Semester Courses of M.Sc. Zoology Based on CBCS

The course of M.Sc. Zoology will be spread in two years previous and final. Each year will have two semester examinations and thus there will be total four semester examinations.

Programme Specific Outcomes of Zoology

1. Developing better understanding of concepts of biology at biochemical, molecular and cellular level, physiology and reproduction studying them at organism level, and ecological impact on animal behavior.
2. Developing the advance level of statistical knowledge which helps in data handling and practical assessments. There is extensive study of instruments so that the students can handle them with ease for further research work.

3. Developing the concept of animal adaptation by exploring the diversity of functional characteristics of various kinds of organisms which is closely related to evolutionary processes and environmental changes.

4. Understanding of Mendel's principle of heredity, its extension and chromosomal basis; chromosomal anomalies and associated diseases; developing concepts of regulation of gene activity in prokaryotes and eukaryotes of transcriptional and post transcriptional level.

5. Study of environment is focused with the aim to make students aware of the structure and function of environment and the climate change, adaptations and losses due to it.

6. Development of an understanding of animal science for its application in entomology, apiculture, aquaculture, agriculture and modern medicine.

7. Detailed acquaintance of developmental biology correlating it to the evolution. Elucidation of early embryonic development and organogenesis of invertebrates and vertebrates, explanation of embryonic stem cells and their application.

8. To understand animal physiology in detail and a comparative outlook between non vertebrates and vertebrate physiology.

9. Development of theoretical and practical knowledge in handling the animals and using them as model organism.

10. Each semester is having a departmental seminar in order to make students aware of the research paper writing and presentation.

11. To understand the impact of chemicals on biodiversity of microbes, animals and plants; Bioindicators and biomarkers of environmental health. Biodegradation and bioremediation of chemicals; competition and existence; intraspecific and interspecific interactions.

12. Dissertation work is incorporated as theoretical/practical project work with the aim to inculcate the ability to develop a research question, organize relevant available literature and development of technical writing skill.

(ZOOLOGY)

TWO-YEAR FULL-TIME PROGRAMME

AFFILIATION

The proposed programme shall be governed by the Department of Zoology, Faculty of Science, **Mahatma Gandhi Kashi Vidyapith, Varanasi .**

PROGRAMME STRUCTURE

The M.ScProgramme is divided into two parts as under. Each part will consist of two semesters as given below

Semester-odd	**Semester-Even**	Part-I	First Year
Semester-1	Semester-2	Part-II	Second Year
Semester-3	Semester-4		

Each semester would consist of four papers (course) and one practical course (based on all four papers, four credits for each paper). Semesters I and II (Part I) would have core papers (courses) to be studied by all students of the M.Sc. Zoology p

Programme. Semesters III would have three compulsory papers and one special paper(to be selected any one from **ZOO304A, ZOO304B, ZOO304C**)and the fifth paper will be practical paper divided in two parts: **ZOO305A** (General) and **ZOO305B** (Special) both carrying 4 Credits. Semester IV would comprise of two compulsory papers (**ZOO401** and **ZOO402**), twooptional papers (**ZOO403A, ZOO404A ZOO403B, ZOO404B** and **ZOO403C, ZOO404C**) from which each student would have to select one and the fifth paperwill be practical paper divided in two parts: **ZOO405A** (General) and **ZOO405B** (Special) both carrying 4 credits. It is mandatory for each student to complete a dissertation/research project, assigned in semester I as IIIsemester and will carry 8 credits each. It would be theoretical or laboratory or both components.

M. Sc. Previous (w.e.f. 2022-23)

FIRST SEMESTER			
PAPER	**NAME OF PAPER**	**MARKS**	**CREDIT**
ZOO101	Non-Chordata	**100(75+25)**	**4**
ZOO102	Biostatistics,Bioinformaticsand Bioinstrumentation	**100(75+25)**	**4**
ZOO1O3	Environmental Biology	**100(75+25)**	**4**
ZOO104	Biochemistry	**100(75+25)**	**4**
ZOO105	Practical Examination	**100(75+25)**	**4**
MinorZOO106**	Wildlife Conservation and Sustainable Development	**100**	**4**
	Research Project/Dissertation*		**4**
	Total	**500**	
SECOND SEMESTER			
PAPER	**NAME OF PAPER**	**MARKS**	**CREDIT**
ZOO201	**Chordata**	**100(75+25)**	**4**
ZOO202	**Animal Physiology**	**100(75+25)**	**4**
ZOO203	**Cytology and Genetics**	**100(75+25)**	**4**
ZOO204	**Molecular Biology**	**100(75+25)**	**4**
ZOO205	**Practical Examination**	**100(75+25)**	**4**
	Research Project/Dissertation*	**100**	**4+4=8**
	Total	**500**	

M. Sc. Final (w.e.f. 2023-2024)

THIRD SEMESTER			
PAPER	**NAME OF PAPER**	**MARKS**	**CREDIT**
ZOO301	**Applied Zoology**	**100(75+25)**	**4**
ZOO302	**Developmental Biology**	**100(75+25)**	**4**
ZOO303	**Endocrinology**	**100(75+25)**	**4**
ZOO304	**Special**		
ZOO304A **ZOO304B** **ZOO304C**	. Fish – Taxonomy and Morphology . Entomology – Morphology, Physiology, Development and Ecology . Cell Biology – Cytological Techniques	**100(75+25)**	**4**
ZOO305 **ZOO305A AND ZOO305B**	Practical Examination . General and Special	**100(75+25)**	**4**
	Research Project/Dissertation*		**4**
FOURTH SEMESTER			
PAPER	**NAME OF PAPER**	**MARKS**	**CREDIT**
ZOO401	Biosystematics and Evolution	**100(75+25)**	**4**

