

Rabindranath Tagore University

Department of Zoology

B.Sc. Syllabus

Semester	Paper code	Paper name
1st sem	ZOO-MAJ- 1.1	Diversity of Non- chordate and parasitology
	ZOO-MIN- 1.1	Principle of Ecology
	ZOO- SEC- 1.1	Bee keeping
2ndsem	ZOO-MAJ- 2.1	Diversity of Chordates
	ZOO-MIN- 2.1	Introduction to Non-chordates
	ZOO-SEC- 2.1	Sericulture
3rdsem	ZOO-MAJ- 3.1	Principle of genetics
	ZOO-MAJ- 3.2	Cell biology
	ZOO-MIN- 3.1	Diversity of chordates
	ZOO- SEC- 3.1	Ornamental fish and fisheries
4thsem	ZOO-MAJ- 4.1	Animal taxonomy Systematics & Biostatistics
	ZOO-MAJ-4.2	Principle of Ecology & Evolution
	ZOO-MAJ- 4.3	Comparative anatomy of vertebrates
	ZOO-MIN-4.1	Cell biology and genetics
5thsem	ZOO-MAJ-5.1	Animal physiology and Endocrinology
	ZOO-MAJ-5.2	Fundamental of biochemistry and metabolic processes
	ZOO-MAJ-5.3	Entomology and fishery
	ZOO-MAJ-5.4	Immunology and Histology
	ZOO-MIN- 5.1	Molecular biology and evolution
6thsem	ZOO-MAJ-6.1	Molecular biology and bioinformatics
	ZOO-MAJ-6.2	Wildlife conservation and animal behavior

	ZOO-MAJ-6.3	Reproductive and Developmental biology
	ZOO-MAJ-6.4	Animal biotechnology and instrumentation
	ZOO-MIN- 6.1	Fundamental of Biochemistry and instrumentation

Department of Zoology
Rabindranath Tagore University
Syllabus
BSC 1st SEM

ZOO-Major

Course Title : Diversity Of Non Chordates

Course Code : MAJ-ZOO-1.1

Nature of Course : MAJOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

THEORY

(Credits 3)

Unit 1: Protista and Parazoa

6

General characteristics and Classification upto classes of protista.
Locomotion and nutrition in Protozoa.

Unit 2: Porifera

6

General characteristics and Classification upto classes Canal system and spicules in sponges

Unit 3: Cnidaria

6

General characteristics and Classification upto class.Polymorphism in Cnidaria. Corals and coral reef formation.

Unit 4: Platyhelminthes

7

General characteristics and Classification up to classes.Life cycle and pathogenicity of *Fasciola hepatica*.

Unit 5: Nematelminthes

7

General characteristics and Classification up to classes.Lifecycle, and pathogenicity of *Ascarislumbricoides*.

Unit 6: Introduction to Coelomates

4

Evolution of coelom and metamerism

Unit 7: Annelida **6**

General characteristics and Classification upto classes Excretion in Annelida

Unit 8: Arthropoda **6**

General characteristics and Classification upto classes. Respiration in Arthropoda Metamorphosis in Insect.

Unit 9: Mollusca **6**

General characteristics and Classification upto classes. Torsion and detorsion in Gastropoda. Evolutionary significance of trochophore larva

Unit 10: Echinodermata **6**

General characteristics and Classification upto classes Water-vascular system in echinodermata.

PRACTICALS

(Credits 1)

1. Study of whole mount of Euglena, Amoeba and Paramecium.
2. Examination of pond water collected from different places for diversity in protista
3. Study of Sycon (T.S. and L.S.), Hyalonema, Euplectella, Spongilla
4. Study of Obelia, Physalia, Millepora, Aurelia, Tubipora, Corallium, Alcyonium, Gorgonia, Metridium, Pennatula, Fungia, Meandrina, Madrepora
5. Study of adult Fasciola hepatica, Taenia solium.
6. Study of adult Ascaris lumbricoides.
7. Study of following specimens: Annelids - Aphrodite, Nereis, Heteronereis, Sabella, Serpula, Chaetopterus, Pheretima, Hirudinaria
Arthropods - Limulus, Palaemon, Daphnia, Balanus, Sacculina, Cancer, Eupagurus, Scolopendra, Julus, Bombyx, Periplaneta, termites and honey bees
Onychophora - Peripatus
Molluscs - Chiton, Dentalium, Pila, Doris, Helix, Unio, Ostrea, Pinctada, Sepia, Octopus, Nautilus
Echinoderms - Pentaceros/Asterias, Ophiura, Clypeaster, Echinus, Cucumaria and Antedon
8. Dissection of digestive system and nervous system of periplaneta.
9. To submit a Project Report on any related topic to larval forms (crustacean, molluscan and echinoderm)

B.Sc. 1st SEM

ZOO-MINOR

Course Title : Principle Of Ecology

Course Code : MIN-ZOO-1.1

Nature of Course : MINOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

Theory

credits 3

Unit 1: Introduction to Ecology

6

History of ecology. Autecology and synecology, Levels of organization, Laws of limiting factors, Study of physical factors

Unit2: Population

24

Unitary and Modular populations, Unique and group attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion Exponential and logistic growth, equation and patterns, r and K strategies Population regulation - density-dependent and independent factors Population interactions, Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition and Predation, functional and numerical responses

Unit3:Community

12

Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect; Ecological succession with one example Theories pertaining to climax community

Unit4:Ecosystem

14

Types of ecosystems with one example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow through the ecosystem, Ecological pyramids and Ecological efficiencies Nutrient and biogeochemical cycle with one example of Nitrogen cycle, Human modified ecosystem

Unit 5:Applied Ecology

4

PRINCIPLES OF ECOLOGY

PRACTICALS

(Credits 1)

1. Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided
2. Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon-Weiner diversity index for the same community
3. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method).
4. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary

B.Sc. 1st SEM

ZOO-SEC

Course Title : Principle Of Ecology

Course Code : SEC-ZOO-1.1

Nature of Course : SEC

Total Credits : 3

Distribution of Marks :60(Theory) +15(Internal Assessment)

THEORY

(Credits 3)

Unit 1: Biology of Bees History, Classification and Biology of Honey Bees, Social Organization of Bee Colony

Unit 2: Rearing of Bees Artificial Bee rearing(Apiary),Beehives–Newton and Langstroth Bee Pasturage Selection of Bee Species for Apiculture Bee Keeping Equipment Methods of Extraction of Honey (Indigenous and Modern) 72

Unit 3: Diseases and Enemies Bee Diseases and Enemies, Control and Preventive Measures

Unit 4: Bee Economy

Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc

Unit 5: Entrepreneurship in Apiculture

Bee Keeping Industry–Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens.

