

# **CAREER POINT UNIVERSITY KOTA (RAJASTHAN)**

**School of Basic and Applied Science**

**Syllabus and Course Scheme  
(Annual Scheme)**

**Master of Science  
(Zoology)**

**Session – 2021-22**

**Duration of the Course – Two Years**

**University Campus :** Alaniya, Kota 325 003, Rajasthan Ph: +91-80941-62999

**City office:** CP Tower (4<sup>th</sup> Floor), IPIA, Road No-1, Kota (Raj.) -324005 Ph: +91-744-3040045 Fax: +91-744-3040050

# Course Scheme of M.Sc. Previous

Annual Course Scheme of M.Sc. Previous				
Branch-Zoology				
S.No.	Paper Code	Paper Name	Marks	
			Min. Marks	Max. Marks
1	MSCZL101	Invertebrates & Principle og Animal Taxonomy	36	100
2	MSCZL102	Biological Chemistry, Immunology and Physiology	36	100
3	MSCZL103	Cell Biology, Genetics and Biotechnology	36	100
4	MSCZL104	Evolution and Statistical Methods In biology	36	100
5	MSCZP100	Zoology Practical	72	200
				G.T. 600

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# **MSCZL101 - Invertebrate & Principles of animal taxonomy**

## **UNIT - I**

1. A study of the classification of invertebrates with distinguishing features & examples of various subdivisions.
2. **Locomotory mechanisms:**
  - a) Amoeboid movements, ultra structure of cilia and flagella: ciliary and flagellar movements; molecular and physiological mechanisms involved in the three kinds of movements.
  - b) Myonemes and muscle fibers in invertebrate structure and their role in locomotion.
  - c) Locomotion in relation to hydrostatics, coelome, metamerism, arthropodization.
  - d) An outline of flight mechanism in insects.
3. **Feeding mechanisms:**
  - a) Amoeboid feeding.
  - b) Ciliary feeding.
  - c) Filter feeding.
  - d) Parasitic mode of feeding.
  - e) Feeding mechanisms in insect and echinoderms.

## **UNIT - II**

1. **Respiration:**
  - a) Respiration in lower invertebrates (Protozoans to helminthes).
  - b) Gills and Lophophores.
  - c) Gills and lungs in Mollusca.
  - d) Gills, trachea and lung like structures in Arthropods.
  - e) Physiology of respiratory pigments in invertebrates.
2. **Excretion** : A study of structural and functional organization of excretory systems in various invertebrate groups and a survey of various excretory products met with in them.
3. **Osmoregulation and ionic regulation** : a survey of principal mechanisms in fresh water, marine and terrestrial forms.

## **UNIT - III**

1. Structural and functional organization of nervous systems and receptors :
  - a) Plan of nervous systems in the Cocciferates, Platyhelminthes, Annelids, Arthropods. Molluscs and Echinoderms: structural and functional complexities of brain and ganglionic structures.
  - b) Receptors : Structural and functional organization of the mechanoreceptors. chemoreceptors and photoreceptors.
2. **Endocrine system** : a survey of endocrinal structures and their hormones: role of neurosecretions and hormones in developmental events of insects and crustaceans.
3. **Reproduction:**
  - a) Reproduction in Protozoa
  - b) Reproduction in Porifera
  - c) Reproduction in Metazoa : Sexual reproduction; Parthenogenesis.
  - d) Reproduction in Metazoa : Asexual reproduction in Coelenterata and Polychaeta.
  - e) Larval forms and their significance.

## **UNIT - IV**

1. Criteria for phylogenetic interrelationships between Invertebrate phyla.
2. Origin of Parazoa, Mesozoa and Metazoa.
3. Origin of Radiata (Coelenterata and Ctenophora).
4. Origin of Bilateria from Radiata (Importance of Planula larva and Ctenophores)
5. Phylogenetic significance of Rhynchocoela.
6. Interrelationship of important Pseudocoelomate groups, Rotifera. Gastrotricha, Kinorhynca, Nematomorpha and Entoprocta.
7. Affinities and evolutionary significance of the unsegmented lesser protostome phyla (Priapulida, Echiuroidea and

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Sipunculida.

8. Phylogenetic relationship between the coelomate phyla (Annelida, Onychopoda, Arthropoda & Mollusca).
9. Affinities and evolutionary significance of the Lophophorate coelomate phyla (Brachiopoda, Phoronida & Ectoprocta).
10. Affinities of the invertebrate deuterostome phyla (Chaetognatha, Echinodermata, Pogonophora & Hemichordata).

