Bhupal Nobles` University, Udaipur

Faculty Of Science

Department Of Zoology

Scheme Of Studies

M.Sc. I Semester

2016-2017

S. No.	PAPER	NOMENCLATURE	COURSE CODE	UNIVERSITY EXAM	INTERNAL ASSISMENT	MAX. MARKS
1.	Paper I	BIOSYSTEMATICS & EVOLUTION (CORE)	ZOOL- 611	70	30	100
2.	Paper II	STRUCTURE & FUNCTION OF INVERTEBRATES (CORE)	ZOOL-612	70	30	100
3.	Paper III	VERTEBRATE PHYSIOLOGY I (CORE)	ZOOL-613	70	30	100
4.	Paper IV	ECOLOGY AND ANIMAL BEHAVIOR (CORE)	ZOOL-614	70	30	100
5.	Practical	VERTEBRATE PHYSIOLOGY & ECOLOGY	ZOOL-615	70	30	100

The marks distribution of internal Examination-

1. **Mid Term Examination – 15 marks**
2. **Attendance & Presentation/ Assignment= 15 marks**

PAPER I
BIOSYSTEMATICS & EVOLUTION
PAPER CODE- (ZOOL 611)

UNIT I

- Biosystematics
  - Definition
  - Importance of Biosystematics
  - Applications of Biosystematics in Biology

- Neotaxonomy – Consequences of New Systematic
  - Chemotaxonomy -
    - Kinds
      - Immunological Approach
      - Chromatographic Approach
      - Histo-chemical Approach
- Cytotaxonomy –
    - Chromosomal behaviour
    - Karyotype test
    - Chromosome number
    - Chromosome morphology
    - Linkage, recombination , frequency analysis
  - Banding pattern – G,C,R,Q Banding

- Molecular Taxonomy
    - Source of variation, satellite DNA (Mini and micro DNA)
    - Molecular markers –RFLP, RAPD, and AFLP
    - Ribotyping and DNA sequencing

UNIT II

- Taxonomic Procedure -
  - Collection -
    - Value of Collection
    - Purpose of Scientific Collection
    - Collecting & Research
    - Scope of Collection
    - Where & How to Collect
    - Content of Collection
  - Preservation -
    - Formalin Preservation
    - Preservation in Alcohol

  - Curating -
    - Preparation of Material for Study
    - Housing
    - Cataloging
    - Arrangement of Collection
    - Curating of types
    - Exchange of Material
    - Expendable Material

- Taxonomic Keys - Types
  - Indented Key
  - Bracket Key
  - Ground Types

- Pictorial Type
- Branching Type
- Circular Type
- Box Type

UNIT III

- International code of Zoological nomenclature
    - Principles -
        - Principle of Binominal Nomenclature
        - Principle of Priority
        - Principle of Coordination
        - Principle of the First Reviser
        - Principle of Homonymy
        - Principle of Typification
    - Structure
    - Gender agreement
    - Commission

- Species Indices -
    - Shannon – Weiner Index
    - Dominance Index
    - Similarity & Dissimilarity
    - Association Index

UNIT IV

- Modern Theory of Evolution
    - Lamarcks Theory and Neo Lamakism
    - Theory of Catastrophism
    - Theory of Darwin and Neo Darwinism
    - Weismann's Theory
    - Modern Synthetic Theory

- Isolation & Isolating Mechanism
    - Definition
    - Pre-mating Mechanism -
        - Geographic isolation
        - Isolation due to distance
        - Climatic isolation
        - Seasonal isolation
        - Habitat isolation
        - Ethological isolation
        - Mechanical isolation
        - Physiological isolation
    - Post-mating Isolation –
        - Gametic Mortality
        - Zygotic Mortality
        - Hybrid Inviability
        - Hybrid Sterility
    - Origin of Reproductive Isolation-

- Muller's view
- Dobzhansky's View

- Speciation -
  - Modes of Speciation
    - Phyletic Speciation
    - Quantum Speciation
    - Gradual Speciation
- Evolution of Man –
  - Pre human ancestors
  - Evolution of man in Pleistocene

UNIT – V

- Mutation Pressure
- Variation –
  - Kinds of Variation-
    - Meristic & substantive
    - Continuous & Discontinuous
    - Determinate & Indeterminate
    - Somatic & Germinal
  - Sources of Variation
  - Basis of Variation –
    - Chromosomal Aberration
    - Variations in chromosome number
- Natural Selection –
  - Types –
    - Stabilizing selection
    - Directional Selection
    - Disruptive Selection
  - Selection Pressure
- Genetic Drift –
    - Theory of genetic Drift
    - Salient Features of Genetic Drift
    - Genetic basis of Random Genetic Drift
    - Hardy-Weinberg equilibrium & Genetic Drift
- Mimicry –
  - Kinds –
    - Protective
    - Aggressive
    - Conscious
  - Significance of Mimicry

PAPER II
STRUCTURE & FUNCTION OF INVERTEBRATES
PAPER CODE – ZOOL 612

Unit I

- Organization Of Coelom
  - Evolution of Coelom (Various Theories)
  - Modification of Coelom
  - Significance of Coelom
- Acoelomate
- Pseudocoelomate
- True Coelomate
- Metamerism – Types, Origin and Evolution
- Difference between Protostomia and Deuterostomia

Unit II

- Nutrition, Feeding, Structure and physiology of Digestion
  - Protozoa
  - Platyhelminthes (Class Turbillaria)
  - Annelida (Class Polychaeta)
  - Arthropoda (Class Insecta and Crustacea)
  - Mollusca (Class Cephalopoda)
  - Echinodermata

Unit III

- Different types of Respiratory organs in Invertebrates- their structure and functions
  - Gills
  - Lungs
  - Trachea
- Respiratory Pigments (Specific to invertebrates only)

Unit IV

- Different types of Excretory organs in Invertebrates- their structure and functions
  - Nephridia
  - Malphigian Tubules

  Brief idea about accessory excretory organs
  - Coaxial Glands
  - Kebers Organ
  - Bojanus Organ
- Mechanism of Excretion

Unit V

- Nervous System
  - Primitive Nervous System – Echinodermata
  - Advanced Nervous System –
    - Annelida (Class Oligochaeta)
    - Arthropoda (Class Insecta)
    - Mollusca (Class Cephalopoda)

PAPER III
VERTEBRATE PHYSIOLOGY I
PAPER CODE – ZOOL 613

Unit I

- Digestion:
  - Digestive glands and alimentary canal
  - Digestive enzymes and their secretion
  - Digestion of Protein, Fat and Carbohydrate
- Vitamins-
  - Types
  - Sources
  - Physiological Functions
  - Diseases Caused By Deficiency

Unit II

- Respiration
- Respiratory Organs Structure – Structure of lungs
- Mechanism of Breathing-
  - Inspiration
  - Expiration
- Exchange and Transport of Gasses-
  - Oxygen dissociation curve
- Regulation of Breathing
- Respiratory Pigments- Haemoglobin structure

Unit III

- Blood
  - Composition
  - Function of Blood & Lymph
  - Blood Clotting – Factor theory
  - Heart beat Origin and Conduction
  - Cardiac Cycle
  - E.C.G
  - Blood Pressure
  - Anemia

Unit IV

- Excretion-
  - Structure of Kidney and Nephron
  - Mechanism of Urine Formation and Elimination-
    - Ultra filtration
    - Selective Absorption
    - Tubular Secretion.
  - Counter Current Multiplier Hypothesis
  - Urea Cycle.

Unit V

- Muscles-
  - Types
  - Ultra structure
  - Muscle Proteins-
    - Actin
    - Myosin
    - Tropomyosin
    - Troponin
  - Physiology of Muscle Contraction – Sliding filament theory, Cori Cycle,
  - Muscle Properties-
    - Muscle twitch

- Summation
- Tetanus
- Isometric and Isotonic contraction
- Muscle fatigue

PAPER IV
ECOLOGY AND ANIMAL BEHAVIOR
PAPER CODE- ZOOL 614

UNIT I

- Ecological Energetics
    - Concept of energy
    - Laws governing energy transformation
    - Energy flow in ecosystem
    - Energy flow models
- Theories of limiting similarity
- Community
    - Introduction
    - Classification
    - Characteristics
- Concept of Niche
- Succession
    - Types
    - Process
    - Patterns
    - Climax concept
    - Models of succession

Unit II

- Secondary Productivity
    - Characteristics of Secondary Production in a Ecosystem
    - Methods of estimating secondary production
        - Increment summation
        - Removal summation,
        - The instantaneous growth method
        - The Allen curve method
- Predation
    - Models of predatory dynamics
    - Optimal foraging theory
        - Patch choice
        - Diet choice
        - Prey selectivity
        - Foraging time
    - Role of predation in nature

Unit III

- Demography of Population
    - Structure and patterns of population
    - Life tables and its Statistical analysis
    - Generation time ,net reproductive rate
- Population growth
    - Growth of organisms with non-overlapping and overlapping population
    - Population growth model –Verhulst- Pearl Logistic Model

Unit IV

Animal behavior

- Innate behavior- Types
    - Taxis
    - Kinesis
    - Reflexes
    - Fixed action pattern (Instinct)
    - Motivation and its different phases

- Learned behavior- Types
    - Habituation
    - Conditioned reflexes
    - Trail & error
    - Latent learning
    - Insight learning
    - Reasoning
    - Imprinting
- Rhythmic behaviour and Biological clocks

Unit V

- Role of hormones in Behavior
- Role of pheromones in behavior
- Communication in animals
- Social behavior and organization in
    - Insects
    - Fishes
    - Birds
    - Mammals (Primates)

ZOOLOGY PRACTICAL
INVERTEBRATES, PHYSIOLOGY & ECOLOGY
PAPER CODE – ZOOL 615

A. Dissections - *Sepia* – Nervous system, Crab - Nervous system, *Aplysia* – Nervous system, *Echinus*- Aristotle Lantern
B. Microscopic preparation- Gemmules, Hastate plate, Statocyst T.S, Radula, L.S Ospharidium, gills, *Nereis* Parapodium
C. Identification and Systematic position up to order of following Museum specimens-
Protozoa- *Paramecium, Noctiluca, Opalina, Balantidium, Nyctotherus, Vorticella*.
Porifera- *Sycon, Hyalonema, Euplectella, Euspongia*
Coelentrata- *Physalia, Porpita, Corallium, Gorgonia, Pennatula*.
Platyhelminthes- *Fasciola, Taenia, Schistosoma*
Aschelmenthes- *Ascaris, Dracunculus, Wucheria.*
Annelida- *Nereis and Hetronereis* Phase, *Aphrodite, Hirudinaria.*
Arthropoda- *Limulus, Palaemon, Apus, Lepas, Balanus, Sacculina, Schistocerca, Papilio, Bombyx, Apis, Julus, Scolopendra*.
Mollusca- *Chiton, Mytilus, Ostrea, Teredo, Nautilus, Octopus*
Echinodermata- *Pentaceros, Holothuria, Antedon*.
D. Study of prepared slides- T.S *Sycon*, Ephyra Larva, Mature and Gravid Proglottid of *Taenia*, Developmental stages of *Fasciola* (Miracidium, Sporocyst, Radia, Cercaria, Metcercaria), Arthropoda Larval forms- Nauplius, Zoea, Megalopa, Mysis. Mollusca - Glochidium Larva, Echinodermata- Pedicillariae
E. Physiology/ecology experiment
    1. Preparation of Haemin crystals
    2. Estimation of Packed Cell Volume (PCV)
    3. Estimation of Haemoglobin in blood sample
    4. Identification of Blood Groups
    5. Estimation of Soil Moisture
    6. Estimation of Water holding capacity of different soil.
    7. Recording of Rainfall, Humidity and Air Pressure
    8. To determine the minimum size of the quadrant by species area curve method.
    9. To determine the minimum no of quadrant to be laid down in the field under study.
    10. To study the community by quadrant method by determining frequency, density and abundance of different species present in community.

Distribution of marks	**Marks allotted Time duration 6 hrs**
1. Dissection –	16
2. Microscopic preparation –	12
3. Spots – (8 x 3)	24
4. Physiology / Ecology experiment-	18
5. Year work/ practical record – (CIA)	10
6. Seminar – (CIA)	10
7. Viva voice -	10
Total	100

Suggested Readings

1. Principles Of Animal Taxonomy – G.G Simpson- Oxford Nd Ibh Publication
2. Elements Of Taxonomy – E. Mayer – Tata Mcgraw Hill Co
3. Biosystematics And Taxonomy – R.C. Tripathi- University Book House
4. Biodiversity, Taxonomy And Ecology – G K Singh- Alp Books
5. Theory And Practices Of Animal Taxonomy- VC Kapoor – Oxford And Ibh Co
6. Fundamentals Of Biodiversity And Taxonomy (HB) – J.Juneja- Cubertech Publications
7. The Invertebrates- Vol I- VI –L.H Hyman – Mcgraw Hill Co
8. The Invertebrate Structure And Function – E.J.W Barrington- Thomas Nelson And Sons

9. Invertebrate Zoology – Rc Barnes- W.B Saunders And Co, Phillidelphia
10. Text Book Of Zoology By T.J Parker And W.A Haswell- Vol I – Mcmillan And Co, London
11. Biology Of Invertebrates – Pechenik – McGraw Hill Higher Education (Hb)
12. General And Comparative Animal Physiology- Ws Hoar – Prientice Hall Of India
13. Animal Physiology: Adaptation And Environment – Knet Schemdt Nelson – Cambridge University Press
14. Animal Physiology : Mechanism And Adaptation- R Eckert Randall- Wh Freeman And Co
15. Principles Of Animal Physiology (PB) – Christopher Moyes- Pearson Education
16. Text Book Of Animal Physiology By Sherwood – Cengage Learning India
17. Introduction To Animal Physiology – I Kay- Garland Publishing
18. Animal Physiology By Margaret Brown- Apple Academic
19. Text Book Of Animal Physiology – R. Nagabhushnam, Kodarkar & Sarojini- Oxford IBH Co
20. Animal Behavior – Manning – Cambridge University Press
21. Ecology – Odum- W.B Saunders And Co
22. Environment And Ecology – R. Rajgopalan- Oxford India
23. Elements Of Ecology – Smith – Pearson Education
24. Animal Behavior – Dr Reena Mathur –Rastogi Publications Animal Behavior – Alcock
25. A Text Book Of Animal Behavior – F.B.Manda- Phi Publication
26. Animal Behavior – H.V. Bhaskar – Campus Book International
27. Animal Behavior – V.K Agarwal – S. Chand And Co , India
28. Fundamentals Of Animal Behavior – A Sarkar –Discovery Publishing House