ZOO402	Animal Beheviour	**100(75+25)**	**4**
ZOO403	Special Paper I **ZOO403A**. Fish Biology -Applied Ichthyology and Development **ZOO403B**. Entomology – Economic Entomology **ZOO403C**. Cell Biology – Cell Regulation and Principles of Biotechnology	**100(75+25)**	**4**
ZOO404	Special Paper II **ZOO404A**. Fish – Physiology and Ecology **ZOO404B**. Entomology – Economic Entomology **ZOO404C**. Cell Biology – Cell Regulation and Principles of Biotechnology	**100(75+25)**	**4**
ZOO405 **ZOO405A AND ZOO405B**	Practical Examination General and Special	**100(75+25)**	**4**
	Research Project/Dissertation*	**100**	**4+4=8**
	Total	**500**	

***Research projects include industrial training/internship/survey work etc.**

***It will be evaluated at the end of each year out of 8(4+4) credits**

****It will be opted by students of other faculties.**

Syllabus for M. Sc. (Zoology)

Semester I

ZOO101 –Non-chordata **Marks 100(75+25)Credit 4**

Unit 1

Protozoa,Porifera and Coelenterata

Protozoa-Locomotion- locomotory organelles and methods of locomotion, Nutrition- Holozoic, Holophytic, Saprozoic and Myxotrophic nutrition, Reproduction- Asexual and sexual,Protozoa and Diseases

Porifera-Skeleton- Spicules and spongin (vii) Canal System- Types and functions of canal system

Coelenterata-Origin of Metazoa, Polymorphism- Basic forms and patterns, Importance of polymorphism, Corals- coral polyp, coral skeleton, types of corals. General organization and affinities of Ctenophora.

Unit 2

Platyhelminthes and Aschehelminthes

Parasitism in Platyhelminthes and Aschehelminthes, Parasitic adaptations in Trematodes and Cestodes-Morphological and physiological adaptations, larval stages of Trematoda and Cestoda.

Unit 3

Annelida and Arthropoda

Segmental organs, Filter feeding, Coelom and Metamerism. Larval forms of crustacean, Parasitism in crustacean, Respiration in Arthropods, General organization in Onychophora.

Unit 4

Mollusca and Echinodermata

Respiration in Mollusca, Torsion in Gastropods, Water vascular system and Larval forms in Echinodermata.

Suggested readings

1. Barnes et al (2009). The Invertebrates: A synthesis. Wiley Backwell

2. Hunter: Life of Invertebrates (1979, Collier Macmillan)

3. Marshall: Parker & Haswell Text Book of Zoology, Vol. I (7th ed 1972, Macmillan) 19

4. Moore: An Introduction to the Invertebrates (2001, Cambridge University Press)

5. Brusca and Brusca (2016) Invertebrates. Sinauer

6. Jan Pechenik (2014) Biology of the invertebrates. McGraw Hill

ZOO102– Biostatistics, Bioinformatics and Bioinstrumentation Marks 100(75+25) Credit 4

Unit 1

Biostatistics

Population sample, random sample, tabular and graphical representation of data

Major of central Tendencies (Mean, Median, Mode), Standard deviation, Variance, Co-efficient of variance, Analysis of Variance

Unit 2

Bioinformatics

Biology & IT, Computers in Biology and medicine, Introduction to Genomics and Proteomics etc. Definition and terminology: Cladogram, Dendrogram, Phylogram and Phenogram; Operational taxonomic unit (OTU), Informative sites. Biological sequence data banks (GENBANK, EMBL, PDB)

Unit 3

Biological Techniques

Working principles, types and application of: Colorimetry, Spectrophotometry, Centrifugation, Chromatography, Electrophoresis.

Unit 4

Microscopy

Principles and construction of - Compound microscope, Phase contrast microscope, Electron microscope (SEM, TEM)

Suggested readings

Statistical Methods (Eighth Edition) by G. W. Snecdecor and W. G. Cochran, Willey Blackwell

Biostatistics (Tenth Edition) by W.W. Daniel and C. L. Cross, Wiley Introductory

Primrose: Molecular Biotechnology Panima 2001

Clark & Switzer: Experimental Biochemistry Freeman 2000

Bioinformatics-Sequence and Genome Analysis-David W. Mount, CSHL Press

Molecular Systematics, 2nd ed. D.M. Hillis, C. Moritz and B.K. Mable, Sinauer Associates, Sunderland. Massachusetts.

Fundamental Concepts of Bioinformatics, Krane, D.E. and Raymer M.L. Pearson Education

ZOO103 - Environmental Biology **Marks100(75+25)Credit 4**

Unit 1

Population Ecology

Characteristics of Population, Population size and exponential growth, Population dynamics, Competition ,Intra-specific and Inter-specific competition , Mutualism and Commensalism

Unit 2

Ecosystem

Nature of Ecosystem, Production, Food webs and Energy flow through ecosystems, Biogeochemical cycle66,Biomes

Unit 3

Environment

Environmental stresses , Global warming , Acid Rain, Environmental contaminants- their uptake and bioaccumulation and biotransformation,Bio-indicators and Biomarkers.

