

**Yashwantrao Chavan Institute of Science,  
Satara**  
(Autonomous Institute)  
**Under Choice Based Credit System (CBCS)**

**Syllabus for Master of Science Part – I**  
**Year 2018-19**

## **M. Sc. I – Sem. I**

### **Paper- I Biosystematics and Biodiversity**

**Credit: (Theory – 04 Practical - 04)**

#### **Unit I**

##### **Taxonomy:**

**Introduction to taxonomy**, Stages and importance of taxonomy; Problems, Aim and Tasks of Taxonomy.

**Modern Trends in Taxonomy:** Morphological approach, immature stages and Embryological approach, Ecological, behavioral and Cytological approach.

##### **Methodologies in systematics:**

Molecular markers for detection/evaluation of polymorphism, RFLP, RAPD etc.

#### **Unit II**

##### **Concept of species:**

**Introduction**, Typological, Biological, Nominalistic, Evolutionary and recognition species concept with conclusions, taxonomic identification.

**Zoological nomenclature:** Origin of the code, international code of Zoological nomenclatures rules of nomenclature. Species and their number, polytypic species, Subspecies, other intraspecific group, super species.

#### **Unit III**

##### **Biodiversity Science:**

Evolution of biodiversity, Factors promoting high diversity, Endemism and Hotspots, Measures of Bio-diversity, Values of Biodiversity, Uses and Importance of Biodiversity.

**Evaluation of priorities for conservation of habitats and species:**

Selection criteria for protection of species–species quality, Hotspots, Conservation indices.

## **Unit IV**

### **Biodiversity Conservation:**

Loss of biodiversity, Listing of threatened biodiversity, Threats to biodiversity, Role of NGOs, Colleges and Universities.

IUCN Guidelines for Red List categories and criteria (version 7.0), Red List of Indian Flora and Fauna.

## **M. Sc. I – Sem. I**

### **Paper – II - Ecology and Environmental Pollution**

**Credit: (Theory – 04 Practical - 04)**

**Theory Lectures: 60**

#### **Unit I**

1. Habitat and Niche: Concept and types of habitat, Ecological niche, Niche width and overlap.
2. Species interaction: Types of interactions, Interspecific competition, Symbiosis.
3. Community ecology: Types and nature of communities, Structure of community, Community dominance, edge and ecotones.

#### **Unit II**

1. Ecological Succession: Types and Patterns of succession, Climax.
2. Ecosystem: Structure and Functions of ecosystem, Primary production.
3. Environmental Impact Assessment: Definition and scope, characteristics, objectives, components, methodology, procedure for obtaining EIA clearance, preparation of EIA document.
4. Biogeochemical Cycles

#### **Unit III**

##### **Concept, Scope and Definitions of Environmental Pollution**

- Types of pollutants- based on physical properties, forms, causes of environmental pollution, pollution in relation to public health (Air, water, pesticide and radiation pollution).

**Air pollution** -Definition, sources, principle air pollutants, effects of air pollutants.

**Smog** - Classical smog and industrial pollution, photochemical smog and vehicular emission. Prevention and control of air pollutants.

**Environmental Legislation:** Central and state boards for the prevention and control of environmental pollution, powers and functions of pollution control boards, penalties and procedure, duties and responsibilities of citizens for environmental protection, Wildlife Protection Act 1972.

#### **Unit IV**

**Water pollution-** Definition, Sources of water pollution, Types of water pollutants and their effects, BOD, COD water pollution control, Sewage treatment.

**Soil pollution-** Sources, effects of soil pollutants and remedial measures.

**Radioactive pollution** - Types, sources and effects of radiation.

**Agricultural pollution-** Farm animal waste, Soil erosion plants residues, agrochemical- fertilizers and pesticides.

**M.Sc. Zoology**  
**Academic Flexibility, Credit System**  
**M.Sc.-I Sem.- I**  
**Paper – III Cell and Molecular Biology**  
**Credit: (Theory – 04 Practical - 04)**

**Theory Lectures: 60**

#### **Unit I**

##### **Membrane Structure and Function**

1. Structure of model membrane, lipid bilayer and membrane protein diffusion,
2. Osmosis, ion channels, active transport, membrane pump
3. Cell-cell adherence, Gap junction, ECM, Integrin

#### **Unit II**

##### **Secretory Pathway:**

1. ER-structure (SER, RER), transport.
2. Ribosomes, polysomes, free ribosomes, membrane associated ribosomes and secretory pathway.
3. Vesicles involved in intracellular transport.

#### **Unit III**

##### **Cellular respiration & degradation:**

1. Peroxisomes – structure and functions.
2. Endosomes – late and early – structure, formation, assembly & components.
3. Lysosomes – structure & polymorphism.