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Faculty Of Science

Department Of Zoology

Scheme Of Studies

M.Sc. II Semester

2016-2017

S. No.	PAPER	NOMENCLATURE	COURSE CODE	UNIVERSITY EXAM	INTERNAL ASSISMENT	MAX. MARKS
1.	Paper I	DEVELOPMENTAL BIOLOGY (CORE)	ZOOL- 621	70	30	100
2.	Paper II	MICROBIOLOGY (CORE)	ZOOL-622	70	30	100
3.	Paper III	VERTEBRATE PHYSIOLOGY II (CORE)	ZOOL-623	70	30	100
4.	Paper IV	QUANTITATIVE BIOLOGY (CORE)	ZOOL-624	70	30	100
5.	Practical	MICROBIOLOGY & BIOSTATISTICS	ZOOL-625	70	30	100
6.	Skill Course	SCIENTIFIC WRITING	ZOOL- 626	70	30	100

The marks distribution of internal Examination-

1. **Mid Term Examination – 15 marks**
2. **Attendance & Presentation/ Assignment= 15 marks**

PAPER I
DEVELOPMENTAL BIOLOGY
PAPER CODE – ZOOL 621

UNIT I:

Origin of germ cells –

Spermatogenesis –

- Formation of spermatid
- Spermiogenesis
- Spermiation
- Structure of mammalian sperm

Oogenesis

- Formation of ova
- Structure of mammalian ova

Types of eggs

- On basis of amount of yolk
- On basis of distribution of yolk

Egg membranes

- Primary egg membranes
- Secondary egg membranes

UNIT II:

Fertilization:

- Biochemical aspect of fertilization
- Penetration and activation of ova,
- Formation of fertilization membrane,

UNIT III:

Early development –

Cleavage

- Characteristics
- Planes and patterns,

Blastulation

Gastrulation

- Prominent physiological features
- Epiboly
- Emboly
- Invagination, ingression, and involution
- Gastrulation in amphioxus, amphibian , and Birds

Fate map

- Mapping techniques

Early embryonic induction and differentiation.

UNIT IV:

Organogenesis of following organs / organ system of mammal

- Eye
- Brain,
- Alimentary canal,
- Kidney
- Gonads

UNIT V:

- Assisted reproductive technologies (ART)-
- IVF – Procedure-
    - Ovarian hyper stimulation
    - Natural and Mild IVF
    - Egg retrieval
    - Fertilization

    - Embryo culture
    - Embryo transfer
    - Complications of the IVF procedure
- ICSI - Procedure
- GIFT
    - Method
    - Indications
    - Success rate
- Cloning in mammals by nucleus transfer techniques.

PAPER II
MICROBIOLOGY
PAPER CODE- ZOOL 622

UNIT - I:

- Historical background of Microbiology:
- Contribution of
    a) Antonie Von Leeuwenhoek,
    b) Lazaro Spallanzani,
    c) Robert Koch,
    d) John Tyndall
    e) Edward Jenner,
    f) Louis Pasteur,
    g) Alexander Fleming,
- Description of Protist, Prokaryotes and Eukaryotes
- Classification of bacteria : Bergeys manual

UNIT - II:

- Bacteria
    1. Gram Positive Bacteria
    2. Gram Negative Bacteria
    3. Gram staining Techniques
- Bacterial Culture- Pure culture (Axenic culture)
- Culture media:
    A. Components of media
    B. Types of media
        1. Natural and synthetic media
        2. Chemically defined media
        3. Complex media
        4. Selective and enrichment media
    C. Handling Method
- Types of Culture Techniques :
    2. Pure culture techniques; Streak plate and spread plate method
    3. Enrichment culture technique: - Rolling tube and Candle jar method

UNIT – III:

Medical Microbiology:

- Pathogenecity, infection, mode of transmission of Coliform bacteria- (*Escherichia coli*, *Salmonella* and *Vibrio cholerae*)
- Causative agents, mode of transmission and control measures of diseases- Amoebiasis , Malaria, AIDS and Viral Hepatitis A&B.
- Microbial control: Physical, chemical and anti microbial (Antiobiotics)

UNIT IV:

- Food Microbiology
    1. Important microbes involved in spoilage of food - meat, poultry, Fish and sea food, vegetables and dairy products ,
    2. Food poisoning
    3. Food preservation- Principal and methods
    4. Milk Microbiology
        - Composition of milk
        - Sources of contamination of milk and types of microbes in milk
        - Pasteurization of milk
        - Milk products: Cheese, butter, and yoghurt
    5. Life cycle of Yeast : *Saccharomyces* and its role in production of various fermented food product- bread ,wine, beer, and vinegar .

Unit V: Environmental Microbiology:

- Role of Microbes in Environment Protection
    - Biodegradation-Cellulose, Pectin, plastics and pesticides
    - Biopesticides -Introduction types (bacterial-*Bacillus thruingiensis*, Viral –NPV, fungal-*Trichoderma*)
    - Biofertilizers-Definition, Types (bacterial, Mycorrhizal -fungal, Plants-*Azolla*); kind of association, mode of application and merits.
    - Bioleaching – Role of microbes in metal and petroleum recovery

PAPER III
VERTEBRATE PHYSIOLOGY II
PAPER CODE- ZOOL 623

UNIT - I:

Endocrine system – I

Location, structure and function and their hormones and diseases caused by deficiency

- Pineal
- Hypothalamus
- Pituitary,
- Thymus,
- Thyroid,
- Parathyroid,
- Pancreas

UNIT- II:

Endocrine system- II

- Location structure and function and their hormones and diseases caused by their deficiency
- Adrenal- cortex and medulla
- Testis
- Ovary
- Mechanism of action of peptide and steroid hormones.

UNIT - III:

Nerve conduction-

- Conduction of nerve impulse – neuronal and synaptic transmission
- Neurotransmitters and their mode of action
- Structure and physiology of eye
- Retinal pigments
- Photoreception
- Photochemistry of vision.

UNIT - IV:

Physiology of reproduction –

- Mammalian reproductive system
  - Structure and function of Male and Female
  - Reproductive cycles
  - Hormonal control

UNIT – V:

- Osmoregulation in different animal groups.
- Thermoregulation
- Bioluminescence
- Chromatophore and colour change

PAPER IV
QUANTITATIVE BIOLOGY
PAPER CODE- ZOOL 624

Unit - I

1. Introduction to biostatistics:
2. Graphical representation of data- Bar, Pie, Histogram, Frequency Polygon, frequency curve
3. Measures of central tendency- Mean, Median and Mode in grouped and ungrouped data.

Unit II:

- Matrix: Types, Addition, Multiplication & Uses
- Vectors: Types, Addition & Multiplication,
- Data analysis: Collection, classification, Tabulation

Unit III:

Measures of dispersion-

1. Range, mean deviation, standard deviation, and variance
2. Concept of Skewness and kurtosis
3. ANOVA.

Unit IV:

Probability theory – Introduction, theorem and distribution patterns

Test of significance

1. Hypothesis testing: Null Hypothesis and alternative hypothesis,
2. Chi square test,
3. Student "t" test,

Unit V:

- Correlation- definition, kinds & measures
- Regression analysis- kinds, Regression analysis X on Y & Y on X, Regression coefficient
- SPSS package and Statistical Analysis Software

ZOOLOGY PRACTICAL
MICROBIOLOGY & BIOSTATISTICS
PAPER CODE – ZOOL 625

A. Physiology experiment

1. Total RBC count
2. Total WBC count
3. DLC (Differential Leucocyte Count)
4. Qualitative test for urea, creatinine and chloride in urine
5. Detection of carbohydrate, protein and lipid in milk
6. Blood sugar estimation
7. Separation of amino acid with paper chromatography & TLC

B. Ecological experiments

1. Water analysis for pH, dissolved oxygen, free carbon dioxide, alkalinity/salinity and hardness.
2. Estimation of conductivity of water sample by conductivity meter
3. Identification, study and permanent preparation of zooplanktons from various water bodies
4. Estimation of productivity of water body using light and dark bottle method.

C. Microbiology Experiments

1. Study of microbes in food material – fish and fish products
2. Bacteriological analysis of potable water
3. Identification of gram positive and gram negative bacteria
4. Brief idea of composition of readymade culture media
5. Preparation of bacterial broth, slants, plating and streaking
6. Preparation of bacterial growth curve of *E.coli,* its confirmation and status reporting.

D. Biostatistics problem

1. To derive mean, median, mode
2. Derivation of standard deviation
3. To determine correlation between two data
4. Application of chi square test
5. Use of computers for analysis of variance (ANOVA)
6. Use of SPSS software package for statistical analysis

E. Microtomy- Microtomy of different organs of Rat- Liver, Lung, Kidney, Intestine, Stomach, Heart, Testis, Ovaries (Submission of 15 Microtomy Slides)

Distribution of marks

	Marks allotted	**Time duration 6 hrs**
1. Physiology experiment	10	
2. Ecological experiment	10	
3. Microbiology experiment-	10	
4. Biostatics problem-	10	
5. Microtomy -	12	
6. Year work/ practical record and Submission of slides – (CIA*)	10 (5+5)	
7. Seminar – (CIA*)	10	
8. Viva voice -	10	
9. Tour report	18	
Total	100	

Suggested Readings

1. Developmental Biology – Scott Gilbert – PB- Palgrave Publication
2. Foundations Of Embryology – Bradley M Patten And Carlson

3. Human Embryology And Developmental Biology – Bruce Carlson – Mosby Publication
4. Introduction To Embryology – B.I Balinsky- Thomson Nelson Publication
5. Developmental Biology – Weiner A Muller- Springer Publication
6. Embryology – Rajendra Kausik – Oxford Book Co
7. Text Book Of Embryology - D.R. Khanna- Discovery Publishing House
8. Microbiology – Jr. Michael Pelezar- Mcgraw Hill Education
9. Essential Microbiology – Stuart Hogg- Pb- John Wiley And Sons
10. Microbiology – An Introduction – Gerard Tortora- Pearson Education
11. Food Microbiology – William Frazier, Dennis Westhoff-Pb- Tatamcgraw Hill Education
12. A Text Book Of Microbiology – R. Ananthnaryan , Ck Jayaram Paniker
13. Text Book Of Microbiology – Naveen Kango- Ik Publishing House
14. Text Book Of Microbiology And Immunology – Sc Parija- Elsevier India
15. Introduction To Food Microbiology- Kamal Duggal- Cybertech Publication
16. Food Microbiology – Sk Sinha, Ashok Kumar Shrma-Hb- Oxford Book Co
17. Fundamentals Of Food Microbiology – Bebek Ray, Arun Bhunia-Hb- Taylor And Francis Group
18. Medical Microbiology – Michael Fraud-Pb- Oxford Univerity Press
19. Essential Of Medical Microbiology- Volkwesely- Lippincott Williams And Wikins Publisher
20. Microbial Taxonomy And Culture Techniques- R P Singh- Kalyani Publisher
21. Introduction To Parasitology – C. Chandler And C.P Read- John Wiley And Sons

PAPER – VI

SKILL DEVELOPMENT

SCIENTIFIC WRITING SKILL

PAPER CODE- ZOOL- 626

Detailed Course Outline

LAB WORK & LECTURE: 30 HRS.

USE OF VIDEO & ONLINE RESOURCES: 20 HRS

ASSIGNMENTS: 60 HRS

SKILL TEST AND PRESENTATIONS: 10 HRS

UNIT I-

Know the language (Basic English course)- Choosing the right word, using a dictionary and thesaurus, basic elements of a sentence, clauses, true sentence, tenses, active and passive verbs, punctuation and parallelism, Paragraphs, logic, and organization. Organizational strategies, art of précis writing Reading material will be given

Assignments:

1. Take a science article and reduce it to 1/10 th length and make a brief abstract.
2. Make a press release for the general masses about a scientific event in your city.

Skill learned: writing proper sentences with clarity and brevity.

UNIT II-

Groundwork for effective scientific writing using web based search engines, authenticating the information, editing in MS office, style analysis programs, data entry and working knowledge of excel, creating tables, figures, graphs, photographs and other documentary illustrations, explanatory artwork, An

introductory idea about use of abode, photoshop and coral making powerpoint presentation, making and refining presentations using advanced presentation features, making a poster, using a library, indexing systems available for various science streams, e-resources, e-journals, INFLIBNET and Sodhganga. Field work: Visit to the library

Assignments:

3. Make a Review of an instrument, technique or Technology
4. Make a Powerpoint presentation on topic of your choice.
5. Make a poster on selected topic.

Skill learned: using e resources and library, making powerpoint presentation and poster

UNIT-III:

Start Writing (Part-I) Introduction-Overview of science writing, how is scientific writing different from general writing, know your audience, writing for general public, science reporting, Science news, explanatory writing, lengthy magazine article, popular articles and popular lectures. Reading material: Popular science magazine articles.

Assignments:

6. Convert the assignment 3 for general public
7. Collect few science news, science magazine article, popular articles on science and read them in class and critically discuss them.
8. Make a report of a practical exercise or a field visit.

Skill learned: science reporting and writing for common masses.

UNIT-IV

Start Writing (Part-II) Writing for scientific community, types of paper (short communication, original research article, review), the various components for each type and the content of each components (title, author affiliation, abstract , keywords, introduction, material and methods, results and discussion, conclusion, references and bibliography, citation. Ethics in writing, plagiarism, plagiarism checker on line.

Publishing work: selection of journal, impact actors, h index, following author guidelines, on line submission, proof reading of a manuscript, understanding the symbols, reviewing of a manuscript, making corrections and answering reviewers query, galey proof reading

Assignments:

9. Write a short communication on the given selected practical exercise in the given selected journal.

10. Peer review the article written by your class mates with proof reading symbols and on line review tool.

Skill learned: writing for scientific community and research journals.