#### UNIT – V

1. Introduction to the science of taxonomy; rules of nomenclature.
2. Principles of classification : theories of biological classification & their history; the species category; the polytypic species; population systematic intraspecific categories.
3. Methods of classification : taxonomic collection & the processes of identification, taxonomic characters; types of variations (qualitative and quantitative) within a single population, methods of arriving at taxonomic decisions on species level; preparation and use of taxonomic keys.
4. **Cytotaxonomy** : importance of cytology and genetics in taxonomy.

### **MSCZL102 - Biological Chemistry, Physiology & Immunology**

#### UNIT – I

1. **Basic chemical concepts** : a study of the chemical bonds and functional groups.
2. **Biocatalysts** : Classification and nomenclature of the enzymes; nature of enzymes, enzyme specificity; factors affecting enzyme activity; enzymatic and non-enzymatic catalysts; coenzymes and their functions.
3. **Energy considerations** : Biological oxidation & reduction. Fundamental reactions of biological oxidation; redox potential and electron transport system, enzymes and prosthetic groups.
4. Metabolic pathways of protein, carbohydrates, lipids and nucleic acids (including sequence determination).

#### UNIT - II

1. **Physiology of the nervous system** :
  - a) Nerve impulse : Molecular physiology of nerve impulse.
  - b) Synapse physiology and integration of information; coding in the neural information processing. Neuro transmitters.
  - c) Reflex action : Various types of central and peripheral reflexes in mammalian nervous system.
2. **Physiology of the receptor system** :
  - a. General mechanism involved in stimulus transduction at receptor sites.
  - b. Functional architecture and stimulus processing in retina, organ of Corti and olfactory epithelium.

#### UNIT - III

1. Physiology of Respiration : Regulation of breathing and transport of O<sub>2</sub> and CO<sub>2</sub>. An elementary idea of emphysema, asthma, occupational disorders and spirometry.
2. Stress Physiology : A general idea of stress physiology with special reference to elastic and plastic strain, stress resistance avoidance and tolerance. Physiological response to oxygen deficient stress and body exercise. Concept of homeostasis, adaptations and acclimatization.

#### UNIT - IV

1. Innate and Acquired Immunity; phylogeny and ontogeny of Immune system, organization and structure of lymphoid organs, cells of the immune system and their differentiation.
2. Nature of Immune responses, Nature of antigens and superantigens, factors influencing Immunogenicity, epitopes and haptens.

#### UNIT – V

1. Structure and functions of Antibodies, Antigen-Antibody interactions in vitro and in vivo, complement system, Major histocompatibility complex in mouse and HLA system in humans.

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2. Organization and expression of Ig genes. T-cell and B-cell generation, activation and differentiation. Cytokines, cell mediated effector functions.
3. Immunological tolerance and Anti-immunity; Hyper sensitivity and immune responses to infection agents especially intracellular parasites

## **MSCZL103 - Cell Biology, Genetics and Biotechnology**

### **UNIT-I**

#### **Microscopy, Cytological-techniques and Cell-organelles**

1. A general idea of properties of light, lenses and magnification power. An elementary knowledge of principles and functioning of light (dissecting and compound), interference, polarising, fluorescence, phase contrast, UV and electron (SEM and TEM) microscopes.
2. Cytological techniques: Centrifugation and ultracentrifugation, intravital and supravital staining, preparation of cell cultures, isolation and fractionation of cell.
3. Plasma membrane and intracellular compartments: Structure and functions of membrane, principles of membrane transport, carrier proteins, ion channels. Structure and functions of endoplasmic reticulum. Signal recognition particles, ER signal peptides; signal transduction.
4. Vesicular traffic organelles: Structure and functions of Golgi complex and lysosomes, transport from Golgi bodies to lysosomes. Endocytosis and exocytosis; structure and functions of microbodies, glyoxysomes, peroxysomes, and spherosomes.
5. Energy transducers and other organelles: Structure, functions and evolution of mitochondria and plastids; their role as energy transducers. Structure and functions of ribosomes; structure of cilia, flagella, vacuoles and cytoskeleton.

### **UNIT-II**

#### **Nucleus, Chromosomes and Cell-division**

1. Nucleus: Structure of interphase nucleus, pore complex, nucleoplasm and nucleolus.
2. Chromosomes: Chromatin organisation in dividing and nondividing cells, structure of chromosomes, solenoid model, importance of C-value paradox, centromere and telomere, karyotype, banding techniques, FISH, GISH, Mc FISH, cytometry ; giant and mini chromosomes.
3. Cell cycle and mitosis: Stages of cell cycle (G1, S, G2 and M stage), centriole cycle, mechanism of mitosis, anaphasic movements.
4. Mechanism of meiosis, nondisjunction.
5. Regulation of cell division and abnormalities: Genetic regulation of cell cycle, check points, cyclins, MPF, chalone, mitotic poisons; molecular origin of cancer; apoptosis.

