Dr. Bhimrao Ambedkar University, Agra

A State University of Uttar Pradesh (Paliwal Park, Agra -282004)

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A Documentary Support

for

Matric No. – 1.3.1

Institution integrates cross-cutting issues relevant to **Professional Ethics, Gender, Human Values, Environment & Sustainability and other value framework enshrined in Sustainable Development goals and National Education Policy – 2020** into the Curriculum

under the

Criteria – I

(Curriculum Design and Development)

Key Indicator - 1.3

in

Matric No. – 1.3.1

M.Sc. (Zoology)

2022

PROFESSIONAL ETHICS

ENVIRONMENT & SUSTAINABILITY

NATIONAL EDUCATION POLICY – 2020

HUMAN VALUES

GENDER

Registrar
Dr. B.R.A. University, Agra

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REVISED COURSES AND SYLLABI
OF
M.SC. ZOOLOGY
Faculty of Life Science
BASED ON CHOICE BASED CREDIT SYSTEM (CBCS)
Department Of Zoology
School of Life Science, Dr. Bhimrao Ambedkar University, Agra
UNDER NEP -2020

Courses	M Sc Zoology I Semester	Max Marks		Total Marks	Credits
	Course Titles	CIE	End Semester Examination		
MZ-C101	Biosystamatics and Invertibrates	25	75	100	4
MZ-C102	Molecular and Cell Biology	25	75	100	4
MZ-C103	Biological Techniques and Instrumentation	25	75	100	4
MZ-C104	Microbiology and Immunology	25	75	100	4
	Minor	25	75	100	4
MZ-C105	Practical		100	100	4
	Research Project /Survey/Industrial Training				
	Total Marks End Semester Examination			**600**	**24**
	M Sc Zoology II Semester				
MZ-C201	Chordates and Evolutionary Biology	25	75	100	4
MZ-C202	Genetics and Biotechnology	25	75	100	4
MZ-C203	Animal Physiology	25	75	100	4
MZ-C204	Biostatistics and Computer application	25	75	100	4
MZ-C205	Practical		100	100	4
MZ-C206	Research Project/Survey/Industrial Training		200	200	8
	Total Marks End Semester Examination			**700**	**28**
	M Sc Zoology III Semester				
MZ-C301	Developmental Biology	25	75	100	4
MZ-C302	Animal Behaviour	25	75	100	4
MZ-C303	Environmental Pollution, Health and Education	25	75	100	4
MZ-E304	Systematics and Morphology of Fishes	25	75	100	4
MZ-E305	Wild Life Ecology				
MZ-C306	Practical		100	100	4
	Research Project /Survey/Industrial Training				
	Total Marks End Semester Examination			**600**	**20**
	M Sc Zoology IV Semester				
MZ-C401	Biological Chemistry	25	75	100	4
MZ-C402	Cell and Molecular Toxicology	25	75	100	4
MZ-E403	Physiology and Embryology of Fishes	25	75	100	4
MZ-E404	Wild life Biodiversity and Conservation				
MZ-E405	Aquaculture and Fisheries	25	75	100	4
MZ-E406	Environmental Physiology				
MZ-C407	Practical		100	100	4
MZ-C408	Research Project/Survey/Industrial Training		200	200	8
	Total Marks End Semester Examination			**700**	**28**
	Grand Total Marks and Credits (I, II, III & IV Semesters)			**2500**	**100**

Note: **The I and II semesters of the first year of the M. Sc. Zoology in Faculty of Life Science Programme will be Known as VII and VIII semester of The B. Sc. Research in Faculty of Life Science.**

*** Courses Code having 'C' abbreviation is Core course and having 'E' abbreviation is Elective course.**

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M. Sc. Zoology I Semester

Course-MZ-C101: Biosystematics and Invertebrates

(Total Credits = 04; End Semester Marks = 75; CIE=25)

UNIT – I — 15 Hrs

1. **Definition of basic concept of biosystematics and taxonomy:** Historical resume of systematic, importance and application of biosystematics and material basis of biosystematics.
2. **Trends in biosystematics:** Concepts of different conventional and newer aspects of chemotaxonomy, cytotaxonomy and molecular taxonomy.
3. **Procedure keys in taxonomy:** Taxonomy collections, preservations and curetting process of identification, different kinds of taxonomy keys their merit and demerits and International code for Zoological Nomenclature.

