.

UNIT II – Enzymes and Metabolism **15 Hrs**

2.1 Classification, nomenclature and properties of enzymes – catalysis and energy of activation; Enzyme kinetics, Michaelis–Menten Constant; (Km values) and LB plot; mechanism of enzyme action and regulation of enzyme activity.

2.2 Metabolism of carbohydrates – Glycolysis; TCA cycle; Gluconeogenesis; biological oxidation; the role of the respiratory chain in energy capture; ATP synthesis.

2.3 Catabolism of amino acids – Transamination, deamination and decarboxylation.

2.4 Oxidation and biosynthesis of fatty acids.

2.5 Metabolic disorders of different biomolecules (carbohydrates, proteins, lipids).

UNIT III – Cellular Organization **15 Hrs**

3.1 Molecular organization and functions of cell membranes.

3.2 Cell permeability – Transport across the cell membrane; transport of small molecules; Carrier proteins; Ion pumps; membrane-bound enzymes.

3.3 Cell communications – Intercellular communication and gap junctions; chemical signalling between the cells; strategies of chemical signalling.

3.4 Signalling mediated by intracellular receptors; signalling mediated cell surface receptors –second and third messengers; C–AMP, G–proteins, Ca++, Inositol Triphosphate (IP_3) and prostaglandins.

3.5 Cell cycle; molecular events in the cell cycle; mitotic spindle.

UNIT IV – Synthetic Biology **15 Hrs**

4.1 DNA replication – Semi conservative, enzymology of DNA replication, replication of circular DNA, initiation, elongation and termination of replication process; Proofreading function of DNA polymerases.

4.2 Enzymatic synthesis of RNA; Regulation of genetic code – Wobble's concept, translation in prokaryotes and eukaryotes.

4.3 Protein synthesis – Events of protein synthesis; transcription in prokaryotes and eukaryotes; post-transcriptional processing.

4.4 DNA repair mechanism – High fidelity of DNA sequence – Repair of damage caused by UV light, Eukaryotes repair systems.

4.5 Synthetic genomics – Basics theoretical and computational modelling of the replicating system.

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PRACTICALS

1 Determination of proteins by Biuret method/ Folin Phenol method.
2 Determination of glucose by Somogyi / Anthrone method.
3 Determination of lipids by Vanillin method.
4 Determination of glycogen by Kemp's method.
5 Estimation of cholesterol.
6 Determination of enzyme activities of SDH and LDH.
7 Effect of substrate concentration and pH on SDH activity.
8 Protein fractionation using sodium sulphate.
9 Extraction of DNA and RNA.
10 Electrophoretic analysis of proteins/DNA.
11 Feulgen reaction method for DNA localization.
12 Preparation and characterization of a synthetic molecule.
13 Submission of assignment **To be submitted at the time of Internal Examination –[5 Marks]**

SUGGESTED BOOKS

1 Textbook of Biochemistry by Harper.
2 Textbook of Biochemistry by Lehninger.
3 Textbook of Biochemistry by Stryer and Stryer.
4 Textbook of Biochemistry by Conn and Stumpf.
5 Textbook of Biochemistry by A.B.V. Rama Rao.
6 Cell and molecular biology by De Robertis and De Robertis, 8th ed.
7 Molecular Biology by Friefielder.
8 Molecular cell biology by Darnell, Lodish and Baltimore (Scientific American Books).
9 Molecular biology by H. D. Kumar.
10 Biochemistry and molecular biology by W. H. Elliot and D.C. Elliot (OU Press).
11 Molecular Biology of Cell by Bruce Alberts et al.
12 Cell by Karp.
13 Synthetic Biology – Tools and Application by Humin Zhao

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M.Sc. Zoology

Code Zoo_102

Semester – I
CORE PAPER
Paper II: Environmental and Conservation Biology [ECB]

UNIT I – Basic Concepts of Ecology **15 Hrs**

1.1 Laws of limiting factor, Laws of Minimum, Laws of Tolerance and Tragedy of Commons.

1.2 Types of ecosystems – Freshwater, marine and terrestrial.

1.3 Micronutrients and macronutrients.

1.4 Population characteristics and dynamics – A conceptual approach and Growth curves

UNIT II – Community Organization and Structure **15 Hrs**

2.1 Community analysis, species diversity, ecotone concept and edge effect; ecological niche and niche overlap; the concept of biome.