B.Sc. 2ndSEM

ZOO-Major

Course Title : Diversity Of Chordates

Course Code : MAJ-ZOO-2.1

Nature of Course : MAJOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

THEORY

(Credits 3)

Unit 1: Introduction to Chordates

2

General characteristics and outline classification

Unit2:Protochordata

8

General characteristics of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata

Unit 3: Origin of Chordata

3

Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata

Unit4:Agnatha

2

General characteristics and classification of cyclostomes up to class

Unit5:Pisces

8

General characteristics of Chondrichthyes and Osteichthyes, classification upto order Migration, Osmoregulation and Parental care in fishes

Unit6:Amphibia

6

Origin of *Tetrapoda* (Evolution of terrestrial ectotherms); General characteristics and classification upto order; Parental care in Amphibians

Unit7:Reptilia

7

General characteristics and classification up to order; Affinities of *Sphenodon*; Poison apparatus and Biting mechanism in snakes

Unit8:Aves**8**

General characteristics and classification up to order *Archaeopteryx*-- a connecting link; Principles and aerodynamics of flight, Flight adaptations and Migration in birds

Unit9: Mammals**8**

General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages

Unit10: Zoogeography**8**

Zoo geographical realms, Theories pertaining to distribution of animals, Plate tectonic and Continental drift theory, distribution of vertebrates in different realms

**DIVERSITY OF CHORDATA
PRACTICAL****(Credits 1)**

- 1. Protochordata** Balanoglossus, Herdmania, Branchiostoma, Colonial Urochordata Sections of Balanoglossus through proboscis and branchio genital regions, Sections of Amphioxus through pharyngeal, intestinal and caudal regions. Permanent slide of Herdmaniaspicules
- 2. Agnatha** Petromyzon, Myxine
- 3. Fishes** Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetradon/ Diodon, Anabas, Flat fish
- 4. Amphibia** Ichthyophis/Ureotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra
- 5. Reptilia** Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus Key for Identification of poisonous and non-poisonous snakes
- 6. Aves** Study of six common birds from different orders. Types of beaks and claws
- 7. Mammalia** Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Erinaceus. Mount of weberian ossicles of fish Power point presentation on study of any two animals from two different classes by students (may be included if dissections not given permission)

B.Sc. 2ndSEM

ZOO-MINOR

Course Title : Introduction To Non Chordates

Course Code : MIN-ZOO-2.1

Nature of Course : MINOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

THEORY

(Credits 3)

Unit 1: Protista and Protozoa

6

General characteristics and Classification upto classes of protista.
Locomotion in protozoa.

Unit 2: Porifera

6

General characteristics and Classification upto classes Canal system in sponges

Unit 3: Cnidaria

6

General characteristics and Classification upto class.Polymorphism in Cnidaria.

Unit 4: Platyhelminthes

7

General characteristics and Classification up to classes.Life cycle and pathogenicity of *Fasciola hepatica*.

Unit 5: Nematelminthes

7

General characteristics and Classification up to classes.Lifecycle, and pathogenicity of *Ascarislumbricoides*.

Unit 6: Introduction to Coelomates

4

Evolution of coelom.

Unit 7: Annelida

6

General characteristics and Classification upto classes.Locomotion in leech.

Unit 8: Arthropoda

6

General characteristics and Classification upto classes. Metamorphosis in Insect.

Unit 9: Mollusca **6**

General characteristics and Classification upto classes. Torsion and detorsion in Gastropoda.

Unit 10: Echinodermata **6**

General characteristics and Classification upto classes Water-vascular system in echinodermata.

PRACTICALS

(Credits 1)

10. Study of whole mount of Euglena, Amoeba and Paramecium.
11. Examination of pond water collected from different places for diversity in protista
12. Study of Sycon (T.S. and L.S.), Hyalonema, Euplectella, Spongilla
13. Study of Obelia, Physalia, Millepora, Aurelia, Tubipora, Corallium, Alcyonium, Gorgonia, Metridium, Pennatula, Fungia, Meandrina, Madrepora
14. Study of adult Fasciola hepatica, Taenia solium.
15. Study of adult Ascaris lumbricoides.
16. Study of following specimens: Annelids - Aphrodite, Nereis, Heteronereis, Sabella, Serpula, Chaetopterus, Pheretima, Hirudinaria
Arthropods - Limulus, Palaemon, Daphnia, Balanus, Sacculina, Cancer, Eupagurus, Scolopendra, Julus, Bombyx, Periplaneta, termites and honey bees
Onychophora - Peripatus
Molluscs - Chiton, Dentalium, Pila, Doris, Helix, Unio, Ostrea, Pinctada, Sepia, Octopus, Nautilus
Echinoderms - Pentaceros/Asterias, Ophiura, Clypeaster, Echinus, Cucumaria and Antedon
17. Dissection of digestive system of periplaneta.
18. To submit a Project Report on any related topic to larval forms (crustacean, molluscan and echinoderm)

BSC 2ND SEM (NEP)

ZOO-SEC

Course Title : Sericulture (Non- Mulberry)

Course Code : SEC-ZOO-2.1

Nature of Course : SEC

Total Credits : 3

Distribution of Marks :50(Theory) + 25 (Practical)

THEORY

CREDITS-2

Unit 1: Introduction

10

Sericulture: Definition, history and present status of Mulberry and Non-Mulberry Sericulture; Varieties of Silk; Types and distribution of non-mulberry or wild sericigenous insects in N-E India

Unit 2: Biology of Non-mulberry Silkworm:

10

Life cycle of silkworm- Eri and Muga , Structure of silk gland and Nature of Silk

Unit 3: Rearing of Silkworms

10

(Eri and Muga Silkworm): Food plants of Eri and Muga Silkworm

Rearing Operation: Rearing house/Site and rearing appliances

Disinfectants: Formalin, bleaching powder

Rearing technology: Early age and Late age rearing

Environmental conditions in rearing-Temperature, Humidity, Light and Air Types of mountages

Harvesting and storage of cocoons , Spinning and Reeling of silk

Unit 4: Pests and Diseases:

10

Pests of eri and muga silkworm, Pathogenes of eri and muga silkworm diseases: Protozoan, viral, fungal and bacterial. Prevention and control measures of pests and diseases

Unit 5: Entrepreneurship in Non-Mulberry Sericulture:

10

Varieties of Non-Mulberry Silk products and economics in India

Prospectus of Non-Mulberry Sericulture in India: Non-Mulberry Sericulture industry in different states, employment generation and potential

Practical:**credit: 1**

1. Identification of various non mulberry silkworms of different stages.
2. Identification of different pests of silkworm.
3. Study of rearing techniques of non mulberry silk worm.
4. Reeling and weaving techniques.
5. Identification of silk products.