UNIT – II — 15 Hrs

1. **Feeding Mechanism:** Filter feeding, Parasitic mode of feeding.
2. **Excretion:** Structural and functional organization of excretory systems in various invertebrates and survey of various excretory products met within them.
3. **Receptors:** Structural and functional organization of the mechano receptors, chemoreceptor's and photoreceptors.

UNIT – III — 15 Hrs

1. **Organization of Coelom:** Acoelmates, Pseudocoelomates and Coelomates.
2. **Respiration:** Structural and Functional organization of Respiratory organs and mechanism in Invertebrates.
3. **Minor Phyla:** Concept, Characteristics and Affinities of Rotifera and Hemichordata.

UNIT – IV — 15Hrs

1. **Reproduction:** Reproduction in Invertebrates.
2. Larval forms of Crustacea Echinodermata and Helminthes.
3. Ploymorphism in Coelentrate, Torsion in Gastropoda.

Suggested Reading:

1. Structure and Function of Invertebrates by Barrington
2. Invertebrates by Barns
3. Invertebrate Series by Hyman

M. Sc. Zoology I Semester

Course-MZ-C102: Molecular and Cell Biology

(Total Credits = 04; End Semester Marks = 75; CIE=25)

UNIT: I **15Hrs**

1. Structure of DNA and Types of DNA
2. **Replication of DNA**: Semi-conservative replication of DNA; DNA replication in Prokaryotes and Eukaryotes, DNA damage, DNA repair
3. Nucleosome and structure of chromatin.

UNIT – II **15Hrs**

1. Three dimensional structure of t-RNA, Clover Leaf model, L type model.
2. Transcription Mechanism Prokaryotes and Eukaryotes
3. Regulation of gene expression: Prokaryotie organism: Lac operon, Trp operon

UNIT – III **15Hrs**

1. Modern concepts of the structure and functions of biomembranes
2. Structural and functional Organization of Cell Organelles (Mitochondrial, lysosomes, Golgi apparatus and Endoplasmic reticulum)
3. Nuclear membrane, interphase nucleus, different types of chromosomes,

UNIT – IV **15Hrs**

1. Cellular differentiation and cell cycle
2. Role of Ribosomes in protein synthesis, Operon model.
3. Cellular origin of diseases: Cancer, Glycogen storage diseases, Lipid storage diseases, inborn error of metabolism Phenyl ketonuria, galactosaemia, Thalassemia, and sickle cell anaemia.

Suggested Reading:

1. Molecular Cell Biology, Lodish et al. Scientific American Books (1995)
2. Principles of cell and Molecular Biology, Kleinsmith LJ & Kish VM, Harper Collins College Publishers (1995).
3. Cell and Molecular Biology, Karp G, John Wiley and Sons. (1999).
4. Molecular Biology, Friedfelder D, Jones and Bartlett Publication, (1998).
5. Molecular Biology of Cell, Alberts B *et al.* Garland Publishers, (2001)

M. Sc. Zoology I Semester

Course-MZ-C103: Biological Techniques and Instrumentation

(Total Credits = 04; End Semester Marks = 75; CIE=25)

UNIT-I **15Hrs**

1. **Fixation:** principle and chemical bases of fixation by formaldehyde, gluteraldehyde, chromium salts, mercury salts tetra oxide, alcohol and acetones, freeze drying and freeze substitution techniques.
2. Embedding, block making and sectioning.
3. **Chemical basis of staining:** Pas, metachromasis, Feulgen, lipid and protein staining.

UNIT-II **15Hrs**

1. Measurement of cell size
2. **Biochemical Methods:** Carbohydrates, Lipids and Proteins
3. **Haematological methods:** Total Leucocyte Count, Taotal erythrocytes Count, Differential Leucocyte count, Hb Concentration, PCV, ESR and Res cell indices

UNIT- III **15Hrs**

1. Various types of microscope, phase contrast, interference, fluorescence, polarized microscope, transmission and scanning microscope.
2. Centrifugation types and their applications
3. Electrophoresis types and their applications

UNIT – IV **15Hrs**

1. Chromatography types and their applications
2. Autoradiography types and their applications
3. X-ray diffraction types and their applications

Suggested Reading:

1. Principles and Techniques in biochemistry and molecular biology - Wilson & Walkes
2. Techniques in microscopy and cell Viology, Tata-Mc Craw Hil.
3. Robert Braun Introduction to instrumental analysis - Mc.Crew.Hil
4. Bisen & Mathw. Tools and Techniques in Life Sciences,- CBS Publishers & distributors.

