

Sri Sathya Sai College for Women, Bhopal

(An Autonomous College affiliated to Barkatullah University, Bhopal)

(NAAC Accredited 'A' Grade)



SYLLABUS

PG

SESSION- 2023-24

Class: M.Sc. Semester-I & II

SUBJECT: Zoology

Sri Sathya Sai (Autonomous) College For Women, Bhopal
Department of Zoology

Class : M.Sc. I & II Sem

Course Objective

(Course Code-USc02)

- Knowledgeable persons in concerned subjects.
- Identify, formulate, research, literature, and analyze complex problems, reaching substantiated conclusions using first principles of biological, physical, chemical and mathematical science.
- Individuals with aptitude and skill in research.
- Persons having innovative ideas and necessary training to initiate unique start-ups like fish farming, apiculture, sericulture.
- Young leaders who offer their service to the betterment of the community.
- Prepare successful professionals in industry, government, academia, research, entrepreneurial pursuits and consulting firms.
- Face and succeed in high level competitive examinations like NET, GATE and TOFEL

Learning outcomes

Class : M.Sc. I Sem

(Course Code-Sc02)

Paper I : Biosystematics, Taxonomy And Evolution

- Understanding of the universal common ancestor and tree of life, three domain concept of living kingdom
- Conceptualization of mode of speciation, evolution, systematics, biological classification, origination, extinction, and causes of differential rates of diversification.
- An insight to the overview of evolutionary biology, concept of organic evolution during pre- and post-Darwin era evolution and molecular biology- a new synthesis.

Paper II : Structure and Function of Invertebrates

- Understanding structure and function of different systems of invertebrates.
- Study of origin of metazoan, organization of coelom, locomotory organs and locomotion in different invertebrates.
- Understand the mechanism of digestion, excretion and respiration in metazoan, and other lower invertebrates.

Paper III : Quantitative Biology, Biodiversity And Wildlife

- Develops practical understanding of research methodology and applies in research (formulation and defining a research problem, different types of research design techniques involved).
- Get a deep knowledge about the basic types of biodiversity, biodiversity in India (features, structure and biodiversity of important Indian ecosystems).
- Become able to diagnose the causes of biodiversity depletion.

Paper III : Biomolecules and Structural Biology

- Understand chemical foundation of biology i.e. pH, PK, acids, bases, buffers, acid soluble pool of living tissues.
- Get a deep knowledge about structure of protein. DNA, RNA, DNA replication, recombination and repair and membrane channels and pumps.
- Acquire theoretical knowledge of enzyme action, concepts of free energy and thermodynamic principals in biology

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Session : 2023-2024

SCHEME OF EXAMINATION

M.Sc. Zoology (SEMESTER -I)

Number	Title of the course	Max. Marks	Min. Marks for Passing	Min. Aggr. Marks for Passing
	(A) THEORY PAPERS			
I	Biosystematics, taxonomy and evolution	85	31	
II	Structure and function of Invertebrates	85	31	
III	Quantitative Biology, biodiversity and wild life	85	31	
IV	Biomolecules and structural Biology	85	31	
	(B) PRACTICALS			
	I (based on Course I & II)	50	18	
	II (based on course III & IV)	50	18	
	(C) INTERNAL ASSESSMENT			
	CCE *4 Written Test based on each course (each of 15 marks)	60	5 in each test	
	TOTAL	500	-----	200

*Candidate has to pass in each test separately

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Session : 2023-2024

Max. Marks : 100 (85+15)
Class : M.Sc.
Semester : First
Subject : Zoology
Paper : I
Title /शीर्षक : Biosystematics, Taxonomy and Evolution

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

Unit I

- Definition and basic concepts of biosystematics taxonomy and classification.
- History of Classification
- Trends in biosystematics : Chemotaxonomy ,cytotaxonomy and molecular taxonomy
- Dimensions of speciation .
- Species concepts : species category, different species concepts, subspecies and other infra-specific categories.
- Theories of biological classification, hierarchy of categories.

Unit II

- Taxonomic Characters . Different kinds.
- Taxonomic procedures: Taxonomic collections , preservation, curation, process of identification.
- Taxonomic keys: different types of keys, their merits and demerits.
- International code of Zoological Nomenclature (ICZN): Operative principles, interpretation and application of important Rules, Formation of Scientific names of various Taxa.

Unit III

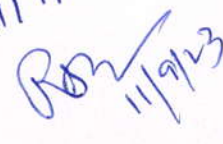
- Taxonomic categories.
- Evaluation of biodiversity indices.
- Evaluation of Shannon -Weiner Index.
- Evaluation of Dominance Index.
- Similarity and Dissimilarity Index.

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Unit IV

-Concepts of evolution and theories of organic evolution.

-Neo Darwinism and population genetics:

Hardy-Weinberg law of genetic equilibrium.

B-A detailed account of

i-Natural selection as a destabilizing force in Hardy-Weinberg law of equilibrium.

ii- Mutation as a destabilizing force in Hardy-Weinberg law of equilibrium.

iii- Genetic Drift as a destabilizing force in Hardy-Weinberg law of equilibrium.

iv- Migration as a destabilizing force in Hardy-Weinberg law of equilibrium.

-Meiotic Drive. -Trends in Evolution

Molecular Evolution

a) Gene evolution

b) Evolution of gene families

c) Assessment of molecular variation

Unit V

-Origin of higher categories

a) Phylogenetic , gradualism and punctuated equilibrium.

b) Major trends in the origin of higher categories

c) Micro and macro evolution.

-Molecular population genetics

a) Pattern of changes in nucleotide and amino acid sequence.

b) Ecological significance of molecular variations (genetic polymorphism)

-Genetics & Speciation

a) Phylogenetic and biological concept of species.

b) Origin ,patterns and mechanism of reproductive isolation.

c) Biological mechanism of genetic incompatibility

-Origin and Evolution & Economically important microbes.

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Suggested Reading Materials:

1. M. Koto-The. Biology of biodiversity-Springer
2. E.O. Wilson-Biodiversity-Academic Press Washington.
3. G.G.-Simpson-Principle of animal taxonomy Oxford IBH Publication company.
4. E-Mayer-Elements of Taxonomy
5. Bastchelet-F-Introduction to mathematics for life scientists Springer Verlag, Berling.
6. Skoal R.R. and F.J.Rohiff Biometry-Freeman, San-Francisco.
7. Snecdor, G.W. and W.G. Cocharan Statistical Methods of affiliated-East-West Press, New Delhi.
8. Murry J.D. Mathematical Biology-Springer, Verlag, Berlin.

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Max. Marks	:	100 (85+15)
Class	:	M.Sc.
Semester	:	First
Subject	:	Zoology
Paper	:	II
Title /शीर्षक	:	Structure and Function of Invertebrates

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

Unit . I

Origin of Metazoa .

Organization of Coelom

a) Acoelomates b) Pseudo coelomates c) Coelomates

Locomotion

a) Amoeboid , Flagellar and Ciliary movements in Protozoa

b) Hydrostatic movements in Coelenterata , Annelida and Echinodermata .

Unit . II

Nutrition and digestion

a) Patterns of Feeding and digestion in Lower Metazoans , Mollusca and Echinodermata .

b) Filter feeding in Polychaeta.

Respiration

a) Organs of Respiration : Gills , Lungs and Trachea

b) Respiratory pigments .

c) Mechanism of Respiration .

Unit . III

Excretion

a) Excretion in Lower invertebrates : Simple diffusion , Contractile vacuole ,

Protonephridia and Solenocytes

b) Excretion in Higher invertebrates : Coelom, Coelomoduct , metanephridia ,

Coxal gland , Malpighian tubules , Organ of Bojanus and Green gland .