UNIT –V

Start Writing (Part III) Writing research grant proposal, Bookreview, write up mini profiles of prominent scientists, letters to editor, opinion writing,interview of a scientist, career in scientific writing

Assignments :

11. Frame questions for interview of a well known scientist/or on campus scientists

12. Make a small research grant proposal.
13. Write a mini profile of a prominent scientist.

Skill Learned: writing research grant, mini profile and drafting interview.

Bhupal Nobles` University, Udaipur

Faculty Of Science

Department Of Zoology

Scheme Of Studies

M.Sc. III Semester

S. No.	PAPER	NOMENCLATURE	COURSE CODE	UNIVERSITY EXAM	INTERNAL ASSISMENT	MAX. MARKS
1.	PAPER I	CHORDATE BIOLOGY I (CORE)	ZOOL-631	70	30	100
2.	PAPER II	VERTEBRATE IMMUNOLOGY AND ANIMAL CELL CULTURE (CORE)	ZOOL-632	70	30	100
3.	PRECTICAL	VERTEBRATES AND ANIMAL CELL CULTURE	ZOOL-633	70	30	100
4.	PAPER IV	ENVIRONMENTAL BIOLOGY I /(DSE)	ENVBIO-634	70	30	100
5.	PAPER V	ENVIRONMENTAL BIOLOGY II (DSE)	ENVBIO-635	70	30	100
6.	PRACTICAL	ENVIRONMENTAL BIOLOGY	ENVBIO-636	70	30	100
7.	PAPER IV	ENTOMOLOGY-I (INSECT-STRUCTURE & FUNCTION) (DSE)	ENTO-634	70	30	100
8.	PAPER V	ENTOMOLOGY-II (SYSTEMATICS, ECOLOGY AND	ENTO-635	70	30	100

		ECONOMIC ENTOMOLOGY) (DSE)				
9.	PRACTICAL	ENTOMOLOGY	ENTO-636	70	30	100
10.	PAPER IV	WILDLIFE BIOLOGY I: BIODIVERSITY AND WILDLIFE ECOLOGY (DSE)	WILDLIFE-634	70	30	100
11.	PAPER V	WILDLIFE BIOLOGY II: CONSERVATION BIOLOGY (DSE)	WILDLIFE-635	70	30	100
12.	PRACTICAL	WILDLIFE BIOLOGY	WILDLIFE-636	70	30	100
13.	PAPER IV	LIMNOLOGY AND FISHERIES I: LIMNOLOGY (DSE)	LIMNO-634	70	30	100
14.	PAPER V	LIMNOLOGY AND FISHERIES II: FRESH WATER AQUACULTURE (DSE)	LIMNO-635	70	30	100
15.	PRACTICAL	LIMNOLOGY AND FISHERIES	LIMNO-636	70	30	100
16.	PAPER IV	CELL & MOLECULAR BIOLOGY I (DSE)	CELL & MOL-634	70	30	100
17.	PAPER V	CELL & MOLECULAR BIOLOGY II (DSE)	CELL & MOL-635	70	30	100

18.	PRACTICAL	CELL & MOLECULAR BIOLOGY	CELL & MOL-636	70	30	100

The marks distribution of internal Examination-

1. **Mid Term Examination – 15 marks**
2. **Attendance & Presentation/ Assignment= 15 marks**

PAPER I
CHORDATE BIOLOGY I
(CORE SUBJECT)
PAPER CODE – ZOOL 631

Unit: - I Classification of Protochordata and Cyclostomata (up to order), Evolution and affinities of Protochordata, Life history of *Pyrosoma, Doliolum, Salpa*, Evolution and affinities of Cyclostomata.
Unit: - II Origin and Classification of Pisces, Adaptations in Fishes- Deep sea Adaptations, Offensive and Defensive Adaptations, Parental care in Fishes, Accessory Respiratory organs, Migration in Fishes. Sensory organs and lateral line System in Fishes.
Unit:- III Classification, Origin and Adaptive Radiations in Amphibia, Extinct Amphibia (Stegocephalia), Parental care in Amphibia, Neoteny & Paedogenesis.
Unit: - IV Origin and Adaptive Radiations in Reptiles, Extinct reptiles (Dinosaurs), Comparative account of Snakes and Lizards. Temporal regions of Chelonia, Crocodilia and Ophidia. Locomotion in Snakes.
Unit V Poisonous and Non Poisonous Snakes , Poison apparatus and Biting Mechanisms in Snakes, Symptoms of Snakes Bite and First Aid measures, Snakes venom, Antisera and its production.

PAPER II
VERTEBRATE IMMUNOLOGY AND ANIMAL CELL CULTURE
(CORE SUBJECT)
PAPER CODE- ZOOL632

Unit: - I Types of Immunities - Innate, Acquired, Active, Passive. Hematopesis. Cells of Immune system and their differentiation, Organization and structure of Primary and Secondary lymphoid organs.
Unit: - II Antigen and Super antigen, antigenic determinates (Isotypes, Allotypes and idiotypes) , Epitope and haptens , Structure and types of various classes and sub classes of immunoglobulin, Evolution of antibody diversity.
Unit: - III Antigen – antibody interaction- Agglutination, RIA, ELISA and its types- "Indirect" ELISA, Sandwich ELISA, Competitive ELISA, Western blotting, MHC I and II molecules, expression and diversity, compliment system : Classical and alternate pathway, lymphocyte trafficking.
Unit: - IV Regulation of immune response, antigen processing and presentation, Hypersensitivity and its types, Autoimmune disorders (Autoimmunity), Immunodeficiency and AIDS, Hybriodoma technology and production of monoclonal antibodies.
Unit: - V Animal cell culture, equipments needed for cell culture. Culture procedure , Disintegration of tissue and primary cell culture, culture media and nutritional requirement of cell in vitro, types of culture media, evolution and maintenance of cell lines, Cryopreservation.

PRACTICAL
VERTEBRATES AND ANIMAL CELL CULTURE
(BASED ON CORE PAPER)
PAPER CODE – ZOOL 633

A. Dissection
1. *Scoliodon* – Efferent & Afferent System, Cranial nerves, Internal Ear, Brain & Scroll valve
2. *Wallago* - Cranial nerves
3. *Torpedo* - Electric organs

B. Osteology of representative classes- Amphibia, Reptiles,

C. Permanent Slides
1. *Scoliodon* T.S. Gill,
2. *Branchiostoma*- T.S. oralhood, pharynx, gonad, intestine, Caudal region.
3. Histology of various Amphibia organs- Liver, Intestine, Duodenum, Stomach, Spleen, Kidney, Ovary, Testis

D Permanent stain preparation- Placoid, Ampulla of Lorenzini

E. Animal cell culture exercise –
1. Preparation of tissue culture medium
2. Preparation of single cell suspension of spleen / thymus

F. Museum Specimens
1. Hemichordate:-*Balanoglosus*
2. Urochordate:- *Salpa, Doliolum, Oikopleura, Herdmania*
3. Cephalochordate:- *Petromyzon, Myxine*
4. Pisces: *Zygaena, Scoliodon, Pristis, Torpedo, Trygon, Belone, Exocoetus, Anabas, Echeneis*

Distribution of Marks	**Marks allotted**
1. Dissection	20
2. Spots 6 spots x 3	18
3. Preparation / animal cell culture exercise	12
4. Year work / practical record (CIA)	10
5. Seminar (CIA)	10
6. Tour report	20
7. Viva voice	10
Total	100

Suggested readings
(COVERING MSZO311 AND MSZO312)

1. Text book of Zoology Vol-1I Vertebrates – Parker & Haswell (Edited by Marshall &
1. Williams) (ELBS & Macmillion)
2. Vertebrate life- Pough and McFerland
3. Life of Vertebrates . J. Z. Yong
4. Vertebrates : Comparative anatomy, function, Evolution- K. V. Kardong
5. (Tata MaGraw-Hill Edition)
6. Comparative Anatomy of Vertebrates- G.C. Kent & R. Carr
7. The Vertebrate body- Romer & Parsons
8. Biology of Vertebrates- Walter & Sayles
9. Elements of Chordate Anatomy- Weichert
10. Analysis of Vertebrate Structure- Hildebrand
11. Kuby Imuunology – by R.A Goldsby, Thomas. J Kindt, Barbara A. Osborne, W.H Freeman publication
12. Immunobiology by Janeway, Travers, and Walport and Shlomchick, Garland science publication
13. Essential Immunology by Lan M. Roitt, etc Blackwell science publication

14. Fundamentals of Immunology by William Paul, Lippinot Williams and Wilkins publication
15. Understanding immunology –by A.J Cunnigham , Academia press publication
16. Immunology by Benjamini
17. Immunology- an introduction by Ian Tizzard, Sauders college publication
18. Animal cell culture techniques by Martin Clynes
19. Animal Cell Culture *Volume 5 of Methods in Molecular Biology* Jeffrey W. Pollard, John Marsten Walker, Humana Press, 1990
20. Introduction to cell and tissue culture [electronic resource]: theory and technique by Jennie P. Mather, Penelope E. Roberts, Springer, 1998
21. Animal Cell Culture: Concept and Application-Shweta Sharma, Oxford University Press 2012
22. Animal Cell Culture: Concept and Application by Sheelendra Mangal Bhatt, Alpha Science International Ltd
23. Animal cell culture & technology 2e, 2nd Revised Edition by M. Butler, Michael Butler, Mike Butler, CBS Pub. & Distributors Pvt. ltd.
24. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications 6th Edition, by Freshney, R. Ian Freshney, Wiley India Pvt. Ltd
25. Animal cell culture by Ravi, Samanthi Publication,
26. Animal Cell Culture: Essential Methods, John M. Davis (Editor) ,John Wiley & Sons Animal cell culture concept and application by Sharma, S, 2012, Scientific publisher, Jodhpur
27. Animal tissue culture , by Aruni, A.W, 2011- Scientific publisher
28. Cell and tissue culture (HB) – by C.K.Arora and M Prakash –Anmol publication –
29. Animal cell culture – concept and application – S.M Bhatt – Alpha science international ltd.
30. Cell culture techniques – (PB) – by Swati Rauthan – Lambert academic publishing
31. Lab Manual in Biochemistry, Immunology and Biotechnology -Arti Nigam Book

PAPER IV
ENVIRONMENTAL BIOLOGY I
(DSE)
PAPER CODE – ENVBIO 634

Unit I:- Ecosystem – Dynamics, Management and stability, homeostasis, niche and its overlapping .Biosphere – composition and characteristics and types - Lithosphere, hydrosphere and atmosphere.

Unit: - II Biosphere- Bio geochemical cycle. C, O, N, P, and S. Types of ecosystem- Terrestrial Ecosystem- characters and biota of forest, grassland, and desert. Desertification – causes creation and control, Deserts of World.

Unit: - III Thar Desert: Its Biota and geophysiological adaptation. Aquatic ecosystem- characteristics, and biota of Fresh water, Estuarine and marine. Ecological adaptations of animals in – cold desert, high altitude, lotic and marine environment.

Unit IV:-. Wildlife zoogeography of India and World with reference to Amphibia, Reptiles, Birds and Mammals. Endangered & Threatened species of Amphibia, Reptiles, Birds and Mammals of India. (with examples)

Unit V:- National parks and sanctuaries- with reference to Corbett, Ranthambore, Manas, Desert National Park, Tal Chhapar Sanctuary, Keoladev National Park. Biosphere reserves- with reference to Nanda devi, Agasthiayamalai, Dibru-Saikhowa, Nilgiri, Panchmarhi, and Sunderbans.

PAPER V
ENVIRONMENTAL BIOLOGY II
(DSE)
PAPER CODE- ENVBIO 635

Unit I:- Basic concept of Ecology - Holism, Ecosystem, Succession and Conservation. Ecological factors- – Climatic (light, temperature, rainfall, humidity), Topographic (altitude, direction of mountain chain and valley, steepness of slopes), Edaphic(soil complex). Biotic – positive and negative interactions.

Unit II:-Sustainable development – concept, strategies, principles, threats, and Commissions (national and internationals). Unsustainability – concept cause, effect

Unit III - Biodiversity: Types, Mega diversity with special reference to India. Hot spots of biodiversity of India, conservation of biodiversity.- introduction to strategies, insitu, exsitu, protected areas, biosphere reserve, restoration of endangered species, public participation.

Unit IV:- Natural resources- Management, monitory and conservation, watershed and wetland management, Energy crisis

Unit V:- Impact of urbanization and Industrialization on environment, environmental awareness - role of Government and voluntary organization. Environment education and role of information technology, role of women in environmental awareness.