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M. Sc. Zoology I Semester

Course-MZ-C104: Microbiology and Immunology

(Total Credits = 04; End Semester Marks = 75; CIE=25)

UNIT- I

15Hrs

1. **History and scope of Microbiology:** Recognition of the microbial role of diseases, Microbial effects on organic & inorganic matter, the composition of microbial world and scope and relevance of microbiology.
2. **Virus:** Concepts, general properties, cultivation, purification Assay, structure and structural properties.
3. **Microbial Taxonomy:** Morphological, Physilogical, Metabolic ecological and molecular characteristics. Aerobic and Anaerobic motile and non motile gram negative and gram positive bacteria.

UNIT – II

15Hrs

1. **Nature of symbiotic microbial association:** Types of symbiosis, functions commensalism, mutualism, distribution microbiota of human body, Host parasite relationship.
2. **Microbial Diseases:** Viral air born, Direct contact, Food born and Water born diseases, Bacterial air born direct contact, Food born and Water born disease, Fungi and Protozoan diseases.
3. **Microorganism as components of environment:** Microorganism and the structure of natural environment, physiological state of microorganisms in environment, Soil microorganism, Aquatic microorganism community.

UNIT – III

15Hrs

1. Basic concepts of immunity, Types of immunity, Phagocytosis, Inflammation.
2. Cells and molecules of the immune system, functions of immune response, antibody production and their function.
3. The adaptive immune response- T cell immunity, properties, cytotoxicity, Antibody production by B lymphocyte.

UNIT-IV

15Hrs

1. Deficiency of immune system, autoimmune diseases, allergy and hypersensitivity.
2. Structure of antibody molecule and immunoglobulin genes.
3. Interaction of antibody molecules with specific antigens, antigen recognition by T lymphocyte.

Suggested Reading:

1. Microbiology by Presscott
2. Immunology by Kuby

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M. Sc. Zoology I Semester
Course-MZ-C105: Practical
(Total Credits = 04; End Semester Marks = 75; CIE=25)

1. Identification and Comments of Museum Specimens and Slides
2. Identification of Zooplanktons
3. Preparation of permanent slides of Invertebrates
4. Cell and molecular exercises
5. Identification and comments on microbiological slides
6. Measurement of Cell size
7. Identification and comments of different chromosomes
8. Preparation of temporary slides of chromosomes
9. Preparation temporary Slides of different stages of cell division
10. Identification and principle of different instruments
11. Write down the methods of different biochemical and haematological methods

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M. Sc. Zoology II Semester

Course-MZ-C201: Chordates and Evolutionary Biology

(Total Credits = 04; End Semester Marks = 75; CIE=25)

UNIT-I **15Hrs**

1. Outline classification of various classes of chordates
2. General organization and affinities of Cephalochordata and Cyclostomata
3. General organization and affinities of Holocephali and Dipnoi

UNIT- II **15Hrs**

1. Adaptation and parental care in Ambhibia.
2. Characters and affinities of Ratitiae, palate in birds and Mirgration in birds
3. Characters and affinities of Prototheria and Matatheria

Unit- III **15Hrs**

1. Modern concept of Natural Selection; characteristics of evolution; extinction, replacement irreversibility of specialization.
2. Genetic and quantitative aspects of evolution; population as unit of evolution gene frequency, gene pool, evolution result of gene frequency, genetic equilibrium and Hardy- Weinberg law.
3. Genetic drift (Sewal Wright effect).

UNIT-IV **15Hrs**

1. Speciation- Definition of species, sub-species and races, speciation a gradual or a sudden process.
2. Isolation mechanism- Geographical, ecological, physiological, biochemical, anatomical, developmental, behavioural, psychological and social.
3. Effects of isolation- Restrictions of random disperse and random mating, character displacement, reduction of fertility.

Suggested Reading:

1. Biology of Animals-Cleveland P. Hickman JR Larryds. Roberts.
2. Evolution by Monroe W Strickberger
3. Evolution by Dobzhansky, Ayala, Stebbins, Valentine

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M. Sc. Zoology II Semester

Course-MZ-C202: Genetics and Biotechnology

(Total Credits = 04; End Semester Marks = 75; CIE=25)

UNIT-I **15Hrs**

1. Interaction of genes Complementary, supplementary, epitasis, duplicate and inhibitory actions, polygenes, pleiotropy and penetrance.
2. Allelism: Pseudoulleles, (ABO, Rh and Mn types of blood groups and their genetics).
3. Cytoplasmic inheritance and maternal effects.