### **UNIT-III**

#### **Genetics-I**

1. **Basics:** Definitions of heredity, variation, gene, allele, autosomes, allosomes, homologous chromosomes, locus, homozygous, heterozygous, hemizygous, dominant, recessive, phenotype, genotype, filial generations, test cross, back cross, reciprocal cross, probable gamete formation for cross, use of symbols.
2. **Laws of heredity and their variations:** Works of Mendel and Morgan; incomplete dominance, multiple allele, pleiotropy, genetic interactions.
3. **Linkage and crossing over:** Mechanism of crossing over, linkage groups, linkage maps; Tetrad Analysis in *Neurospora*, accessory genetic elements ( plasmids, transposons and retereoelements).
4. **Genetics of sex:** Sex linkage, sex influenced and sex limited traits, sex determination, effects of environment on sex determination.
5. **Human genetics:** Abnormalities in chromosome structure and number, Inborne errors of metabolism, Pedigree analysis, eugenics, euphenics and euthenics, genetic counselling.

### **UNIT-IV**

#### **Genetics-II Molecular basis of inheritance**

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1. **DNA:** Structure and types of DNA; DNA as a genetic material, gene structure, replication of DNA, enzymes and accessory proteins involved in DNA replication, DNA damage and repair, gene mutation and its molecular mechanism.
2. **RNA:** Structure and types of RNA (r-RNA, m-RNA, t-RNA, Hn-RNA, Sn-RNA, antisenseRNA); types of RNA polymerase, transcription, step initiation, chain elongation and termination; post transcriptional modification, cap and tail formation, RNA splicing.
3. **Translation:** Mechanism of prokaryotic and eukaryotic translation, protein folding; role of chaperons.
4. **Gene regulation:** Gene regulation in Prokaryota, positive and negative regulation- Lac operon, tryptophan operon; gene regulatory proteins (motifs); gene regulation in Eukaryota.
5. **Applied Molecular Biology:** RNA interference, molecular mechanism of antisense molecules, ribozymes, molecular mapping- RFLP analysis and its application in forensic, disease diagnosis and generic counselling.

#### UNIT-V

##### Biotechnology

1. **Basics:** Genetic engineering, culture media, culture methods, restriction enzymes, cloning vectors, cell fusion, somatic hybridisation.
2. **Recombinant DNA technology:** Isolation of genetic materials gel-electrophoresis, amplification by PCR, insertion of r-DNA in host.
3. Bioreactors and downstream processing.
4. **Biotechnology in agriculture:** BT cotton, pest resistant and virus resistant plants, golden rice, flavr savr transgenic tomato.
5. **Biotechnology in medicine:** Humulin production, gene therapy, molecular diagnosis (DNA fingerprinting, ELISA), transgenic animals; liposomes (spheroplasts) in biomedical science.

### MSCZL104 - Evolution and Statistical Methods In Biology

#### UNIT - I

1. Concepts of evolution and theories of organic evolution, Darwinism, Neo-Darwinism.
2. Geological time – scale
3. Hardy-Weinberg law of genetic equilibrium. A detailed account of destabilizing forces :
  - a) Natural selection
  - b) Mutation
  - c) Isolation and its role in species formation
  - d) Genetic drift
  - e) Migration
  - f) Meiotic drive

#### UNIT – II

1. **Quantifying genetic variability :**
  - a) Genetic structure of natural populations
  - b) Phenotypic variation
  - c) Models explaining changes in genetic structure of populations
2. **Molecular population genetics :**
  - a) Patterns of change in nucleotide and amino acid sequences
  - b) Ecological significance of molecular variations
  - c) Emergence of Non-Darwinism-Neutral Hypothesis
3. **Genetics of quantitative traits in populations :**
  - a) Genotype-environment interactions
  - b) Inbreeding depression and heterosis
  - c) Molecular analysis of quantitative traits
  - d) Phenotypic plasticity
4. **Genetics of speciation :**

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- a) Phylogenetic and biological concept of species
- b) Patterns and mechanisms of reproductive isolation
- c) Models of speciation (Allopatric, sympatric, parapatric)

#### UNIT - III

##### 1. Molecular Evolution :

- a) Gene Evolution
  - b) Evolution of gene families, Molecular drive
  - c) Assessment of molecular variation
2. Origin of higher categories :
    - a) Micro-and Macro-evolution
  3. Characteristic of evolution Extinction, replacement, irreversibility of specialization etc.
  4. Adaptation diversity & nature of adaptation : adaptive radiations & occupation of new environments & niches : mimicry and coloration.