PRACTICAL
ENVIRONMENT BIOLOGY
PAPER CODE- ENVBIO 636

1. Measurement of Dissolved oxygen in water ,
2. Measurement of free carbon dioxide in water
3. Measurement of Total Alkalinity in water
4. Measurement of Sodium in water using flame photometric method.
5. Measurement of Sulphide in water
6. Measurement of Nitrate in water
7. Measurement of phosphate in water
8. Estimation of biochemical oxygen demand (BOD).
9. Estimation of chemical oxygen demand (COD).
10. Quantitative estimation of aquatic biota- population density, Phytoplankton / Zooplankton identification, count, and significance in primary productivity.
11. Estimation of Soil variables- EC (Electrical conductivity), Phosphate and Nitrate

Marking scheme **Maximum marks 100**

Distribution of Marks	**Marks allotted**
1. Experiment A	20
2. Experiment B	15
3. Spots 5 x 3	15
4. Preparation	10
5. Year work / practical record (CIA)	10
6. Project work review of literature and synopsis preparation (CIA)	10
7. Slide preparation and submission	10
8. Viva voice	10
Total	100

Suggested Readings

1. Environmental Law for the Built Environment by Jack Rostron
2. Fundamental of Ecology by Odum
3. Environment Protection and the Law by Dr. R K Khitoliya
4. Environmental Studies by Singh, Thakur & chauhan
5. Concepts of Ecology by Edward J. Kormondy
6. Ecology, Environment & Pollution - P K Gupta
7. Ecology and Environment by P D Sharma
8. Modern Concept of Ecology by H D Kumar
9. Biodiversity: Science and Development by Castri, f d & Younes
10. Environment and Ecology by R. Rajgopalan – Oxford India publication
11. Diversity Management: Theoretical Perspectives and Practical Approaches- Dr. Sheying Chen
12. Biodiversity by E O Wilson
13. Diversity of life by E O Wilson
14. Threatened Animals of India- B K Tikadar
15. Environmental science – A Practical manual – l.g Swarjya –PB- B.S Publication
16. Practical skills in Environmental science – PB – by Allen Jones
17. Water analysis – by N.K Dutta (HB) Eastern book house
18. Handbook of water and waste water analysis – by Kanwaljeet Kaur (HB) –Atlantic publisher
19. Manual of soil, plant & water analysis –Tahar Ali and Sumiti Naryan – Daya Publishing house
20. Manual of soil, plant and water analysis – by Dhyan singh – Westville publishing house –
21. Soil analysis –P.C Bandyopadhyay (HB) Daya Publishing house
22. Modern methods in environmental pollution analysis- Harh Kumar – Sarup and sons
23. Principles and practices of air pollution, control & analysis –J.R Mundakavi –IK P. house
24. Environmental pollution analysis - S.M Khopkar – PB- New Age publication

25. Handbook of methods in Environmental studies – water and waste water analysis –S.K Maiti – vol I and II – Oxford Book Company
26. Standard Methods For the Examination of Water and Wastewater - Lenore S. Clesceri, Andrew D. Eaton, Eugene W. Rice , Rodger B. Baird – 22 nd Ed by American Public Health Association APHA- – Published by Alpha publishing

PAPER IV
ENTOMOLOGY-I
(INSECT- STRUCTURE & FUNCTION) (DSE)
PAPER CODE- ENTO 634

Unit-I: Insect morphology - Head- Structure & Different Mouth parts. Thorax- Appendages and Wings, Wing venation & Flight. Abdomen & its Appendages

Unit-II: Structure & Function of Alimentary Canal & Associated glands, Feeding, Nutrition, Digestion and Absorption

Unit-III: Excretory organs, Elimination of Nitrogenous Waste, Storage excretion. Salt and water regulation, Detoxification

Unit-IV: Tracheal system & Respiration in Terrestrial Insects. Respiration in Aquatic insects & Endoparasitic insects.

Unit-V: Circulatory system, Composition and function of Haemolymph, Insect immunity.

PAPER V
ENTOMOLOGY-II (DSE)
(SYSTEMATICS, ECOLOGY AND ECONOMIC ENTOMOLOGY)
PAPER CODE- ENTO 635

Unit-I: Systematics-
Classification, habit, habitat and distinguishing characters of different orders of class insect (up to major families.)

1. Thysanura
2. Collembolla
3. Thysanoptera
4. Hemiptera
5. Lepidoptera
6. Isoptera

Unit-II:-Ecology-Intraspecific & Interspecific relations, Social behavior in Hymenoptera and Isoptera, Effect of various Abiotic factors on Insect life.

Unit-III: Medical entomology- Morphology, Vectorship, Pathogenecity, & Control of –

1. *Anopheles, Culex, Aedes*- (Mosquito)
2. *Musca* (Housefly)
3. *Xenopsylla* (Ratflea)
4. *Pediculus* – (Human louse)

Veterinary entomology- Morphology, vectorship, pathogenecity, & control of

1. *Tabanus* (Horse fly)
2. *Stomoxys* (Stable fly)

Unit-IV: Industrial entomology - Biology Cultivation of beneficial insects -

1. *Laccifera lacca*
2. *Bombyx mori*
3. *Apis sps.*

Unit-V: Household pests:-Morphology, damage caused & control measures -

1. Cockroach
2. Cricket

3. Ants & termites
4. Bedbugs
5. Silver fish
6. Carpet beetle

PRACTICAL
ENTOMOLOGY
PAPER CODE- ENTO 636

1. To study variations and different modifications of external morphology of insect
2. To study variations and different modifications of Antennae, Mouth parts, Wings, Legs, genetalia & ovipositor of different insects
3. Study of effect of abiotic factors on insects life
4. To study different developmental stages of life cycle of mulberry silk worm (*Bombyx mori*) & lac insects (*Laccifer lacca*)
5. To study different developmental stages of life cycle of stored grain pests- *Oryzaephilus/ Callosobruchus/ Rhyzopertha / Sitophilus*
6. To isolate and culture bacteria from Housefly (*Musca domestica* L.) larvae.
7. To study different developmental stages of life cycle of mosquito.
8. To study different developmental stages of life cycle of Butterfly (Daniadae / Papilionidae)
9. To study the food preference of *Tribolium* in different food grains.
10. To study structure of termitarium / Bee Hive/ Wasp Hive
11. Mounting:- Antennae, Mouth parts, Wings, Legs, genitalia & ovipositor of different Insects.
12. Dissection of Digestive system & nervous system of-
    a. *Gryllus*
    b. Cockroach
13. Insect's collection, preservation & identification (25 insects) of the orders Hemiptera, Lepidoptera, Isoptera.
14. Identification of different insect upto families using dichotomous key.
15. Preparation and submission of 20 permanent entomological slides
16. Preparation of Synopsis of assigned Project Work

Marking scheme	**Maximum marks 100**
Distribution of Marks	**Marks allotted**
1. Dissection-	20
2. Slide preparation-	10
3. Spots(5 spots X 3)-	15
4. Collection of insects, preservation & identification-	10
5. Year work / practical record (CIA)	10
6. Project work Synopsis (CIA)	10
7. Slide submission(20 slides)-	10
8. Viva voice	10
9. Identification from dichotomous key.-	05
Total	100

Suggested Readings

1. Agricultural Pests of India and South-East Asia - A. S. Atwal, Publisher- Kalyani Publishers, 1986
2. Forest Entomology - William Ciesla, Publisher- John Wiley & Sons, 2011
3. Useful and Destructive Insects by Matcalf & filt
4. Elements of Entomology- Rajendra Singh- Rastogi Publications.
5. Imms General text book of Entomology, Eds. O. W. Richards and R. G. Davis Chapman and Hall, London.
6. Applied Entomology by Nigum & Kumar
7. Introduction to General and Applied *Entomology* by V B Avasthi
8. General and Applied Entomology, K.K. Nayar, T. N. Ananthkrishan and B.V. Davis, Tata McGraw -Hill Co.Ltd. Bombay.
9. The Insect: Structure and function, R.F. Chapman, Cambridge University Press.
10. The Physiology of Insect , Ed. M.Rockstein ,Vol, 1-5, Academic Press, New York.
11. Analytical Biochemistry of Insect, Ed. R. B. Turner, Elsevier, Amsterdam.
12. A Text Book of General Entomology by M.S. Mani
13. Modem Entomology by Tembhare, D.B.

14. How to Know The Insects. 1978 , by Roger Bland and H. E. Jaques. 3rd edition, Waveland Press, Inc.
15. How to Collect and Preserve Insects: Guide Leaflet Series, No. 39 - Frank Eugene Lutz (Author) , Publisher: Literary Licensing, LLC (Aug 25 2012),
16. Handbook of Entomology- M. R. Dhingra, Publisher- Oxford Book Company,
17. Medical Entomology for Students - Mike Service (Author), Publisher: Cambridge University Press; 4 edition,
18. Handbook of Medical Entomology- William A. Riley, Publisher- Dyson Press, 2009,
19. Medical Entomology: A Textbook on Public Health and Veterinary Problems Caused by Arthropods- B.F. Eldridge, J.D. Edman, Publisher- Springer, 2003,
20. Handbook of Medical Entomology- O. A. 1870-1961 Johannsen, William Albert Riley, Publisher- BiblioBazaar, 2011,
21. Ray, D.N. and A.W.A. Brown : Entomology Medical & Veterinary
22. Bursel, E. : An Introduction to Insect Physiology
23. Rockstein M. : The Physiology of Insects (Vol. 1–VI)
24. Shrivastava, K.P. : A Text Book of Applied Entomology (Vol.I–H)
25. Ross, H.A. : Text Book of Entomology
26. Practical entomology: a guide to collecting butterflies, moths and other insects *Wayside and woodland series* - Richard L. E. Ford, Publisher- F. Warne, 1963,
27. Forensic Entomology: The Utility of Arthropods in Legal Investigations, Second Edition, Jason H. Byrd (Editor), James L. Castner (Editor), Publisher: CRC Press; 2 edition

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE)

PAPER IV

Wildlife Biology-I: Biodiversity and Wildlife Ecology

PAPER CODE- WILDLFE 634

UNIT I

Concepts of biodiversity, levels of biodiversity – biological, genetic, species and ecosystem diversity, Types of species: Key stone species, Umbrella species, Indicator species, Flagship species, Exotic, Indigenous and Introduced species, Value of biodiversity – direct and indirect economic values, ethical values; Threats to biodiversity – habitat destruction, fragmentation and degradation, introduction, overexploitation

UNIT II

Biotic community – organization and characteristics of community, ecological dominance, ecotone and edge effect, community structure and organization (guilds, resource partitioning, niche, competitive exclusion), Ecosystem services Population ecology – intra and interspecific competition and mutualism, density dependence – optimum foraging theory, carrying capacity, population analysis – density, sex ratio, age distribution, fecundity by age, survival by age

UNIT III

Ecology of major habitats: Deserts, Grasslands and Forests Patterns of habitat utilization and dispersion, including home range – migration and corridors, predator – prey interaction Physical factors influencing terrestrial habitats: Drought, flood, soil erosion, grazing, fire

UNIT IV

Major vegetation types of India – basis of classification – their physiognomy and seasonal characteristics; phenology – species composition – distribution Forest soils and their conservation, classification, factors affecting soil

formation, physical and chemical properties, causes of soil erosion and conservation methods

UNIT V

Forest mensuration – methods of measuring diameter/girth, height and canopy cover Silviculture – general principles, ecological and physiological factors influencing vegetation, natural and artificial regeneration of forests – nursery techniques, seed technology – collection, storage, pre-treatment and germination.

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE)

PAPER V

Wildlife Biology-II : Conservation Biology

PAPER CODE -635

UNIT I

Introduction to conservation biology, conservation of biodiversity – patterns and processes – in situ and ex situ conservation, international conservation bodies – IUCN, UNDP, FAO, WWF Ex situ conservation – role of zoos and aquariums, introduction/reintroduction and translocation In situ conservation – national parks and wildlife sanctuaries – formation and management, protection and administration.

UNIT II

National parks of India – Ranthambore, Ghana, Kaziranga, Kanha, Bandipur, Gir, Corbett, Silent Valley; Marine National Parks of India – Mannar, Gulf of Kutch Biospheres of India and their concept Wildlife Sanctuaries in India – Periyar, Mudumalai, Sariska, Jaisamand, Kumbhalgarh, Sitamata, Phulwari ki Nal.

UNIT III

Zoological Parks – formation, management – food and feeding; zoo sanitation CommUNITy reserves and sacred groves IUCN categories in context to Indian Wildlife (Extinct, Extinct in wild, critically endangered, endangered, vulnerable, near threatened, least concern.

UNIT IV

Endangered and threatened animals - Mammals (Panthera tigris, Panthera pardus, Tetraceros quadricornis, Manis crassicaudata,Gazella gazelle bennetti, Bos gaurus, Elephas maximus), Birds (Pavo cristatus, Grus leucogeranus – Siberian white crane, Choriotis nigriceps – Great Indian Bustard, Gyps bengalensis), reptiles (Crocodylus palustris, Python, Kachuga kachuga).

UNIT V

Captive breeding and propagation: rehabilitation, gene banks Wildlife forensics:

DNA banks for endangered animals; Pug mark analysis, Hair analysis

Conservation ethics and values.

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE)

PRACTICAL II

Biodiversity, Wildlife Ecology and Conservation Biology

PAPER CODE -636

1. Visit to a zoological garden. Student should submit the report on the study covering various aspects like animals observed, their food preparation and presentation
2. Identification of mammalian species using hair imprinting and scat analysis
3. . Determination of population density of animals using transect and random survey methods.
4. Population density determination on the basis of mark recapture technique.
5. Determination of species dominance and frequency using quadrant/plot method
6. Analysis of habitat characteristics (gbh/dbh, tree height, canopy volume).
7. Analysis of vegetation in given area.
8. Project work
9. Analysis of species diversity using diversity indices.
10. Study of light intensity using Lux Meter.
11. Soil analysis: Physical: temperature, colour, texture, Chemical: moisture content, carbonates, nitrates, pH.

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE)

PAPER IV

Limnology and Fisheries- I Limnology

PAPER - LIMNO 634

UNIT-I

Definitions of lakes. Benefits of lakes. Origin of Lakes. Lake classification Morphometric features of Lake and their importance in trophogenecity of lakes

UNIT-II

Physical factors of Lake water with particular reference to- Temperature: Thermal stratification and heat budget; Light; Turbidity; Density; Waves and currents (a brief account).

UNIT-III

Chemical factors of Lake water with particular reference to-pH; Dissolved gases, BOD and COD; Nitrates and Nitrogen Cycle; Phosphates and Phosphorus cycle;CO2 and carbon cycle.

UNIT-IV

Definition, classification, distribution and limnological significance of plankton, nekton and benthos. Biological productivity and Energy flow.

UNIT-V

Indices of Lake Productivity, Eutrophication- causes and control. Water purification techniques. Wet lands – definition, brief account and conservation measures.

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE)

PAPER V

Limnology and Fisheries- II : Fresh Water Aquaculture

PAPER CODE- LIMNO 635

UNIT-I

Aquaculture: Extensive, intensive and semi intensive culture. Scope and importance of Aquaculture in India. Culture of Indian major carps- Labeo rohita, Catla catla and Cirrhinus mrigala. Culture of exotic fishes introduced in India – Cyprinus carpio, Ctenopharyngodon idella, Hypopthalmicthys molitrix and Tilapia mossambica.

UNIT-II

Biology and culture of indigenous and exotic freshwater prawns in India. Cold water fishes- Trout, tench and golden Mahseer. Brackish water fishesmullets, Lates calcarifer and Chanos chanos.

UNIT-III

Planning, construction and maintenance of fish farm. Site selection and culturable fish selection. Liming Fertilization and soil micronutrients. Fresh water weeds: importance and harmful effects, methods of eradication.