UNIT-II **15Hrs**

1. Mutation and mutagenic agents: Classification of mutations, translocation, inversion, deletion, duplication and gene mutation.
2. Genetic mapping, three point test- Interference. Coincidence.
3. Bacterial genetics: Bacterial mutation, conjugation and transduction. Sex linked inheritance.

UNIT-III **15Hrs**

1. Hybridization Technology
2. Primary & Established cell line culture and Culture Media
3. Applications of Animal Cell Cultures

UNIT-IV **15Hrs**

1. DNA recombination and expression in bacterial cell
2. DNA finger printing
3. Application of Biotechnology in industry.

Suggested Reading:

1. Principles of Genetics, Gardner EJ and Sunstad DP, John Wiley and Sons, (2000).
2. Genetics, Strickburger MW, Macmillan Pub. Co., (1994).
3. Human Molecular Genetics, Strachan T and Read AP, Garland Science, (2004).

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M. Sc. Zoology II Semester

Course-MZ-C203: Animal Physiology

(Total Credits = 04; End Semester Marks = 75; CIE=25)

UNIT-I **15Hrs**

1. Role of digestive glands and regulation of their activities. Digestion und absorption of carbohydrates, Lipids, Proteins,
2. Water and electrolyte absorption, Symbiotic digestion, Vitamins.
3. Body fluids and compartments of intracellular and extracellular fluids.

UNIT-II **15Hrs**

1. Physiology of RBCS and WBCS and their functions, Blood group, Blood clotting, Blood vascular system, Cardiac cycle and its regulation.
2. Mechanism of urine formation in a mammal, Acid base balance and regulation of kidney function, Osmoregulation.
3. Physiology of respiration and transport of gases and respiratory pigments

UNIT-III **15Hrs**

1. Physiology of Pituitary, Thyroid, Parathyroid, Adrenal glands, Pancras and their functions.
2. Types of muscles, Ultra structure of skeletal muscle mechanism, Skeletal muscle contraction tetanus, and fatigue and summation
3. Effect of sympathetic and parasympathetic activity on autonomic effectors, Central nervous system regulation, spinal reflex arc

UNIT-IV **15Hrs**

1. Integrated functions of hypothalamus, limbic system
2. Hypothalamic control of pituitary activity and phenomenon of neurosecretion
3. Physiology of reproductive hormones and their functions

Suggested Reading:

1. G. Giese: "Cell Physiology" (3rd Ed) Saunders, Toppan
2. C. A. Keil, E. Neil & E.N. Joeb (1982): "Samson Wright, Applied Physiology" Oxford Univ. Press.
3. R. Eckert & D. Randall (1982): "Animal Physiology: 2nd Ed." W. H. Freeman & Co.
4. W. A. Hoar (1982): "General& Comparative Animal Physiology 3rd Ed." Prentice Hall Inc.
5. C. L. Prosser (1973): "Comparative Animal Physiology" W. B. Saunders.

M. Sc. Zoology II Semester

Course-MZ-C204: Biostatistics and Computer application

(Total Credits = 04; End Semester Marks = 75; CIE=25)

UNIT- I **15Hrs**

1. Introduction to Biostatistics – Definition, Terms, Applications and Role of biostatistics in modern research.
2. Sampling techniques and data representation
3. Measures of central tendency and Distribution
4. Measures of dispersion

UNIT- II **15Hrs**

1. Probability and chi square test
2. Correlation and liner regression
3. Test of significance
4. Experimental design and analysis of variance

UNIT-III **15Hrs**

1. Basic components of computers – Hardware (CPU, input, output storage devices), Software (operating systems).
2. Introduction to MS EXCEL – use of worksheet to enter data, edit data, copy data, move data and Graphical tools in EXCEL for presentation of data.
3. MS – WORD – editing, copying, moving, formatting, table insertion, drawing flow charts etc.,
4. Introduction to Power Point, image, data handling and Graphical tools in PPT for Presentation.