Unit 4

Biodiversity

What is Biodiversity,

Biodiversity Types: (a) Species, Ecosystem level, Genetic Level: (b) Alpha, Beta, Gamma level; Indian Biodiversity & Its Distribution; Importance/Significance; Biodiversity Hotspots/Parks; Keystone species, Indicator Species

Suggested Readings

1. Biodiversity and Ecosystem functioning. edited by Michel Lorean ,ShahidNaureen and Pablo Inchausti (Oxford University Press.)

2. Biodiversity and Conservation in Forests. By Diana. F. Tomback. Publication MDPIMultidisciplinary Digital Publishing Institute.

3. Fundamental Processes in Ecology: An Earth system Approach. 2007. Wilkinson, D.M. Oxford University Press, UK.

4. Essentials of Ecology. G.T. Miller, Jr. & Scott. E. Spoolman, 2014, Brooks/Cole, Cengage Learning.

5. Fundamentals of Ecology. E.P. Odum& Gray. W. Barrett, 1971, Saunders.

6. Handbook of Population 2005, Dudley L. Poston, Michael Micklin, Springer

ZOO104 – Biochemistry **Marks 100(75+25) Credit 4**

Unit1

Bioenergetics - Elementary thermodynamics- First law and second law of thermodynamics, Cell as an open thermodynamic system,Calculation of free energy change during biological oxidation-reduction reactions

Unit2

Enzymes- Kinetics, inhibition, mechanism of action, Michaelis and Menton equation, Allosteric enzymes, isoenzymes, Ribozymes, Abzymes.

Unit 3

Carbohydrates- Structure, general properties and biological significance, Lipids- Classification, structure, general properties and biological significance , Metabolic pathways- Glycogenesis and Glycogenolysis, HMP shunt, Oxidative phosphorylation, Beta oxidation of fatty acids

Unit 4

Amino Acids: Structure, properties and metabolism, Ramachandran plot, protein isolation, solubilities and protein targeting

Classification and significance of Vitamins.

Suggested readings

1. Nelson & Cox Lehningers Principles of Biochemistry McMillan 2000

2. Zubay et al Principles of Biochemistry WCB 1995

3. Voet & Voet Biochemistry Vols 1 & 2 Wiley 2004

4. Murray et al Harper's Illustrated Biochemistry McGraw Hill 2003

5. Wilson and Walker Practical Biochemistry – Principles and Techniques Cambridge University Press

ZOO105 – Practical Examination Particulars Marks 100(75+25)Credit 4

Labeling of Dissected animal figures (one lower and one higher non-chordate)- 05 +05

Preparation- 05

Spotting (10) – 20

Environmental Biology exercise- 10

Biochemistry exercise- 10

Biostatistics exercise- 10

Class record, collection and viva 10

TOTAL 75

Major Dissections Labeling: Labeling ofdissected circulatory system and reproductive system of earthworm, Reproductive and Nervous system of Unio, Pila, Prawn,Sepia and other available non-chordates.

Preparations: Slide preparation of Euglena and Paramecium, sponge gemmules, Obelia colony, Nereis parapodia, Hastate palate of Prawn, salivary glands of Cockroach, mouth parts of other insects.

Museum study: General survey and classification of lower non-chordates Protozoa- Prepared slides of Paramecium (conjugation and binary fission), Euglena, Vorticella, Ceratium, Noctiluca.

Porifera- Museums of Euplectella, Spongilla, Euspongia Prepared slides of T.S. Sycon, L.S. Sycon, Spicules of sponges.

Coelenterata- Museums of Physalia, Corralium, Madrepora, Fungia, Pennatula, Metridium, Vellela, Porpita, Tubipora, Gorgonia, Prepared slides of Hydra, Obelia,

Helminths- Museums of Taenia solium, Cysticercus larva of Taenia solium, Schistosoma, Ascaris male, Ascaris female, Ancyclostoma,

Annelida- Nereies, Heteroneries, Aphrodite, Chaetopterus, Arenicola, Terebella, Pheretima, Eutyphoeus, Dero, Branchellion, Bonellia, Sipunculus and other available museums

Arthropoda- Museums and slides of major representatives of different classes of phylum Arthropoda Mollusca- Museums and slides of major representatives of Mollusca

Echinodermata- Museums and slides of major representatives of Echinodermata.

Prepared slides – Miracidium larva, Redia larva, Cercaria larva, Scolex of Taenia solium, Mature proglottid and gravid proglottid of T. solium, T.S of Mature proglottid and gravid proglottid of T. solium, T.S. through body of male Ascaris, T.S. through body of female Ascaris,T.S.Nereies through body segments, Parapodium of Nereies, etc.

Environmental Biology exercise- Study of different structural adaptations to ecological conditions

Study of micro and macro fauna of soil by froth-floatation method

Comparative study of physico-chemical eco-factors in different localities- temperature, pH

Estimation of CO2, O2, carbonate in freshwater

Study of plankton in a water body

Study of biological effects of certain pollutants.

determination of glycogen in animal tissues. Kinetic assay of salivary amylase and study of the effects of time and temperature on urease activity

Biostatistics exercise- Experiments on probability, Sampling of data for frequency diagram and calculation of mean, median and mode and standard deviation.