2.2 Concepts of productivity; Biogeochemical cycles; eutrophication of lakes; biological indicator and water quality.

2.3 Pollution ecology: Inorganic pollutants and their impact SO_2, NO_2, CO, Phosphates, heavy metals (Arsenic, Lead and Mercury); radioactive nucleotides and their impact on the biological system.

2.4 Acid rain sources and its impact on the biological system; greenhouse effect and ozone depletion.

UNIT III – Biogeography of India, Habitats and Resources **15 Hrs**

3.1 Classical concepts of biogeography – continental drift and Plato tectonic theory; endemism, refugia.

3.2 Biogeographical regions of India and their salient features.

3.3 Concepts of natural resources – renewable and non-renewable resources.

3.4 Overexploitation of resources – deforestation, water table depletion and land degradation.

UNIT IV – Natural Resource Management **15 Hrs**

4.1 Environmental Impact Assessment – principle, scope and purpose.

4.2 Role of ecological restoration in conservation; displacement and settlement of local communities.

4.3 Major conservation movements in India; NGOs in conservation efforts.

4.4 National legislation for protecting biological resources

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PRACTICALS

1 Draw the biogeographical regions of India and provide in brief the salient features of each biogeographical zone.
2 Estimation of total alkalinity of water and soil.
3 Estimation of phosphates in the water sample.
4 Estimation of nitrates and nitrites in the water sample.
5 Estimation of magnesium in the water sample.
6 Estimation of calcium in the water sample.
7 Biological indicators of water quality and their population dynamics – Collection of the water sample.
8 Identification of zooplanktons, and their ecological significance.
9 Enumeration and identification of the freshwater biodiversity of the local habitats.
10 Enumeration and identification of the terrestrial biodiversity of the local habitats.
11 Estimation of particulate matter in the air.
12 Submission of assignment **To be submitted at the time of Examination – [5 Marks]**

Suggested Books

1 Caughley, G., and A. Gunn. 1996. Conservation Biology in Theory and Practice. Blackwell Science, Cambridge, Massachusetts, U.S.A.
2 Cox, G. W. 2005. Conservation Biology: Concepts and Applications. McGraw-Hill, Dubuque, Iowa, U.S.A.
3 Dasmann, R., 1981. Wildlife Biology, 2nd ed. John Wiley and Sons, NY.
4 Dobson, A. P. 1996. Conservation and Biodiversity. Scientific American Library, New York, New York, U.S.A.
5 Jeffries, M. J. 1997. Biodiversity and Conservation. Routledge, New York, New York, U.S.A.
6 Mills, L. Scott 2006. Conservation of Wildlife Populations. Blackwell Science, Oxford, U. K.
7 Milner-Gulland, E. J., and R. Mace. 1998. Conservation of Biological Resources. Blackwell Science, Oxford.
8 Morris, W. F., and D. F. Doak2002. Quantitative Conservation Biology: Theory and Practice of Population Viability Analysis. Sinauer Associates, Sunderland, Massachusetts, U.S.A.
9 Sinclair, A. R. E., J. M. Fryxell, and G. Caughley2006. Wildlife Ecology, Conservation and Management, Blackwell Publishing.
10 Soulé ME (ed) 1986. Conservation biology: the science of scarcity and diversity-Sinauer, Sunderland.
11 Bram F. Noble 2005. Introduction to Environmental Impact Assessment: A Guide to Principles and Practice. Oxford University Press, London.
12 John A. Wiens and Michael R. Moss 2005. Issues and Perspectives in Landscape Ecology. Cambridge University Press, London.
13 Aparna Sawhney 2004. The New Face of Environmental Management in India. Ashgate Publishing Ltd., Sheffield.