B.Sc. 3rd Semester

ZOO-Major

Course Title : Principle of Genetics

Course Code : MAJ-ZOO-3.1

Nature of Course : MAJOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

THEORY

CREDIT- 3

Unit 1: Mendelian Genetics and its Extension

8

Principles of inheritance, Incomplete dominance and codominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Sex-linked, sex- influenced and sex-limited characters inheritance.

Unit 2: Linkage, Crossing Over and Chromosomal Mapping

12

Linkage and crossing over, Cytological basis of crossing over, Molecular mechanisms of crossing over including models of recombination, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence, Somatic cell hybridization.

Unit3: Mutations

10

Types of gene mutations (Classification), Types of chromosomal aberrations (Classification, figures and with one suitable example of each), Molecular basis of mutations in relation to UVlight and chemical mutagens; Detection of mutations: CLB method, attached X method.

Unit 4:SexDetermination

4

Chromosomal mechanisms of sex determination in Drosophila and Man

Unit 5: Extra-chromosomal Inheritance

6

Criteria for extra-chromosomal inheritance, Antibiotic resistance in *Chlamydomonas*, Mitochondrial mutations in *Saccharomyces*, Infective heredity in *Paramecium* and Maternal effects

Unit 6: PolygenicInheritance

3

Polygenic inheritance with suitable examples; simple numericals based on it.

Unit 7: Recombination in Bacteria and Viruses **9**

Conjugation, Transformation, Transduction, Complementation test in Bacteriophage

Unit 8: Transposable Genetic Elements **8**

Transposons in bacteria, Ac-Ds elements in maize and P elements in *Drosophila*, Transposons in humans

GENETICS

PRACTICALS

(CREDITS 1)

1. To study the Mendelian laws and gene interactions.
2. Chi-square analyses using seeds/beads/*Drosophila*.
3. Linkage maps based on data from conjugation, transformation and transduction.
4. Linkage maps based on data from *Drosophila* crosses.
5. Study of human karyotype (normal and abnormal).
6. Pedigree analysis of some human inherited traits.

B.Sc. 3rd Semester

ZOO-Major

Course Title : Cell biology

Course Code : MAJ-ZOO-3.2

Nature of Course : MAJOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

THEORY	(Credits 3)
Unit 1: Over view of Cells	3
Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions	
Unit 2:Plasma Membrane	7
Various models of plasma membrane structure Transportacrossmembranes:ActiveandPassivetransport,Facilitatedtransport Cell junctions: Tight junctions, Desmosomes, Gapjunctions	
Unit 3:Endomembrane System	10
Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes	
Unit 4: Mitochondria and Peroxisomes	8
Mitochondria:Structure,Semiautonomousnature, Endosymbiotichypothesis Mitochondrial Respiratory Chain, Chemi-osmotichypothesis Peroxisomes	
Unit5:Cytoskeleton	8
Structure and Functions: Microtubules, Microfilaments and Intermediate filaments	
Unit6:Nucleus	12
Structure of Nucleus: Nuclearenvelope, Nuclear pore complex, Nucleolus Chromatin: Euchromatin and Hetrochromatin and packaging (nucleosome)	
Unit 7: Cell Division	8
Mitosis, Meiosis, Cell cycle and its regulation	

Unit 8:Cell Signaling

4

GPCR and Role of second messenger (cAMP)

CELL BIOLOGY

PRACTICAL

(Credits 1)

1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis
2. Study of various stages of meiosis.
3. Preparation of permanent slide to show the presence of Barrbody in human female blood cells/cheek cells.
4. Preparation of permanent slide to demonstrate:
 - iDNA by Feulgen reaction
 - iiMucopolysaccharides by PAS reaction
 - iii Proteins by Mercurbromophenol blue/FastGreen

B.Sc. 3rd Semester

ZOO-MINOR

Course Title : Diversity of Chordates

Course Code : MIN-ZOO-3.1

Nature of Course : MINOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

THEORY

(Credits 3)

Unit 1: Introduction to Chordates

2

General characteristics and outline classification

Unit2: Protochordata

8

General characteristics of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates.

Unit 3: Origin of Chordata

3

Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata

Unit4:Agnatha

2

General characteristics and classification of cyclostomes up to class

Unit5: Pisces

8

GeneralcharactersticsofChondrichthyesandOsteichthyes,classification upto order Migration, Osmoregulation.

Unit6:Amphibia

6

General characteristics and classification upto order; Parental care in Amphibians

Unit7:Reptilia

7

General characteristics and classification up to order; Poison apparatus and Biting mechanism in snakes

Unit8:Aves**8**

General characteristics and classification up to order. Principles and aerodynamics of flight, Flight adaptations and Migration in birds

Unit9: Mammals**8**

General characters and classification upto order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages

Unit10: Zoogeography**8**

Zoo geographical realms, Theories pertaining to distribution of animals, distribution of vertebrates in different realms

**DIVERSITY OF CHORDATA
PRACTICAL****(Credits 1)**

1. ProtochordataBalanoglossus, Herdmania, Branchiostoma, Colonial Urochordata Sections of Balanoglossusthrough proboscis and branchio genital regions, Sections of Amphioxus through pharyngeal, intestinal and caudal regions. Permanent slide of Herdmaniaspicules

2. AgnathaPetromyzon, Myxine

3. Fishes Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetradon/ Diodon, Anabas, Flat fish

4. AmphibiaIchthyophis/Ureotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra

5. ReptiliaChelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, CrocodylusKey for Identification of poisonous and non-poisonoussnakes

6. Aves Study of six common birds from different orders. Types of beaks and claws

7. Mammalia Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Erinaceus. Mount of weberianossicles of fish Power point presentation on study of any two animals from two different classes by students (may be included if dissections not given permission)