Semester II

ZOO201- Chordates **Marks 100(75+25) Credit 4**

Unit I

Origin of Chordates; Origin of Gnathosomes

Pisces: Ostracoderms and Devonian fishes,

Unit II

Lung fishes and their peculiar features.

Amphibia:Origin of Tetrapoda

Unit III

Origin and Evolution of Reptiles, Mesozoic reptiles, Extinct reptiles, Origin of birds, Flightless birds

Unit IV

Mammals

Origin and evolution of Mammals,

Characteristic features of Monotremes, Marsupials and Placentals

Aquatic mammals

Suggested Readings

1. Harvey et al: The Vertebrate Life (2006)
2. 2. Colbert et al: Colbert's Evolution of the Vertebrates: A history of the backboned animals through time (5th ed 2002,Wiley - Liss)
3. Hildebrand: Analysis of Vertebrate Structure (4th ed 1995, John Wiley)
4. McFarland et al: Vertebrate Life(1979, Macmillan Publishing)
5. Parker and Haswell: TextBook of Zoology, Vol. II (1978, ELBS)

ZOO202 - Animal Physiology **Marks 100(75+25) Credit 4**

Unit1- Physiology of Digestion.

Digestion and Absorption of Proteins, Carbohydrates and lipids . Physiology of Respiration. Gaseous exchange in terrestrial and aquatic animals, Respiratory pigments.

Unit 2- Physiology of Circulation

Patterns of Circulation among different animals, Physiological categories of Heart, Haemodynamics. Physiology of Excretion Excretory products, Biosynthesis of Urea, Structure and functional mechanism of nephron.

Unit 3- Physiology of Nerve Conduction

Ionic basis of resting and Action potential, Synaptic transmission Physiology of Muscle Contraction Structure and Mechanism of Contraction of skeletal muscles

Unit 4- Concept of Homeostasis

Physiology of Defense Mechanism Immunity, Types of Immune response, Immune cells, Antigen and antibody reaction, Antibody diversity

Suggested readings

1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. /W.B. Saunders Company.

2. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons
3. Christopher D. Moyes, Patricia M. Schulte 2016 Principles of Animal Physiology. 3rd Edition, Pearson Education

4. Hill, Richard W., et al. Animal physiology. Vol. 2. Sunderland, MA: Sinauer Associates, 2004.

5. Chatterjee C C (2016) Human Physiology Volume 1 & 2. 11th edition. CBS Publishers

ZOO203–Cytology and Genetics **Marks 100(75+25)Credit 4**

Unit-1

Mendel's Law and their chromosomal basis ; extension of Mendel's principles; Allelic variation and gene function incomplete dominances and co- dominances , allelic series , testing , gene mutation for allelism

; gene action – form genotype to phenotype – penetrance and expressivity , gene interaction , epistasis pleiotropy ; Interaction of gene .

Unit-2

Cytoplasmic inheritance : environment and heredity : lethal genes; sex – linked inheritance ; chromosomal Mapping

Unit-3

Sex chromosome : sex determination ; multiple allelism; Numerical and structure chromosome aberrations and their significance ; DNA replication , Transposable elements in prokaryotes and eukaryotes ; Role of transposable elements in genetic regulation

Unit-4

Microbial genetics : Bacterial transformation , transduction , conjugation , Bacterial chromosome , Bacteriophages; Molecular cytogenetics techniques (FISH , GISH, DNA Fingerprinting , Flow cytometry) ;Elements of Eugenics ; Imprinting of genes , chromosomes and gene , gene therapy .

Suggested literature

1. Development genetics of higher organisms by George M. Malacinski ,Maxmillan

2. Fundamantal of human genetics by sanjaymadsal , new central book agency , landon

3. Fundaments of genetics by G.S.Migalani , norsa publishing house

4. Genetics by P.K gupta , Rastogi publication

5. Genetics by E. Conrad , apple academics press

ZOO204 - Molecular Biology **Marks 100(75+25)Credit 4**

Unit 1- Gene Action

Chromosomal organization of genes, DNA Replication, Transcription, Genetic code

Unit 2- Intracellular Protein Trafficking

Protein Architecture, Protein synthesis on free/bound polysomes, Uptake into ER, Trafficking mechanism of proteins

Unit 3- Regulation of Gene Action

Regulation of Gene action in prokaryotes and eukaryotes, Operon model- lac operon and Trp operon

Unit 4- Cell Signalling

Types of Cell Signaling, Second messenger system, Cell surface Receptors

Suggested readings

1. Gardner et al Principles of Genetics John Wiley 1991

2. Hartl and Jones Genetics-Principles and Analysis Jones & Bartlett 1998

3. Hartwell et al Genetics: From Genes to Genomes McGraw-Hill 2004

4. Gilbert Developmental Biology Sinauer 2003

5. Snustada and Simmons Principles of Genetics JohnWiley& Sons

6. Russell Genetics BenjaminCummings

ZOO205 – Practical Examination ParticularsMarks 100(75+25)Credit 4

Labeling of major Chordate systems (dissected)-10

Comparative osteology of different classes of vertebrates- 10

Preparation- 05

Spotting (10) - 20

Physiology exercise- 05

Molecular Biology exercise- 05

Cytology and Genetics exercise- 05

Class record, tour and collection- 10

Comprehensive viva - 05

TOTAL 75

Major Dissection Labeling: labelingof cranial nerves of major representative types of fish and amphibian. Afferent and efferent branchial arteries of scoliodon, urinogenital system of scoliodon.