M.Sc. Zoology

Code Zoo_103

Semester – I
CORE PAPER
Paper III: Immunology [IMM]

UNIT I – Introduction to Immunology **15 Hrs**

1.1 Evolution of Immune system - Invertebrates and Vertebrates.

1.2 Immune system – Innate and adaptive immunity.
Humoral mediated immunity and cell-mediated immunity.

1.3 Cells involved in the immune system, the role of macrophages in immunity

1.4 The Lymphoid tissues – primary and secondary lymphoid organs, lymphatic traffic.

UNIT II – Immunoglobulins and Complement system **15 Hrs**

2.1 Antigens nature, epitope, haptens, antigen-presenting cells, adjuvants. Antigenicity

2.2 Immunoglobulin's structure, function and classification of antibodies.

2.3 Monoclonal antibodies and their application.
Antigen antibody reactions immunological techniques-
Principles and application of ELISA, RIA, immunoprecipitation, FISH and GISH.

2.4 Complement system – Components of the complement system, pathways classical and alternative, biological consequences of complement activation and complement significance.

UNIT III – Hypersensitivity Reactions and Autoimmune Diseases **15 Hrs**

3.1 Hypersensitivity – Classification of hypersensitivity reactions;
Type – I – Anaphylactic hypersensitivity;
Type – II – Antibody-mediated cytotoxic hypersensitivity.

3.2 Type – III – Immunocomplex mediated hypersensitivity.
Type – IV – Cell-mediated (Delayed) hypersensitivity.

3.3 Autoimmune diseases – Organ-specific autoimmune diseases –
Grave's disease, insulin-dependent *diabetes mellitus* (type–I diabetes).

3.4 Autoimmune diseases – Systemic autoimmune diseases –
Systemic Lupus Erythematosus (SLE), Rheumatoid arthritis.

UNIT IV – Transplantation and Tumour Immunology **15 Hrs**

4.1 Transplantation – Barriers to transplantation.

4.2 Genetic predisposition for graft rejection, prevention of rejection.

4.3 Tumour immunology – Immunity to tumours, tumor Vaccine development and Immune based techniques.

4.4 Immunosurveillance.

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PRACTICALS

1 Slide agglutination test – A,B,O blood groups.

2 HIV test (Tridot method).

3 RDT Kit for Malaria/ Dengue (Source for kit – NVBDCP).

4 RPR Test for Syphilis.

5 Widal test for diagnosis of enteric fever.

6 Blood smear preparation and identification of lymphocytes.

7 Identification of histological slides of lymphoid tissues - Spleen, thymus, lymph node and bone marrow.

8 Single Radial immunodiffusion for estimating the concentration of antibodies and antigens.

9 Immunization schedules and rising of antibodies.

10 Demonstration of Immunoelectrophoresis.

11 Submission of assignment**[To be submitted at the time ofInternal Examination – [5 Marks]**

Suggested Books

1 Immunology, Kuby, W.F.Freeman, U.S.A.

2 Fundamentals of Immunology, W.Paul.

3 Essentials of Immunology, I.M.Roitt.

4 Immunology A Foundation Test by Basiro Davey.

5 An introduction to immunology, by Ian R. Tizard.

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Semester – I
CORE PAPER

Paper IV: Biosystematics, Structure & Functions of Invertebrates

UNIT I – Advances in Taxonomy **15 Hrs**

1.1 Basic concepts of biosystematics, taxonomy and classification; Branches of taxonomy – Cytotaxonomy, Chemotaxonomy, Numerical Taxonomy, and Cladistics Taxonomy.