B.Sc. 3rd Semester

ZOO-SEC

Course Title : Ornamental fish and fisheries

Course Code : SEC-ZOO-3.1

Nature of Course : SEC

Total Credits : 3

Distribution of Marks :50(Theory) + 25 (Practical)

THEORY

CREDITS-2

1. Ornamental Fish Diversity of North East India.
2. Aquarium plant diversity in the wetland of Assam.
3. Construction and management of Home Aquarium.
4. Natural feed of Ornamental Fish
5. Strategies for maintenance of natural colour of Ornamental Fish
6. Natural Breeding of Tricogaster species
7. Health management of Ornamental Fish
8. Feed formulation of Ornamental Fish
9. Development of Biological filtration in Aquarium
10. Pure culture of planktons Practical's

PRACTICAL

CREDITS-1

1. Identification of Ornamental Fish
2. Culture of Indigenous ornamental fish in Aquarium
3. Estimation of Physico-chemical characteristics of Aquarium water
4. Biological filter for removal of Ammonia from Aquarium
5. Culture of Planktons

B.Sc. 4thSemester

ZOO-Major

Course Title : Animal taxonomy, systematic and Biostatistics

Course Code : MAJ-ZOO-4.1

Nature of Course : MAJOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

Unit 1- Taxonomy and systematic.

7

Taxonomy: Introduction, traditional and cladistic taxonomy, stages of taxonomy.

Systematic: Introduction, derivation of term, relationship between taxonomy and systematic.

Newer aspects of Taxonomy: Cytotaxonomy, Chemotaxonomy , molecular taxonomy.

Unit 2: Zoological classification:

12

Biological classification, need of classification, advantage of classification, systems of classification: classical taxonomy, artificial taxonomy, natural system of classification. evolutionary classification. .

` Species concept:

Nominalistic species concept, typological species concept, phenetic species concept, biological species concept, evolutionary species concept.

Unit 3: Taxonomic collection:

6

Importance of collection, method for collecting invertebrates: method for terrestrial habitats, methods for aquatic habitats,.

Methods for collecting chordates: lower chordates, pisces, amphibian and reptiles, aves, mammalian.

Unit 4: Preservation techniques and identification:

10

Fixation and preservation.

Preservation for invertebrates: invertebrates killing methods, dry methods of preservation, wet methods of preservation,

Preservation of chordates: lower chordates, fish preservation, amphibian , reptiles, bird and mammalian preservation techniques.

Identification methods, taxonomic key.

Unit 5: Zoological nomenclature:

5

ICZN: Basic concepts, important rule, Historical background of the code. Binomial nomenclature: history, rule of the system, trinomial nomenclature.

Unit 6- Concept, importance and application of biostatistics.

20

Collection and classification of statistical data.

Measures of central tendency. Measures of dispersion- range, quartile deviation, mean deviation, standard deviation, standard error.

Testing of hypothesis. ANOVA, Chi-square test, Student's t- test.

Practical:

credit 4

1. Morphometry and meristic study of insect and fish.
2. Identification of distinguish species of insects/ fishes/ amphibian/ reptiles/ birds/ mammals using appropriate taxonomic keys.
3. Preparation, mounting and stuffing of fishes.
4. Collection and preservation of insects using appropriate methods.
5. Calculation of F value for a given set of data.
6. Graphical representation of statistical data using statistical software.
7. Calculation of t- test for given set of data.
8. Field visit to any natural history museum/ Zoo/ National park and preparation of scientific report and submission.

B.Sc. 4thSemester

ZOO-Major

Course Title : Principle of Ecology and Evolution

Course Code : MAJ-ZOO-4.2

Nature of Course : MAJOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

Theory	credits 3
Unit 1: Introduction to Ecology History of ecology. Autecology and synecology,	4
Unit2: Population Unitary and Modular populations, Unique and group attributes of population: Density, natality, mortality, life tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion Exponential and logistic growth, Population regulation - density-dependent and independent factors Population interactions, Gause's Principle with laboratory and field examples Community characteristics: species richness, dominance, diversity, abundance, Ecological succession with one example.	8
Unit3:Ecosystem Types of ecosystems with one example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow through the ecosystem, Ecological pyramids, biogeochemical cycle with one example of Nitrogen cycle,	8
Unit 3: Life'sBeginnings: Origin of photosynthesis, Evolution of eukaryotes. Historical review of evolutionary concept: Lamarckism, Darwinism, Neo-Darwinism	5
Unit3: Evidences of Evolution: Fossil record (types of fossils, transitional forms, geological time scale,Population genetics: Hardy-Weinberg Law (statement and derivation of equation, application of law to human Population); Evolutionary forces upsetting H-W equilibrium; Natural selection, types of selection, density-dependent selection, heterozygous superiority, kin selection, adaptive resemblances, sexual selection. Genetic Drift (mechanism, founder's effect, bottleneck phenomenon;	8

Unit6: 7
Product of evolution: Micro evolutionary changes (inter-population variations, clines, races, Species concept. Modes of speciation—allopatric, sympatric, Adaptive radiation / macroevolution (exemplified by Galapagos finches).
Extinctions, Background and mass extinctions (causes and effects), detailed example of K-Textinction

Unit7: 5
Origin and evolution of man, Unique hominin characteristics contrasted with primate characteristics, primate phylogeny from *Dryopithecus* leading to *Homo sapiens*, molecular analysis of human origin

Unit8: 5
Phylogenetic trees, multiple sequence alignment, construction of phylogenetic trees, interpretation of trees

Principle of Ecology and Evolution

PRACTICALS

(Credits 1)

1. Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided
2. Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon-Weiner diversity index for the same community
3. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method).
4. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary
5. Study of fossils from models/pictures
6. Study of homology and analogy from suitable specimens
7. Study and verification of Hardy-Weinberg Law by chi square analysis
8. Graphical representation and interpretation of data of height/weight of a sample of 100 humans in relation to their age and sex.
9. Construction of phylogenetic trees.