Comparative Osteology Study of bones of different chordate class with focus on evolutionary significance

Preparation- Placoid scale of scoliodon, Ampulla of Lorenzini; T.S. through liver, intestine, skin etc of frog.

Museum study- Study of museums and slides of representative types of Protochordates, Cyclostomata, fishes and amphibian, Reptilia, Aves and Mammalia.

Physiology exercise- Total counts of erythrocytes, total leucocyte counts and differential leucocyte counts of fish, frog, bird and rat. Estimation of hemoglobin content in fish, frog, bird and rat. Rate of Oxygen consumption of aquatic animals and effects of different stresses upon it. Determination of respiratory quotient of an air breathing animal. Study of functional properties of the cardiac muscles of frog using acetylcholine and adrenalin.

Molecular Biology exercise- Isolation and colorimetric determination of protein from fat bodies of cockroach and liver. Isolation and colorimetric determination of DNA from fat bodies of cockroach and liver. .

Cytology and Genetics exercise Demonstration of mitochondria in human buccal epithelium by supra vital staining. Study of mitosis in onion root tip and meiosis in testis of grasshopper with acetocarmine squash method. Study of salivary gland chromosomes of Drosophila and Chironomos. Study of the pattern of different hereditary traits in human beings.

M.Sc. FINAL YEAR M. Sc. (Zoology)

SemesterIII

ZOO301–Applied Zoology **Marks 100(75+25) Credit 4**

Unit 1

Aquaculture; marine, riverine and lacustrine fishes; Some food fishes of India: Wallago ,Anquilla , Harpodon, Notopterus, Channa , Clarias, Labeo, Catla, Cirrhinus, Barbus: Fish culture in India: Culture of Carps.

Unit 2:

Domestication of animals- Animal husbandry and Poultry: Important breeds of cattle in India, Exotic breeds, cattle breeding, artificial insemination, feeding and management of dairy stock , dairy product and chemistry of milk, poultry industry in India, important poultry breeds, poultry farming, disease of fowl.

Unit 3:

Apiculture : importance of Bee keeping, Apiculture, Apis species, bee hive, social life of honey bee, properties of honey: Sericulture : Mulberry and non mulberry Sericulture (tasar , munga and eri sericulture) ; lifecycle of silk moth; physical and chemical properties of silk.

Unit 4:

Vermiculture: Introduction, ecology and distribution of earthworms: Vermiculture and vermicomposting methods : chemical composition of waste based vermicompost: Economics of vermiculture and vermicomposting : species of earthworms for vermicomposting ; In situ application of vermiculture and crop productivity; use of earthworm in land improvement and reclamation.

Suggested readings:

1 Bee keeping in India by A.M. Wadhwani

2 Poultry Husbandry by Morley A. Jull.

3 Domestic Water Buffalo by M.Fahimuddin

4 Life stock and Poultry Production by Harbans Singh and E.N.MOORE

5 Textbook of dairy chemistry by M.P. Mathur, D.D Roy, P.Dinaker

ZOO302 - Developmental Biology **Marks 100(75+25)Credit 4**

Unit 1. **Gonads and Gametogenesis**

(i) Sex differentiation in vertebrates (ii) Comparative account of differentiation of gonads in mammals, (iii)Spermatogenesis in vertebrates (iv)Endocrinology of ovary, oogenesis and vitellogenesis in vertebrates, superovulation.

Unit2. Fertilization and Embryogenesis

(i) Mechanism of Fertilization: in vivo and in vitro, (ii) Patterns of Cleavage (iii)Patterns of Gastrulation in frog and chick.

Unit3. Organogenesis

(i) Development of Brain in vertebrates (ii) Development of Eye in vertebrates.

Unit 4

(i) Hormones and Reproduction- Seasonal and continuous breeders (ii) Differentiation of cells during embryonic development (iii)Mechanism of Induction during Organogenesis, Primary organizer

Suggested readings:

1. A survery of embryology by F.G.Gilchirst , McGraw –Hill Bokk company

2. An introduction to embryology by B.lBalansky , CBS college publishing

3. An introduction to embryology by B.L. Balinsky; Dr. Biol.Sci , sunders college publishing

4. Analysis of biology development by kathoff , McGraw –hill science , new delhi , india.

5. Deveplomentbology by Gillbert ,Sinauer Associates Inc, Massachusetts, USA

ZOO303: Endocrinology **Marks 100(75+25) Credit 4**

Unit 1

Hormones as messengers and their types, Structure and functioning of Pituitary, Pancreas, Adrenal Glands

Unit 2

Phylogeny of Thyroid gland , Structure and functioning of Thyroid, Parathyroid, and Gonads

Unit 3

Nature of action of peptide and steroid hormones , Biosynthesis and secretion of Hormones

Unit 4

Neuroendocrine system and neurosecretion , Hormones and Behaviour

Suggested Readings:

1. William's Text Book of Endocrinology: Shlomo Melmed, Kenneth S. Polonsky, P.Reed Larsen

2. Guyton's text book of Medical Physiology

ZOO304: Special Paper **Marks 100(75+25) Credit 4**

ZOO304A: Fishery Biology Taxonomy & Morphology

Unit 1.Taxonomy

(i) Classification of fish up to orders as proposed by L. S. Berg(1940)
(ii) (ii) Systematic/Taxonomic study of freshwater fish with Special reference to identification of local forms(up to their families)
(iii) 1- Order- Clupeiformes. Families- ClupeidaeNotopteroidae.
(iv) 2- Order- Beloniformes. Families – BelonidaeHemiramphidae
(v) 3- Order – Masacembeliformes .Family - Mastacembelidae.
(vi) 4- Order – Mugiliformes. Family - Mugilidae

Unit 2. Identification of Fish

Study and preparation of identification key of the fish of following order with suitable diagrams, fin formula, local and biological names,

1- Ophiocephaliformes
2- 2- Cypriniformes
3- 3- Perciformes

Unit 3

Study of differentiating characters of pair of fish from the orders of Fresh water fish given in to (Ophiocephaliformes, Cypriniformes Perciformes) with special reference to fin formula, suitable diagrams, local and biological names.

Unit 4 Morphology

(i) Specialized organs (electric organs, poison glands ,sound producing organs , light producing organs and sense organs)
(ii) (ii) Endocrine glands (Pineal, hypophysis, thyroid, adrenal, ultimobranchial body, corpuscles of stannous and urophysis).

ZOO304B: Entomology Morphology, Physiology, Development and Ecology

Unit 1

Morphology

Structure and nature of integument.

Morphology of head (antennae and mouth parts), thorax (legs, wings, venation and coupling mechanism) and abdomen (external genitalia).

Nervous system and sense organs.

Bioluminescence.

Unit 2 Physiology

Anatomy of digestive system and nutritional physiology (nutritional requirement, feeding behaviour and food utilization).

Circulatory system and components of hemolymph.

Excretory organs and physiology of excretion.

Respiratory organs, physiology of respiration and respiratory adaptations of aquatic and endoparasitic insects.

Reproductive organs and different modes of development.

Unit 3 Development

Postembryonic development, different type of larvae and pupae and hormones control of dipause

Unit 4 Ecology

Role of temperature, humidity and light in development and metamorphosis.

Origin and evolution of apterygotes and pterygotes and their Interrelationships.

ZOO304 C: Cell Biology Cytological Techniques

Unit I

Elementary principles of phase, interference, polarization, electron and Scanning electron microscope. Unit II Theory and application of freeze – drying, X-ray diffraction, radio autography, Fluorescent antibody techniques and differential centrifugation. Methods of tissue culture.

Unit III Theoretical basis of colorimetric and biochemical estimations of nucleic acid, proteins.

Unit IV Chemical basis of fixation and cytochemical localization of proteins, lipids, glycogen, RNA, DNA, phosphatases, esterases and oxidases. Biosynthesis of proteins and Nucleic Acids

ZOO305 – PRACTICAL EXAMINATION **Marks 100(75+25) Credit 4**

ZOO305 A: GENERAL AND ZOO305 B- SPECIAL

Field study- 05

Preparation- Microtomy- 05

Developmental biology- 05

Endocrinology- 05

Spotting (05)- 10

Class record, collection and viva 05

(A)Fishery Biology

Major Dissection- 10

Preparation- 05

Identification of One fish- 05

Spotting (05)- 10

Seminar- 05

Class record, collection and Viva- 05

(B) Entomology

Dissection major- 10

Dissection minor 05

Identification of one insects- 05

Seminar- 05

Spotting (5) 10

Class record,collection and viva -05

(C) Cell Biology

Cytological localization- 10

Vital staining -05

Microtomy -05

Seminar 05

Spotting (5) 10

Class record and viva 05

Field Study Field study at different Government/ Non Government farm houses/ apiaries/ dairies/ poultries/ seri culture in local areas and project has to be submitted.

Preparation- Microtomy of tissues (from block making to section cutting, stretching etc.)

Museum study- Study of different culture animals (including fishes, cattles, poultry, bees, silk worm and earthworms).

Developmental Biology- Study of life stages of frog, mounting of eggs and embryo of frog, incubation and mounting of chick embryo, study of prepared slides of embryo of frog, chick and mammal,egg window.

Endocrinology- Study of prepared slides of different endocrine glands of fish and frog, dissection of vertebrate types to demonstrate different endocrine organs.

SemesterIV

ZOO401–Biosystematics and Evolution Marks 100(75+25) Credit 4

UNIT I

Definition and basics concept of biosystematics & Taxonomy: Historical resume of systematic and its important and application in biology; trends in biosystematics: concepts of different conventional and newer aspects – chemotaxonomy, cytotaxonomy, ethotaxonomy, molecular taxonomy and numerical taxonomy.

Dimensions of speciation and taxonomic characters: type of lineage changes, production of additional lineage, species concepts – species category, different species concepts, subspecies and infraspecific categories, theories of biological classification hierarchy of categories taxonomic and nontaxanomic character

UNIT II

Concept of organic evolution: Evolution of Protein and Nucleic Acid Facts and theories of evolution: during pre- and Darwin era.