1.2 Taxonomic hierarchy of ranks; Species concepts – Biological, Evolutionary, and Phylogenetic.

1.3 Recent trends in biosystematics – Molecular taxonomy and Integrative approaches.

1.4 International Code for Zoological Nomenclature (ICZN) – Operative principles, interpretation and application of important rules.

UNIT II – Nutrition & Respiration in Invertebrates **15 Hrs**

2.1 Patterns of feeding and digestion in metazoan

2.2 Filter feeding mechanism in polychaeta Reproduction and development in Cnidaria.

2.3 Modifications in the digestive system of invertebrates with special reference to Arthropoda & Mollusca Reproduction, development and larval forms of Platyhelminthes.

2.4 Respiration: Respiratory pigments, Organs of respiration-gills, trachea and lungs, mechanism of respiration

UNIT III – Excretory and Nervous systems in Invertebrates **15 Hrs**

3.1 Organs of excretion- coelome, coelomoducts, Nephridia, Malphighian tubules. Mechanism of excretion and osmoregulation

3.2 Nervous system: Coelenterates and Echinodemata Shell and foot & their functions in Mollusca.

3.3 Nervous system: arthropods (Crustaceans and insects) and Molluscs Cephalopoda)

3.4 Eusociality in insects and Autotomy and regeneration in echinoderms.

UNIT IV – Minor Phyla **15 Hrs**

4.1 General organization and affinities of Ctenophora, Nemertea, Bryozoa, Entoprocta, Chaetognatha

4.2 Larval forms of free-living invertebrates (Coelenterata, Annelida, Arthropoda, Mollusca and Echinodermata)

4.3 Larval forms of helminthes and crustacean

4.4 Evolutionary significance of larval forms.

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PRACTICALS

1 Specimen studies - Salient characteristics, identification and classification of representative types of invertebrate groups from Protozoa, Porifera, Cnidaria, Ctenophora, Annelida, Mollusca, Arthropoda, Echinodermata, and Hemichordata.
2 Collection and identification of invertebrates in pond water.
3 Preparation of permanent slides of zooplanktons (minimum three different types of species).
4 Collection and identification of parasites from the cockroach.
5 Dissections -
1. Minor – a) Reproductive system of cockroach, b) Mouthparts of cockroach
2. Major – a) Nervous system of prawn
6 Submission of assignment **To be submitted at the time of Practical Examination – [5 Marks]**

Suggested Books

1 Principles of Systematic Zoology (2nd Edition) by E. Mayr and P.D. Ashlock.
2 Five Kingdoms - An Illustrated Guide to the Phyla of Life on Earth by Lynn Margulis & M.J. Chapman.
3 A Textbook of Zoology Vol. I by Parker and Haswell (Revised).
4 The Invertebrates Vol. I to Vol. VI by L. H. Hyman.
5 Invertebrate structure and function by E. J. W. Barrington.
6 Invertebrate Zoology by P. A. Meglitsch (Oxford Press).
7 Life of Invertebrates by Russel Hunter.
8 Invertebrate Zoology by Rupport and Barnes (Saunders College Publishing Co.).
9 Life of Invertebrates by S. N. Prasad.
10 Evolutionary Biology by Eric C. Mitkoff.
11 Worms and Man by D. W. T. Crompton.
12 Parasitology by Noble and Noble.
13 Regeneration by S. M. Rose-Appleton.

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M.Sc. Zoology

Code Zoo_201

Semester – II

CORE PAPER

Paper I: Tools, Techniques and Biostatistics [TTB]

UNIT I – Tools and Separation Techniques **15 Hrs**

1.1 Principles of Microscopic Techniques: light, UV, confocal phase contrast, Fluorescent Microscopy; Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM).

1.2 Homogenization; cell fractionations; Types of Centrifugations, principles and applications of Preparative, analytical and ultra-centrifugation.