4. Proteasomes – types structures, assembly & functions.

5. Mitochondria -structure, assembly components.

6. Role of cytochrome P-450 in detoxification (Xenobiotic Transformation)

## Unit IV

### Nuclear Components:

1. Nucleus – EM. Structure.

2. Nuclear envelope – structure & function.

3. Chromosomes – Packaging of genome, genetic maps, nucleolus.

4. Heterochromatin.

### Cell cycle division and signal transduction:

1. Cell cycle – cyclins & cyclin dependent kinases & check points.

2. Cytoskeleton & intracellular movement – microtubule, MTOC.

3. Micro filaments & intermediate filaments.

4. Signal transduction pathway.

## M. Sc. Zoology

### Academic Flexibility, Credit System

### M. Sc. I – Sem. I

### Paper- IV- Applied Entomology

Credit: (Theory – 04 Practical - 04)

Theory Lectures: 60

## Unit I

**Study of generalized insect:** Grass hopper (Morphology and Anatomy Brief Account) Identification, Characteristics, Biology, Damage and Control of following insect pests.

**House hold pests:** Cockroach, Ant, Cricket, Clothes Moth, Carpet beetle, Furniture beetle, Cigarette beetle, House hold hairy caterpillar, Silverfish, Book louse, Wasp.

**Medicinal Pests:** Mosquitoes, Housefly, Bedbug, Sand fly, Human lice, Tsetse fly, Rat flea, Hippoboscids.

## Unit II

**Veterinary pests:** Mosquitoes, Sandfly, Horsefly, Blowfly, Stable fly, Warble fly, Creeping worm fly, Flea.

**Forest Pests:** Termites, *Eutectonamachearalis*, *Hyblea puera*, *Sahyadrasinus malabaricus*, *Batocera rufumaculata*,

*Shisham defoliator*, *Plecopterareflexa*, Deodar defoliator Oak bark weevil, Scolytid beetle,

## Unit III

**Sericulture:** History of Sericulture, Life cycles of Mulberry and Non-Mulberry

Silkworms, Rearing technology of mulberry silkworm, Diseases and pests of Mulberry silkworm, Moriculture and cultural practices and pests of Mulberry.

**Lac culture:** Lac insect- Taxonomy, distribution and life history, Host plants and lac insects, Strains of lac insect and their propagation, Cultivation practices, Lac extraction and uses.

**Apiculture:** The honey bees, Social organization of honey bees, Life history of honey bees, Methods of bee keeping.

**Unit IV**

**Principles and methods of pest management** in residential places and public buildings, insecticides for domestic use and their safety, Organic methods of domestic pest management.

**M. Sc. Zoology**

**Academic Flexibility, Credit System**

**M.Sc.-I Sem.-I**

**Practical – I: Practical based on paper – I & II**

1. Study of museum specimens and slides invertebrate's phyla (one representative from each class) for biosystematics & biodiversity.
2. Study of museum specimens of chordates phylum (one representative from each class) for biosystematics and biodiversity.
- 3) Identification of insects/ molluscs with the help of keys up to orders.
- 4). Identification of insects/ molluscs with the help of keys up to families.
6. Identification of animals with the help of keys up to families (fish/ amphibian with the help of preserved specimens / models / pictures).
7. Methods of collection and preservation of animals.
8. Visit to ZSI/ fields.
9. Study of inter relationships parasitism, symbiosis, commensalisms (2-3 examples from each).
10. Study of endangered species. (Models, pictures, charts.).
11. Study of adaptations in animals from pisces, amphibian, reptilian, birds & mammals (2-3 examples from each).
12. Visits to sanctuaries and National parks to study wild life management.
13. Study biodiversity of plateau by Quadrant & transect method, Shannon index and Simpsons index
14. Detection of heavy metal by Atomic absorption Spectrophotometer
15. Use of software for identification of plants & animals.

16. Assessing existing data base on www.
  17. Harnessing information through Internet regarding Biodiversity.
  18. Preparation of culture media isolation of DNA from plants & animals.
  19. Study of microbes isolation, culture and staining from soil & water.
  20. Identification of planktons from different water samples
  21. Determination of DO, CO<sub>2</sub> Hardness, Chloride, Alkalinity of freshwater and sewage water.(Physicochemical parametres)
  22. Determination of COD of sewage water.
  23. Determination of BOD of sewage water.
  24. Estimation of inorganic phosphate and nitrate from water sample.
  26. Qualitative and quantitative estimation of Zooplanktons.
  26. Detection of heavy metal from the water sample.
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27. Practicals set on the network – internet, protein information, Genome & Chromosome database set by teacher.
  28. Any other experiment set by the concerned teacher