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Mechanism of Osmoregulation with special to Protozoa .

Unit . IV

Nervous system

- a) Primitive Nervous system : Coelenterata and Echinodermata.
- b) Advanced Nervous system : Annelida and Arthropoda
(Crustacea and Insecta) and Mollusca (Cephalopoda).

Unit . V

Invertebrate larval forms and their evolutionary significance .




- a) Trematoda and Cestoda .
- b) Larval forms of Crustacea .
- c) Larval forms of Mollusca .
- d) Larval forms of Echinodermata .

Structure ,affinities and life history of the following Non – Coelomate and Coelomate Minor phyla :

- a) Rotifera
- b) Entoprocta
- c) Phoronida
- d) Ectoprocta

Suggested Reading Materials:

1. Hyman, L.H. The invertebrates, Nol. I.protozoa through Ctenophora, McGraw Hill Co., New York
2. Barrington, E.J.W. Invertebrate structure and function. Thomas Nelson and Sons Ltd., London.
3. Jagerstein, G. Evolution of Metazoan life cycle, Academic Press, New York & London.
4. Hyman, L.H. The Invertebrates. Vol. 2. McGraw Hill Co., New York.
5. Hyman, L.H. The Invertebrates. Vol. 8. McGraw Hill Co., New York and London.
6. Barnes, R.D. Invertebrates Zoology, III edition. W.B. Saunders Co.Philadelphia.
7. Russel-Hunter, W.D. A biology of higher invertbrates, the Macmillan Co.Ltd., London.
8. Hyman, L.H. The Invertebrates smaller coelomate groups, Vol. V.Mc.Graw Hill Co., New York.
9. Read, C.P. Animal Parasitism. Parasitism. prentice Hall Inc., New Jersey.
10. Sedgwick, A.A. Student text book of Zoology. Vol. I,II and III. CentralBook Depot, Allahabad.
11. Parker, T.J., haswell W.A. Text book of Zoology, MacmillanCo., London.

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Max. Marks	:	100 (85+15)
Class	:	M.Sc.
Semester	:	First
Subject	:	Zoology
Paper	:	III
Title /शीर्षक	:	Quantitative biology, Biodiversity and Wildlife

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

Unit I

- Distribution of the data in biology -mean, mode and median
- Measures of dispersion : range, mean deviation, IQD ,standard deviation and coefficient of variation
- Chi square test
- Normal distribution
- Experimental designing and sample method-

Unit II

- Probability :distribution, properties and probability theory
- Completely randomized design and randomized block design
- Analysis of variance
- Co-relation-types of correlation
- Karl pearson -coefficient of correlation
- Regression

Unit III

- Biodiversity**
- concept and principal of biodiversity
 - causes for the loss of biodiversity
 - Biodiversity conservation methods
 - Medicinal uses of forest plant (any five)
 - Biodiversity hot spots .

Unit IV

- Wildlife of India, types of wildlife**
- Values of wildlife, positive and negative
 - Wildlife protection Act
 - Conservation of wildlife in India
 - Endangered and threatened species

Unit V

- Wildlife and conservation
- National Parks and Sanctuaries
- Project Tiger
- Project Gir Lion and Crocodile breeding project
- Wildlife in M.P. with references to Reptiles Birds and mammals
- Biospheres reserves

Suggested Reading Materials:

- Batschelet. E. Introduction to mathematics for site scientist springer-verlag, berling
- Jorgenserr, S.E. Fundamental of Ecological modling E. sevier New York
- Lenderen D. Modelling in behavioral ecology. Chapman & Hall London U.K.
- Sokal, R.R. and F. J. Rohit Biometry Freeman San Francisco
- Snedecor, G.W. and W.G. cochran, statical methods, Affilited East, West Press New Delhi (Indian ed.)
- Muray , J.D. Methamatical Biology, Springer Verlag Berlin
- Pelon, E.C. The interpretation of ecological data : A promer on classification and ordivation.
- Wild life management -Hossetti -A. lewis . Biostatics
- B.K. Mahajan Methods in Biostatics
- V.B. Saharia wildlife in India
- S.K. Tiwari wildlife in central India
- J.D. Murrey Mathematical Biology
- Georgs & Wilians Startical method
- R.K. Tondon Biodiversity Texonomy & Ecology
- M.P. Arora An Introduction to prevantology
- P.C. Kotwal Biodiversity and conservation


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Max. Marks	:	100 (85+15)
Class	:	M.Sc.
Semester	:	First
Subject	:	Zoology
Paper	:	IV
Title /शीर्षक	:	Biomolecules and Structural Biology

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

Unit . I

Chemical Foundation of biology

1. PH, PK, acids bases, buffers, weak bonds
2. Free energy, resonance, isomerisation
3. Acid soluble pool of living tissues . aminoacids, monosaccharides, oligosaccharides, nucleotides, peptides.
4. Nanoparticles
5. Biomaterials

Unit . II

1. Primary, Secondary, tertiary and quaternary structures of proteins, protein folding and denaturation
2. DNA & RNA: Double helical structure of DNA, Structure of RNA, role of RNA in gene expression
3. DNA replication, recombination and repair
4. Functional importance of lipid storage and membrane lipids
5. Membrane channels and pumps

Unit . III

1. Basic concepts of metabolism: Coupled and interconnecting reactions of metabolism cellular energy resources and ATP synthesis
2. Glycolysis and Gluconeogenesis
3. Citric acid cycle
4. Oxidative phosphorylation : Protein and its regulation
5. Fatty acid metabolism: Synthesis and degradation of fatty acids

Unit . IV

1. RNA synthesis and splicing
2. Biosynthesis of amino acids
3. Biosynthesis of nucleotides
4. Biosynthesis of membrane lipids and steroids
5. Protein synthesis

Unit .V

1. Enzymes: Terminologies, classification and basics of enzyme kinetics
2. Mechanism of enzyme catalysis
3. Regulation of enzyme reaction
4. Concept of free energy and thermodynamic principals in biology
5. Energy rich bonds, compound and biological energy transducers

Suggested Reading Materials:

1. Voet, D. and J.G. Voet. Biochemistry John Wiley & Sons.
2. Freifelder, D. Physical Biochemistry W.H. Freeman & Co.
3. Segal, I.H. Biochemical calculations John Wiley and Sons
4. Creighton, T.E. Protein Structure and Molecular Properties W.H. Freeman & Co.
5. Freifelder, D. Essentials of Molecular Biology
6. Wilson, K. and K.H. Goulding A Biologists Guide to Principals and Techniques of Practical Biochemistry
7. Cooper, T.G. Tools of Biochemistry
8. Hawk, Practical Physiological Chemistry
9. Garret, R.H. and C.M. Grisham. Biochemistry. Saunders college Publishers.