1.3 Chromatography Techniques; Adsorption Chromatography, TLC, Ion Exchange Chromatography, Gel Chromatography, HPLC, Affinity Chromatography.

1.4 Electrophoresis Techniques - Principles and applications of continuous disc, iso-electro focusing and isotachophoresis.

UNIT II – Separation and Imaging Techniques **15 Hrs**

2.1 Spectroscopy Techniques: principles and applications: Fluorescence, UV, Visible, Infrared, NMR, Gc-MS, FTIR

2.2 Radioisotope Techniques: Principles and application of Geiger-Muller and scintillation counter. Principles and applications of tracer techniques in biology; radioactive isotopes and autoradiography.

2.3 Electrophysiological Techniques: Single neuron recording, patch-clamp recording,

2.4 Imaging Techniques: PET, MRI, fMRI, ECG and CAT.

UNIT III – Biostatics-I: Introduction, Measure and theories of probability **15 Hrs**

3.1 Introduction to biostatistics; Statistical data& tabulation of data. Frequency distribution; graphical representation of data

3.2 Measures of central tendency – Mathematical average (Mean – Arithmetic, Geometric & Harmonic Mean) and Positional Averages (Median and Mode);

3.3 Measures of dispersion (or variability) – types, range, quartile deviation, mean deviation, variance, standard deviation, coefficient of variance.

3.4 Basics of Probability – Concept of probability, addition and multiplication laws of probability and application to the problems of biology. Normal, Binominal and Poisson distribution

UNIT IV – Biostatistics–II: Hypothess testing and inferential statistics **15 Hrs**

4.1 Sampling concept, sampling, distribution of mean, slandered error, random variable concept, expectation and variance of random variable

4.2 Statistical estimations- types methods and application; statistical hypothesis- types testing (Hypothesis, Null Hypothesis, Alternative Hypothesis) Decision Making (Types -I Type -II errors), Determination (Fixation of levels of Significance)

4.3 Parametric tests- student's t-test; analysis of variance (ANOVA or F- ration one way and two way analysis); Chi-Square test (Test of independence and Test of Goodness of Fit)

4.4 Correlation and regression analysis concepts and their application

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PRACTICALS

1. To fix a tissue with Bouin's fixative and stain using hematoxylin-eosin stain for histochemical studies
2. Separation of AMINO ACIDS by paper chromatography
3. Quantitative detection of total carbohydrates using Anthrone technique
4. Quantitative detection of total lipids using sulpho-phospovanillin technique
5. Quantitative detection of total proteins using Lowry et al's Biuret technique
6. Graphic presentation of data – bar diagram, histogram, frequency polygon and pie chart
7. Calculation of measures of central tendencies – mean, median and mode
8. Calculation of measures of dispersions – range, mean deviation, standard deviation, variance and coefficient of variance
9. Computation of test of significance – comperasion of sample mean with population mean and two sample means.
10. Calculate the coefficient of correlation between two variable
11. Computation of liner regression
12. Computation of one way analysis of variance (ANOVA)
13. Using Chi Square test, test the independence of two variables
14. Submission of assignment **[To be submitted at the time of INENRAL Examination – 5 Marks]**

Suggested Books

1. Principles and techniques of Practical Biochemistry Ed. B.L. Williams &K. Wilson, Arnold Publishers
2. Practical Biochemistry by Plummer
3. Immunology – Roit
4. Cell and Molecular Biology – DeRoberties
5. Cell and Molecular Biology – Ladish et al.
6. Statistical methods, Snedecor, G.W. and W.G. Cochran, Iowa State Univ. Press
7. Biometry by W. H. Freeman and Francisco
8. Fundamentals of Biometry by L.N. Balaram (1980)
9. Biostatistics by N. Gurumani
10. Techniques in life sciences – by Tembhare

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M.Sc. Zoology

Code Zoo_202

Semester – II

CORE PAPER

Paper II: Animal Physiology [AP]

UNIT I – Digestion, Respiration & Circulation **15 Hrs**

1.1 Cellulose digestion –Ruminant and non-ruminant digestion; absorption in mammals; events of absorptive and post-absorptive states and their regulation (endocrine and neural).