UNIT-IV

Predatory fishes, weed fishes and their control.Induced breedingHypophysation. Ovaprim, cryopreservation of gametes and embryos. Different type of hatcheries.

UNIT-V

Composite fish culture, Integrated Fish Farming, Monosex culture, Pen culture and Cage culture. Indigenous crafts and gears.

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE)

PRACTICAL

LIMNOLOGY AND FISHERIES

PAPER CODE- LIMNO 636

1. Measurement of the area of the lake.

2. To calculate shore line development index of a lake.

3.To measure following parameters. (a) Water temperature (b) Depth of visibility (c) pH

4. Estimation of total alkalinity in a water sample.

5. Estimation of chlorides in the water sample

6. Estimation of dissolved oxygen in the water sample

7. Estimation of gross primary productivity of water by dark and light bottle method

8. Estimation of BOD of the given lake water/waste water

9. Qualitative analysis of plankton sample

10. Report on freshwater weeds of a lake

11. Report on freshwater benthos of a lake

12. Identification and writing comments on various limnological instruments, weeds, phytoplankton, zooplankton benthos and insects.

13 Visit to various lakes and polluted streams

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE)

PAPER IV

CELL AND MOLECULAR BIOLOGY – I

PAPER CODE – CELL & MOL 634

UNIT I

1. Biomembranes

- Universality of biomembranes
  - Difference in phospholipid composition in two membrane leaflets.
  - Intrinsic and extrinsic proteins.
  - Integral and glycolipids.
  - Mobility of lipids and integral proteins in biomembrane.
  - Fluidity of biomembranes.
  - Cell junctions (Gap, tight and demosomes etc.).

2. Transport

- Mechanism of diffusion, Facilitated diffusion.
- Osmosis and water channels/ movement, Flick's law, Donnan equilibrium across cell membrane.
- Uniporter-catalyzed transport. Difference between uniport-catalyzed transport and passive diffusion, GLUT- 1 transport & its kinetic.
- Intracellular ion environment and membrane electric potential.
- Active transport - P-class ion pumps, F-class and V-class ion pumps and ABC superfamily. Plasma Membrane Ca+ +AT Pase pump Muscle Ca ++AT Pase pump and Na+/K+.
- Cotransport by symportors and antiporters.

- Transport across epithelia, Receptor mediated endocytosis. ATPase pump.

UNIT II

3. Cytoskeleton

- Microfilaments
- Actin cytoskeleton G-actin and F-actin and structural and functional polarity. Cortical actin network, erythrocyte and platelet cytoskeleton.
- Actin bundle support projecting fingers of membrane.
- Dynamics of actin assembly Actin polymerization. Toxins effect on actin monomer - polymer equilibrium stabilization of actin filaments by actin capping protein. Movement actin polymerization
    - Intracellular bacterial and viral movements.
    - Actin polymerization at the leading edge of moving cells.

- Myosin
    - Structure and mechanism of movement with actin.
    - Conformational changes in myosin during movement.

- Microtubules: Microtubules structure and microtubule assembly from organizing centers, Microtubule dynamics, Microtubule associated proteins (MAP's) and cross-linking of microtubules, Microtubules and mitosis
    - Centrosome duplication.
    - Kinetochore and force for poleward chromosome movement.
    - Organization of spindle pole and orientation of assembly.
    - Formation of poles and capture of chromosomes.
    - Kinetochore and force of poleward chromosome movement.
    - Astral microtubule and cytokinesis.
    - Microtubules and plant cell formation.

- Kinesin and Dynein.
- Cell movements

- Intracellular transport: Role of kinesin and dynein, microtubule tracks and intracellular membrane vesicles.
- Amoeboid movements.
- Second messengers and signal transduction pathways for coordination of migration of cells.

4. Cilia

- Structure and movements and Flagella
  - Sliding of outer doublet.
  - Dynein sliding forces in axonemes.
  - Dynein and exonemal bending.
  - Dyein regulatory complex.

UNIT III

5. Cell- Cell adhesion and communication

- Cadherin mediated Ca++-- dependent homophilic cell-cell adhesion.
- N-CAM's mediate Ca++-- independent homophilic cell-cell adhesion.
- Cadherin containing junctions.
- Gap junctions and connexins.

6. Cell matrix adhesion

- Integrin-in cell matrix and cell-cell interaction.
- Integrin and cell to substratum attachment.
- Collagen-Basic structure and assembly.
- Non-collagen components of extracellular matrix (Laminin, fibronectin and cell surface proteoglycans).
- Plant cell wall.
- Auxin and cell expansion.
- Cellulose fibril synthesis and orientation.

- Plasmodesmata.

UNIT IV

7. Cell- Cell Signaling

- Endocrine, paracrine and autocrine signaling.Receptor .

- Proteins- Cell Surface receptors and intracellular receptors.
- Cell Surface receptors-G-protein coupled receptors, ion channel receptors, tyrosine kinase-linked receptors and receptors with intrinsic enzymatic Activity.
- Second messenger System - cAMP and IP3, DAG MAP kinase cascade, JAK/STAT and TGF –β / Smad signaling, NF-kB signaling.
- Signaling from plasma membrane to nucleus (a) CREB links cAMP signals to transcription (b) MAP kinase.

8. Signal - Mediated transport through Nuclear Pore

- Nuclear pore complex
- Nuclear exports signals and transport of cargo proteins from nucleus to cytosol.
- Nuclear localization signal and transport of cargo proteins from cytoplasm to nucleus.

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE)

PAPER V

CELL AND MOLECULAR BIOLOGY –II

PAPER CODE- CELL & MOL 635

UNIT I

1. Cell Cycle

- Bacterial cell cycle (Helmstetier - Cooper or I+C+D model).
- Partition and cytokinesis.
- Eukaryotic cell cycle – G l, S, G 2 and M phases.
- Cell cycle and check points.
- Molecular basis of cell cycle regulation
    - Cyclins and cyclin - dependent kinases.
    - Regulation of CDK cyclin activity.

2. Cell Death

- Apoptosis and necrosis.
- Apoptosis-its characteristics.
- Genes involved in apoptosis.

UNIT II

3. Aging: The biology of senescence

- Maximum life span and life expectancy.

- Causes of aging:
  - General wear and tear and genetic instability.
  - Free radicals, oxidative damage and antioxidants.
  - Telomerases and aging.

4. Cancer

- Tumor cells and onset of cancer.
- Proto-oncogenesis and tumor suppressor genes.
- Mutation causing loss of cell cycle.
- Mutations affecting genuine stability.

UNIT III

5. Molecular structure of genes and chromosomes

- Molecular definition of gene.
- Chromosomal organization of genes and non-coding DNA.
- Mobile DNA.
- Functional re-arrangements in chromosomal DNA.
- Organizing cellular DNA into chromosomes.
- Morphological and functional elements of eukaryotic chromosomes.

6. Genetic analysis in Cell Biology

- Mutation: type and causes.
- Isolation and analysis of mutants.
- Genetic mapping of mutations.
- Molecular cloning of genes defined by mutations.

UNIT IV

7. Regulation of Gene expression

- Operon concept.
- Positive and Negative regulation.

- Inducers and corepressors.
- Regulation by attenuation: his and trp operons.

8. DNA binding proteins and gene regulation

- DNA binding domains.
- Homeodomain proteins.
- Zinc finger proteins.
- Winged-helix (Forked head) proteins.
- Leucine-Zipper proteins. 8.6 Helix Loop helix proteins.

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE)

PRATICAL

CELL AND MOLECULAR BIOLOGY

PAPER CODE- CELL & MOL 636

1. Operation of various microscopes

    1. Use of phase contrast.
    2. Use of fluorescence microscope and demonstration of nucleic acid by acridine orange or ethidium bromide.
    3. Use of transmission electron microscope .
    4. Use of occulometer-standardization and measurements of cell height, nuclear diameters and tabular diameters.
    5. Use of occular grid- standardization and counting of cells or nuclei in cross section or epithelium

2. Preparation of biological tissues and sectioning for

    1. Paraffin wax histology by microtome
    2. Fresh- frozen by cryostat
    3. Ultra-thin sectioning by ultratome

3. Cytochemistry

    1. Carbohydrate (a) PAS method (b) Alcian blue method
    2. Proteins (a) Mercury bromophenol blue method (b) Ninhydrin method
    3. Lipids (a) Phosphomolybic acid method (b) Copper phthalocynin n method
    4. Nucleic acid (a) Feulgen method (b) Methyle green- Pyronin method.

4. Biochemical methods

1. Determination of pK value of buffer
2. Determination of absorption maximum of a solution
3. Determination of relationship between absorption and various concentration of a solution using a colorimeter, spectrocolorimeter/spectrophotometer.
4. Preparation of standard curve for proteins, lipids and carbohydrates
5. Quantitation of enzymes
    1. by end point techniques as exemplified by alkaline and acid phosphatise
    2. by substrate - left over technique as exemplified by LDH

5. Immunization techniques

1. Emulsification with Freunds reagents
    1. Preparation of emulsions with syringe method
    2. Preparation of emulsion with hubbed needle method
2. Testing type of emulsion.
3. Absorption of soluble proteins on insoluble colloidal carrier
    1. Alum precipitates
    2. Alum hydroxide adjuvants

6. Immunization route

1. Intradermal
2. subcutaneous
3. Intramuscular
4. Intraperitioneal
5. Intravenous
6. Foot pad

7. Bleeding schedules and collection of blood

1. Bleeding from ear
2. Retro-orbital
3. Cardiac Puncture
4. Branchial vein
5. From external jugular vein

8. Separation and Preservation of serum

1. Liquid storage
    1. Using preservative
    2. Sterilization
2. By freezing
3. By lyophilization

9. Permanent slides: Types of cells (squamous, cuboidal, columnar epithelial cells, blood cells, nerve cells, muscle cells), connective tissues of various types. Adipose tissue, mitotic & meiotic chromosomes and their different phases.

SUGGESTED BOOKS

• Micklos D.A. and Freyer G. A. DNA science A first course in recombinant DNA Techanology. Carolina Biological supply compo and Cold Spring Harbour Lahovatoy Press, Burhington , North corolina, 1990.

• Lucent Micklos D.A. and Freyer G. A. DNA science A first course in recombinant NA Technology. Carolina Biological supply compo and Cold Spring Harbour Lahovatoy Press, Burhington , North Carolina 1990B. Genes VII. Oxford University Press, Oxford, 2000.

• Old R. W. and Primrose S. B. Principles of Gene Manipulation An introduction to genetic engineering. Blackwell Scientific Pub li- cation. London, 1989.

• Twyman R. M. and Wisden W. Advanced Molecular Biology A Concise Reference Viva Books Pvt. Ltd. New Delhi: 1999

• Meyers R.A. Molecular Biology and Biotechnology A comprehen sive desk Reference. VCH Publishers, Inc. New York, 1995

• Lodish H, BerkA, Zipurjky S. L., Matsudaira P, Baltimore D. and Darnell 3. Molecular Cell Biology W.H. freeman and company New York, 2000.

• De Robertis E.D.P. and De Robertis Jr, E.M.F., Cell andiEMolecular Biology. K. M. Varghese Cop. Bombay, 1998.

• Adams RLP. knowler J.T. and Leader D.P. The Biochemistry of the Nucleic Acids. Chapman and Hall, London, 1986

• Alhberts B, Bray D, LewisJ RaffM, Roberts K and Watson J.D. Molecular Biology of the Cell. Garland Publishing, Inc. New York, 1994.

• Glick B. R. and Pasternak 1.1. Molecular Biotechnology Principles and Applications of Recombinant DNA. ASM Press, Washington, 1998.

• Bolrover S.R. Hyams J.S., Jones S. Shephard E.A. and White H.A. From genes to cells. Wiley-liss, New York, 1997.

• Gerbare J. and Kirschner M. Cells, Embryos and Evolution. Blackwell science, Inc. Massachusetts, 1997.

• Frieerg E.C., Walker G.C. and Siede, W DNA Repair and Mutagen- esis. ASM Press Wadbington DC, 1995.

• Karp G. Cell and Molecular Biology. Concepts and experiments. John Wiley and sons. Inc. New York, 1999

• Malacinski G.M. and Freifelder D. Essentials of Molecular Biology Jones and Bartlett Publishers Boston, 1999

• Cooper, G .M. The cell A molecular approach. ASM Press, Washington DC, 2000.

• Shelve P. and Blanch DEW, Cell and Molecular Biology. John Wile) and Sons Inc., New York, 1994.

• Twyman R. M. and Wisden W. Advanced Molecular Biology A Concise Reference Viva Books Pvt. Ltd. New Delhi: 1999

• Meyers R.A. Molecular Biology and Biotechnology A comprehen sive desk Reference. VCH Publishers, Inc. New York, 1995

• Lodish H, BerkA, Zipurjky S. L., Matsudaira P, Baltimore D. and Darnell 3. Molecular Cell Biology W.H. freeman and company New York, 2000.

• De Robertis E.D.P. and De Robertis Jr, E.M.F., Cell andiEMolecular Biology. K. M. Varghese Cop. Bombay, 1998.

• Walker J.M. and Gingold E.B. Molecular Biology and Biotechnology. Panima Educational Book Agency,New Delhi

• Alhberts B, Bray D, LewisJ RaffM, Roberts K and Watson J.D. Molecular

Biology of the Cell. Garland Publishing, Inc. New York, 1994.

• Glick B. R. and Pasternak 1.1. Molecular Biotechnology Principles and Applications of Recombinant DNA. ASM Press, Washington, 1998.

• Bolrover S.R. Hyams J.S., Jones S. Shephard E.A. and White H.A. From genes to cells. Wiley-liss, New York, 1997.

• Gerbare J. and Kirschner M. Cells, Embryos and Evolution. Blackwell science, Inc. Massachusetts, 1997.