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Class: M.Sc.
SEMESTER - I
Practical : Ist

1. Spotting – Classification and identification of various phylum.	10
2. One major dissection of various systems of invertebrates – Squilla, Prawn, Sepia, Loligo.	10
3. One minor dissection-Grosshopper,Honeybee,Echinus,Starfish,Aplysia.	05
4. Mounting material – Permanent balsum mount.	05
5. Spotting related with Adaptation. Homologics , Analogics and modification of mouth parts	05
6. Viva Voce.	10
7. Practical Records,collection.	05
Total marks	50

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Class: M.Sc.
SEMESTER - I
Practical : IInd

1. Problem based on Biodiversity and wild life. Mammals and Fishers group (Spots 5 + 5)	20
2. Exercise on mean, mode & Median.	05
3. Cell division preparation of slide on Meiosis & Mitosis.	05
4. Preparation of different types of Chromosomes.	05
5. Viva Voce.	10
6. Practical Records & collection.	05
Total marks	50

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SCHEME OF EXAMINATION

M.Sc. Zoology (SEMESTER -II) 2019-20

Number	Title of the course	Max. Marks	Min. Marks for Passing	Min. Aggr. Marks For Passing
	(A) THEORY PAPERS			
V	General and comparative animal physiology and endocrinology	85	31	
VI	Population ecology and environmental physiology	85	31	
VII	Tools and techniques in Biology	85	31	
VIII	Molecular cell biology and genetics	85	31	
	(B) PRACTICALS	50	18	
	I (based on Course I & II)	50	18	
	II(based on course III & IV)			
	(C)INTERNAL ASSESSMENT	60	5 in each test	
	CCE *4 Written Test based on each course (each of 15 marks)			
	TOTAL	500	-----	200

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Class: M.Sc. II Sem

(Course Code-Sc02)

Paper I : General and Comparative Vertebrate Physiology and Endocrinology

- Understand the concept of Osmoregulation, Kidney functions and diversity, Extra-renal osmoregulatory organs, Patterns of nitrogen excretion.
- Concept of thermoregulation - Heat balance in animals, Adaptations to temperature extremes, torpor, Aestivation and hibernation.
- Description of phylogeny and ontogeny of endocrine glands.
- Understand the classification, chemical nature and mechanism of hormone action, and role of hormones and reproduction.

Paper II : Population Ecology and Environmental Physiology


- An overview of evolutionary ecology and environmental concepts and eco-physiological adaptations to fresh, marine and terrestrial environment.
- Understanding the characteristics of population and population dynamics.
- Illustration of competition and coexistence, intra-specific and inter-specific interactions, scramble and contest competition model, mutualism and commensalism, prey-predator interactions.
- Understand the concept Meditation, yoga and their effects.

Paper III : Tools and Techniques in Biology

- Students know the computer added techniques, cryotechniques, separation techniques and microbiological techniques.
- Students learn about histological, cell culture, cytological, molecular cytological and surgical techniques etc.
- Acquires knowledge about radioactivity, radio-labelling methods.
- Learns the principles and acquires working knowledge of different laboratory equipments and techniques such as microscopes, centrifuges, colorimeter, flame photometer, Spectrophotometer, Electrophoresis, Chromatography.

Paper IV : Molecular Cell Biology and Genetics

- Acquire detailed knowledge about membrane structure, membrane pumps and membrane transport.
- Students learn cell cycle and its regulation in detail.
- Acquire detailed knowledge on transcription and RNA processing, translation-gene expression and gene regulation mechanisms.
- Acquires deep understanding of sex determination, cytogenetics of human chromosome, gene therapy, genetics disease and genomics.







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Max. Marks	:	100 (85+15)
Class	:	M.Sc.
Semester	:	Second
Subject	:	Zoology
Paper	:	I
Title /शीर्षक	:	GENERAL AND COMPARATIVE VERTEBRATE PHYSIOLOGY AND ENDOCRINOLOGY

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

Unit . I

1. Respiratory pigments through different phylogenic groups
2. Transport of oxygen and carbon dioxide in blood and body fluids
3. Regulation of respiration
4. Physiology of impulse transmission through nerves and synapses
5. Autonomic nervous system, neurotransmitters and their physiological functions

Unit . II

1. Patterns of nitrogen excretion in different animal groups
2. Comparative physiology of digestion
3. Osmoregulation in different animal groups
4. Thermoregulation in homeotherms, poikilothermas and hibernation
5. Physiology of pregnancy, placental hormones, pregnancy diagnosis tests, parturition and breast and lactation

Unit . III

1. Comparative study of mechanoreception
2. Comparative study of photoreception
3. Comparative study of phonoreception
4. Comparative study of chemoreception

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5. Comparative study of equilibrium reception

Unit . IV

1. Bioluminescence as means of communication among animals
2. Pheromones and related chemicals as means of communication among vertebrates
3. Chromatophores and regulation of their function among fishes
4. Phylogeny of endocrine glands (pituitary and adrenal)
5. Ontogeny of endocrine glands (pituitary and adrenal)
6. Neuroendocrine System

Unit . V

1. Hormones, their classification and chemical nature
2. Mechanisms of hormone action
3. Hormone receptors, signal transduction mechanisms
4. Hormones and reproduction
 - a. Seasonal breeders
 - b. Continuous breeders

Suggested Reading Materials:

1. EJW Barrington-General & comparative Endocrinology-Oxford, Claredon Press
2. R.H. Williams-Text Book of Endocrinology-W.B. Saunders
3. C.R. Martin- Endocrine Physiology-Oxford University Press.
4. Molecular Cell Biology-J. Darnell, H. Lodish and D. Baltimore-Scientific American Book USA
5. Molecular Biology of the cell-B. Alberts, D-Bray, J.Lewis, M. Raff, K. Roberts and J.D. Watson, Garland Pub. New York.

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Max. Marks	:	100 (85+15)
Class	:	M.Sc.
Semester	:	Second
Subject	:	Zoology
Paper	:	II
Title	:	POPULATION ECOLOGY AND ENVIRONMENTAL PHYSIOLOGY

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

Unit I

1. Populations and their characters.
2. Demography : Life tables, generation time, reproductive value.
3. Population growth: Growth of organisms with non-overlapping generations, stochastic and time lag models of population growth, stable age distribution.
4. Population regulation: Extrinsic and intrinsic mechanisms.

Unit II

1. Adaptations : Levels of adaptation, significance of body size.
2. Aquatic environments : Fresh water, marine, shores and estuarine environments.
3. Eco-physiological adaptations to fresh water environments.
4. Eco-physiological adaptations to marine environments.
5. Eco-physiological adaptations to terrestrial environments.

Unit III

1. Environmental limiting factors.
2. Inter and intra-specific relationship.
3. Predatory-prey relationship, predator dynamics, optimal foraging theory (patch choice, diet choice, prey selectivity , foraging time)
4. Mutulism , evolution of plant pollinator interaction.

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Unit IV

Environmental pollution and human health.

1. Conservation management of natural resources .
2. Environmental impact assessment.
3. Sustainable development.

Unit V

1. Concept of homeostasis.
2. Endothermi and physiological mechanism of regulation of the body temperature
3. Physiological response to oxygen deficient stress.
4. Physiological response to body exercise.
5. Meditation, yoga and their effects.

Suggested Readings:

1. Cherrett,J.M. Ecological Concepts. Blackwell Science Publication, Oxford, U.K.
2. Elseth,B.D. and K.M. Baumgartner,population Biology, Van Nostrand Co., New York.
3. Jorgensen,S.E. Fundamentals of ecological modeling. Elsevier, New York.
4. Krebs, C.J. Ecology. Harper and Row, New York.
5. Krebs,C.J. Ecological Methodology. Harper and Row , New York.
6. Eckert, R. Animal Physiology: Mechanism and Adaptation. W.H. Freeman and Co., New York.
7. Hochachka, P.W. and G.N., Somero. Biochemical adaptation. Priceton, New Jersey.