1.2 Respiration – Cascade of oxygen transport to tissues at high altitude; adaptation to diving.

1.3 Responses to CO_2 and O_2 rich environment; oxygen toxicity; hypercapnea, control of respiration.

1.4 Circulation - Cardiac cycle and principles of hemodynamics; blood coagulation, haematome formation; Anti-coagulants.

UNIT II – Osmoregulation, Excretion & Thermoregulation **15 Hrs**

2.1 Osmoregulation – Osmoregulatory problems in brackish water, fresh water and marine organisms; osmotic problems in terrestrial animals; hormonal control of osmoregulation.

2.2 Excretion – Urine formation, counter-current mechanism; juxtaglomerular apparatus, rennin-angiotensin system; hormonal regulation – ADH and aldosterone.

2.3 Detoxification of nitrogen products; purine cycle and miscellaneous detoxification pathways.

2.4 Thermal physiology – temperature regulation in poikilotherms, homeotherms and heterotherms, and their mechanisms of survival; central control of homeothermy.

UNIT III – Muscle Physiology, Neurophysiology & Receptors **15 Hrs**

3.1 Comparative molecular structure and function of skeletal, smooth and cardiac muscles; energy metabolism in skeletal muscle, muscle fatigue.

3.2 Types of neurons and glial cells.

3.3 Basis and significance of membrane potentials, equilibrium potentials, their change during the stimulus, Na, K currents in the action potential.

3.4 Types of synapses, synaptic transmission - electrical and chemical; synaptic inhibition and neurotransmitters.

UNIT IV – Endocrinology, Bioluminescence & Stress Physiology **15 Hrs**

4.1 Structure and function of endocrine glands of invertebrate hormones.

4.2 Structure and function of endocrine glands of invertebrate hormones.

4.3 Mechanism of hormone action - Peptide and steroid hormones.

4.4 Bioluminescence - Luminescent organisms - Neural control; Biochemistry and significance of luminescence.

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PRACTICALS

1 Estimation of blood chlorides under hetero osmotic media.
2 Cold and heat stress on metabolic rate in tilapia fish/crab.
3 Effect of heat stress on glycogen levels in tilapia fish/crab.
4 Estimation of Acetylcholinesterase activity.
5 Estimation of phosphorylase activity.
6 Adrenalin and insulin induced changes in blood glucose levels in rat/mice.
7 Kymographic recordings of twitch, tetanus and fatigue.
8 Estimation of Hb, ESR and blood clotting time.
9 Cell fragility.
10 Submission of assignment. **[To be submitted at the time of Internal Examination – 5 Marks]**

Suggested Books

1 Principles of Animal Physiology by D.W. Wood.
2 Principles of Animal Physiology by Gordon.
3 Animal Physiology-Adaptations and environment by Schmidt-Nielson.
4 Principles of Animal Physiology by Wilson.
5 Text Book of Medical Physiology by Guyton.
6 General & Comparative Animal Physiology by William Hoar.
7 Comparative Animal Physiology by Florey.
8 Comparative Animal Physiology by L.C. Prosser.
9 Human Physiology by Vander.

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Code Zoo_203

Semester II
CORE PAPER
Paper III: Molecular Genetics and Developmental Biology [MGDB]

UNIT I – Introduction to Genetics **15 Hrs**

1.1 Mendelism; Mendelian inheritance; modification of mendelian inheritance.

1.2 Linkage studies, crossing over and extrachromosomal inheritance, multiple alleles blood group antigens, karyotype.

1.3 Genetic disorders – Chromosomal disorders; inborn errors metabolism, polygenic inheritance, pedigree analysis.

1.4 Bacterial genetics – Transformation, , conjugation, transduction, viral lytic and lysogenic cycle.

UNIT II – Molecular Genetics **15 Hrs**

2.1 Introduction of DNA technology – Restriction endonucleases, methods of ligation – DNA ligases, ligation of the fragment with cohesive and blunt ends.