B.Sc. 4thSemester

ZOO-Major

Course Title : Comparative anatomy of vertebrates

Course Code : MAJ-ZOO-4.3

Nature of Course : MAJOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

THEORY

(CREDITS 3)

Unit 1: Integumentary System **8**

Structure, functions and derivatives of integument

Unit 2: Skeletal System **8**

Overview of axial and appendicular skeleton, Jaw suspensorium, Visceral arches

Unit 3: Digestive System **8**

Alimentary canal and associated glands, dentition

Unit 4: Respiratory System **8**

Skin, gills, lungs and air sacs; Accessory respiratory organs

Unit 5:Circulatory System **8**

General plan of circulation, evolution of heart and aortic arches

Unit 6: Urinogenital System **6**

Succession of kidney, Evolution of urinogenital ducts, Types of mammalian uteri

Unit 7: Nervous System

Comparative account of brain Autonomic nervous system, Spinal cord, Cranial nerves in mammals

Unit 8: Sense Organs **6**

Classification of receptors Brief account of visual and auditory receptors in man

COMPARATIVE ANATOMY OF VERTEBRATES

PRACTICAL**(CREDITS 1)**

1. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs
2. Disarticulated skeleton of Frog, Fowl, Rabbit
3. Carapace and plastron of turtle/tortoise
4. Mammalian skulls: One herbivorous and one carnivorous animal
5. Study of structure of any two organs (heart, lung, kidney, eye and ear) from video recording (may be included if dissection not permitted)

B.Sc. 4th Semester

ZOO-MINOR

Course Title : Cell Biology And Genetics

Course Code : MIN-ZOO-4.1

Nature of Course : MINOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

THEORY	(Credits 3)
Unit 1: Over view of Cells	3
Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions.	
Unit 2:Plasma Membrane	5
Various models of plasma membrane structure Transportacrossmembranes:ActiveandPassive transport, Facilitated transport	
Unit 3:Endomembrane System	6
Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes	
Unit 4: Mitochondria and Peroxisomes	7
Mitochondria:Structure,Semi-autonomou nature, ETS, Chemi-osmotichypothesis. Peroxisomes	
Unit6:Nucleus	6
Structure of Nucleus: Nuclearenvelope, Nucleolus Chromatin: Euchromatin and Hetrochromatin and packaging (nucleosome)	
Unit 7: Cell Division	5
Cell cycle, mitosis and meiosis	
Unit 8: Mendelian Genetics and its Extension	10
MendelianPrinciples of inheritance, Incomplete dominance and codominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Sex-linked inheritance.	
Unit 9: Linkage, Crossing Over, Mutations	12

Linkage and crossing over, Molecular mechanisms of crossing over including models of recombination,

Types of gene mutations (Classification), Types of chromosomal aberrations (Classification, figures and with one suitable example of each), genetic disease: causes and types.

Unit 10:SexDetermination

6

Sex determination in various organisms including human.

CELL BIOLOGY AND GENETICS

PRACTICAL

(Credits 1)

1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis
2. Study of various stages of meiosis.
3. Preparation of permanent slide to show the presence of Barrbody in human female blood cells/cheek cells.
4. To study the Mendelian laws and gene interactions.
4. Linkage maps based on data from *Drosophila* crosses.
5. Study of human karyotype (normal and abnormal).
6. Pedigree analysis of some human inherited traits.

B.Sc. 5thSemester

ZOO-Major

Course Title : Animal Physiology And Endocrinology

Course Code : MAJ-ZOO-5.1

Nature of Course : MAJOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

THEORY

CREDITS-3

Unit 1: Physiology of Digestion

6

Structural organization and functions of gastrointestinal tract and associated glands; Mechanical and chemical digestion of food; Hormonal control of secretion of enzymes in Gastrointestinal tract.

Unit 2: Physiology of Respiration

6

Mechanism of respiration, pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood; Dissociation curves and the factors influencing it;

Unit 3: Renal Physiology

6

Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; counter current mechanism.

Unit 4: Physiology of Heart

8

Structure of mammalian heart; Origin and conduction of cardiac impulses. Cardiac cycle; Cardiac output and its regulation, nervous and chemical regulation of heart rate. Electrocardiogram, Blood pressure and its regulation

Unit 5: Nervous System

6

Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; Types of synapse, Synaptic transmission and, Neuromuscular junction; Reflex action and its types - reflex arc. Physiology of eye.

Unit 6: Muscle 6
Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; summation and tetanus

Unit 7: Introduction to Endocrinology 4

History of endocrinology, Classification, Characteristic and Transport of Hormones, Neuro secretions and Neuro hormones

Unit 8 : Epiphysis, Hypothalamo-hypophysial Axis 6

Structure of pineal gland, Secretions and their functions in biological rhythms and reproduction. Structure of hypothalamus, Structure of pituitary gland, Hormones and their functions, Hypothalamo- hypophysial portal system, Disorders of pituitary gland.

Unit 9:Peripheral Endocrine Glands 6

Structure, Hormones, Functions and Regulation of Thyroid gland, Parathyroid, Adrenal, Pancreas, Ovary and Testis Hormones in homeostasis, Disorders of endocrine glands

Unit10: Regulation of Hormone Action 6

Hormone action at Cellular level: Hormone receptors, transduction and regulation Hormone action at Molecular level: Molecular mediators, Genetic control of hormone action

ANIMAL PHYSIOLOGY AND ENDOCRINOLOGY

PRACTICALS

CREDITS 1

1. Determination of ABO Blood group
2. Enumeration of red blood cells and white blood cells using haemocytometer
3. Estimation of haemoglobin using Sahli's haemoglobinometer
4. Preparation of haemin crystals
5. Recording of blood pressure using a sphygmomanometer
6. Identification of Nervecell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid through permanent slides.
5. Dissect and display of Endocrine glands in laboratory bred rat.

B.Sc. 5thSemester

ZOO-Major

Course Title : Fundamentals Of Biochemistry And Metabolic Processes

Course Code : MAJ-ZOO-5.2

Nature of Course : MAJOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

THEORY

CREDITS 3

Unit1: Carbohydrates

6

Structure and Biological importance: Monosaccharides, Disaccharides. Polysaccharides and Glycoconjugates

Unit2: Lipids

5

Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Triacylglycerols, Phospholipids, Glycolipids.

Unit3: Protein

10

Amino acids: Structure, Classification and General properties of amino acids; Physiological importance of essential and non-essential amino acids. Proteins: Bonds stabilizing protein structure; Levels of organization in proteins; Denaturation; Introduction to simple and conjugate proteins

Unit4: Enzymes

8

Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of K_m and V_{max} , Lineweaver- Burk plot;; Regulation of enzyme action

Unit 5: Overview of Metabolism

4

Catabolism vs Anabolism, Stages of catabolism, Compartmentalization of metabolic pathways,; ATP as "Energy Currency of cell"; coupled reactions; Use of reducing equivalents and cofactors.