Bhupal Nobles` University, Udaipur
Faculty Of Science

Department Of Zoology

Scheme Of Studies

M.Sc. IV Semester

2016-2017

S. No.	PAPER	NOMENCLATURE	COURSE CODE	UNIVERSITY EXAM	INTERNAL ASSISMENT	MAX. MARKS
1.	Paper I	CHORDATE BIOLOGY II (CORE)	ZOOL-641	70	30	100
2.	Paper II	APPLIED ZOOLOGY – ITS TOOLS AND TECHNIQUES (CORE)	ZOOL-642	70	30	100
3.	Practical	CHORDATES & APPLIED ZOOLOGY	ZOOL-643	70	30	100
4.	Paper IV	SKILL DEVELOPMENT: INFORMATION AND COMMUNICATION TECHNOLOGY ,ICT (SKILL)	ZOOL-644	70	30	100
5.	Paper V	ENVIRONMENTAL BIOLOGY I (DSE)	ENVBIO-645	70	30	100
6.	Paper VI	ENVIRONMENTAL BIOLOGY II (DSE)	ENVBIO-646	70	30	100
7.	Practical	ENVIRONMENTAL BIOLOGY	ENVBIO-647	70	30	100
8.	Paper V	ENTOMOLOGY I : INSECTS-FUNCTION & DEVELOPMENT (DSE)	ENTO-645	70	30	100
9.	Paper VI	ENTOMOLOGY II : SYSTEMATICS, AGRICULTURE ENTOMOLOGY AND PEST MANAGEMENT (DSE)	ENTO-646	70	30	100

10.	Practical	ENTOMOLOGY	ENTO-647	70	30	100
11.	Paper V	WILDLIFE BIOLOGY I: INDIAN WILDLIFE (DSE)	WILDLIFE-645	70	30	100
12.	Paper VI	WILDLIFE BIOLOGY II: WILDLIFE MANAGEMENT (DSE)	WILDLIFE-646	70	30	100
13.	Practical	WILDLIFE BIOLOGY	WILDLIFE-647	70	30	100
14.	Paper V	LIMNOLOGY AND FISHERIES I: FISHERIES MANAGEMENT (DSE)	LIMNO-645	70	30	100
15.	Paper VI	LIMNOLOGY AND FISHERIES II: FISH AND FISHERIES BIOLOGY (DSE)	LIMNO-646	70	30	100
16.	Practical	LIMNOLOGY AND FISHERIES	LIMNO-647	70	30	100
17.	Paper V	CELL & MOLECULAR BIOLOGY I (DSE)	CELL & MOL-645	70	30	100
18.	Paper VI	CELL & MOLECULAR BIOLOGY II (DSE)	CELL & MOL-646	70	30	100
19.	Practical	CELL & MOLECULAR BIOLOGY	CELL & MOL-647	70	30	100

The marks distribution of internal Examination-

1. **Mid Term Examination – 15 marks**
2. **Attendance & Presentation/ Assignment= 15 marks**

PAPER I
CHORDATE BIOLOGY II
PAPER CODE- ZOOL 641

Unit I –Origin of birds, Affinities, Feathers in birds, Mechanism of flight in birds, Flightless birds, Palate, Aquatic birds

Unit II –Types of Beaks and Claws in birds, Parental Care in Birds, Migration in birds, Economic importance of birds, connecting link- *Archaeopteryx*

Unit III – Origin and Classification (up to sub orders) of Mammals, Prototheria, Metatheria and Eutheria, Parental care in Mammals, Aquatic Mammals, Dentition in Mammals

Unit IV- Flying mammals (Chiroptera) and their adaptation, Comparative account of Old & New world Monkeys, Ancestory of Horse and Man

Unit V- Wild life Sanctuaries and National Park of Rajasthan- Keoladeo (Ghana) Bird National Park, Ranthambore National Park , Wild life Conservation, Important Indian Fauna- Great Indian Bustard *(Ardeotis nigriceps),* Gray Langur (*Semnopithecus entellus),* Tiger *(Panthera tigris),* Common Peafowl (*Pavo cristatus),* Demosielle Crane *(Anthropoides virgo),*Wild life organizations-WWF

PAPER II
APPLIED ZOOLOGY – ITS TOOLS & TECHNIQUES
PAPER CODE- ZOOL 642

Unit: I - Microscopy: Principle of light transmission, Light Microscopy, Phase contrast, fluorescence microscopy, confocal electron microscopy, organelle separation by centrifugation, Sepctrophotometry -Principle & application of UV and visible spectophotometer .

Unit II- Medical Zoology: Host- Parasite relationship. Mode of infection & pathogenicity of following pathogens with reference to main prophylaxis and treatment – *Plasmodium , Giardia, Schistosoma,Wucheria, Taenia, Enterobius*

Unit III- Apiculture: Species of Honey bees in India, identification of Queen, worker, drone, Types of care & maintenance of bee colonies. Bee hives, Bee Enemies , Extraction of honey and Processing, Nutritive & Medicinal values of Honey. Lac culture- cultivation, processing, enemies and uses of lac

Unit IV Aquaculture: Fresh water fishes, Transportation of fish seed & brooders, Induced breeding, Composite fish culture, Fish Farm layout and its management, Fish products, Fresh water Prawn culture – Species, Technology and Economics, Pearl culture - Culture techniques

Unit V- Population dynamics of Insect Pests, Principles of biological, chemical, mechanicals, Cultural control of pest, Integrated Pest Management.

PRACTICALS
CHORDATES & APPLIED ZOOLOGY
PAPER CODE- ZOOL 643

A. Dissection
1. *Labeo*- cranial nerve
2. *Cirrhinus mrigala*- cranial nerve
3. *Clarias, Ophiocephalus, Anabas*-Accessory Respiratory organs & Webarian organs.

B. Osteology of representative classes- Aves and Mammals.

C. Permanent Slides
1. Histology of various Mammal organs- Liver, Intestine, Duodenum, Stomach, Spleen, Kidney, Ovary, Testis.
2. Reptiles- V.S. skin
3. Aves- Various types of Feathers
4. Chick embryology – 18,24,33, 48,72 hours

D.Permanent stain preparation- Cycloid and Ctenoid Scales, Sting of Honey bee, Ticks and mites, Aphids, *Pediculus*.

E . Museum Specimens
1. Amphibia: *Necturus, Amphiuma, Ambystoma,* Axolotal Larva,
2. Reptiles : *Ophiosaurus, Naja, Bungarus, Echis, Hydrophis, Eryx, Python, Crocodilus, Gavialis*
3. Aves: *Columba, Pavo, Choriotis*
4. Mammals: *Funambulus, Rattus, Suncus, Presbytis, Maccaca.*

F. To study diversity of beaks in birds

G. To study diversity of feet in birds

H. Report on Public awareness about environmental issues.

Distribution of Marks	**Marks allotted**
1. Dissection	20
2. Spots 6 spots x 3	18
3. Preparation	12
4. Year work / practical record (CIA)	10
5. Seminar (CIA)	10
6. Awareness file	20
7. Viva voice	10
Total	100

Suggested readings

1. Text book of Zoology Vol-1I Vertebrates – Parker & Haswell (Edited by Marshall & Williams) (ELBS & Macmillion)
2. Vertebrate life- Pough and McFerland
3. Life of Vertebrates . J. Z. Yong
4. Vertebrates : Comparative anatomy, function, Evolution- K. V. Kardong (Tata MaGraw-Hill Edition)
5. Comparative Anatomy of Vertebrates- G.C. Kent & R. Carr
6. The Vertebrate body- Romer & Parsons
7. Biology of Vertebrates- Walter & Sayles
8. Elements of Chordate Anatomy- Weichert
9. Analysis of Vertebrate Structure- Hildebrand
10. Fish and Fisheries- Shukla, Pandey
11. Applied Entomology- P. G. Fenemore, A Prakash
12. Freshwater Aquaculture- Santhanam *et al.*
13. Aquaculture- T. V. R. Pilley

14. Sericulture & Silk Industry- D. C. Sarkar
15. Economic Zoology- Shukla Upadhyay
16. Elements of Entomology- Rajendra Singh
17. Insect Pest of crop- S. Pradhan
18. Applied zoology- Ansari,Varma,Sharma
19. Medical Entomology: A Textbook on Public Health and Veterinary Problems Caused by Arthropods- B.F. Eldridge, J.D. Edman, Publisher- Springer, 2003,
20. Handbook of Medical Entomology- O. A. 1870-1961 Johannsen, William Albert Riley, Publisher- BiblioBazaar, 2011

PAPER IV

SKILL DEVELOPMENT

INFORMATION AND COMMUNICATION TECHNOLOGY SKILL (ICT)

PAPER CODE- ZOOL 644

DETAILED COURSE OUTLINE

USE OF VIDEO & ONLINE RESOURCES: 10 HRS

ASSIGNMENTS/SELF STUDY: 60 HRS

SKILL TEST AND PRESENTATIONS: 10 HRS

Identification of various components of a computer system: Identify Mother board, CPU, Memory, various ports and connectors, drives, keyboards, mouse, types of monitors and its connection to computer, hardware specifications.

Skill: Identification of various components of a PC and writing specification of a computer

Operating a computer system: Desktop, using help, My computer, folders and files, word pad, copy, save and print.

Skill: Operation of a PC

Word Processing: Creating New documents, Entering text, saving, closing and opening files, editing & formatting, Cut, Copy and paste, search and replace, insert page number, date, picture, page layout, spell and grammer check, headers and footer, footnoting,table of contents, table,mail merge, mailing labels using Menu items etc.

Skill: Preparation of a given document.

Spreadsheet: Creating and editing a Workbook, using charts, managing workbook. Candidates should be trained to create, enter and edit data, save and close workbook, change column width, moving, centering and merging cells, using formulae, using functions, formatting worksheet, creating charts,printing.

Skill: Preparation of Invoice, balance sheet, plotting selected columns of a table etc.

Database Management System: Creating a database, modifying table, creating forms, queries and reports. Candidates should be trained in creating, data entry, close and open table and database, customizing and inserting fields, sorting, form wizard, adding records, using queries, creating and printing reports.

Skill: Prepare Telephone directory, catalogue and making queries and required reports

Presentation Graphics: Creating, modifying and refining presentation, using advanced presentation features.

Skill: Prepare a good presentation on given topic.

Internet and Personal Information Management: Internet & Intranet, Browsers and finding information, URL's, search services, e-mail, checking internet connection. Using calendar for appointment, creating and managing task, address book and its management.

Skill: Creation of mailing list, preparing appointment and tasks.

Web Authoring & IT work: Creating a web page using HTML editor, Modifying and refining web page, inserting hyperlink, changing theme and layout,Inserting images, publishing web page .

Skill: Creating and Publishing a web page.

Installation of Software including antivirus software, Printer and other devices. Installing and using image Scanner, CD writing,creating PDF files, Using FTP, using Google Drive.

Skill: Preparing a PC for office by installing necessary software

PAPER V
ENVIRONMENTAL BIOLOGY I (DSE)
PAPER CODE –ENVBIO 645

Unit -I – Population Ecology – Definition, Density, Mortality, Natality, population fluctuation, dispersal, equilibrium, age pyramid, distribution, growth curve. Factors affecting population growth and regulation.

Unit – II – Environmental Pollution – Air pollution – Types of pollutants, secondary air pollution, effect and control. Water pollution – Types of pollutants, sources, effects and control. Noise pollution – Source, properties, measurements of noise, effect & control.

Unit –III- Environmental Pollution - Soil pollution- sources, effects and control, Radiation Pollution – Types of radiation, nuclear fallouts, effect of radiation on ecosystem, Nuclear accident. Thermal Pollution – Source, effect and control.

Unit IV – Impact of environmental pollution – Global warming, Acid rain, Green house effect, Ozone layer depletion, Solid Waste – Disposal & Management.

Unit – V – Ecotoxicology – Introduction, principle, types of ecotoxicants, Dose –Response Relationship. Toxic effects and impact from individual to ecosystem.

PAPRE VI
ENVIRONMENTAL BIOLOGY II (DSE)
PAPER CODE –ENVBIO 646

Unit -I- Bioaccumulation, Biomagnifications – Biological transfer of bioaccumulation in ecosystem. Bioremediation – Need, merits, scope and current status. Biodegradation – plastic and pesticides.

Unit – II- Health Hazards – Pesticides, Heavy metals, Dyes, Detergents and Fertilizers. Monitoring and remedial measures to control these pollutants.

Unit III-Environment Impact Assessment (EIA) – Concept, objectives, components, methodology, Environment Appraisal committees. Benefits of EIA Process.

Unit – IV- Remote Sensing – Introduction, physical basis for remote sensing, process, specified remote sensing satellites , system for data collection. Application & advantages of remote sensing.

Unit – V – Environmental policy in India, problems in making & implementing the
Environmental laws, Indian Environmental Acts – Duties of State & Central Board, Wild life protection Act 1972, Biodiversity Act 2002, Environment protection Act1986, National Environment Tribunal Act 1995, Air (Prevention and Control of Pollution) Act 1981, Water (Prevention and Control of Pollution) Act 1974.

PRACTICALS
ENVIRONMENTAL BIOLOGY
PAPER CODE- ENVBIO 647

1. Biomass and population density of terrestrial group, sampling and statistical analysis.
2. Measurement of potassium in water using flame photometric method.
3. Measurement of magnesium in water
4. Measurement of Chloride in water
5. Measurement of Silicate in water
6. Estimation of tannin and lignin in polluted water
7. Estimation of water quality index
8. Air pollution study
9. Study of microbes in polluted and fresh water
10. Identification and study of different migratory birds of this region
11. Visit to environmental important site.
12. Project Report

Marking scheme	**Maximum marks 100**
Distribution of Marks	**Marks allotted**
1. Experiment A	20
2. Experiment B	15
3. Experiment C	10
4. Spots 5x 3	15
5. Year work / practical record (CIA)	10
6. Project work report submission and presentation (CIA)	10
7. Visit to environmental important site	10
8. Viva voice	10
Total	**100**

Suggested Readings

1. Environmental Law for the Built Environment by Jack Rostron
2. Fundamental of Ecology by Odum
3. Environment Protection and the Law by Dr. R K Khitoliya
4. Environmental Studies by Singh, Thakur & chauhan
5. Concepts of Ecology by Edward J. Kormondy
6. Ecology, Environment & Pollution by P K Gupta
7. Ecology and Environment by P D Sharma
8. Modern Concept of Ecology by H D Kumar
9. Threatened Animals of India by B K Tikadar
10. Environmental science – A Practical manual – l.g Swarjya –PB- B.S Publication
11. Practical skills in Environmental science – PB – by Allen Jones
12. Water analysis – by N.K Dutta (HB) Eastern book house
13. Handbook of water and waste water analysis – by Kanwaljeet Kaur (HB) –Atlantic publisher
14. Manual of soil, plant and water analysis – by Tahar Ali and Sumiti Naryan – Daya Publishing house
15. Manual of soil, plant and water analysis – by Dhyan singh – Westville publishing house –
16. Soil analysis – by P.C Bandyopadhyay (HB) Daya Publishing house
17. Modern methods in environmental pollution analysis- Harh Kumar – Sarup and sons
18. Principles and practices of air pollution , control and analysis – byJ.R Mundakavi –IK publishing house
19. Environmental pollution analysis – by- S.M Khopkar – PB- New Age publication
20. Handbook of methods in Environmental studies – water and waste water analysis – byS.K Maiti – vol I and II – Oxford Book Company

21. Standard Methods For the Examination of Water and Wastewater (Hardcover) by Lenore S. Clesceri, Andrew D. Eaton, Eugene W. Rice , Rodger B. Baird (HB) – 22 nd Ed by American Public Health Association APHA- – Published by Alpha publishing

PAPER V
ENTOMOLOGY I
(INSECTS- FUNCTION AND DEVELOPMENT) (DSE)
PAPER CODE – ENTO 645

Unit I:- Nervous System – Basic Components, Basic Function Anatomy, Brain, Transmission of nerve, impulse in insects.