Evolution: a new synthesis: Developments and concept of synthetic theory, Elemental forces of evolution, Mutation, Selection (types of selection, selection coefficient, selection in natural population), Genetic drift: Changes in gene frequency in small population.

UNIT III

Population genetics: Gene frequencies in Mendelian population, Hardy-Weinberg equilibrium, Conditions for the maintenance of genetic equilibrium

UNIT IV

The nature of reproductive isolation, genetic basis of isolating mechanisms Concepts of species and models of speciation: allopatric and sympatric speciation. Polytypic species, subspecies and infraspecies categories.

Suggested readings:

1. Biology Systematics by A. Mielli, Chapmon and Hall

2. Evolution by Hall and Hallgrimsson ,johnsn and Bartlett publisher

3. Evolution by mark ridley . Blackwell science

4. Evolution by bartonn.Hbriggs, D.E.G., Eisen J.A., Goldstein , A.E. Ptel , N.H., cold spring Harbor Laboratory press new York , U.S.A.

5. Methods and principle of systematic Zoology by E.Mayer , E.G.Linsley , R.L. vsinger, McGraw – Hill Book Company , ICN

ZOO402 - Animal Behaviour **Marks 100(75+25) Credit 4**

Unit-I:

Introduction, definition, historical out line, pattern of behavior, objective of behavior, mechanism of behaviour;

Reflexes and complex behavior; orientation; primary and secondary orientation kinesis-orthokinesis and klinokinesis, taxis-different kinds of taxis;

Unit-II:

Fixed action pattern; mechanism, deprivation experiment, controversies; FAP characteristic and evolutionary feature; learning and instincts, conditioning, habituation, sensitization.

Unit-III:

Innate releasing mechanism; key stimuli, stimulus filtering, supernormal stimuli, mimetic releaser, code breaker, Homeostasis and behavior; motivational system, physiological basis of motivation; Hormones and pheromones influencing animal behavior.

Unit-IV:

Pattern of communication (chemical, visual, light, audio, species specificity of songs, evolution of language with respect to primates).

Sexual behavior; Courtship, sexual selection, mating patterns, parental care, migratory behavior of fishes.

Suggested Readings:

1. Manning, A. An Introduction of Animal Behaviour.

2. Russell, E.S. The behaviour of Animals.

3. Mc Farland, D. Animal Behaviour: Psychology, Ethology & Evolution.

4. Alcock, J. Animal Behaviour: An evolutionary approach.

5. Dugatkin, L.A. Principles of Animal Behaviour.

6. Silverman, P. Animal Behaviour in the laboratory.

ZOO403- Special Paper I **Marks 100(75+25) Credit 4**

ZOO403AFishery Biology

Applied Ichthyology and development

Unit 1

(i) Fisheries of India; Brief study of Marine, fresh water, estuarine and cold water fishery.
(ii) (ii) Fish Farming- Type of fish farming, fish ponds, construction of fish ponds, physico chemical and biological characteristics of ponds
(iii) (iii)Fertilization and management of fishery pond (spawning, hatcheries, reusing, stocking), transport, mortality of fish fry
(iv) (iv)Composite culture and cage culture

Unit 2

(i) Principle and importance of fish preservation, traditional and advanced methods of fish preservation : sun–drying, salting, pickling,smoking,chilling,frying and canning etc.
(ii) (ii) Fish products like oil, fishsauce, fish glue etc.

Unit 3

(i) Aplication of genetics in aquaculture – sex manipulation,chromosomal manipulation, gene engineering.

(ii) (ii) Transgenic fish
(iii) (iii) Production of monosex and sterile fish and their Significance in aquaculture.
(iv) (iv)Induced breeding

Unit 4

Development :
(i) Gastrulation.
(ii) Neurilation .
(iii) Organ formation.
(iv) Larval development.
(v) Metamorphosis.
(vi)

ZOO404 A Special Paper II **Marks 100(75+25) Credit 4**

Physiology and Ecology
Unit 1
1**.** Nutrition - Alimentary canal, associated glands
Food and feeding habits, digestion
2. Excretion - Kidney structure and modifications, nitrogenous and
excretory products, urine formation.
3.Osmoregulation - Definition, osmoregulation in freshwater, marine and migratory fishes.
Unit 2
4. Respiration - Structure and function of gills.
Fish blood, process of respiration in a typical fish, accessory respiratory organs.
5. Circulatory System - Heart structure and function, Blood vessels,
Arterial and venous system.
Unit 3
6. Reproduction - Gonads structure, spermatogenesis, Oogenesis, gonadal steroids,
endocrine control of reproduction.
7. Common enemies and symptoms, etiology and treatment of disease of food fishes.
Unit 4
Ecology :
Abiotic factors : Density; Pressure; Temperature; salt
content in water; Light; Sound; Electric currents; Bottom
deposits; Particles suspended in water.
(i) Biotic factors : interspecific interrelationship among fishes
and with other organisms; Intraspecific into relationship
among fishes.
(ii) Pollutants affecting fishery water with special reference to oil
spills, domestic pollutants, industrial water, radioactive
wastes and sewage fed fisheries.
(iii) Plankton in relation to fish production.