Unit 6:Carbohydrate Metabolism	8
Sequence of reactions and regulation of glycolysis, Citric acid cycle, Phosphate pentose pathway, Gluconeogenesis, Glycogenolysis and Glycogenesis	
Unit 7:Lipid Metabolism	6
β -oxidation and omega-oxidation of saturated fatty acids with even and odd number of carbon atoms; Biosynthesis of palmitic acid; Ketogenesis	
Unit 8: Protein Metabolism	8
Catabolism of amino acids: Transamination, Deamination, Urea cycle; Fate of C-skeleton of Glucogenic and Ketogenic amino acids	
Unit 9:Oxidative Phosphorylation	5
Redox systems; Review of mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System	

FUNDAMENTALS OF BIOCHEMISTRY AND METABOLIC PROCESS

PRACTICALS

(CREDITS 1)

1. Qualitative tests of functional groups in carbohydrates, proteins and lipids.
2. Paper chromatography of amino acids.
3. Action of salivary amylase under optimum conditions.
4. Effect of pH, temperature on the action of salivary amylase.
5. Demonstration of proteins separation by SDS-PAGE.
6. Estimation of total protein in given solutions by Lowry's method.
7. Detection of SGOT and SGPT in serum/tissue
8. To study the enzymatic activity of Salivary amylase, Trypsin and Lipase
9. To perform the Acid and Alkaline phosphatase assay from serum/tissue.

B.Sc. 5thSemester

ZOO-Major

Course Title : Entomology And Fishery

Course Code : MAJ-ZOO-5.3

Nature of Course : MAJOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

THEORY

(Credits 3)

Unit I: Introduction

2

General Features of Insects Distribution and Success of Insects on the Earth

Unit II: Insect Taxonomy

4

Basis of insect classification; Classification of insects up to orders

Unit III: General Morphology of Insects

6

External Features; Head – Eyes, Types of antennae, Mouth parts.

Unit IV: Physiology of Insects

8

Structure and physiology of Insect body systems - digestive, circulatory, respiratory,

Unit V: Insect Society

6

Social organization and social behavior of insects (w.r.t. any one example)

Unit VI: Insects as Vectors

6

Insects as mechanical and Biological vectors. Houseflies and mosquitoes as important insect vectors

Unit VII Introduction and classification:

4

General description of fish. Classification of Fishes upto class. Habit and Habitat Fins: Their Origin and Evolution, Locomotion in Fishes.

Unit VII: Morphology and Physiology:

10

Types of fins and their modifications, locomotion in fishes, hydrodynamics, types of scales. Gills and gas exchange, Swim bladder: their role in respiration. Osmoregulation in fresh water and marine fishes. Migration in fishes.

Unit VIII: Fisheries:

8

Inland fisheries, marine fisheries. Fishing crafts and gears. Application of remote sensing and GIS in fisheries.

Unit IX: Aquaculture:

6

Sustainable aquaculture, Composite fish culture, Brood stock management. Induced breeding of fish.

ENTOMOLOGY AND FISHERY

PRACTICAL

(CREDITS 1)

1. Study of one specimen from each insect order
2. Study of different kinds of antennae, legs and mouth parts of insects
3. Study of head and sclerites of any one insect
4. Study of insect wings and their venation.
5. Methodology of collection, preservation and identification of insects.
6. Study of any three insect pests and their damages
7. Study of any three beneficial insects and their products
8. Morphometric characteristics of fishes.
9. Study of different types of scales through permanent slides.
10. Study of craft and gears used in fisheries.

B.Sc. 5thSemester

ZOO-Major

Course Title : Immunology And Histology

Course Code : MAJ-ZOO-5.4

Nature of Course : MAJOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

Theory **credits 3**

Unit-1 12

Introduction and Historical Background: Cells and Organs of Immune System

Definition, Overview of Immune System- Anatomical, Physiological and Inflammatory Barriers. Hematopoiesis - Formation of B-Lymphocytes and T-Lymphocytes. Cells of the Immune System- NK Cells, B-Lymphocytes, T-Lymphocytes, Granulocytic Cells, Dendritic Cells Primary Lymphoid Organs and their Functional Role- Bone Marrow and Thymus. Secondary Lymphoid Organs and Its Functional Role- Lymph Nodes. Spleen, Mucosal-Associated Lymphoid Tissue (MALT), Intraepithelial Lymphocytes [IEL]. Cutaneous-Associated Lymphoid Tissue [CALT]

Unit-II 12

Antigen and Immunogen, Structure and Function of Immunoglobulins, Structure and Function of MHC:Antigen- Definition and Its Properties; Immunogen-Definition and Its Properties. Antigenicity Vs. Immunogenicity and Factors Affecting It. Haptens and Adjuvants. Basic Structure of Immunoglobulin. Classes of Immunoglobulin and Its Biological Activities. Major Histocompatibility Complex [MHC] Structure.

Unit – III 10

Primary and Secondary Line of Defence (Innate and Acquired Immunity). Antigen-Antibody Interactions: Innate Immunity-Phagocytic Barriers. Antigen Presenting Cells: Antigen Processing and Presentation.

Acquired Immunity- B-Cell Mediated Immunity, T-Cell Mediated Immunity. Its Mechanism and Regulation, Immune Memory of B-Lymphocytes. Interaction of Antigen-Antibody.

Unit-IV

8

Immune Effector Mechanism, Allergy and Hypersensitivity and their types.

Unit 1: Tissues

10

Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue

Unit 2: Bone and Cartilage

8

Structure and types of bones and cartilages, Ossification, bone growth and resorption

IMMUNOLOGY AND HISTOLOGY

PRACTICAL

(Credits 1)

1. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cells
2. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, nerve cells, intestines, stomach, kidney, liver, testes and ovary.
3. Study of blood group.
4. Demonstration of ELISA
5. Study of agglutination reaction.
6. Demonstration of antigen- antibody reaction.

B.Sc. 5th Semester

ZOO-MINOR

Course Title : Molecular Biology And Evolution

Course Code : MIN-ZOO-5.1

Nature of Course : MINOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

THERORY

CREDITS-3

Unit 1: Nucleic Acids

4

Salient features of DNA and RNA Watson and Crick model of DNA

Unit 2:DNA Replication

6

DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Semi-conservative,

Unit3: Transcription

6

RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes, synthesis of rRNA and mRNA, transcription factors

Unit4: Translation

9

Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of protein synthesis in prokaryotes: Ribosome structure and assembly in prokaryotes, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptide chain; Inhibitors of protein synthesis; Difference between prokaryotic and eukaryotic translation

Unit 5: Post Transcriptional Modifications and Processing of Eukaryotic RNA

6

Structure of globin mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA

Unit 6: Gene Regulation

6

Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from *lac* operon

Unit 7:

5

Life's Beginnings: Origin of photosynthesis, Evolution of eukaryotes.