UNIT-IV **15Hrs**

1. Introduction to Internet – Basics and Applications of Internet, Internet working Internet access.
2. Understanding the World Wide Web (WWW).
3. Searching Tools – World Search Engines, Search Directories and Encyclopedias.
4. Online safety – spywares and viruses

Suggested Reading:

1. Statistical methods, Snedecor, G.W. and W.G. Cochran, Iowa State Univ. Press Biometry by W. H. Freeman and Francisco
2. Computer Fundamentals 1St Edition 2017 by RS Salaria

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M. Sc. Zoology II Semester
Course-MZ-C205: Practical
(Total Credits = 04; End Semester Marks = 75; CIE=25)

1. Cranial Nerves of *Scoliodon*
2. Museum specimens (from each Class not less than 15 specimens).
3. Slides related to vertebrate parts.
4. Problems based on multiple alleles – Blood groups
5. Problems based on Mendel's Laws – monohybrid and dihybrid ratios
6. Problems based on gene frequency – Hardy Weinberg Law
7. Karyotype studies
8. Haematological estimations of Blood

M. Sc. Zoology III Semester

Course-MZ-C301: Developmental Biology

(Total Credits = 04; End Semester Marks = 75; CIE=25)

UNIT: I **15Hrs**

1. **Theories of Development:** Preformation of epigenesis
2. **Biochemistry of semen**: semen composition and formation, assessment of sperm function and Y – specific probes
3. **Fertilization**: significance of fertilization for development, the essence of activation of egg, pre and post fertilization events and biochemistry of fertilization

UNIT: II **15Hrs**

1. Different types of eggs in chordates
2. **Early embryonic development:** patterns of cleavage, Blastulation and Gastrulation in chordates (Tunicates to Mammals), fate maps, morphogenic movements, mechanics and significance of gastrulation
3. **Casual basis of development**: primitive embryonic induction, concepts of potencies, prospective fates, progressive determination, induction of the primitive nervous system (Speman's primary organization), nature and regionally specific properties of the inductor

UNIT: III **15Hrs**

1. **Organogenesis:** morphogenesis of brain and heart
2. **Embryonic development:** development and physiology of extra- embryonic membranes in amniotes
3. Development, types and physiology of mammalian placenta

UNIT: IV **15Hrs**

1. **Metamorphosis in Amphibia:** structural and physiological changes during metamorphosis, endocrine control of metamorphosis
2. **Regeneration**: types of regeneration (physiological, reparative and compensatory, hypertrophy), regenerative ability in chordates, morphological and histological process in amphibian limb regeneration, origin of cells for regeneration, differentiation.
3. Environmental regulation of animal development.

Suggested Reading:

1. Gilbert, S.F. Developmental Biology. 10th Edition, Sinauer Associated Inc., Massachusetts
2. Balinsky, B.I. Introduction to Embryology. Saunders, Philedelphia
3. Berril, N.J. and Karp, G. Development Biology. McGraw Hill, New York
4. Hamburger V and Hamilton HL. Handbook of chick developmental stages. Saunders Publications. 1965.

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M. Sc. Zoology III Semester

Course-MZ-C302: Animal Behaviour

(Total Credits = 04; End Semester Marks = 75; CIE=25)

UNIT: I **15Hrs**

1. Different patterns of behaviour
2. A general picture of the mammalian nervous system with system special reference to the involvement of hypothalamus in the regulation of behaviour patterns.
3. Hormones and behaviour
4. Methods of studying behaviour: brain lesions, electrical stimulation and drug administration

UNIT: II **15Hrs**

1. Behavioural genetics
2. Components of feeding behaviour; hunger and drive, directional movement, avoidance, eating, carrying and hoarding, Factors influencing choice if food,
3. Nervous regulation of food and energy intake
4. Learning: Habituation, conditioned reflex, trial and error, latent learning, learning and discrimination, imprinting neural mechanism of learning

UNIT: III **15Hrs**

1. Concept of Instinctive behaviour, phyletic decent and physiology
2. Motivated behaviour: Drive, satiation and its neurophysiological control
3. Orientation- classification of various types of taxes and kinases
4. Social behavior in primates: Social signals; olfactory, tactile, visible, audible

UNIT: IV **15Hrs**

1. Status, dominance, hierarchy, territorial behaviour, courtship and mating, aggression, primate societies
2. Reproductive behaviour in fish (stcikle back or any other fish)
3. Social behaviour in insects: communications, concealment behaviour
4. The role of pheromones (a general account)

Suggested Reading:

1. Animal Behaviour: an Evolutionary Approach – John Alcock.
2. Measuring behaviour: an Introductory Guide – Martin Bateson.
3. Animal Behaviour by Reena Mathur

M. Sc. Zoology III Semester

Course-MZ-C303: Environmental Pollution, Health and Education

(Total Credits = 04; End Semester Marks = 75; CIE=25)

UNIT- I **15Hrs**

1. Natural resources, their conservation and development
2. Mineral resources
3. Energy resources
4. Waste management

UNIT-II **15Hrs**

Pollution (Monitoring sources, effects and control)

1. Water
2. Air
3. Land
4. Sound

UNIT-III **15Hrs**

1. Urban health problem, Impact of urbanization stress, Behaviour pattern of health, Health status and Health management
2. Rural health problem
3. Socioeconomic environment, impact of weather, natural disaster, Pollution water availability, food resources, safely in relation to human health

UNIT -IV **15Hrs**

1. Education and improvement of social environment.
2. Indian society in transition-status of socio-culture values-ecological ethics.
3. People's science movements.
4. UNESCO's Man and Biosphere programme.