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Max. Marks	:	100 (85+15)
Class	:	M.Sc.
Semester	:	Second
Subject	:	Zoology
Paper	:	III
Title /शीर्षक	:	TOOLS AND TECHNIQUES IN BIOLOGY

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

Unit . I

1. Microscopy, principle & applications
 - Light microscope and phase contrast microscope
 - Fluorescence microscope
 - Electron microscope
 - Confocal microscopy
2. General Principle and applications of
 - Beer and Lamberts law.
 - Colorimeter
 - Spectrophotometer
 - Flame photometer
3. Microbiological techniques
 - Media Preparation and sterilization
 - Inoculation and growth monitoring.
 - Microbial assays.
 - Microbial identification (cytological staining methods for bacterial and fungal strains)
 - Use of fermentors

Unit . II

1. Computer aided techniques for data presentation data analysis, statistical techniques.
2. Cryotechniques
 - Cryopreservation of cells, tissues, organs and organisms.
 - Cryosurgery
 - Cryotomy
 - Freeze fracture and freeze drying.
3. Separation techniques.
 - Chromatography, principle type and applicants.
 - Electrophoresis, Principles, types and applications PAGE and agarose gel electrophoresis.
 - Organelle separation by centrifugation

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Unit . III

1. Radioisotope and main isotope techniques in biology.
 - a. Sample preparation for radioactive counting
 - b. Autoradiography.
2. **Immunological techniques**
 - Immunodiffusion (Single & Double)
 - Immuno electrophoresis
3. **Techniques immuno detection**
 - Immunocyto / histochemistry
 - Immunoblotting, immunodetection, immunofluorescence.
4. **Surgical techniques.**
 - Organ ablation (eg. Ovariectomy, adrenalectomy)
 - Perfusion techniques
 - Stereotaxy
 - Indwelling catheters
 - Biosensors.

Unit .IV**1. Histological techniques**

- Principles of tissue fixation
- Microtomy
- Staining
- Mounting
- Histochemistry

2. Cell culture techniques.

- Design and functioning of tissue culture laboratory
- Culture media, essential components and Preparation
- Cell viability testing.

UNIT V**1. Cytological techniques**

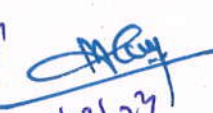
- Mitotic and meiotic chromosome preparations from insects and vertebrates.
- Chromosome banding techniques (G.C.Q. R. banding)
- Flowcytometry.



2. Molecular cytological techniques

- In situ hybridization (radio labeled and non-radio labeled methods)
- FISH
- Restriction banding

3. Molecular biology techniques

- Southern hybridization
- Northern hybridization
- DNA Sequencing
- Polymerase chain reaction (PCR)


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SUGGESTED READING MATERIAL:

1. Introduction to instrumental analysis-Robert Braun-McGraw Hill.
2. A biologist Guide to principles and Techniques of Practical Biochemistry- K, Wilson and K.H. Goulding EIBS Edn.
3. Clark & Swizer. Experimental Biochemistry. Freeman, 2000.
4. Locquin and Langeron. Handbook of Microscopy. Butterwaths, 1983
5. Boyer. Modern Experimental Biochemistry. Benjamin, 1993
6. Freifelder. Physical Biochemistry. Freeman, 1982.
7. Wilson and Wlaker. Practical Biochemistry. Cambridge, 2000.
8. Cooper. The Cell-A Molecular Approach. ASM, 1997
9. John R.W. Masters. Animal Cell culture- A practical approach. IRL Press

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Sri Sathya Sai College (Autonomous) For Women, Bhopal
Department of Higher Education Govt of M.P. Post Graduate semester wise syllabus as
recommended by Central Board of studies and approved by the Governor of M.P.
Session : 2023-2024

Max. Marks	:	100 (85+15)
Class	:	M.Sc.
Semester	:	Second
Subject	:	Zoology
Paper	:	IV
Title /शीर्षक	:	MOLECULAR CELL BIOLOGY AND GENETICS

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

Unit . I

- Biomembrane
- Molecular composition arrangement and functional consequences
- Transport across cell membrane diffusion active transport, pumps, uniports, symports and antiports
- Micro filaments and microtubules structure and dynamics
- Cell movements intracellular transport, role of kinesin and dynein

Unit . II

- Cell . Cell signaling
- Cell surface receptors
 - Second messenger system
 - Signaling from plasma membrane to nucleus
 - Gap junctions and connexins
 - Integrins

Unit . III

- Cell . Cell adhesion and communication
- Ca⁺⁺ dependent homophilic cell . cell adhesion
 - Ca⁺⁺ independent homophilic cell . cell adhesion
 - Genome organization, hierarchy in organization
 - Chromosomal organization of genes and non-coding DNA

Unit .IV

- Sex determination
- Sex determination in Drosophila
 - Sex determination in mammals
 - Basic concept of dosage compensation
 - Cytogenetics of human chromosomes
 - Elementary idea of Human genome project (HGP)

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Unit . V

- Genetic Diseases & Genomics
- Human gene therapy
- Prenatal diagnosis & genetic counseling
- Genetic screening
- Structural Genomics
- Functional Genomics
- Gene libraries
- Transgenic animals & Knockout animals their applications

Suggested Readings:

- J. Darnell, H. Lodish and D. Baltimore molecular cell biology scientific American book. Inc. USA
- B. Alberts D. Bray, J. Lewis, M. raff, K. roberts and J.D. Wattson. molecular biology of the cell. Garland Publishing Inc. New York.
- Masters John R. W. animal cell culture A practical approach. Irl. Press
- Alberts et. al Essentials cell biology garland publishing Inc. New York 1998
- J.M. Barry molecular biology- Philip E. Hartman Gene Action
- L.C. dunn, principals of Genetics
- A.M. Winchester genetics
- Edgar Alterbrg Genetics
- L.C. Dunn genetics and the oregon of species
- Bengt A. Kihlman actions of chemicals of dividing cells

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Sri Sathya Sai College (Autonomous) For Women, Bhopal
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 Session : 2023-2024

Class: M.Sc.
SEMESTER - II
Practical : Ist

MM 50

General & Comparative Physiology and Endocrinology
Population Ecology and Environmental Physiology.

Exercise :

- | | |
|--|----|
| 1. Experiment on Hematology Blood group, Total and different counts. | 5 |
| 2. Demonstration of Enzyme Action, and chromatography | 10 |
| 3. Estimation of pH. | 5 |
| 4. Detection of protein carbohydrate and fats. | 5 |
| 5. Endocrinological spots comments on prepared histological slides. | 10 |
| 6. Detection of Nitrogenous products in given samples. | 5 |
| 7. Viva Voce | 5 |
| 8. Practical Records and collection. | 5 |

Total Marks

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Sri Sathya Sai College (Autonomous) For Women, Bhopal
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 Session : 2023-2024

Class: M.Sc.
SEMESTER - II
Practical : II

MM 50

Tools and Techniques for biology.
Molecular cell Biology and Genetics

1. Comments upon the structure and application of analytical instruments	10
i. Colorimeter	
ii. Spectrophotometer	
iii. Ultracentrifuge	
iv. ESR and NMR spectrometer	
v. Microtomy	
vi. Chymographic Instruments	
2. Problem and based on genetics	10
3. Estimation techniques based for RNA and DNA	10
4. Estimation of Gene and Genotypic frequencies in light of hardy weinbecey law based on facial traits.	5
5. Demonstration of chromosome polymorphism isozyme polymorphism in some insect population.	5
6. Viva – Voce	5
7. Practical Record	5
Total Marks	<u>50</u>

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Sri Sathya Sai College for Women, Bhopal

(An Autonomous College affiliated to Barkatullah University, Bhopal)

(NAAC Accredited 'A' Grade)



SYLLABUS

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SESSION- 2023-24

Class: M.Sc. Semester-III & IV

SUBJECT: Zoology

Sri Sathya Sai College (Autonomous) For Women, Bhopal
Department of Higher Education Govt of M.P. Post Graduate Semester wise syllabus
as recommended by Central Board of Studies and approved by the Governor of M.P.