Unit: - II Endocrine System – Endocrine organs, Hormones and Pheromones, Endocrine control of Polymorphism in Insects.

Unit III:- Perception of the Environment:-

1. Eyes - Compound eyes, functioning of eyes other visual receptors.
2. Sound producing organs.
3. Light producing organs.
4. Thermoregulation.

Unit IV; - Reproduction in Insects.

1. Reproduction System male.
2. Reproduction System female
3. Insects Embryology – Egg and its development upto formation of extra embryonic membranes, viviparity, Polyembryony, Parthenogenesis and Paedogenesis.

Unit V:- Post embryonic Development:-

1. Hatching
2. Metamorphosis
    a. Larval development and type of larvae
    b. Pupal development
3. Control of post embryonic development
4. Diapause.

PAPER VI
ENTOMOLOGY II
(SYSTEMATICS, AGRICULTURE ENTOMOLOGY AND PEST MANAGEMENT)(DSE)
PAPER CODE- ENTO 646

Unit I:- Systematics
Classification, habit, habitat and distinguishing characters of different order of class Insecta classification up to major families.

1. Odonata
2. Orthoptera
3. Diptera
4. Hymenoptera
5. Coleoptera

Unit II:- Agriculture entomology - I
Systematic position, morphology, Damage and Control Measures of –

1. Pests of Vegetables & Fruits ;-
    a. *Dacus cucurbitae* (Melon fly)
    b. *Papilio demoleus* (Lemon butterfly)
2. Pests of Sugarcane:-
    a. *Pyrilla perpusilla* (Sugarcane leaf hopper)
    b. *Scirpophaga novella* (Sugarcane top borer)
3. Pests of pulses and oilseeds;-
    a. *Helicoverpa armigera* (Cotton boll worm)
    b. *Lipaphis erysimi* (Mustard Aphid)
4. Polyphagus Pests :-
    a. *Schistocerca gregaria* (Desert Locust)
    b. *Locusta migratoria* (Migratory Locust)

Unit III:- Agriculture entomology - II

1. Pests of cereals :-
    a. *Mythimna seperata* (Northern armyworm)
    b. *Sitobion avenae* (Wheat Aphid)
2. Pests of fiber crop:-
    a. *Pectinophora gossypiella* (Pink boll worm)
    b. *Dysdercus koenigii* (Cotton stainer)
3. Pests of paddy:-
    a. *Dicladispa armigera* (Spiny Leaf Beetle)
    b. *Spodoptera sps* (African army worm)
4. Pests of stored grains:-
    a. *Rhyzopertha dominica* (Lesser Grain Borer)
    b. *Tribolium sps* (Red Flour Beetles)

Unit IV:- Forensic entomology:

1. Introduction
2. Insects of forensic importance
3. Entomological evidence collection during death investigations
4. Forensic entomological decomposition
5. Preliminary Idea about Post Mortem Interval (PMI)
6. Preliminary idea about some forensic important insects- Flies & Beetles

Unit V:- Pests management

1. Concept of Pests.
2. Physical, Mechanical, Cultural & Biological Control.
3. Modern methods of Control.
4. Integrated pest management (IPM)

PRACTICALS
ENTOMOLOGY
PAPER CODE- ENTO 647

1. Culture of *Drosophila* and study of its different developmental stages of life cycle.
2. To isolate and mount salivary glands of *Drosophila*.
3. To identify male and female individual from the given Grasshopper set.
4. To identify male and female individual from the given *Drosophila* set.
5. Demonstration of biological control of Aphids using *Coccinella* (Lady bird beetle)
6. To study modern bee hive structure and its different parts.
7. To study different plant protecting equipments. (Spraying & Dusting)
8. Method of formulation and dilution of different insecticides.
9. Study of different castes of honey bee and termite.
10. Mounting : sting apparatus of Honey bee/ Wasp
11. To identify and locate tympanum of Grasshopper
12. Dissection :- Digestive and Nervous System of
    a. Grasshopper
    b. Honey bee
    c. Wasp
13. Insect Collection, preservation and identification of insects. 25 different insects of - Odonata, Orthoptera, Diptera, Hymenoptera, Coleoptera.
14. Identification of different order of insects up to families by using dichotomous keys.
15. Preparation and submission of 20 permanent entomological slides
16. Project Report.

Marking scheme	**Maximum marks 100**
Distribution of Marks	**Marks allotted**
1. Dissection-	20
2. Slide preparation-	10
3. Spots(5 spots X 3)-	15
4. Collection of insects, preservation & identification-	10
5. Year work / practical record (CIA)	10
6. Project work report submission and presentation (CIA)	10
7. Slide submission (20 slides)-	10
8. Viva voice	10
9. Identification from dichotomous key.-	05
Total	100

Suggested reading

1. Modern Entomology (Second edition): D. B. Tembhare, Himalaya Publication House, Bombay.
2. Destruction and Useful Insect, Their Hanits and Control, C. L. Metcalf, W. P. Flint and R. I. Metcalf, Mc Grow I Ill Co. New York.
3. Text Book of Entomology, K. P. Shivastava, Vol. 1 And 2 Kalyani Publication, Ludhiana.
4. Agriculture Entomology, H. S. Dennis, Timber Press Inc.
5. A Text Book of Agricultural Entomology ESSIG : College Entomology by Hemsingh Pruthi
6. Entomology: At a Glance Volume 2 Objective Fundamentals- R.C. Saxena, Agrotech Publishing,
7. The Science of Entomology. William S. Romoser and John G. Stoffolano, Jr. Fourth edition. WBC/McGraw-Hill, Boston, MA 1998
8. Oldoyd, N. : A Collection, Preserving and Studying Insects
9. Roger P. and Anderson : Forest and Shade Tree Entomology
10. Fradt, R.E. : Fundamentals of Applied Entomology
11. Smith, K.G.V. : Insects and Other Arthropods of Medical Importance

12. Berryman, A. (1986) *Forest Insects: Principles and Practice of Population Management.* Plenum Press, New York.
13. Coulson, R.N. and Witter, J.A. (1984) *Forest Entomology*: *Ecology and Management.* John Wiley & Sons, Inc., New York.
14. Applied Entomology: ICAR JRF ARS SAUs Entrance Exams UPSC Civil Services Prelims 2nd ed , Author: D S Reddy

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE)

PAPER V

WILDLIFE BIOLOGY: INDIAN WILDLIFE – I

PAPER CODE- WILDLIFE 645

UNIT I

Zoogeographical regions of India and their fauna: Himalayan, Eastern and Western ghats, Thar, Deccan plateau, Gangetic plains Fauna of Thar Desert (Chinkara, Desert fox, Black buck, Great Indian Bustard, Indian Peafowl, Desert Agama)

UNIT II

Status, distribution, physical characteristics and ethology of: Tiger, Lion, Rhinoceros, Elephant, Mugger, Four-horned Antelope Status, distribution, physical characteristics of some threatened plants: Prosopis cineraria, Albizia lebbeck, Azadirachta indica, Withania somnifera, Commiphora wightii

UNIT III

Special Wildlife programs: Project Tiger, Project Elephant, Operation Rhino, Project Crocodile, Wildlife of Rajasthan Ramsar convention, Ramsar sites of India (Chilka lake, Bhoj Wetland, Wular Lake, Deepor Beel, Point Calimere Wildlife and Bird Sanctuary), Ramsaar sites of Rajasthan (Keoladeo National Park, Sambhar lake) Important Bird Areas (IBAs) of India and Rajasthan

UNIT IV

Wildlife Institutes in India: WII, BNHS, ZSI, IIFM, FSI, CAZRI, Central Zoo Authority of India Wildlife legislation: Wildlife Protection Act, 1972; National Wildlife Action Plan, 2002; National Biodiversity Act, 2002

UNIT V

Wildlife trade and trafficking Damages caused by wildlife- their identification and control Animals in Indian mythology (symbols, vehicles, divinities)

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE)

PAPER VI

WILDLIFE BIOLOGY: WILDLIFE MANAGEMENT – II

PAPER CODE –WILDLIFE 646

UNIT I

History and cultural background of Indian Wildlife, Needs and values of wildlife protection, Types of wildlife management, Significance of wildlife conservation, Management policies and their implementation, Factors injurious to wildlife and forests, Invasive species and its threat to native species.

UNIT II

Wildlife techniques: Data collection; monitoring; Methods of population surveys: Counts (Direct count - Total counts, Drive counts, Time Area counts, Indirect counts - Call counts, Track counts), Line transect estimate, Indices and Mark recapture estimate, Direct and indirect evidences, census methods, Pellet counts: Mark-recapture method - Peterson or Lincoln index method. Environmental impact assessment (EIA), Geographic Information System (GIS), radio telemetry

UNIT III

Forest management: Participatory Approach, Forest Laws in Relation to Tribal Land Conflict, Practices of forest management: water hole management, fire lines, grassland management, parapet covering of wells, Role of corridors in wildlife management, Conservation movements in India Forest laws- Necessity general principles- Indian Forest Act,1927, Forests Conservation Act, 1980, The National Forest Policy, 1988

UNIT IV

Social forestry- Objectives of social forestry programmes and their implementation in India, Types of social forestry: farm forestry, community forestry or rural forestry, extension forestry or urban forestry, wasteland management – tree farming on wastelands, afforestation of hills, slopes, wastelands, riverbanks and water Need of Social forestry programs, Involvement of common people, Extension and education, tourism, finance in wildlife management

UNIT V

Biostatistics: Scope and objectives, terms, units, symbols, mean, mode and median, sample and sampling, collection and representation of data, tabulation, diagrammatic and graphical representation of data Tests of significance: Null hypothesis, Students T-test, Chi-Square test, Correlation and Regression.

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE)

PRACTICAL

WILDLIFE BIOLOGY

PAPER CODE- WILDLIFE 647

1. Visit to natural habitats and wildlife sanctuaries, desert, mountain range, wetland and especially Rajasthan for the detail study: Student should submit the report on the study covering major fauna, flora and geography and management.

2. POP preparation of pugmarks and footprints

3. Designing the animal housing, enclosures and kraal.

4. Study of different types of cages.

5. Review of zoo-working plans and maps

6. Visit to a wetland for birding and identification of threats to wetlands. Student should submit the report on the study.

7. Limnological study of wetlands.

8. Permanent preparation of barbs of different avian feathers.

9. To observe foraging behavior in squirrels/mice.

10. Taxonomic identification and preparation of taxonomic key of given animals.

11. Statistical exercise

SUGGESTED READINGS

1. Wild A., Soils and the Environment An Introduction. Cambridge University Press, Cambridge. ..
2. Cunningham W.P. and Saigo B.W. Environmental Science A global concern Win. C. Brown Publishers, London.
3. Goel MM.. Sharma M.C. and Purohit N.K., Problems of Environment Management in India. Anupriya Publishing House, Jaipur.
4. Enger E.D. and Smith B.F., Environmental Science (A study of interrelations) Win. C. Brown Pub. (Latest Edition).
5. Botkin D. And Keller E. Environmental Science. Earth as a Living Planet, Keller.
6. Smith RL. : Ecology and Field Biology. Harper and Reo. Publishers.
7. Berwick S.H. and Saharia, V.B.: The Development of international

   Principles and Practicals of wildlife research and Management: Asian and American Approaches Eds. Oxford Univ. Press, Delhi.
8. VB. Saharia, Wildlife in India, Natraj Publishers, Dehradun.
9. Ali S. and Ripley D.RA pictorial Guide to the birds of the'lndian Subcontinent BNHS Publications.
10. Prater S.H. The Book of Indian Animals, BNHS Publication.
11. Sharma,VD.: Wild wonders of Rajasthan. Prakash Books, New Delhi.
12. Ali S. Hand Book of Indian birds, BNHS Publications.
13. Giles R.H. and Toschik: Wildlife Management Techniques. The Wildlife Society Washington D.C.
14. SK Sharma. Ethno-Zoology.Himanshu Publication.Udaipur.

15. A.Verma. Conserving biodiversity of Rajasthan (With emphasis on Wild Fauna and Flora) Himanshu Publication, Udaipur.

16. Aaron, N.M. (1973). Wildlife ecology. W.H. Freeman Co. San Francisco, U.S.A.

17. Katwal/Banerjee, Biodiversity conservation in managed and protected areas. Agrobios, India.

18. Negi, S.S., Biodiversity and its conservation in India. Indus Publishing Co., New Delhi.

19. Anthony R.E. Sinclair, John M. Fryxell and Graeme Caughly, Wildlife Ecology, Conservation and Management, 2nd Edn. Blackwell Publishimg, U.S.A.

20. Sharma, B.D. Indian Wildlife Resources, Ecology and Development.

Daya Publishing House, Delhi.