#### UNIT - IV

1. **Biostatistics Objective & significance** : important terms & symbols, graphs (bar diagrams, histograms, frequency polygons, line diagrams)
2. Frequency distributions & centering constants (Mean, Median and Mode).
3. Measures of variation (standard deviation, variance, standard error of the Mean).
4. Rates and ratios
5. Chi-square test.

#### UNIT - V

1. Correlation and regression
2. Analysis of Variance (ANOVA)
3. **Probability distributions** : Binomial, Poissons and normal
4. **Bioinformatics** : Elementary idea of bioinformatics and proteomics and Genomics

#### Text Book:

1. R.L. Kotpal "Invertebrates"
2. E.L. Jordan and Dr. P.S. Verma "Invertebrate Zoology" S. Chand Publication
3. Veer Bala Rastogi "Genetics" Rastogi Publication
4. P.S. Verma and V.K. Agrawal "Cell Biology, Genetics, molecular biology, Evolution and Ecology" S. Chand
5. A.K. Berry, "Animal Physiology" S. Chand

#### Reference Books:

1. Benjamin Pierce, "Genetics A Conceptual Approach" 2<sup>nd</sup> edition
2. B.D. Singh, "Biotechnology Expanding Horizon" Kalyani Publication
3. P.K. Gupta, "Cytology, Genetics and Evolution"
4. A.K. Berry, "A Text Book of Immunology" Emkay Publication

### MSCZP100 - Practical Work Based on Paper I to IV

#### I. Invertebrates :

1. Identification, classification & study of distinguishing features of important representatives (Protozoa to Hemichordata).
2. Study of permanent prepared slides (Protozoa to Hemichordata).
3. **Anatomy:**
  - a) Reproductive, excretory, nervous & heamocoelomic systems of leech.
  - b) Nervous system and general anatomy: Patella, lamellidens, Mytilus and Aplysia.
  - c) General Anatomy, reproductive and nervous system of Cockroach, Grasshopper.

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- d) Study of sections of the arm of a starfish: water vascular system of starfish;
4. **Permanent preparations and their study :**
- Preparation of cultures of Amoeba, Paramecium and Euglena. Study of these protozoans using vital dyes.
  - Permanent preparations of Amoeba, Paramecium and Euglena from cultures, vorticella from the pond water; flagellates from the gut of white ant; Rectal ciliates, Trypanosomes in the blood of house rat; lifecycle stages of Monocystis from the seminal vesicle of earthworm.
  - Collection, fixation & permanent preparations of trematodes, cestodes & nematodes found in sheep and pig and in the stool of infected persons.
  - Permanent preparations through various parts of Animals mentioned in III (i-iv) anatomy section and study of the structure.
  - Permanent preparations of different materials provided for study using microtome.
- II. **Biological Chemistry :**
- Identification of protein, carbohydrates and Lipid in various tissues.
  - Identification of different kinds of mono, di and poly saccharides in biological and chemical materials.
  - Quantitative estimation of the following by spectrophotometric / semiautoanalyser method in various tissues:-
    - Carbohydrates : Glycogen and glucose.
    - Proteins: Total proteins.
    - Lipid: Phospholipids and cholesterol.
    - Nucleic acids: DNA and RNA.
    - Enzymes: Acid and alkaline phosphatase.
  - Paper chromatography and Thin Layer Chromatography: Unidimensional chromatography using amino acids from purified samples and biological materials.
  - Study of digestive enzymes in different parts of alimentary canal.
- III. **Physiology:-**
- Elementary idea of Kymographic recording of muscle twitch, summation of twitches, chronic contractions, tetanus, fatigue & staircase phenomenon from the sciatic nerve muscle preparation of rat.
  - Study of ECG. Heart beat, Blood pressure.
  - Photometric determination of haemoglobin in blood sample.
  - Demonstration of the following in blood; clotting time. Bleeding time, erythrocyte sedimentation rate, haemolysis & crenation, differential count of leucocytes.
  - Determination of blood urea and blood sugar value.
- IV. **Cell biology :**
- Squash & smear preparations of testis of cockroach / grasshopper : Acetocarmine & Feulgen staining of these preparations.
  - Study of mitosis in onion root tip and mammalian bone marrow cells.
  - Study of giant chromosomes in the salivary gland of Chironomus larva or Drosophila larva.
  - Vital and supra-vital staining (with neutral red and Janus Green B) of cells of the testis of an insect or mammal to study the mitochondria.
  - Chromosome counts in cells of the testis of an insect or mammal or cells of the bone marrow of a mammal, micrometry and image analysis.
  - Study of prepared microscopic slides of various cell types, mitosis, meiosis and giant Chromosomes.
- V. **Genetics :**
- Culture and identification of male and female Drosophila through prepared culture.
  - Identification of wild and mutant forms of Drosophila.
  - Problems based on Mendelism and gene interaction.
  - Identification of blood groups in man.
  - Demonstration of sex chromatin (Barr Bodies).
- VI. **Statistical Methods of Biology :**
- Preparation of frequency tables and graphs (Computer based exercise).
  - Calculation of standard deviation, variance and standard error of the mean.
  - Correlation and rank of correlation.
  - Calculation of probability & significance between mean using t-test.