M. Sc. (Zoology) IVthSemester

Special Paper I **Marks 100(75+25) Credit 4**

ZOO403B ENTOMOLOGY

Evolution and Taxonomy
Unit I
Origin and evolution of apterygotes and pterygotes and their interrelationships
Unit II
Thysanura :Machilidae; Lepismatidae
Dictyoptera : Blattidae; Manitidae
Orthoptera : Tettigoniidae; Acrididao; Gryllidae;
Gryllotalpidae
Isoptera : Termitidae; Kalotermltidae
Siphunculata :Pediculidae; Haematopinidae
Hemiptera : Cicadidae; Jassidae; LacciferidaeCoccidae;
Cimidae; PyrrbocoridaeBelostomatidae
Unit III
Lepidoptera :Pyralididae; Saturniidae; Bombycidae; Pieredae;
Papilionidae; Lymantriidae
Diptera : Culicidae; Simulidae; Chironomidae; Tabanidae;
DrosophilidaeTachinidae; Muscidae; Hippoboscidae.
Unit IV
Hymenoptera : Ichneumonidae; Aphidiidae; Formicidae;
Vespidae; Apidae; Bombycidae
Coleopteran :Cicindellidae; Carabidae; Hydrophilidae;
Scarabeidae; Lampyridae; Tenebrionidae;
Meloidae; Chrysomelidae; Curulionidae.

ZOO404 B Special Paper II **Marks 100(75+25) Credit 4**

Economic Entomology
Unit 1
Pests of stored grains *: Sitophilus oryzae; Triboliumcastaneum; challosobruchus chinensis; Corcyra cephalonica*
Pests of cotton *:Dysdercusspp; Eariasvitella; Pectinophora Gosaypiella*
Pests of cereal – crops *;heliothisarmigeara; Chilozonellus; Leptocorysa Varicornis; Hieroglyphus spp.*
Unit 2
Pests of fruits :*idiocerusatkinsoni; Dacus cucurbitae; Papilio Demoleus*
Pests of oil-seeds :*Bagradacruciferarum; Athalia proxima; Lipaphis*

Erysimi

Unit 3

Different methods of insect management : Cultural; Mechanical; Biological chemical.

Integrated pest management (IPM).

Properties, formulations, methods of application and mode of action of insecticides.

Physiology of insect resistance to insecticides.

Unit 4

Life – history of beneficial insects.

Life – history and biology of silk – worm and its products.

Life – history and biology of honey – bee and its products.

Life – history and biology of lac – insect and its products.

M. Sc. (Zoology) IVthSemester

ZOO403C Cell Biology Special Paper I Marks 100(75+25) Credit 4

Ultrastructure and Morphodynamics of Cell

Unit 1

(i) Morphodynamics of Cell.

(ii) Ultrastructure and functions of the following :

Cell membrane, Nuclear membrane

Unit 2. Cellular Organelles: Ultrastructure and Functions

(i) Mitochondria.

(ii) Golgi complex.

(iii) Endoplasmic reticulum.

(iv) Ribosomes.

(v) Lysosomes.

Unit 3. The Chromosomes

(i) Morphodynamics of chromosomes and the achromatic apparatus In cell division.

(ii) Mechanism of chiasma formation.

Unit 4. Cell Physiology

(i) Physiology of a dividing cell.

(ii) Chromosomal changes caused by ultraviolet and ionizing radiations

(iii)Carcinogenesis : Cytopathology; Possible somatic and viral causes

ZOO404 C

Special Paper II Marks 100(75+25) Credit 4

Cell Regulation and Principles of Biotechnology

Unit 1

1. Regulation of cellular function; Hormone action: Hormone receptor Interaction; Membrane receptors; Steroid thyroid and epinephrine receptors; Second messengers (cyclic AMP: Cyclic GMP); Interferon.

Unit 2
2. Genetic code
3. Genetic recombination, transformation, conjugation and transduction
Unit 3
4. Application of genetic engineering and its prospects
5. Microbes and human welfare
Unit 4
6. Thermodynamic principles and study-state conditions of living
Organisms
Organization and methods to study metabolism
7. Degradation of glucose and nucleotides in animals.
8. Energy metabolism and high energy compounds.
Redox potentials
Mitochondrial electron transport chain
Oxidative phosphorylation
9.0 Nature of enzymes
9.1 Classification and nomenclature of enzymes.
9.2 Kinetic analysis of enzyme catalyzed reactions

ZOO405A AND

ZOO405B – PRACTICAL EXAMINATION GENERAL AND SPECIAL Marks 100(75+25) Credit 4

Practical related toAdaptation/Evolution 05

Animal Behaviour Exercise 05

Preparation 05

Spotting (5) 10

Class record , Tour and collection- 05

Viva-voce - 05

ZOO405B -SPECIAL

(A) Fishery Biology

Dissection major- 10

Dissection minor- 05

Preparation- 05

Ecology exercise- 05

Spotting-(5) 10

Class record, collection and viva-voce- 05

(B) Entomology

Dissection major- 10

Dissection minor- 05

Preparation- 05

Physiology exercise- 05

Spotting (5) 10

Class record, collection and Viva- 05

(C) Cell Biology

Quantitative estimation- 10

Cytological preparation- 10

Microbial exercise- 05

Spotting (5) -10

Class record and Viva – 05