Suggested Reading:

1. Pollution (Vol.1-6) by C. S. Stern
2. Environmental ecology by T.N. Khoshoo

M. Sc. Zoology III Semester

Course-MZ-E304: Systematics and Morphology of Fishes

(Total Credits = 04; End Semester Marks = 75; CIE=25)

UNIT-I **15Hrs**

1. Evolutionary Classification, merits and demerits of Berg's classification, Ostracoderms, Placoderms
2. Origen and evolution of Fishes
3. Adaptive radiation of fishes

UNIT-II **15Hrs**

1. Hill stream and Deep sea fishes adaptations
2. Scale and Coloration of fishes
3. Origin of fins, locomotion and electric organs

UNIT-III **15Hrs**

1. Fish nutrition, food and feeding habits
2. Elementary canal in fishes and physiology of digestion
3. Respiration in fishes

UNIT-IV **15Hrs**

1. Morphology of air breathing fishes
2. Morphology of Swim bladder webrion ossicless
3. Fish Skeleton

Suggested Reading:

1. Fish and Fisheries by S S Khanna
2. Fish and Fisheries of India by V.G. Jhingran

M. Sc. Zoology III Semester

Course-MZ-E305: Wild Life Ecology

(Total Credits = 04; End Semester Marks = 75; CIE=25)

Unit I **15Hrs**

1. Population growth of wild life, growth of organism with non - overlapping generation, and exponential growth
2. Predation models of prey - predatory dynamics optional forging theory - Patch choice, diet choic, prey , selection , forging time
3. Population regulation - extrinsic and intrinsic mechanism
4. Mutalism animal- animal relationship

Unit II **15Hrs**

1. Types of Ecosystem - nutrient cycle , food chain , food web
2. Habitat Ecology - Aquatic fresh water ecology, estuarine ecology and oceanography
3. Terrestrial Ecology - Forest and Grassland ecology, desert life , Himalayan ecology , Floristic regions and Islands of India
4. Environmental hazards, destruction of habitat and extrication of specise causes and preventive measures.

Unit III **15Hrs**

1. Morphological variations and adaptations in species of Reptiles, birds and mammals in different Ecosystem, Forest, deserts hills, rivers , sanctuaries and oceans .
2. Behaviour and breeding patterns of Wild species
3. General anatomical organisation and sense organs in wild species
4. Oil field pollution, drilling operations, monitoring, Environmental impact assessment.

Unit IV **15Hrs**

1. Origin and evolution of Reptiles, birds and mammals
2. Special features in the development Biology of Reptiles, birds and mammals.
3. Management of Soil racecourses
4. Zoogeographical regions and world biota

Suggested Reading:

1. Wildlife Ecology, Conservation, and Management by John M fryxell
2. Ecology by Peter Sterling
3. Fundamentals of Ecology by E.O. Odum

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M. Sc. Zoology III Semester
Course-MZ-C306: Practical
(Total Credits = 04; End Semester Marks = 75; CIE=25)

1. Observation of living Chick embryo.
2. Larval Developmental stages of Drosophila.
3. Chromosome squash preparation from Drosophila larval salivary glands.
4. Chemical communication in ants
5. Maze learning in small mammals
6. Selective predation of coloured prey items
7. The practical of Elective courses 13 and 14 based as per syllabus

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M. Sc. Zoology IV Semester

Course-MZ-C401: Biological Chemistry

(Total Credits = 04; End Semester Marks = 75; CIE=25)

Unit – I **15Hrs**

1. **Bio-Catalysis:** Classification, nomenclature and mechanism of action of enzymes; nature of enzymes; enzyme specificity; factors affecting enzyme activity; enzymatic and co-enzymatic catalysis, coenzyme and their functions.
2. Organic constituents in living systems
3. Bee Lambert's law, Principles and applications of colorimetry and spectrophotometry.
4. Metabolism of Amino acids

Unit – II **15Hrs**

1. Structure and importance of monosaccharides, sugar derivatives, disaccharides, polysaccharides.
2. Catabolism of glycogen, glucose and fructose; details of Glycolysis, Kreb's cycle and Cori cycle.
3. Phosphogluconate pathway(pentose phosphate pathway)
4. Synthesis of glycogen; glycogensis and glyconeogenesis.