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5. Calculation of significance using Chi-square test.
6. Plotting the slope of a line on a graph: calculations of the slope of a line, coefficient and regression.
7. Preparation of histogram, bar diagram and line graph preferably using computer.

**(Note : Use of animals for practical work is subject to the condition that they are not banned under the wild life protection act)**



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# Course Scheme of M.Sc. Final

Annual Course Scheme of M.Sc. Final				
Branch-Zoology				
S.No.	Paper Code	Paper Name	Marks	
			Min. Marks	Max. Marks
1	MSCZL201	Chordata and Development Biology of Chordates	36	100
2	MSCZL202	Animal Ecology and Ethology	36	100
3	MSCZL203-A	Entomology(Morphology, Physiology & Systematics)	36	100
4	MSCZL204-A	Entomology(Ecology and Applied Entomology/Toxicology)	36	100
5	MSCZP200-I	Zoology Practical I	36	100
5	MSCZP200-II	Zoology Practical II	36	100
				G.T.
				600

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# **MSCZL201 - Chordata and Developmental Biology Of Chordates**

## **UNIT - I**

1. Origin and outline classification of chordates.
2. Interrelationships of Hemichordata, Urochordata and Cephalochordata and their relations with other deuterostomes.
3. Life histories of sessile and pelagic tunicates (ascidian), Pyrosoma, Salpa, Doliolum and Oikopleura.
4. **Origin, evolution and adaptive radiations of vertebrates :**
  - a) Geological time scale and fossils.
  - b) Origin, evolution and general characters of Agnatha.(Ostracoderms and Cyclostomes).
  - c) Early gnathostomes (Placoderms).
  - d) A general account of Elasmobranchi, Holocephali, Dipnoi and Teleostomi.
  - e) Adaptive radiation in bony fishes.

## **UNIT – II**

1. Origin, evolution and adaptive radiation of Amphibia.
2. Origin and evolution of reptiles; the conquest of land Seymouria and related forms; Cotylosauria; basic skull types and outline classification of reptiles.
3. Dinosaurs : Types and evolutionary significance.
4. Living reptiles : a brief account of Rhynchocephalia, Chelonia, Squamata & Crocodilia.
5. Origin and evolution of birds.
6. Origin of flight; flight adaptations.
7. Origin of mammals, primitive mammals (Prototheria & Metatheria)
8. A general survey of main radiations in eutherian mammals, excluding detailed reference to individual orders.
9. Evolution of man; relationships of man with other primates; fossil record of ancestry of man.

## **UNIT - III**

1. **Theories of development :** Preformation and epigenesis.
2. **Oogenesis:**
  - a) Growth of oocyte and vitellogenesis.
  - b) Organization of egg cytoplasm; role of the egg cortex.
  - c) Morphogenetic determination in egg cytoplasm.
3. **Fertilization :** Significance of fertilization in development and the essence of activation of the egg.
4. **Early embryonic development.** (a) Patterns of cleavage, blastulation and gastrulation in chordates (tunicates to mammals). (b) Fate maps. (c) Morphogenetic movements. (d) Mechanics and significance of gastrulation.
5. **Causal basis of development and primary embryonic induction:** (a) Concepts of potencies; prospective fates; progressive determination, totipotency and pluripotency, nuclear transfer experiment. (b) Induction of the primitive nervous system (Spemann's primary organizer) (c) Nature & regionally specific properties of inductor . (d) Competence. (e) Abnormal (heterogeneous) inductors. (f) Chemistry and mechanism of action of inducing substances.

## **UNIT - IV**

1. Cell differentiation and differential activity.
2. **Organogenesis :**
  - a) Morphogenetic processes in epithelia and mesenchyme in organ formation.
  - b) Morphogenesis of brain, neural crest cells and their derivatives.
  - c) Development of the eye, heart, alimentary canal and its accessory organs.
3. Maternal contributions in early embryonic development.
4. Genetic regulations of early embryo development.