Session : 2023-24

SCHEME OF EXAMINATION

(SEMESTER -III) 2020-21

Number	Title of the course	Max. Marks	Min. Marks for Passing	Min. Aggr. Marks for Passing
	(A) THEORY PAPERS			
I	Comparative Anatomy of Vertebrates	85	31	
II	Limnology	85	31	
III	Eco- Toxicology	85	31	
IV	Aquaculture	85	31	
	(B) PRACTICALS			
	I (based on Course I & II)	50	18	
	II (based on course III & IV)	50	18	
	(C) INTERNAL ASSESSMENT			
	CCE *4 Written Test based on each course (each of 15 marks)	60	5 in each test	
	TOTAL	500	-----	200

*Candidate has to pass in each test separately

Sri Sathya Sai (Autonomous) College For Women, Bhopal

Class : M.Sc. III Sem

(Course Code-Sc02)

Course Objective

- Knowledgeable persons in concerned subjects.
- Identify, formulate, research, literature, and analyze complex problems, reaching substantiated conclusions using first principles of biological, physical, chemical and mathematical science.
- Individuals with aptitude and skill in research.
- Persons having innovative ideas and necessary training to initiate unique start-ups like fish farming, apiculture, sericulture.
- Young leaders who offer their service to the betterment of the community.
- Prepare successful professionals in industry, government, academia, research, entrepreneurial pursuits and consulting firms.
- Face and succeed in high level competitive examinations like NET, GATE and TOFEL

Paper I : Comparative Anatomy of Vertebrate

- Students able to understand the comparative anatomy of different systems of vertebrates i.e. digestive, respiratory, circulatory, nervous etc.
- Flight and aquatic adaptation in vertebrates.
- Origin, evolution general organization and affinities of Ostracoderms, Cyclostomes, Gnathostomes.
- Comparative account of lateral line system and electroreception.

Paper II : Limnology

- Detailed understanding of Limnology – Definition, historical development and scope of Limnology.
- Understanding of different types of freshwater habitats and their ecosystem.
- Understand the importance of different physio-chemical Characteristics of water.
- Study of Phytoplankton, Zooplankton and their inter-relationship and Aquatic insects, birds and their environmental significance.

Paper III: Eco- Toxicology

- Understand the general principles of Environmental Biology with emphasis on ecosystems, abiotic and biotic factors of ecosystems.
- Aware regarding use and misuse, alternatives of Agrochemical.
- A detailed understanding of basic concepts, Principles and various types of toxicological agents.
- Aware about Occupational Health Hazards and their Control.

Paper IV : Aquaculture

- Learning aquaculture technology for fresh and marine fishes.
- Management of water quality requirements for aquaculture.
- Learn how to Set and manage a fresh water aquarium.
- A detailed learning of transportation of finfish and shellfish, eggs, fry, fingerlings and adults.

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Sri Sathya Sai College (Autonomous) For Women, Bhopal

Department of Higher Education Govt of M.P.

Post Graduate semester wise syllabus as recommended by central board of studies and approved by the Governor of M.P.

Session : 2023-2024

Max. Marks	:	100 (85+15)
Class	:	M.Sc.
Semester	:	Third
Subject	:	Zoology
Paper	:	I
Title /शीर्षक	:	Comparative Anatomy of Vertebrates

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

Unit-1

1. Origin of Chordata: Concept of Protochordata
2. Development, structure and functions of integument and its derivatives (glands, scales, feathers and hairs)
3. Respiratory system : Characters of respiratory tissue, external and internal respiration. Comparative account of respiratory organs.
4. Comparative account of Digestive System.

Unit-2

1. Evolution of heart.
2. Evolution of aortic arches and portal systems.
3. Blood circulation in various vertebrates groups.
4. Comparative account of jaw suspensorium and vertebral column.

Unit-3

1. Evolution of urinogenital system in vertebrates.
2. Comparative account of organs of olfactory and taste.
3. Comparative anatomy of brain and spinal cord (CNS).
4. Comparative account of peripheral and autonomous nervous system.

Unit-4

1. Comparative account of lateral line system.
2. Comparative account of electroreception.
3. Flight adaptations in vertebrates.
4. Aquatic adaptations in birds and mammals.

Unit-5

1. Origin, evolution general organization and affinities of Ostracoderms .
2. General organization, specialized, generalized and degenerated characters of Cyclostomes.
3. Origin, evolution general organization of early Gnathostomes .
4. General account of Elasmobranchi, Holocephali, Dipnoi and Crossoptergii

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Suggested Reading Materials:

1. Carter, G.S. Structure and habit in vertebrate evolution – Sedgwick and Jackson, London.
2. Kingsley, J.S. Outlines of Comparative Anatomy of Vertebrates, Central Book Depot. Allahabad,
3. Kent, C.G. Comparative anatomy of vertebrates
4. Malcom Jollie, Chordata morphology. East – West Pres Pvt. Ltd., New Delhi.
5. Milton I lildergrand. Analysis of vertebrate structure. IV. Ed. John Wiley and Sons Inc., New York.
6. Smith, H.S. Evolution of Chordata structure. Hold Rinchart and Winstoin Inc. New York.
7. Sedgwick, A.A. Students Text Book of Zoology, Vol.II.
8. Walter, H.E. and Sayles, L.D. Biology of vertebrates, MacMillan & Co. New York.
9. Romer, A.S. Vertebrate Body, IIIrd Ed. W.B. Saunders Co., Philadelphia
10. Young J.Z. life of vertebrates. The oxford University Press, London
11. Parker & Haswell to III Rev. by Marshall willians latested Macmillan Co. ltd.
12. Young J.Z. Life of mammals. The Oxford University Press, London
13. Weichert, C.K. and Presch, W. Elements of chordate anatomy, 4th Edn. McGraw Hall Book Co., New York.

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Sri Sathya Sai College (Autonomous) For Women, Bhopal

Department of Higher Education Govt of M.P.

Post Graduate semester wise syllabus as recommended by central board of studies and approved by the Governor of M.P.

Session : 2023-2024

Max. Marks	:	100 (85+15)
Class	:	M.Sc.
Semester	:	Third
Subject	:	Zoology
Paper	:	II
Title /शीर्षक	:	LIMNOLOGY

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

Unit-1

1. Limnology – Definition, historical development and scope of Limnology.
2. Types of freshwater habitats and their ecosystem -
 - (a) Ponds, Streams and rivers.
 - (b) Lakes – Origin and classification.
3. Morphometry – Use of various morphometric parameters and Zonation.

Unit-2

Physico – Chemical Characteristics.

1. Light and Temperature-
 - (a) Light as an ecological parameter in freshwater.
 - (b) Temperature- Radiation, Stratification and Heat Budget.
 2. Dissolved Solids – Carbonate, Bicarbonates, Phosphate and Nitrate.
- Physico – Chemical characteristics of freshwater with special reference to different parameters-Turbidity, dissolved gases (Oxygen, Carbon dioxide, Hydrogen Sulphide), Seasonal changes in dissolved gases and pH.

Unit-3

1. Study of Biota
 - (a) Phytoplankton, Zooplankton and their inter-relationship.
 - (b) Aquatic insects, birds and their environmental significance.
2. Ecological classification of aquatic fauna higher aquatic plants and their significance.

Unit-4

1. Methods of water quality testing BOD and COD.
2. Sewage – Definition, composition and its treatment.
3. Bioindicators- Aquatic flora and fauna in relation to water quality in an aquatic environment.

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Sri Sathya Sai College (Autonomous) For Women, Bhopal

Department of Higher Education Govt of M.P.

Post Graduate semester wise syllabus as recommended by central board of studies and approved by the Governor of M.P.