**M.Sc. Zoology**  
**Academic Flexibility, Credit System**  
**M.Sc.-I Sem.-II**  
**Paper- V: Physiological chemistry**  
**Credit: (Theory – 04 Practical - 04)**  
**Theory Lectures: 60**

### **Unit I**

**Principles of Biological chemistry:** Principles of biophysical chemistry (pH, buffer, reaction kinetics dissociation and association constants) Physical constants, Structure of atoms, molecules and chemical bonds, Van derWaal's electrostatic, Hydrogen bonding and hydrophobic interactions. thermodynamics, Concept of free energy, Enthalpy, Entropy,

**Water:** Structure and physicochemical properties, Energy rich bonds.

**Basics of solution preparation:** Molarity, Molality, Normality, W/V, % solution, ppm, Stock dilution

### **Unit II**

**Carbohydrates** - structure, classification and function, Carbohydrate metabolism: Glycolysis, TCA cycle, Electron transfer and ATP generation, Bioenergetics of ATP cycle, glycogenesis, glycogenolysis, gluconeogenesis and Pentose phosphate pathway

### **Unit III**

**Proteins** – structure, classification and function, Biosynthesis and Oxidation of amino acids.

Primary structure of proteins and nucleic acids, Conformation of proteins and , Reverse turn and Ramachandran plot.

**Nucleic acids: DNA, RNA** structure, functions and Biosynthesis of nucleotides

#### **Unit IV**

**Lipids-** structure, classification and function, Catabolism of fatty acid – Beta oxidation, significance of beta oxidation, Biosynthesis of saturated and unsaturated

fatty acids, Biosynthesis of triglyceride, biosynthesis of membrane phospholipids, Biosynthesis of cholesterol, Steroidal hormones- structure and functions.

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**M. Sc. I Sem. II**

**Paper. VI. Quantitative Biology and Tools and Techniques in Biology**

**Credit: (Theory – 04 Practical - 04)**

**Theory Lectures: 60**

#### **Unit I**

1. Introduction, Application in Biology.
2. Measurement of Central tendency.
3. Measures of dispersion.
4. **Correlation-** Types and methods of correlation.
5. **Regression-** Regression lines and coefficients.
6. **Analysis of Variance (ANOVA).**

#### **Unit II**

1. **Probability-** Introduction, addition and multiplication theory.
2. **Probability distribution-** Binomial, Poisson and Normal.
3. **Testing of hypothesis.**
  - 3.1 Tests of Significance.
  - 3.2 Null hypothesis.
  - 3.3 Alternative hypothesis.
  - 3.4 Level of significance.
4. **Student t- test.**
5. **Chi- square test (X<sup>2</sup>).**

## 6. Confidence integral.

### Unit III

#### **Separation techniques:**

2. Chromatographic techniques – Chromatography theory & practices, Molecular Sieve chromatography, affinity chromatography, ion exchange chromatography, HPLC, GLC, Thin layer chromatography.
3. Electrophoretic techniques – General principles, support media, electrophoresis of proteins and nucleic acids, Isoelectric focusing.
4. Density gradient centrifugation and its application

### Unit IV

#### **(A) Analytical instruments and their applications in Biology:**

1. Spectroscopy (Spectrophotometry, Spectrofluometry, NMR, ESR).

#### **(B) Microscopy, Radiometry & Immunochemical techniques.**

1. Light microscope, phase contrast microscope, fluorescence microscope, Electron Microscope (SEM & TEM).
2. Immunoprecipitation, Labelling antibodies, immunoblotting, immunoassays & immunohisto /cytochemistry.

**M.Sc. Zoology**  
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**M.Sc.-I Sem.-II**  
**Paper – VII: Elements of physiology**  
**Credit: (Theory – 04 Practical - 04)**  
**Theory Lectures: 60**

### Unit I

#### **Gastrointestinal Physiology**

- Functional anatomy of gastrointestinal tract
- Gastrointestinal tract associated glands ( Liver, Pancreas and salivary gland) with their control mechanism
- Digestion and absorption in gastrointestinal tract
- Dietary balance, regulation of feeding ,obesity and starvation, BMR, Vitamins and their role in metabolism

### Unit II

## **Physiology of Respiration:**

- 2.1 Mechanism of breathing and pulmonary ventilation
- 2.2 Pulmonary volumes and capacities
- 2.3 Physiology of gas exchange
- 2.4 Regulation of respiration

### **Unit III**

## **Physiology of Circulation:**

- 3.1 Body fluids, blood coagulation and homeostasis
- 3.2 Blood groups and blood transfusion
- 3.3 Cardiac muscles and cardiac cycle
- 3.4 Control of excitation and conduction in heart
- 3.5 Normal electrocardiogram