Unit – III **15Hrs**

1. Definition, general properties, classification and importance of amino acids and proteins, nucleo-proteins.
2. Structure formulae of the amino acids.
3. Structure of proteins; primary, secondary, tertiary and quaternary.
4. Basic knowledge of the determination of amino acid sequence exemplifies by a tripeptide.

Unit – IV **15Hrs**

1. Definition, general properties and classification.
2. Fatty acids, structure, properties, types and importance, with special reference to essential fatty acids.
3. Structure and impotence of different types of Lipids.
4. Metabolism of fat and fatty acid

Suggested Reading:

1. Principles of biochemistry, by Lehninger
2. Biochemistry, by Donald Voet and Judith Voet.
3. Biochemistry, by Harper.
4. Biochemistry. Jeremy M.Berg, JohnL.Tymovzko, Lubert Stryer

M. Sc. Zoology IV Semester

Course-MZ-C402: Cell and Molecular Toxicology

(Total Credits = 04; End Semester Marks = 75; CIE=25)

UNIT – I **15Hrs**

1. History and scope of Toxicological
2. Effects of toxins on plasma membrane, passive transport, active transport, diffusion, membrane fluidity
3. Toxicity of Mixtures
4. Cytotoxicity

UNIT - II **15Hrs**

1. Genetic Toxicology
2. Introduction of carcinogenesis
3. Effects of toxins on endoplasmic reticulum- ER enzymes, effects of toxins on ER
4. Effects of toxins on mitochondria- mitochondrial membrane permeability, electron transport disturbances, oxidative injury to mitochondria, apoptosis

UNIT – III **15Hrs**

1. Apoptosis and toxicants
2. Effects of toxins on microsomes and peroxisomes- microsomal induction by chemicals, peroxisomal proliferation by toxins, microsomal enzymes, peroxisomal enzymes ad their role in cell injury
3. Cytopathology
4. Occupational toxicology

UNIT - IV **15Hrs**

1. Effects of toxins on cytoskeleton- effects of toxins on actin filaments (microfilaments), intermediate filaments, cilia and flagella
2. Dose time effect relationship
3. Absorption, distribution and elimination of xenobiotics
4. Biotransformation

Suggested reading:

1. Cell and molecular biology: Concepts and experiments by G. Karp , Wiley
2. Molecular biology of the cell by B. Alberts , A. Johnson et al . , Garland Science , T & F Group
3. General and applied toxicology by Ballantyne , T. Marrs , T. Syversen (Volume - II) , McMillan , UK
4. Handbook of Toxicoogical pathology by W.M. Haschek , C.G. Rousseaux , M.A. Walling , (Volume - I) , Academic Press

M. Sc. Zoology IV Semester

Course-MZ-E403: Physiology and Embryology of Fishes

(Total Credits = 04; End Semester Marks = 75; CIE=25)

UNIT-I **15Hrs**

1. Stato - acoustic Lateral line system
2. chemoreceptors; organ of sight & organ of smell
3. Osmoregulation and mechanism of water salt balance in fresh water & marine fishes

UNIT-II **15Hrs**

1. Circulatory system
2. Excretory system
3. Nervous system

UNIT-III **15Hrs**

1. Fish migration
2. Parental care in fishes
3. Reproductive system in fishes
4. Structure and kind of eggs and their maturation

UNIT-IV **15Hrs**

1. Cleavage and early embryonic development in fishes
2. Hatching and post embryonic development including fundamentals of morphogenesis in fishes
3. Endocrine glands in fishes

Suggested Reading:

1. Fish and Fisheries by S S Khanna
2. Fish and Fisheries of India by V.G. Jhingran

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M. Sc. Zoology IV Semester
Course-MZ-E404: Wild life Biodiversity and Conservation
(Total Credits = 04; End Semester Marks = 75; CIE=25)

UNIT- I **15Hrs**

1. Habit and habitat and zoogeographical distributions of Reptiles, bird and mammalia .
2. Groups of allied importance - A fishes, amphibia and Insect
3. Forestry - forest resourc, erosion, deforestation and aforestation .
4. Conservation movements in Himalayan Foot hills and Tribal belts of India and histories