## **UNIT – V**

1. **Embryonic adaptations :**

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- a) Evolution of cleidoic egg and its structural and physiological adaptations.
- b) Development and physiology of extra-embryonic membranes in amniotes.
- c) Evolution of viviparity.
- d) Development, types and physiology of mammalian placenta.
- 2. Metamorphosis in amphibia :**
- a) Structural and physiological changes during metamorphosis.
- b) Endocrine control of metamorphosis.
- 3. Regeneration:**
- a) Types of regeneration - physiological, reparative and compensatory hypertrophy, regenerative ability in chordates.
- b) Morphological and histological processes in amphibian limb regeneration.
- c) Origin of cells of regeneration, de-differentiation, re-differentiation, pattern formation during amphibian limb generation; reasons for failure of limb generation ability in other chordates and mammals; methods for induction of regeneration

## **MSCZL202 - Animal Ecology and Ethology**

### **UNIT – I**

- 1. Concepts of modern ecology.
- 2. **Limiting factors** : Leibig's law of minimum, Shelford's law of tolerance; combined concept of limiting factors, conditions of existence as regulatory factors.
- 3. Analysis of environment :**
- a) The general environment.
- b) Role of physical factors: temperature, light, water, atmospheric gases, media, substratum, climatology.
- c) Brief review of important physical factors as limiting factor.
- d) Nutrients and environment.

### **UNIT – II**

- 1. Organization at the population level :**
- a) General properties of population.
- b) Population growth form and forces shaping the population growth.
- c) Measurement of population; simple numerical problems on population measurement.
- d) Animal aggregation and social life.
- 2. Organization at the community level :**
- a) Biotic community concept.
- b) Community structure and concept of community dominance.
- c) Ecotone and concept of "edge effect".
- d) Patterns in communities : Stratification, zonation, activity, food web, reproductive and social structure.
- e) Community versus continuum.
- f) Evolution of communities : Palaecology; community structure in past ages.
- 3. Ecological regulations :**
- a) Succession in community : Basic types of succession; convergence and divergence in succession; modifications in succession; concept of climax, monocl意思 versus polyclimax theory; barriers and ecesis in succession; biome.
- b) Fluctuations within community : Irruptive cycle, fluctuation, causes of fluctuation, cycles.

### **UNIT – III**

- 1. Environment and animals in ecosystem :**
- a) Nature and constituents of ecosystem.
- b) Fundamental operation of ecosystem.
- c) Flow of matter and energy in ecosystem.
- d) Homeostasis in the ecosystem.
- e) Cycling of chemical elements in ecosystem.

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- f) Concept of productivity : Productivity of land and water, measurement of productivity.
2. **Organization and dynamics of ecological communities** : The habitat approach : A detailed knowledge of extent, zonation, environment, biota, adaptations and communities of fresh water, marine, terrestrial and estuarine ecosystems.
3. **Biodiversity** :
  - a) Need for conservation of biodiversity
  - b) Benefits from biodiversity
  - c) Threats to biodiversity
4. **Endangered species management and biodiversity protection**
5. **The ecological outlook** : Space ecology, nuclear radiations, human population explosion, resources; applied human ecology.

#### UNIT – IV

1. Introduction of animal behaviour.
2. **Orientation** :
  - a) Classification of various types of taxes and kineses.
  - b) Flight orientation in locust.
3. **Methods of studying behaviour** : Brain lesions; electrical stimulation, drug administration.
4. **Types of behaviour and their regulation** :
  - a) Components of feeding behaviour : Hunger drive; directional movement, avoidance, eating, carrying and hoarding.
  - b) Factors influencing choice of food.
  - c) Nervous regulation of food and energy intake :
    - i. Motivated behaviour ; drive, satiation and its neurophysiological control.
    - ii. Feeding behaviour.
    - iii. Learning : Habituation conditioned reflex; trial and error; latent learning; learning and discrimination, imprinting; neural mechanism of learning.
    - iv. Instinctive behaviour: Concept, phyletic decent and physiology.
    - v. Hormones and behaviour. Mammalian nervous system and involvement of hypothalamus in the regulation of behavioural patterns.

#### UNIT - V

1. **Social behaviour in primates** :
  - a) Primate societies.
  - b) Social signals, olfactory, tactile, visual, vocal and acoustic.
  - c) Status : Dominance and hierarchy, territorial behaviour, courtship and mating, aggression.
2. Behaviour of domestic and zoo animals.
3. Behaviour in birds : Behaviour of Streptopelia (ring dove); homing and migration.
4. Reproductive behaviour in fish (Stickle back or any other fish).
5. Behaviour in insects : Social behaviour, communications, concealment behaviour, role of pheromones.
6. Behavioural genetics: Single gene effect, multiple gene effect, behavioural variation in an individual; genetics and human behaviour.