Session : 2023-2024

Max. Marks	:	100 (85+15)
Class	:	M.Sc.
Semester	:	Third
Subject	:	Zoology
Paper	:	III
Title /शीर्षक	:	ECO- TOXICOLOGY

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

Unit-1

1. General principles of Environmental Biology with emphasis on ecosystems.
2. Abiotic and biotic factors of ecosystems.
3. Communities of the environment, their structure & significance.
4. Energy flow in environment: Ecological energetic.

Unit-2

1. Productivity, Production and analysis.
2. Recycling and reuse technologies for solid and liquid wastes and their role in environmental conservation.
3. Remote sensing –basic concepts and applications of remote sensing techniques in environmental conservation.
4. Environmental indicators and their role in environmental balance.

Unit-3

1. Kinds of environmental pollution and their control methods.
2. Radioactive compounds and their impact on the environment.
3. Vehicular exhaust pollution causes and remedies.
4. Noise pollution.

Unit-4

1. Toxicology- Basic concepts, Principles and various types of toxicological agents.
2. Toxicity testing principles, hazards, risks and their control methods.
3. Food toxicants and their control methods.
4. Public Health Hazards due to environmental disasters.

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Unit-5

1. Pesticides, types, nature and their effects on environment.
2. Important heavy metals and their role in environment.
3. Agrochemical use and misuse, alternatives.
4. Occupational Health Hazards and their Control.

Suggested Reading Materials:

1. Clark : Elements of ecology
2. Odum : Fundamentals of Ecology
3. South Woods : Ecological methods
4. Trivedi and Goel : Chemical and biological methods for water pollution studies

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Sri Sathya Sai College (Autonomous) For Women, Bhopal

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Post Graduate semester wise syllabus as recommended by central board of studies and approved by the Governor of M.P.

Session : 2023-2024

Max. Marks	:	100 (85+15)
Class	:	M.Sc.
Semester	:	Third
Subject	:	Zoology
Paper	:	IV
Title /शीर्षक	:	AQUACULTURE

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

Unit-1

1. Aquaculture: history, definition, scope & importance.
2. Fishery resources of India in general & Madhya Pradesh in particular.
3. Abiotic & biotic factors of water necessary for fish life.
4. Ecological characteristics of lakes & rivers.
5. General ecological characteristics of reservoirs of India.

Unit-2

1. Fish culture :- Mono, Poly, mixed and composite Fish culture.
2. Fresh water prawn culture and its prospects in India.
3. Culture of Mussels , clams,oysters & pearl culture.
4. Sewage fed fish culture, paddy cum fish culture
5. Frog culture.

Unit-3

1. Fish breeding in natural conditions , bundh breeding, hypophysation & stripping.
2. Transport of live fish & seed.
3. Different types of crafts & gears used for fish catching.
4. Plankton- its definition, culture & identification.
5. Common weeds of fish ponds and methods of their eradication.

Unit-4

1. Fresh water fish farm engineering: selection of site, construction of fish farm & soil chemistry.
2. Designing, layout & construction of different types of fish ponds.
3. Setting and management of fresh water aquarium.
4. Preservation & processing of fish.
5. By products of fish Industry & their utility.

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Unit-5

1. Water pollution, its effects on fisheries and methods of its abatement.
2. Common fish diseases & their control.
3. Biochemical composition and nutritional value of fish.
4. Fisheries economics and marketing.
5. Fisheries managements and extension.

Suggested Reading Materials:

1. C.B.L. Shrivastava : Fishes of India
2. Jhingan : Fish and fisheries of India
3. S.S. Khanna : An Introduction to fishes
4. R.S. Rath : Fresh water Aquaculture
5. Gopalji Shrivastava : Fishes of U.P. & Bihar
6. H.D. Kumar : Sustainibility & Management of Aquaculture & Fisheries
7. A.J.K. Mainan : Identification of fishes
8. R. Sanatam : A Manual of fresh water Aquaculture
9. S.K. Gupta : Fish & Fisheries
10. P.D. Pandey : Fish & Fisheries
11. K.P. Vishwas : Fish & Fisheries

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Sri Sathya Sai College (Autonomous) For Women, Bhopal

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Post Graduate semester wise syllabus as recommended by central board of studies and approved by the Governor of M.P.

Session : 2023-2024

Practical I

Class: M. Sc. Zoology

Semester :III

Practical I : Related to I & II Theory Papers

1. Study of Specimens, slides, and bones related to theory papers.
2. Major Dissection :- Various system of Labeo, Wallogo, Torpedo
3. Minor Dissection: -
 - A . Accessory respiratory organs of Anabas, Clarias, Heteropneustes
 - B. Herdmania
 - C. Amphioxus
4. Estimation of DO, Chloride, BOD, COD, Hardness, pH and Alkalinity of water
5. Study of fresh water ecosystem

Practical Scheme

Time : 4 Hour

Max Marks : 50

Major Dissection	10
Minor Dissection	04
Spotting	12
Limnological exercise	10
Practical Record	05
Viva Voce	05
Collection	04

Total 50

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Sri Sathya Sai College (Autonomous) For Women, Bhopal

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Post Graduate semester wise syllabus as recommended by central board of studies and approved by the Governor of M.P.

Session : 2023-2024

Practical II

Class: M. Sc. Zoology

Semester :III

Practical II : Related to III & IV Theory Papers

1. Study of plankton.
2. Preparation and Maintenance of Aquarium.
3. Study of common weeds of fish ponds.
4. Methods of culture related to theory papers.
5. Study of abiotic factors of water related to fish life.
6. Determination of different toxic chemicals in samples of soil, water and air.
7. Toxicological testing methods, General tests, acute toxicity test and LD 50 test.
8. Identification and comments on Aquaculture animals.

Practical Scheme

Time : 4 Hour

Max Marks : 50

Spotting	16
Exercise on toxicology	10
Study of culture methods related to theory	05
Maintenance of Aquarium	05
Practical Record	05
Viva Voce	05
Collection	04
Total	50

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SCHEME OF EXAMINATION

(SEMESTER -IV) 2020-2021

Number	Title of the course	Max. Marks	Min. Marks for Passing	Min. Aggr. Marks For Passing
	(A) Compulsory – THEORY PAPERS			
1	Animal Behaviour and Neurophysiology	85	31	
2	Gamete Biology, Development and Differentiation	85	31	
	(B) Optional (Special Paper)– THEORY PAPERS			
3	Group- 1 III A. Fish (Ichthyology) Structure and Function or III B. Wild life Conservation	85	31	
4	Group- 2 IV A. Pisci Culture and Economic importance of fishes (Ichthyology) Or IV B. Environment & Biodiversity Conservation	85	31	
	(B) PRACTICALS	50	18	
	I (based on Course I & II)	50	18	
	II (based on course III & IV)			
	(C) INTERNAL ASSESSMENT CCE *4 Written Test based on each course (each of 15 marks)	60	5 in each test	
	(D) Internship/Job Oriented Project	100	36	
	TOTAL	600	-----	236

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Class : M.Sc. IV Sem

(Course Code-Sc02)

Paper- I : Animal Behaviour and Neurophysiology

- Devising conservation strategies for different animal species. Learning and instincts: conditioning, habituation, sensitization, reasoning.
- Developing compassion towards other animals as well as other individuals, group selection, kin selection and inclusive fitness, cooperation, and alarm call.

Paper II : Gamete Biology, Development and Differentiation in Vertebrates

- Information about history and basic concepts of developmental biology.
- Study biology of sex determination and sex differentiation a comparative account.
- Understand hormonal regulation of ovulation, pregnancy, parturition and lactation.
- Study of multiple ovulation and embryo transfer technology.