Historical review of evolutionary concept: Lamarckism, Darwinism, Neo-Darwinism

Unit8:

10

Evidences of Evolution: Fossil record: types of fossils, transitional forms, geological time scale, Population genetics: Hardy-Weinberg Law (statement and derivation of equation, application of law to human Population); Evolutionary forces upsetting H-W equilibrium;

Unit9:

8

Product of evolution: Micro evolutionary changes (inter-population variations, clines, races, Species concept. Modes of speciation—allopatric, sympatric, Adaptive radiation / macroevolution (exemplified by Galapagos finches).

MOLECULAR BIOLOGY AND EVOLUTION

PRACTICALS

(Credits 1)

1. Study of Polytene chromosomes from Chironomous / Drosophilalarvae
2. Preparation of liquid culture medium(LB)andraisecultureof*E.coli*
3. Quantitative estimation DNA using colorimeter (Diphenylamine reagent)
4. Study and interpretation of electron micrographs/ photographshowing
 - (a) DNA replication
 - (b) Transcription
 - (c) Splitgenes
5. Study of fossils from models/pictures
6. Study of homology and analogy from suitable specimens
7. Study and verification of Hardy-Weinberg Law by chi square analysis

B.Sc. 6thSemester

ZOO-Major

Course Title : Molecular Biology And Bioinformatics

Course Code : MAJ-ZOO-6.1

Nature of Course : MAJOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

THERORY

CREDITS-3

Unit 1: Nucleic Acids

4

Salient features of DNA and RNA Watson and Crick model of DNA

Unit 2:DNA Replication

8

DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Semi-conservative, bidirectional and semi-discontinuous replication, RNA priming, Replication of circular and linear *ds*-DNA,

Unit3: Transcription

8

RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors

Unit4: Translation

8

Geneticcode,DegeneracyofthegeneticcodeandWobbleHypothesis; Processof protein synthesis in prokaryotes: Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyltRNAsynthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptidechain;Inhibitorsofproteinsynthesis; Difference between prokaryotic and eukaryotic translation

Unit 5: Post Transcriptional Modifications and Processing of Eukaryotic RNA

6

Structure of globin mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA

Unit 6: Gene Regulation

8

Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from *lac* operon and *trp* operon; Transcription : regulation in eukaryotes.

Unit 7: DNA repair mechanism **3**

Pyrimidine dimerization and mismatch repair

Unit 8: Regulatory RNAs **3**

RNA interference, miRNA, siRNA

Unit9: introduction to bioinformatics: **6**

Aims and scopes of bioinformatics. Theoretical aspect of sequence analysis. Needleman- Wunch and Smith – Waterman methods of global and local alignment for a pair of sequences.

Unit 10: Molecular phylogeny and evolution. **6**

Properties and types of phylogenetic trees, tree building methods. UPGMA, Neighbour joining.

MOLECULAR BIOLOGY PRACTICAL

(CREDITS 1)

1. Study of Polytene chromosomes from Chironomous / *Drosophilalarvae*
2. Preparation of liquid culture medium(LB)and raise culture of *E. coli*
3. Estimation of the growth kinetics of *E. coli* by turbidity method
4. Quantitative estimation DNA using colorimeter (Diphenylamine reagent)
5. Quantitative estimation of RNA using Orcinol reaction
6. Study and interpretation of electron micrographs/ photograph showing
 - (a) DNA replication
 - (b) Transcription
 - (c) Split genes
7. Construction of phylogenetic tree by UPGMA

B.Sc. 6thSemester

ZOO-Major

Course Title : Wildlife Conservation And Animal Behaviour

Course Code : MAJ-ZOO-6.2

Nature of Course : MAJOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

THEORY

(CREDITS 3)

Unit 1: Introduction to Wild Life

4

Values of wildlife-positive and negative; Conservation ethics; Importance of conservation; Causes of depletion; World conservation strategies.

Unit 2: Evaluation and management of wild life

8

Habitat analysis, Physical parameters: Topography, Geology, Soil and water; Biological Parameters: food, cover, forage, browse and cover estimation; Standard evaluation procedure: remote sensing and GIS.

Unit 3: Management of habitats

8

Setting back succession; Grazing logging; Mechanical treatment; Advancing the successional process; Cover construction; Preservation of general genetic diversity; Restoration of degraded habitats

Unit 4: Population estimation

8

Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation; Faecal analysis of ungulates and carnivores: Faecal samples, slide preparation, Hair identification, Pug marks and census method.

Unit 5: Management of excess population and Protected areas

8

Bio-telemetry; Care of injured and diseased animal; Quarantine; Common diseases of wild animal. National parks & sanctuaries, Community reserve; important features of protected areas in India

Unit 6: Patterns of behaviour.

12

Stereotype innate behaviour: Kinases, Taxes and Reflexes. Concepts of (i) Fixed action patterns (ii) Sign or key stimulus or releasers and (iii) Innate releasing mechanism, Instinctive behaviour. Learned behaviour: Habituation, Conditioned reflexes. Selective learning. Insight learning. Imprinting. Song learning in birds. Hormonal control of Behaviour

Unit: 7 Communication

12

Chemical, Visual, Auditory, Electric and tactile, Dance language of honey bees. Biological clocks. Bird migration with particular reference to the mechanisms of navigation. Introduction to Socio-biology: Social structure in primates

WILDLIFE CONSERVATION AND ANIMAL BEHAVIOUR

PRACTICALS

(CREDITS 1)

1. Identification of flora, mammalian fauna, avian fauna, herpeto-fauna
2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses)
3. Familiarization and study of animal evidences in the field; Identification of animals through pugmarks, hoofmarks, scats, pellet groups, nest, antlers etc.
4. Demonstration of different field techniques for flora and fauna
5. PCQ, Tentree method, Circular, Square & rectangular plots, Parker's 2 Step and dot her methods for ground cover assessment, Tree canopy cover assessment, Shrub cover assessment.
6. Trail/transect monitoring for abundance and diversity estimation of mammals and bird (direct and indirect evidences)
7. Activity budgeting of bird/ mammal
8. Effect of toxicant on opercular movement and surfacing in fish.
9. Effect of toxicant on movement of fish.