21. Tiwari, S.K. Zoogeography of India and Asia. CBS Publisher and Distributors, New Delhi.

22. Ram Bramha Sanyal, A Handbook of the Management of Animals in Captivity.

23. Hosetti, B.B., Concepts in Wildlife Management, Daya Publishing House, Delhi.

24. Negi, S.S. Manual for Wildlife Management in India.

25. Gopal, Rajesh, Fundamentals of Wildlife Management, Justice Home, Allahabad, India.

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE

PAPER V

LIMNOLOGY AND FISHERIES FISHERIES MANAGEMENT – I

PAPER CODE- LIMNO 645

UNIT I

Fisheries and classification of fisheries; Lacustrine fisheries; Riverine fisheries – Ganga river system; Coastal and Deep sea fisheries

UNIT II

Fisheries of Rajasthan Fisheries of economically important fishes: Sardine; Bombay duck; Mackerel; Hilsa.

UNIT III

Pre and Post-harvest Technology: Food of culture fishes, supplementary feed. Probiotics; live-fish transport; Fish spoilage; Fish preservation; Fishery byproducts.

UNIT IV

Fish Biotechnology: Application of genetics and biotechnology in fisheries; Importance of fish genetics and hybridization; Androgenesis. Gynogenesis, Production of transgenic fishes

UNIT V

Aquatic Pollution: Types and sources; Impact of pollution on fishes; Treatment of waste water; Bioremediation

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE)

PAPER VI

LIMNOLOGY AND FISHERIES- : FISH AND FISHERIES BIOLOGY II

PAPER CODE – LIMNO 647

UNIT I

Origin and Taxonomy of fishes: Origin and evolution of major groups of fishes; Classifications of fishes. Bio-geographical distribution of fishes.

UNIT II

Fish Physiology: Respiratory system: Gills and aerial respiration; Air Bladder in fishes; Weberian ossicles; Excretion and osmoregulation in fishes

UNIT III

Fish Physiology: Reproductive system and its endocrine regulation; light and sound production in fishes; Electric organs and electro-receptors in fishes; Age and growth in fishes

UNIT IV

Fish pathology and Population studies: Bacterial diseases; Fungal diseases; Worm infections; Prevention and cure of fish diseases, Fish population dynamics.

UNIT V

Fish Behavior: Migration in fishes; Reproductive and shoaling behavior; Parental care; Orientation and homing.

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE)

PRACTICAL

LIMNOLOGY AND FISHERIES

PAPER CODE – LIMNO 647

1. Identification of fishes upto species level with the help of books and writing notes on fisheries habitat etc.
2. Bio-geographical distribution of fishes on world map.
3. Ova diameter measurement in the given sample of ovary.
4. Gut content analysis of any carp fish.
5. Labelling and identification/Labeling of Weberian ossicles
6. Labelling and identification/Labeling of pituitary gland
7. .Determination of fish age by scale method.
8. Biochemical and haematological studies.
9. Identification and writing comments on commercially important indigenous fishes, exotic fishes, Prawns, fishing nets, boat models,

   hapas, etc.

10. Visits to various lakes, fish farms, landing centres and polluted streams for limnological and fisheries study, preparation of field report.

SUGGESTED READINGS

1. Gerald Karp: Cell and Molecular biology II Eds.
2. John Wiely. David Fried felder: Molecular Biology II Ed. Narosa.
3. T.A.Brown: Gene cloning IV ed. Chapman and Hall.
4. Benjamin Levine: Gene –I to X. Oxford Press.
5. Robert Meyers: Molecular Biology and Biotechnology, VCH Pub.
6. Eric Kendel, J.H. Schwartz, T.M.Jessel: Principals of Neural Science, Mc Graw-Hill.
7. A.Longstaff: Instant Notes-Neuroscience, Viva books.
8. M. S., Gazzaniga, R. B. Ivy, G. R. Mangun : Cognitive Neuroscience, second Ed. WW Norton Press.
9. A. Paul, B. Beltz, J. B-Sweeney: Discovering neurons, the experimental basis of neuroscience, Cold Spring Harbor Laboratory Press.
10. Nigel Jenkins: Animal Cell Biotechnology, methods and Protocols, Humana Press.
11. J. Freshney: Animal Cell Culture.
12. T. Laurencin, L.S.Nair: Nanotechnology and tissue engineering. CRC Press.
13. J. Paul: Cell and Tissue Culture, Fifth Ed. Churchil Livingstone.

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE)

PAPER V

CELL AND MOLECULAR BIOLOGY –I

PAPER CODE – CELL & MOL 645

UNIT I

1. Molecular Immunology

- Components of immunity
- Innate (nonspecific) immunity
  - Anatomic barriers
  - Chemical barriers
  - Phagocytic barriers
  - Inflammatory barriers
- Adaptive (specific) immunity
  - Humoral and cell-mediated immune responses (CMI)
    - Recognition of antigen by B-and T-lymphocytes and antigen presenting cell.
    - Clonal selection of lymphocytes
  - Cellular interactions required for generation of immune responses
    - Activation and proliferation of B and T cells.
    - Generation of humoral immune responses.
    - Generation of CMI.

2. Cells and organs of immune system

- Hematopoiesis
  - B-Lymphocytes, T-lymphocytes and Null cells.
  - Mononuclear cells (antimicrobial and cytotoxic activities,secretion of factors).
  - Granulocytic cells (Neutrophils, Eosinophils and Basophils).
  - Mast cells.
  - Dendritic cells and Langerhans cells.

- Organs of immune system
  - Primary lymphoid organs (Thymus and bone marrow)
  - Secondary lymphoid organs (Lymph nodes, spleen, mucosal associated lymphoid tissue and cutaneous associated lymphoid tissue, tonsils and Peyer’s patches).

- Lymphatic system.

UNIT II

3. Antigens

- Immunogenicity versus antigenicity
- Factors that influence immunogenicity
  - Contribution of the immunogens (foreignness, molecular size, chemical composition and heterogenesity, susceptibility to antigen processing and presentation).
  - Haptens and epitopes.
  - Immunogen dosage and route of administration and adjuvants.

4. Immunoglobulins structure and function

- Molecular structure of Ig
- Immunoglobulin classes (lgG, lgM, IgE and lgD and their biological activities.
- Immunoglobulin - mediated effector functions (Opsonization, activation of complement, antibody dependent cell- mediated cytotoxicity , neutralization).
- Antigenic determinants on immunoglobulin (isotype, allotype and idiotype)
- Monoclonal antibodies
  - Formation and selection of hybrid cells
  - Production of monoclonal antibodies
  - Clinical uses of monoclonal antibodies
  - Catalytic monoclonal antibodies (abzymes).

UNIT III

5. Organization and expression of Ig genes

- Genetic model compatible with Ig structure.
  - Germ line and somatic variation models.

- Two gene model of Dryer and Bennett
- Verification of Dryer and Bennett hypothesis

- Multigene organization of lg genes
  - I-chain multigene family
  - k-chain multigene family
  - Heavy chain multigene family
- Variable region gene rearrangement
  - V-J rearrangements in light chain DNA
  - V-D-J rearrangements in heavy chain DNA
- Mechanism of variable region DNA rearrangement
  - 5.4.1 Recombination signal sequences
  - Enzymatic joining of gene segments
  - Identification of Raf-1 and Raf-2 genes
  - Defects in Ig gene rearrangements
  - Productive and nonproductive rearrangement
  - Allelic exclusions
- Generation and antibody diversity
  - Multiple germ line V.D and J gene segments
  - Combinatorial V-J and V-D-J joining
  - Junctional flexiblity
  - P-addition and N-addition
  - Association of heavy and light chain
- Class switching among constant region genes
  - Expression of Ig genes
    - Differential RNA processing of heavy chain primary transcripts.
    - Expression of membrane of secreted Ig.
    - Simultaneous, assembly and secretion of IgM and IgD.
    - Synthesis, assembly and secretion of Ig.
  - Regulation of Ig gene transcription
    - Effect of DNA rearrangement of transcription.
    - Inhibition of Ig-gene expression in T- cells.
  - Antibody genes and antibody engineering

- Chimeric and hybrid monoclonal antibodies.
- Monoclonal antibodies constituted from Ig gene libraries.

6. Antigen - Antibody Interaction

- Antibody affinity and activity.
- Cross reactivity.
- Agglutination reactions.
- Precipitation reaction.
- Complement and complement fixation test.

UNIT IV

7. Major Histocomptability complex

- General organization and inheritance of MHC.
  - Location and function of MHC.
  - MHC haplotypes.
- MHC molecules and genes
  - Structure of class I molecules.
  - Structure of class II molecules
  - Organization of class I and II genes.
  - Peptide binding by MHC molecules.
  - Class III molecules
- Genomic maps, of MHC genes
  - Maps of class I MHC
  - Maps of class II MHC
  - Maps of class III MHC
  - Regulation of MHC expression.
  - MHC and immune responsiveness.
  - MHC and diseases susceptibility.

8. Antigen processing and presentation

- Role of antigen presenting cell

- Early evidence for the necessity of antigen processing.
- Cells that function in antigen presentation.

- Evidence for two processing and presentation pathways.
  - Endogenous antigens. The cytosolic pathways
    - Peptide generation by proteosomes.
    - Peptide transport from the cytosol to rER.
    - Assembly of peptide with class I MHC molecules

- Exogenous antigens. The endocytic pathway.
  - Peptide generation in endocytic vesicles
  - Transport of class II MHC molecules to endocytic vesicles.
  - Assembly of peptide with class 11 MHC molecules.

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE)

PAPER VI

CELL AND MOLECULAR BIOLOGY – II

PAPER CODE – CELL & MOL 646

UNIT I

1. Cytokines

- Properties of cytokines
- General structure of cytokines
- Function of cytokines
- Cytokines related diseases.
  - Bacterial septic shock
  - Bacterial toxic shock and similar diseases
  - Lymphoid and myeloid cancers
  - Chagas disease

2. Immune system in health and disease

- Immune response to infectious disease
  - Viral infections
    - Viral neutralization by humoral antibody.
    - Cell - mediated antiviral mechanism.
    - Viral evasion of host defense mechanisms.

  Bacterial infections
    - Immune responses to extra cellular and intracellular bacteria.
    - Bacterial evasion of host defense mechanism.
  - Protozoa and diseases.
  - Diseases caused by helminthes.

UNIT II

3. Vaccine

- Active and passive immunization.
- Designing vaccines for active immunization.
- Whole organism vaccine
  - Attenuated viral or bacterial vaccines.

- Inactivated viral or bacterial vaccines.
- Polysaccharide vaccines.
- Recombinant vector vaccines.
- DNA vaccines.
- Synthetic peptide vaccines.
- Multivalent peptide vaccines.

4. AIDS

- Structure and types, genome organization, replication, opportunistic agents and therapeutic agents
- Immunodeficiencies – Lymphoid and myeloid lineage.

UNIT III

5. Hypersensitivity

- Type I, II, III and IV
- In vivo and in vitro

6. Autoimmunity

- Organ specific autoimmune disease
- Systemic autoimmune disease.

UNIT IV

7. Tumor immunology

- Tumor antigen

- Tumor evasion.
- Immune system against tumors.
- Therapies.
- Transplantation immunology
  - Acute ,hyperacute and chronic rejection .
  - Tissue matching(HLA typing)
  - Graft Vs host (GVH) reaction
  - Xenotrasplantation

- Immunosuppressive drugs, role of monoclonal antibodies in transplantation.

DISCIPLINE SPECIFIC ELECTIVE PAPER (DSE)

PRACTICAL

CELL AND MOLECULAR BIOLOGY

PAPER CODE- CELL & MOL 647

1. Fractionation

    - Tissue homogenization and fractionation by differential centrifugation for isolation of mitochondria, nuclei and cytosol and use of marker enzymes for assessment of purity of the components
    - Fractionation of protein, RNA and DNA and their Quantification

2. Separation techniques

    - Separation of proteins and DNA by agarose electrophoresis
    - Separation of proteins and isoenzymes on SDS-PAGE and PAGE
    - Electroeluting of proteins,DNA/RNA from electrophoretic gels
    - Separation of amino acids by paper chromatography
    - Separation of phospholipids by TLC
    - Separation of haemoglobin by column chromatography

3. Chromosomal Techniques

    - Preparation of salivary gland chromosomes from Drosophila / Chironomous larva and stain with acetocarmine/aceto-orcein/ fuelgen
    - Preparation of mammalian chromosomes from bone marrow or testis and stain with Giemsa stain.

4. Isolation of T and B cells from sensitized animals

    - From spleen
    - From lymph nodes
    - From human blood-rosette formation

5. Purification of antibodies and antigens

- Insolubilization of antibodies an antigenic proteins using gluteraldehydates
- Immuno-adsorption
- Dissociation of absorbed material from immuno-adsorbents

6. Quantitation of antibodies

- Precipitation techniques
- Immunodiffusion method
- Immunoelectrophoresis method

7. Immunoassays RIA, ELISA

8. Permanent slides: Thymus, lymph nodes, spleen, bone marrow and cancer cells of various types

SUGGESTED BOOKS

• Abbas AK Lichtman, AR. and Pahes, J.S. Molecular Immunology, WB Saunders & Co, London

• Cruse. J.M. and Lewis, RE. Atlas of Immunology, CRC Press, New York.

• Talwar, G.P. and Gupta. S.K A Handbook o fPractical and Clinical Immu-nology. Vall & II. Vikas Publishing House Pvt. Ltd. New Delhi.

• Roitt I , Brostoff J , Male D, Immunology , Ammazon .com

• Male D, , Brostoff J,Roth D, Roitt I , Immunology ,Ammazon .com

• Goldsby, RA.. Kindt, T.J. and Osborne, B.A. Kuby Immunology, WH Freeman & Co. New York.

• Abbas AK Lichtman, AR. and Pahes, J.S. Molecular Immunology, WB Saunders & Co, London

• Cruse. J.M. and Lewis, RE. Atlas of Immunology, CRC Press, New York.

• Talwar, G.P. and Gupta. S.K A Handbook o fPractical and Clinical Immu-nology. Vall & II. Vikas Publishing House Pvt. Ltd. New Delhi.

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• Male D, , Brostoff J,Roth D, Roitt I , Immunology ,Ammazon .com