2.2 Features of vectors – Cosmids, plasmids and shuttle vector with one example representing each class construction and characterization of new cloning vectors.

2.3 Cloning strategies – Shotgun cloning, construction of gene libraries, genomic library and DNA library. DNA finger printing and its applications

2.4 Hybridization techniques – Southern blot, Northern blot, R-loop mapping methods, *In-situ* hybridization.

UNIT III – Overview of Developmental Biology **15 Hrs**

3.1 Scope and importance of developmental biology.

3.2 Gametogenesis; spermatogenesis, oogenesis, vitellogenesis and chemo differentiation.

3.3 Fertilization, parthenogenesis and its significance.

3.4 Types of cleavage, mechanism of cleavage, chemical changes during cleavage.

UNIT IV – Organogenesis **15 Hrs**

4.1 Gastrulation, metabolic events during gastrulation and rudimentary organs formation.

4.2 Concept of organisers and inducers; Neural tubule formation. Fate maps and stem cells

4.3 Role of hormones in the metamorphosis of insects and frog; regeneration in Cnidaria, Echinodermata, Amphibia (limb and tail regeneration), and Reptiles (tail regeneration).

4.4 Teratogenesis– Genetic and environmental; developmental mechanisms of teratogenesis

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PRACTICALS

1 Identification of blood groups: A, B, O.
2 Karyotyping of human chromosomes.
3 Isolation and estimation of DNA in tissue.
4 Isolation and estimation of RNA in tissue.
5 Estimation of soluble and structural proteinsin chick embryo (any two durations) – 24hrs, 48hrs, 72hrs, &96hrs.
6 Estimation of SDH activity in chick embryo (any two durations) – 24hrs, 48hrs, 72hrs, &96hrs.
7 Estimation of LDH activity in chick embryo (any two durations) – 24hrs, 48hrs, 72hrs, &96hrs.
8 Estimation of calcium in eggshell by EDTA method (any two durations) – 24hrs, 48hrs, 72hrs, &96hrs.
9 Identification of chick embryo developmental stages (any two durations) – 24hrs, 48hrs, 72hrs, &96hrs.
10 Study of cleavage patterns in *Lymnaea*.
11 Submission of assignment**To be submitted at the time of Examination –[5 Marks]**

Suggested Books

1 General genetics by Winchester
2 Molecular Biology of gene by Watson et al. Vol I & II
3 Genetics by Strickberger
4 Molecular Biology by Friefielder
5 Genetics by P.K. Gupta
6 Genes by Lewis
7 General genetics by S. R. B. Owen
8 Cell and molecular biology by De Robertis and De Robertis, 8th ed.
11 Molecular cell biology by Darnell, Lodish and Baltimore (Scientific American books)
12 Molecular biology by H. D. Kumar
13 Biochemistry and molecular biology by W. H. Elliot and D.C.Elliot (OUPress)
14 Textbook of molecular biology by K. S. Sastry et al. (MacMillan Ind. Pvt. Ltd.)
15 Developmental Biology - patterns, problems and principles by W. Saunders Jr.
16 Principles of Animal Developmental Biology by S.C. Goel
17 Introduction to embryology by Balinsky
18 Developmental Biology S. Gilbert
19 Evolution by Savage
20 Process of organic evolution by Stebbings
21 Evolution of vertebrates by Colbert
22 Developmental Biology by Berryl

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Code Zoo_204

Semester – II

CORE PAPER

Paper IV: Evolution & STRUCTURE AND FUNCTIONS OF VERTEBRATES [ESFV]

UNIT I – Evolution of Life **15 Hrs**

1.1 Theories of evolution – Pre-Darwinian concepts, Darwinism, Neo-Darwinism.

1.2 Natural Selection and adaptation; Mutation – Its types, mutation rates; Variation and Genetic drift

1.3 Speciation – Reproductive isolation (pre-zygotic & post-zygotic), modes of speciation (Allopatric, Sympatric & Parapatric).