### MSCZP200-I - Practical Syllabus Based On Paper V & VI

1. **Chordates** :
  - a) **Taxonomy** : Study of museum specimens or representative animals from all chordate groups (Protochordata to Mammalia).
  - b) **Anatomy** :
    - i. General anatomy and neural gland of Herdmania using charts and computer software.
    - ii. Afferent and efferent arteries, cranial nerves, membranous labyrinth, eye muscles and their innervation ,brain of any fish.
    - iii. Study of fish anatomy through serial section of fry and fingerling stages.

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- iv. Limb musculature, cranial nerves and eye muscles and their innervation in frog dissection using computer software.
  - v. General anatomy, major blood vessels and cranial nerves of any nonpoisonous snake through charts / models / computer software. Study of differences between poisonous and non-poisonous snakes.
  - vi. Flight muscles, perching mechanism, air sacs and anatomy of the neck region in pigeon through charts / models / computer software.
  - vii. Reproductive system and anatomy of the neck region in rat.
- c) **Osteology** : Comparative study of the axial and appendicular skeleton from fish to mammals, with particular reference to important skull types in amphibians, reptiles, birds and mammals.
- d) **Permanent preparations** : Whole mounts of pelagic tunicates, cycloid scales, pecten and columella in pigeon, ear ossicles of rat or squirrel or any other mammal.
- e) **Histology** : A detailed study of the histology of all mammalian tissues and organs through prepared slides.
- 2. Developmental biology :**
- a) Study of development of frog or toad through :
- i. Formalin preserved or living material (egg, spawn, embryo, larvae and metamorphic stages).
  - ii. Permanent microscopic slides of sections through successive embryonic and larval stages.
- b) Study of development of chick through :
- i. Permanent whole mounts of successive embryonic stages.
  - ii. Permanent microscopic slides of section through representative regions of successive embryonic stages.
- (Note : Special emphasis should be laid on organogenesis and morphogenesis.)
- c) Removal of chick embryos of 18,21,24,33,72 and 92 hours from the egg and their study and identification in the living state; permanent whole mounts of these embryos using living states.
- d) Study of formalin preserved fetuses with placenta and histology of the placenta of any mammal.
- 3. Ecology :**
- a) Measurement of climatic factors (atmosphere, water, temperature and relative humidity).
- b) Measurement of water and soil pH, edaphic factors of soil; preparation of soil extract, determination of humidity in microhabitat; pH, alkalinity of water, dissolved oxygen, free carbon dioxide, chloride, salinity, temporary and permanent hardness of water, turbidity, velocity of current.
- c) Measurement of population density. Numerical problems of population determination to be done.
- d) A field study of any one of the following habitats to be assigned to an individual or to a group of students
- i. Pond habitat.
  - ii. Marine habitat.
  - iii. Terrestrial habitat.
- 4. Ethology :**
- a) Study of the process of learning in rat with the help of animal maize; analysis of the results with simple experiments.
- b) Study of the shock and avoidance behaviour in rat.
- c) Imprinting in precocial birds.
- d) Chemical communication in the earthworms.
- e) Study of the food preferences and feeding behaviour of an insect pest.
- f) Study of the phototactic response in Tribolium/housefly.
- g) Study of habituation in chicks.

## **MSCZL203-A - Entomology (Morphology, Physiology and Systematics)**

### **UNIT I**

1. Insect integument : Structure, composition and functions.
2. Biochemistry of sclerotisation.
3. Functional morphology : Head, thorax, abdomen and appendages, head segmentation, wing venation. 4. Muscular system and its functions.

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## UNIT II

1. Digestive system : Alimentary canal and physiology of digestion.
2. Circulatory system : Anatomy, physiology; composition of haemolymph.
3. Respiratory system : Structure and physiology.
4. Excretory system : Functional architecture.

## UNIT III

1. Nervous system : Structure and physiology.
2. Neuro endocrine system.
3. Sense organs : Chemoreceptors, mechanoreceptors, photoreceptors, sound and light producing organs, visual organs and physiology of vision.
4. Reproductive system : Structure and physiology.

## UNIT IV

1. Classification of insects upto order and suborders.
2. Comparative study of wing venation in Orthoptera, Hymenoptera (Apis), Diptera (mosquito) and Homoptera (Aphid).
3. Introduction to primitive insects and fossil insects, cause of success of insects.
4. Origin and evolution of insects.