### **Unit IV**

## **Physiology of Excretion:**

- 4.1 Functional anatomy of the kidneys and Mechanism of urine formation
- 4.2 Regulation of urine formation,
- 4.3 process of micturation and diuretics
- 4.4 Cerebrospinal fluid and brain metabolism.
- 4.5 Conduction of nerve impulse and synaptic transmission
- 4.6 Pituitary, Thyroid and Parathroid Structure and functions, Bone marrow and erythropoiesis

**M.Sc. Zoology**  
**Academic Flexibility, Credit System**  
**M.Sc. I Sem II**  
**Paper – VIII: Biology of Parasites**  
**Credit: (Theory – 04 Practical - 04)**  
**Theory Lectures: 60**

### **Unit I**

Animal association, Types of Parasites, Types of Hosts, Interrelationship between host and parasiteresponses and hosts to parasitic infection, Mode of transmission of parasite, Host specificity and parasitic adaptation

### **Unit II**

**Vectors**, i) Definition, types, Epidological consideration, Relationship of vertebrate pathogen to vector immunology, Physiology of vector, Population studies and effectiveness of vector.

ii) Arthropod vector of Medical and veterinary importance Human louse, Triatomine bugs, Blackflies, Sand flies, Mosquitoes, and Rat flea, ticks, mites and Vector control.

Horse fly, House fly, Tsetse fly, Stable fly

### **Unit III**

Study of parasites from protozoa & cestoda

1. Trypanosoma and leishmania of humans.
2. Intestinal flagellates Giardia, Trichomonas, Gregarina.
3. General life cycle of cestodes: Taenia, Dipylidium, Echinococcus.

### **Unit IV**

Study of parasites from Trematoda & Nematoda: Schistosoma, Fasciola, Nematodes: Wuchereria, Ancylostoma, Strongyloides, Enteroebius. Plant nematodes.

Biology, epidemiology and control of waterborne and food borne parasites. Ecological changes & emerging diseases. General pattern of parasitic transmission. Parasitic zoonosis.

#### **Academic Flexibility, Credit System**

**M.Sc.-I Sem.-II**

**Practical – III**

**Practical based on paper – V & VI**

- 1 Estimation of glycogen.
2. Estimation of lipids & phospholipids.
3. Estimation of Vitamin C.
4. Estimation of Cholesterol.
5. Estimation of alpha-amino nitrogen by formol titration..
6. To find saponification value for a given fat.
7. To prepare solution of given concentration change in normality/Molarity Prepare phosphate buffer of known pH and molarity- pH measurement, measurement of pH of lemon juice, urine and serum.
8. To find absorption spectrum of hemoglobin, bovine serum albumin, tyrosine and (uv-visible).
9. To estimate free amino acids by Ninhydrin method.
10. To estimate protein content by Biuret method/ Lowry et.al./ Bradford method.

11. To estimate the sugar by Nelson-Somogyi method and glucose.
12. Separation of sugars by TLC.
13. Spot test of amino acids.
14. Serum cholesterol, Calcium estimation
  
- 14 Examples based on different population genetical principles (Based on theory).
  
15. To isolate proteins by salting out or by adjusting isoelectric point.
16. To estimate tyrosine content by Folin-phenol method.
17. To estimate the purity of ATP.
  
  
18. Examples based on Chi-square test & student t-test.
  
- 19 Examples based on regression.
  
20. Examples based on Correlation coefficient.
21. Examples based on Coefficient of variance.
22. Examples based on ANOVA.
23. Examples based on Probability.
24. Any other practical set by the concerned teacher.

**M.Sc. Zoology**  
**Academic Flexibility, Credit System**  
**M.Sc.-I Sem.-II**  
**Practical – IV**  
**Practical based on paper – VII & VIII**

- Determination of Bleeding time
- Determination of Clotting time
- Estimation of Hemoglobin (Hb) concentration and oxygen carrying capacity
- Enumeration of Red blood corpuscles (R.B.C)
- Enumeration of white blood corpuscles (W.B.C)
- Differential count of W.B.C.
- Erythrocyte sedimentation rate (E.S.R)
- Detections of digestive enzymes
- Microanatomy of Endocrine glands
- To estimate amylase from saliva

- To study normal constituents of urine
- Measurement of breathing rate, heart beat and study of heart sound
- Collection of parasites: Protozoans/ Nematodes/ Helminthes/ Insects.
- Preservation and Identification of parasites: Protozoans
- Preservation and Identification of parasites: Nematodes
- Preservation and Identification of parasites: Helminthes
- Preservation and Identification of parasites: Insects
- Lifecycle studies of parasites: Protozoans
- Lifecycle studies of parasites: Nematodes
- Lifecycle studies of parasites: Helminthes
- Lifecycle studies of parasites: Insects
- Any other practical set by concern teacher.