Paper III: Ichthyology (Fish) Structure and Function

- This will provide a thorough coverage of origin, evolution and classification of fishes.
- Gather information about fish integument, locomotion, air bladder and Weberian ossicles.
- Understand the phenomenon of excretion, osmoregulation, and reproduction.
- Study various adaptation in fishes according to their habit and habitat.

Paper IV: Pisci Culture and Economic Importance of Fishes (Ichthyology)

- To learn Inland fisheries resources ,Fresh water fish culture and management techniques
- Understand the process transportation and marketing of fishes.
- Gather information about types of Breeding and uses of natural & synthetic hormones in breeding.
- Types of Hatchery , Nutritional requirement of carps and supplementary feeding.
- Knowing about economic importance of fishes, fish spoilage & preservation methods.

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Sri Sathya Sai College (Autonomous) For Women, Bhopal

Department of Higher Education Govt of M.P.

Post Graduate semester wise syllabus as recommended by central board of studies and approved by the Governor of M.P.

Session : 2023-2024

Max. Marks	:	100 (85+15)
Class	:	M.Sc.
Semester	:	Forth
Subject	:	Zoology
Paper	:	I
Title /शीर्षक	:	ANIMAL BEHAVIOUR AND NEUROPHYSIOLOGY

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

Unit-1

1. Introduction:

- Ethology as a branch of biology.
- Animal psychology, classification of behavioural patterns, analysis of behaviour (ethogram)

2. Reflexes and complex behaviour.

3. Perception of the environment: mechanical, electrical, chemical, olfactory, auditory and visual.

4. Evolution and ultimate causation: Inheritance behaviour and relationships.

Unit-2

1. Neural and hormonal control of behaviour.

2. Genetic and environmental components in the development of behaviour.

3. Motivation: Drive, timing and interaction of drives, physiological basis of motivation, hormones and motivation, aggregation.

4. Communication: Chemical, visual, light and audio, evolution of language (primates).

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Unit-3

1. Ecological aspects of behaviour: Habitat selection, food selection, optimal foraging theory, anti-predator defences, aggression, homing territoriality, dispersal, host parasite relations.
2. Biological rhythms: Circadian and circannual rhythms, orientation and navigation, migration of fishes, turtles and birds.
3. Learning and memory: Conditioning, habituation, insight learning, association learning and reasoning.

Unit-4

1. Reproductive behaviour. Evolution of sex and reproductive strategies, mating systems, courtship, sexual selection, parental care.
2. Social behaviour. aggregations, schooling in fishes, flocking in birds, herding in mammals, group selection, kin selection, altruism, reciprocal altruism, inclusive fitness, social organization in insects and primates.

Unit-5

1. Thermoregulation: Homoeothermic animals, poikilotherms & Hibernation.
2. Receptor physiology a comparative study –
 - Mechano receptor
 - Photo receptor
 - Phono receptor
 - Chemo receptor
 - Equilibrium receptor
3. Bioluminescence

Suggested Reading Materials:

1. Eibl-Eibesfeldt, I. Ethology. The biology of Behaviour. Holt, Rinehart & Winston, New York.
2. Gould, J.L. The mechanism and Evolution of Behaviour.
3. Kerbs, J.R. and N.B. davies : Behaviourable Ecology. Blackwell, Oxford, U.K.
4. Hinde, R.A. Animal Behaviour : A Synthesis of Ethology and Comparative Psychology. McGraw Hill, New York.
5. Alcock, J. Animal Behaviour : An Evolutionary approach. Sinauer Assoc. Sunderland, Massachsets, USA.
6. Bradbury, J.W. and S.L. Vehrencamp. Principles of Animal Communication. Sinauer Assoc. Sunderland, Massachsets, USA.

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Post Graduate semester wise syllabus as recommended by central board of studies and approved by the Governor of M.P.

Session : 2023-2024

Max. Marks	:	100 (85+15)
Class	:	M.Sc.
Semester	:	Forth
Subject	:	Zoology
Paper	:	II
Title /शीर्षक	:	GAMETE BIOLOGY, DEVELOPMENT AND DIFFERENTIATION IN VERTEBRATES

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

Unit-1

1. Comparative account of differentiation of gonads in mammals.
2. Spermatogenesis : Morphological basis in rodents. Gamete specific gene expression and genomics.
3. Biochemistry of Semen : Semen composition and formation, assessment of sperm function.
4. Fertilization: Prefertilization events , Biochemistry of fertilization and post fertilization events.

Unit-2

1. Ovarian follicular growth and differentiation: morphology, endocrinology, molecular biology, oogenesis and vitellogenesis, ovulation and ovum transport in mammals
2. Biology of sex determination and sex differentiation a comparative account.
3. Multiple ovulation and embryo transfer technology : in vitro oocyte maturation, super ovulation.

Unit-3

1. Hormonal regulation of ovulation, pregnancy and parturition.
2. Hormonal regulation of development of mammary gland and lactation.

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Session : 2023-2024

Max. Marks	:	100 (85+15)
Class	:	M.Sc.
Semester	:	Forth
Subject	:	Zoology
Paper	:	III (A)
Title /शीर्षक	:	ICTHYOLOGY (FISH) STRUCTURE AND FUNCTION

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

Unit-1

1. Origin and evolution of fishes
2. Classification of fishes as proposed by Berg
3. Fish integument
4. Locomotion

Unit-2

1. Alimentary canal and digestion
2. Accessory respiratory organs
3. Air bladder and its functions
4. Weberian ossicles their homologies and functions

Unit-3

1. Excretion and osmoregulation
2. Acoustico-lateral line system
3. Luminous organs
4. Colouration in fishes

Unit-4

1. Sound producing organs
2. Deep sea adaptations
3. Hill stream adaptations
4. Migration in fishes

Unit-5

1. Sexual cycle and fecundity
2. parental care in fishes
3. Early development and hatching
4. Poisonous and venomous fishes.

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Max. Marks	:	100 (85+15)
Class	:	M.Sc.
Semester	:	Forth
Subject	:	Zoology
Paper	:	IV(A)
Title /शीर्षक	:	PISCI CULTURE AND ECONOMIC IMPORTANCE OF FISHES (ICTHYOLOGY)

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

UNIT-1

1. Collection of fish seed from natural resources.
2. Dry bundh breeding of carps.
3. Wet bundh breeding of carps.
4. Hypophysation and breeding of Indian major camps.

Unit-2

1. Drugs useful in induced breeding of fish
2. Types of ponds required for fish culture farms
3. Management of hatcheries, nurseries and rearing ponds
4. Management of stocking ponds

Unit-3

1. Composite fish culture
2. Prawn culture and pearl industries in India.
3. Fisheries resources of MP
4. Riverine fisheries.

Unit-4

1. Costal fisheries in India.
2. Offshore and deep sea fisheries in India.
3. Role of fisheries in rural development.
4. Sewage fed fisheries.

Unit-5

1. Methods of fish preservation.
2. Marketing of fish in India.
3. Economic importance and by product of fishes.
4. Shark liver oil industry in India .
5. Transport of live fish & fish seed.