UNIT-II **15Hrs**

1. National Parks and sancturies in India, concept in regards to Ecology
2. Important Nature reserves in the world
3. Interaction of man and Nature
4. Legislation, wild life protection Act and Regulations administration and economics

UNIT-III **15Hrs**

1. National Parks, Sancturies, planning management
2. National Parks and Sancturies - Case studies
3. Maintenance and rearing of wild species
4. Wild life value as tourism, acethetical game, ethical, commercial and scientific

UNIT-IV **15Hrs**

1. Environmental education, Public awareness and future programmes
2. Conservation movement in India historical perspectives
3. Biodiversity, its significance and conservation measures
4. Role of Biotechnology in species a development

Suggested Reading:

1. Wildlife Ecology, Conservation, and Management by John M fryxell
2. Ecology by Peter Sterling
3. Fundamentals of Ecology by E.O. Odum

M. Sc. Zoology IV Semester
Course-MZ-E405: Aquaculture and Fisheries
(Total Credits = 04; End Semester Marks = 75; CIE=25)

UNIT-I **15Hrs**

1. Types of fisheries - Marine fisheries (deep water , off shore Riverine fisheries (Major river system of North India), Reservoir Estuaries fisheries
2. Prawns Fisheries - Fishing method, Culture methods, future of prawn fisheries in India and processing of Prawns.
3. Molluscan fisheries and Pearl industry, light fishing & ecosounders
4. Net & crafts of inland and marine water; Electric fishing

UNIT-II **15Hrs**

1. Effect of light temperature, turbidity, dissolved gases & solids in water
2. Types of planktons & their role in fish life
3. Maintenance of fresh water aquarium: Pond culture & its management
4. Principle cultivable fishes - Brief account of indigenous & transport of seed.

UNIT-III **15Hrs**

1. Induced breeding - stripping, hypophysation techniques
2. Special culture - Composite fish culture; fish culture in paddy fields sewage fish culture and integrated fish culture
3. Fish diseases and their control - Fungal diseases, bacterial diseases protozoan diseases, helminth diseases and diseases induced by pollutants; prophylectic measures .
4. Fish Preservation and processing - Cause of spoilage, methods of preservation, their merits and demerits

UNIT-IV **15Hrs**

1. Fish bye- products
2. Fish pollution and toxicity
3. Ageand growth, length and weight relationship
4. Tagging of fishes

Suggested Reading:

1. Fish and Fisheries by S S Khanna
2. Fish and Fisheries of India by V.G. Jhingran

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M. Sc. Zoology IV Semester
Course-MZ-E406: Environmental Physiology
(Total Credits = 04; End Semester Marks = 75; CIE=25)

UNIT-I — 15Hrs

1. Environmental physiology, Metabolism rate and body size, Basal metabolism
2. Climatic adaptations- Hibernation, Aestivation, Poikilotherms, Homeotherms, Acclimation and Acclimatization, Survival limits
3. Asphysic responses and their manifestations

UNIT-II — 15Hrs

1. Haematological changes in relation to environment
2. Impact of environment at cellular level
3. Principles and concept of ecosystem

UNIT-III — 15Hrs

1. Development and evolution of ecosystems.
2. Causes and kinds of succession, Diversity and productivity in relation to stages of succession and development.
3. Biotic and abiotic components and their interrelationship, and adaptations of animals to environment.

UNIT-IV — 15Hrs

1. Deserts: types and ecological attributes of desert species. Adaptations.
2. Freshwater: Lakes including salt lakes, ponds, streams, springs, rivers and marshes.
3. Estuarine: ecological peculiarities adaptations including imp of fauna.

Suggested Reading:

1. Ecology by Peter Sterling
2. Fundamentals of Ecology by E.O. Odum

M. Sc. Zoology IV Semester

Course-MZ-C407: Practical

(Total Credits = 04; End Semester Marks = 75; CIE=25)

1. Biochemical estimations of different parameters in Serum and Blood *viz*
   - I. Blood Sugar
   - II. Serum Cholesterol
   - III. Serum Lipids
   - IV. Low Density Lipoprotein
   - V. High Density Lipoprotein
   - VI. Triglyceride
   - VII. Very Low Density Lipoprotein
   - VIII. Total Protein, Albumin, Globulin and A/G ratio
2. Isolation of DNA from goat spleen
3. Estimation of DNA (diphenyl method)
4. Estimation of RNA (Orcinol method)
5. UV absorption spectra of native and denatured DNA
6. Agarose gel Electrophoresis of DNA
7. DNA amplification by PCR
8. Gel Documentation