## UNIT V

1. Detailed classification of the following orders emphasizing selected superfamilies and families : Orthoptera, Isoptera, Coleoptera, Homoptera, Hemiptera, Lepidoptera, Diptera and Hymenoptera, Thysanoptera, Dictyoptera, Odonata and Neuroptera
2. Economic importance of these orders.
3. Social life in Isoptera and Hymenoptera.
4. Caste determination in social insects.

### **MSCZL204-A - Entomology (Ecology and Applied Entomology/Toxicology)**

## UNIT I

1. Effects of physical factors ; population dynamics.
2. Intraspecific and interspecific relations ; host plant insect - interactions.
3. Biochemical adaptation to environmental stress. Pheromonal control of fertility in insects.
4. Embryology : Embryonic and post embryonic development ; diapause, types of larvae, pupae and metamorphosis. Role of endocrine glands in growth and development, viviparity and parthenogenesis.

## UNIT II

1. General idea of damage caused by pests.
2. Principal methods of pest control.
3. Insecticides : Types, mode of action and methods of application.
4. General idea of appliances used in the insecticide treatment and their safe handling.

## UNIT III

1. A general account of chemosterilants, attractants, repellents, pheromones, growth regulators and such other compounds.
2. Development of resistance to pesticides.
3. Insecticide synergists and antagonists.
4. Safety precautions, poisoning and their treatment

## UNIT IV

1. Life history, damage caused and control of three major pests of each of the following crops : Wheat, paddy, maize,

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- jowar, millet, sugarcane, cotton, mustard and soyabean.
2. Stored grain and milled product pests : Sitophilus, Callosobruchus, Rhizopertha, Tribolium, Trogoderma, Oryzaephilus. An elementary idea of storage.
  3. Pests of veterinary and medical importance; preliminary idea of insect borne diseases.
  4. Life cycle of aphid and locust and their control.

#### UNIT V

1. A general idea of plant protection organisations in India; forensic entomology with special reference to human and wild life.
2. Beneficial insects : Silk worm, honey bee, lac insect; their economic importance and industries related to them.
3. Role of genetics in insect vector control.
4. An elementary idea of IPM.

#### Text Book:

1. E.L. Jordan and Dr. P.S. Verma "Vertebrate Zoology" S. Chand Publication
2. Dr. Narendra Jain, Dr. Rajbala Verma, Dr. K.K. Yadav and Dr. K.S. Kohli, "Ecology and Environmental Biology" R.B.D. Publication
3. Reena Mathur, "Concepts of Animal Behaviour"
4. Dr. Y.K. Mathur and Dr. K.D. Upadhyay, "A Text Book of Entomology", Aman Publication

#### Reference Books:

1. P.K. Gupta, "Ecology"
2. Dr. V.K. Agarwal, "Animal Behaviour", S.Chand
3. R.L. Kotpal "Vertebrates"

### **MSCZP200-II - Entomology Practical Syllabus Based On Paper VII And VIII**

1. Museum study for identification of insects from various orders (prescribed in theory syllabus).
2. Permanent Preparation
  - a. Whole mounts of microscopic insects.
  - b. Different types of mouth parts, antennae, legs and wings.
  - c. Sting apparatus and pollen basket of honey bee.
  - d. Tympanum and spiracle of grasshopper.
3.
  - a) Knowledge and use of equipments for rearing, collection and preservation of insects; insect net, lulling bottle, spreading board, insect-box; devices for inflating larva; light trap etc.
  - b) Maintenance of insectary.
4. Collection and preservation of insects and their different stages.
5. Collection of seasonal, nocturnal, aquatic insects, crop pests, stored grain pests, household pests and insects of veterinary and medical importance.
6. Anatomy:-
  - a) Cockroach - Digestive, circulatory, reproductive systems and neuroendocrine complex.
  - b) Grasshopper - Digestive, circulatory, reproductive systems and neuroendocrine complex.
  - c) House cricket - Digestive, reproductive and nervous systems.
  - d) Bug - Digestive and nervous systems.
  - e) Butterfly - Digestive and nervous systems.
  - f) Housefly - Digestive and nervous systems.
  - g) Honey bee - Digestive and nervous systems.
  - h) Wasp - Nervous systems.
  - i) Beetle - Nervous systems.
7. Familiarity with techniques and appliances used for insecticide treatment.
8. Bioassay experiments for testing the insecticides.

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9. Microtechnical procedures (microtomy).
10. Study of food preference in stored grain pests.
11. A tour to visit important centres of entomological / toxicological studies.

**(Note : Use of animals for practical work is subject to the condition that they are not banned under the wild life protection act)**



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