B.Sc. 6thSemester

ZOO-Major

Course Title : Reproductive And Developmental Biology

Course Code : MAJ-ZOO-6.3

Nature of Course : MAJOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

THEORY

(CREDITS 3)

Unit 1: Reproductive System

6

Histology of testis and ovary; Physiology of male and female reproductive system; Puberty.Menstrual cycle.

Unit 2:Gametogenesis

8

Spermatogenesis, Oogenesis; hormonal control of gametogenesis.Types of eggs, Egg membranes; Fertilization (External and Internal): Changes in gametes, Blocks to polyspermy;

Unit1: Historical perspective and basic concepts

4

: Phases of development, Cell-Cell interaction, Pattern formation, Differentiation and growth, Differentialgene expression, Cytoplasmic determinants and asymmetric cell division

Unit 2: Early Embryonic Development

14

Planes and patterns of cleavage; Types of Blastula; Fate maps (including Techniques); Early development of frog and chick up to gastrulation; Embryonic induction and organizers

Unit 3: Late Embryonic Development

8

Fate of Germ Layers; Extra-embryonic membranes in birds; Implantation of embryo in humans, Placenta (Structure,types and functions of placenta). Parturition in human.

Unit 4: PostEmbryonicDevelopment

12

Metamorphosis: Changes, hormonal regulations in amphibians and insects; Regeneration: Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (with one example each); Ageing: Concepts and Theories

Unit 5: Implications of Developmental Biology

8

Teratogenesis: Teratogenic agents and their effects on embryonic development; *In vitro* fertilization, Stem cell (ESC), Amniocentesis

REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY

PRACTICALS

(CREDITS 1)

1. Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages, blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gill stages)
2. Study of whole mounts of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and Hamburger stages)
3. Study of the developmental stages and life cycle of *Drosophila* from stock culture
4. Study of different sections of placenta (photomicrograph/slides)
5. Project report on *Drosophila* culture/chick embryodevelopment
6. Preparation of histological slides from testis and ovary of insect.
7. Preparation of whole mount of chick embryo of different stages.

B.Sc. 6thSemester

ZOO-Major

Course Title : Animal Biotechnology And Instrumentation

Course Code : MAJ-ZOO-6.4

Nature of Course : MAJOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

THEORY

CREDIT-3

Unit 1. Introduction

4

Concept and scope of biotechnology

Unit 2. Molecular Techniques in Gene manipulation

12

Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage, M13, BAC, YAC, MAC and Expression vectors (characteristics). Restriction enzymes: Nomenclature, detailed study of Type II. Transformation techniques: Calcium chloride method and electroporation. Construction of genomic and cDNA libraries and screening by colony and plaque hybridization Southern, Northern and Western blotting DNA sequencing: Sanger method. Polymerase Chain Reaction, DNA Finger Printing

Unit 3. Genetically Modified Organisms

10

Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection. Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knock out mice. Production of transgenic plants: *Agrobacterium* mediated transformation. Applications of transgenic plants: insect and herbicide resistant plants.

Unit 4. Culture Techniques and Applications

8

Animal cell culture, expressing cloned genes in mammalian cells, Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anemia) Recombinant DNA in medicines: Recombinant insulin and human growth hormone, Gene therapy

Unit 5:

6

Microscopy: Principles and applications of phase contrast, Fluorescence and confocal Microscopy.

Unit 6:

5

Principles and application of tracer techniques- autoradiography and radio immunoassay.

Unit 7:	5
Immunological techniques: Immunodiffusion, Immuno-electrophoresis, Enzyme linked Immuno-absorbant assay (ELISA).	
Unit 8:	5
Centrifugation: Density gradient and unit gravity centrifugation, tissue processing and Separation of various sub-cellular organelles by centrifugation	
Unit 9:	5
Molecular separation Techniques: Ion-Exchange, Absorption, partition, gel filtration and affinity chromatography, and HPLC.	

**ANIMAL BIOTECHNOLOGY
PRACTICAL**

(Credits 1)

1. Genomic DNA isolation from *E.coli*
2. Plasmid DNA isolation (pUC 18/19) from *E.coli*
3. Restriction digestion of plasmid DNA.
4. Construction of circular and linear restriction map from the data provided.
5. Calculation of transformation efficiency from the data provided..
6. To study following techniques through photographs
 - a. Southern Blotting
 - b. Northern Blotting
 - c. Western Blotting
 - d. DNA Sequencing (Sanger's Method)
 - e. PCR
7. Separation of biomolecules by centrifugation.
8. Separation of amino acids by paper and thin layer chromatography.

B.Sc. 6thSemester

ZOO-MINOR

Course Title : Fundamental Of Biochemistry And Instrumentation

Course Code : MINOR-ZOO-6.1

Nature of Course : MINOR

Total Credits : 4

Distribution of Marks :60(Theory) + 25 (Practical)+15(Internal Assessment)

THEORY

CREDIT- 3

Unit1: Carbohydrates

7

Structure and Biological importance: Monosaccharides, Disaccharides. Polysaccharides and Glycoconjugates

Unit2: Lipids

6

Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Triacylglycerols, Phospholipids,

Unit3: Protein

10

Amino acids: Structure, Classification and General properties of amino acids; Physiological importance of essential and non-essential amino acids. Proteins: Bonds stabilizing protein structure; Levels of organization in proteins;

Unit4: Enzymes

10

Nomenclature and classification; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of K_m and V_{max} ,

Unit 5:

8

Microscopy: Principles and applications of phase contrast, Fluorescence and confocal Microscopy.

Unit 7:

6

Immunological techniques: Immunodiffusion, Immunoelectrophoresis, Enzyme linked Immuno-absorbant assay (ELISA).

Unit 8:

7

Centrifugation: Density gradient and unit gravity centrifugation, tissue processing and Separation of various sub-cellular organelles by centrifugation

Unit 9:

6

Molecular separation Techniques: Ion-Exchange, Absorption, gel filtration and affinity chromatography, and HPLC.

FUNDAMENTAL OF BIOCHEMISTRY AND INSTRUMENTATION

PRACTICAL

CREDIT 1

1. Qualitative tests of functional groups in carbohydrates, proteins and lipids.
2. Paper chromatography of amino acids.
3. Action of salivary amylase under optimum conditions.
4. Separation of biomolecules by centrifugation.