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Suggested Reading Materials :


Paper III A & IV A

1. JR. Norman - The History of fishes.
2. Nagaraja Rao - An introduction to fisheries.
3. Lagler Ichthyology.
4. Herclen Jones Fish migration.
5. Marshal The life of fishes.
6. Thomas - Diseases of fish.
7. Greenwood - Inter relationship of fishes.
8. Gopalji, Srivastava - Freshwater fishes of U.P. and Bihar.
9. Brown -Physiology of fishes Vol. I & II.
10. Hoar and Randall -Fish physiology of fishes Vol. 1 & IX.
11. Gunther Sterba C.N.H.-Freshwater fishes of the world
12. W. Lanham -The Fishes.
13. G.V. Nikolsky -The ecology of Fishes,
14. Borgstram -Fish as food Vol. I & II.
15. Nilsson -Fish physiology -Recent Advances.
16. P.B. Myle and J.J. Cech Fishes An Introduction to Ichthyology.
17. Carl E. Bond -Biology of fishes.
18. M. Jobling -Environmental Biology of fishes.
19. Santosh Kumar & Manju Ternbhre -Fish and Fisheries.
20. S.K. Gupta -Fish and Fisheries
21. K.P. Vishwas -Fish and Fishries.
22. Jhingaran -Fish and Fishries.


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Max. Marks	:	100 (85+15)
Class	:	M.Sc.
Semester	:	Forth
Subject	:	Zoology
Paper	:	III (B)
Title /शीर्षक	:	WILD LIFE CONSERVATION

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

Unit-1

1. Wild life -

- Values of wild life - positive and negative.
- Our conservation ethics.
- Importance of conservation.
- Causes of depletion.
- World conservation strategies.

2. Habitat analysis, Evaluation and management of wild life.

- Physical parameters - Topography, Geology, Soil and water.
- Biological Parameters - food, cover, forage, browse and cover estimation.
- Standard evaluation procedures - remote sensing and GIS.

3. Management of habitats -

- Setting back succession.
- Grazing logging.
- Mechanical treatment.
- Advancing the successional process.
- Cover construction.
- Preservation of general genetic diversity.

Unit-2

1. Population estimation.

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

2. National Organization.

- Indian board of wild life.
- Bombay Natural History Society.

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- (c) Voluntary organization involved in wild life conservation.
 3. Wild life Legislation - Wild Protection act - 1972, its amendments and implementation.

Unit-3

1. Management planning of wild life in protected areas.
2. Estimation of carrying capacity.
3. Eco tourism / wild life tourism in forests.
4. Concept of climax persistence.
5. Ecology of perturbation.

Unit-4

1. Management of excess population & translocation.
2. Bio- telemetry.
3. Care of injured and diseased animal.
4. Quarantine.
5. Common diseases of wild animal.

Unit-5

1. Protected areas National parks & sanctuaries, Community reserve.
2. Important features of protected areas in India.
3. Tiger conservation - Tiger reserve in M.P, in India.
4. Management challenges in Tiger reserve.

Suggested Reading Materials:

1. Gopal Rajesh : Fundamentals of wild life management
2. Agrawal K.C : Wild life India
3. Dwivedi A.P (2008) : Management wild life in India
4. Asthana D.K : Environment problem and solution
5. Rodgers N.A & Panwar H.S : Planning of wild life / Protected area Network in India
vol. the report, wild life Institute of India Dehradun.
6. Odum E.P : Fundamentals of Ecology
7. Saharia V.B : Wild life in India
8. Tiwari S.K : Wild life in Central India
9. E.P Gee : Wild life of India
10. Negi S.S : Wild life conservation (Natraj Publishers)

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Session : 2023-2024

Max. Marks	:	100 (85+15)
Class	:	M.Sc.
Semester	:	Forth
Subject	:	Zoology
Paper	:	IV(B)
Title /शीर्षक	:	ENVIRONMENT & BIODIVERSITY CONSERVATION

Note: From each unit 2 objective type question 1 marks each, 1 short answer (with internal choice) of 5 marks and 1 long answer (with internal choice) of 10 marks is to be asked in the examination paper.

Unit I

1. Basic concept and Scope of Environmental Biology
2. Biosphere and Biogeochemical cycles.
3. Environmental monitoring and impact assessment.
4. Environmental and sustainable development.
5. Water conservation, rain water harvesting, water shed management.

Unit II

Causes, effects and remedial measures of

1. Air pollution, Water pollution.
2. Noise. radioactive and thermal pollution.
3. Agriculture pollution
4. Basic concepts of Bioaccumulation.
5. Solid waste management.

Unit III

Global warming and disaster management

1. Causes of global warming
2. Impact of global warming – acid rains and ozone depletion, green house effect.
3. Control measures of global warming
(a) Afforestation (b) reduction in the use of CFCS
4. Disaster management -floods, earthquake, Cyclones & landslides.
5. Environmental legislation.

Unit IV

Natural Resources:-

Forest -

- Use and over exploitation of forests.
- Timber extraction.

Land

- Land degradation. Landslides.
- Soil-erosion and desertification.

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Water

- Use and over utilization of surface and ground water
- Floods. Drought
- Dams- benefits and problems

Mineral

- Use and exploitation ,
- Environmental effect of extracting and using mineral resources

Food

- World food problem
- Effects of modern agriculture and overgrazing

Energy

- Conventional and nonconventional energy resources.
- Using of alternate energy sources
- Role of an individual in conservation of natural resources
- Equitable use of resources for sustainable life

Unit V

- Conservation of Biodiversity
- Biodiversity crisis – habitat degradation & poaching of wild life.
- Socio economic and political causes of loss of biodiversity.
- In situ and ex situ conservation of biodiversity
- Value of biodiversity.
- Hot spots of Biodiversity.

Suggested Reading Materials:

Paper III D & IV D

1. Arora : Fundamentals of environmental biology
2. Anathakrishnan : Bioresources ecology
3. Bottain : Environmental studies
4. Bouhey : Ecology of populations
5. Clark : Elements of ecology
6. Dowdoswell : An introduction to animal ecology
7. Goldman : Limnology
8. Kormondy : Concepts of ecology
9. May : Model ecosystems
10. Odum : Ecology
11. Perkins : Ecology
12. Simmons : Ecology of estuaries and costal water
13. Pawlosuske : Physico-chemical methods for water
14. South Woods : Ecological methods
15. Trivedi and Goel : Chemical and biological methods for water pollution studies
16. Willington : Fresh water biology
17. Wetzal : Limnology
18. Welch : Limnology Vols. I-II

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Session : 2023-2024

Class	:-	M.Sc.
Semester	:-	IV
Subject	:-	Zoology
Title of Subject Group	:-	General Practical – I
Paper No.	:-	Paper – I & II (Compulsory)
		Animal behavior and Gamete Biology

1. Exercise on Animal behavior

- a. Taxes
- b. Reflexes
- c. Biological clocks
- d. Social behavior
- f. Reproductive behavior

2. Developmental Biology

- a. Study of different stages of spermatogenesis and oogenesis
- b. Study of gametes of frog and chick
- c. Study of fate maps
- d. Study of embryological slides

Scheme for Practical Examination

1. Exercise based on animal behavior	20
2. Exercise based on developmental biology	16
3. Practical record	05
4. Viva voce	04
5. Collection	05

Total 50

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Class	:-	M.Sc.
Semester	:-	IV
Subject	:-	Zoology
Title of Subject Group	:-	General Practical – II
Paper No.	:-	Paper – III & IV (optional) Wild life conservation, Environment & Biodiversity

1. Identification and comments upon wild life animals.
2. Study of endangered species.
3. Study of local birds and their habit habitats
4. Study of ecosystem
5. Study of local Biodiversity.
6. Distribution of wild life India.(National parks and sanctuaries)
7. Soil and Water Analysis.
8. Interspecific relationship – Naturalism , Symbiosis, Mutualism , Commensalism,
Parasitism, Predation Competition.
9. Field – expedition and project report
10. Viva – voice
11. Practical Record & collection.

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Practical Scheme**Time : 4 Hour****Max Marks : 50**

Spotting	10
Endangered species / interspecific relationship	10
Soil & Water analysis	05
Field expedition	10
Viva Voce	05
Practical Record / collection	10
	Total 50

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