1.4 Patterns of evolution – Sequential, divergent, convergent, gradual, punctuated, monophyletic, polyphyletic & paraphyletic.

UNIT II – Evolution of Vertebrates **15 Hrs**

2.1 Evolution of Agnathans – a) Extinct (Conodonts, Ostracoderms & Pteraspidomorphi) and b) Living (Myxinoidea & Petromyzontiformes).

2.2 Evolution of Gnathostomes – a) Placodermi and b) Chondrichthyes (including Elasmobranchii & Holocephali).

2.3 Evolution of Teleostomi – a) Acanthodii and b) Osteichthyes (Actinopterygii & Sarcopterygii).

2.4 Evolution Tetrapods – a) Labryinthodonts, b) Lepospondyls and c) Lissamphibia (Urodela, Anura & Apoda).

2.5 Evolution of Amniotes – a) Reptilia (Mesozoic and living reptiles), b) Aves (Palaeognathae & Neognathae) and c) Mammalia (Prototheria & Theriiformes).

UNIT III – Functional Anatomy – I **15 Hrs**

3.1 Integumentary system – Integument and its derivatives.

3.2 Cranial skeletal system – a) Basic plan of skull; b) Temporal fossae – its function; c) Jaw suspension and its types.

3.3 Post-cranial skeletal system – a) Axial skeleton; b) Appendicular skeleton; c) Joints (both axial & appendicular and their types).

3.4 Digestive system in Aves and Mammals – Components and function; Dentition in mammals.

3.5 Respiratory system in vertebrates (Fishes to Mammals) – Gills, lungs and other respiratory structures.

UNIT IV – Functional Anatomy – II **15 Hrs**

4.1 Excretory system in vertebrates (Fishes to Mammals) – Kidney and its structure; Modes of excretion.

4.2 Nervous system in vertebrates (Fishes to Mammals) – Brain, spinal cord and peripheral nerves.

4.3 Sense organs, simple receptors, organs of olfaction and taste, Lateral line system and electric organs

4.4 Evolutionary significance of internal fertilization; Placenta and its types.

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M.Sc. Zoology

PRACTICALS

1 Specimen studies - Salient characteristics, identification and classification of representative types of vertebrate groups - Pisces, Amphibia, Reptilia, Aves, and Mammalia.

2 Collection and preparation of slides of scales of fishes.

3 Dissections:

1. Minor – a) Weberian ossicles of *Labeo*, and b) Respiratory trees of *Clarius*
2. Major – a) Cranial nerves of *Labeo* (V, VII, IX & X cranial nerves)

4 Submission of assignment on: Submission of assignment **[To be submitted at the time of Practical Examination – 5 Marks]**

Suggested Books

1 Evolution of Vertebrates by E.H. Colbert

2 Evolutionary Biology by Mitkoff

3 Organic Evolution by Veer Bala Rastogi

4 Vertebrates – Comparative Anatomy, Function & Evolution (8th Ed.) by K.V. Kardong

5 Life of Vertebrates by J.Z. Young

6 A Textbook of Zoology Vol. II by Parker and Haswell (revised by Marshall)

7 Vertebrate Body by A.S. Romer

8 Chordates by Alexander

9 Comparative Vertebrate Anatomy by Hyman

10 Vertebrate Structure and Function by Waterman

11 Comparative Anatomy by Kent

12 Vertebrates by R.L. Kotpal

13 Chordate Zoology E. L. Jordan & P. S. Verma

14 Vertebrate Zoology & Evolution – Yadav B. N. & D. Kumar

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