St. Aloysius College (Autonomous), Jabalpur
Department of Zoology
M.Sc. ZOOLOGY - II Semester
Choice Based Credit System (CBCS)
Scheme of Examination (Session 2023-24)

Course No.	Course Title	Credits	Marks	
			Max. Marks	Min. Marks For Passing
CORE COURSES				
ZC -201	General and Comparative Animal Physiology and Endocrinology	4	40	14
ZC -202	Population ecology and Environmental Physiology	4	40	14
ZC -203	Tools and Techniques in Biology	4	40	14
ZC -204	Molecular Cell Biology and Genetics	4	40	14
ELECTIVE COURSE – (Any 01)				
ZE - 205	• Environment & Biodiversity Conservation • Applied Entomology	4	40	14
INTERNAL ASSESSMENT				
ZI - 206	CCE-Written test (Based on core courses ZC - 201, 202 ,203, 204 & ZE-205) (Each test of 10 marks)	0	50	20 (04 in each Test)
ZI - 207	Project/ Assignment / Seminar	1	25	09
PRACTICALS				
ZP - 208	Practical- I Based on Course ZC-201& ZC-202	2	50	18
ZP - 209	Practical- II Based on Course ZC-203, ZC-204 & ZE-205	2	50	18
SKILL COURSES				
ZS- 210	Skill Based Course	1	10	4
Total Credits & Total Marks		**26**	**385**	**139**

M.Sc. Zoology II Semester

Session 2023-24

CORE COURSE

Paper-I

General and Comparative Animal Physiology and Endocrinology

MM: 40

Unit I

1. Respiratory pigments wsr Haemoglobin
2. Transport of oxygen and carbon dioxide in blood and body fluids and Chloride shift
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 vertebrates
2. Comparative physiology of digestion in different vertebrates
3. Osmoregulation in different vertebrates
4. Thermoregulation in homeotherms and poikilotherms
5. Hibernation.

Unit. III

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

Unit. IV

1. Exocrine gland: Human salivary gland
2. Phylogeny of endocrine glands (pituitary and adrenal)
3. Ontogeny of endocrine glands (pituitary and adrenal)
4. Neuroendocrine system

Unit .V

1. Hormones, their classification and chemical nature
2. Mechanisms of hormone action -
   a. Hormone receptors
   b. Signal transduction mechanisms wsr Thyroid hormone
3. Hormones and reproduction wsr menstrual and ovarian cycle
   a. Seasonal breeders
   b. Continuous breeders

Suggested readings

- EJW, Barringtom, general and comparative endocrinology- Oxford, Claredon Press
- RH Williams- Text book of endocrinology-WB Saunders
- CR Martin-Endocrine physiology- Oxford University Press
- J Darnell, H Lodish and D. Baltimore, Molecular Cell Biology-Scientific American Books, USA
- B Alberts, D. Bray, J Lewis, M Raff, K Roberts and J D Watson, Molecular cell biology of the cell, Garland Publication New York

M.Sc. Zoology II Semester

Session 2023-24

CORE COURSE

Paper-II

Population Ecology and Environmental physiology

Unit **I**

MM: 40

1. Populations and their characters wsr natality, mortality, population growth forms, age pyramids, dispersal and density.
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 adaptions, Adaptations of muscle for diverse activities wsr jumping in frog and swimming in fishes.

2. Aquatic environments: Fresh water, marine, shores and estuarine environments.
3. Eco-physiological adaptations to fresh water environments wsr fishes.
4. Eco-physiological adaptations to marine environments wsr fishes and birds.
5. Eco-physiological adaptations to terrestrial environments wsr to reptiles and birds.

Unit III

1. Environmental limiting factors.
2. Inter and intra-specific relationship.
3. Predatory- prey relationship, predator dynamics,
4. Mutualism wsr evolution of plant pollinator interaction.
5. Types of ecological niche and niche overlap.

Unit IV

1. Biodiversity Act and its amendments.
2. Environmental impact assessment – a general idea.
3. Sustainable development.
4. A general idea of biohazards and Biosafety Levels.
5. Introduction to bioremediation

Unit V

1. Concept of homeostasis wsr electrolyte balance.
2. Physiological response to oxygen deficient stress.
3. Physiological response to body exercise wsr to cardiac and respiratory system.
4. Meditation, yoga ,Sleep Cycle .

and their effects

14/7/23

Suggested Readings:

1. Cherrett,J.M. Ecological Concepts. Blackwell Science Publication, Oxford, U.K.
2. Elseth,B.D. and K.M. Baumgartner,populationBiology,VanNostrandCo., New York.
3. Jorgensen,S.E. Fundamentals of ecological modeling. Elsevier, NewYork.
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.
8. Schmidt and Neilson- Adaptations and animal physiology

M.Sc. Zoology II Semester

Session 2023-24

CORE COURSE

Paper-III

Tools and techniques in Biology

Unit.I **MM: 40**

1 Microsocopy, principle & applications

- Light microscope and phase contrast microscope
- Fluorescence microscope
- Electron microscope
- Confocal microscope

2. General Principle and applications of
   - Colorimeter
   - Spectrophotometer
   - Flame photometer
3. Principle, working and applications of fermenter.
4. Microbiological techniques
   - Methods of sterilization
   - Inoculation and growth monitoring.
   - Microbial identification (cytological staining methods for bacterial and fungal strains)

Unit. II

1. Communication skill in life science - Computer aided techniques for data presentation and data analysis wsr MS office, excel, power points for preparing scientific projects and assignments.
2. Cryotechniques
   - Cryopreservation of gametes.
   - Cryosurgery
   - Cryotomy
   - Freeze fracture and freeze drying.
3. Separation techniques.

Chromatography, principle, type and applications wsr Paper Chromatography, TLC & HPLC.

- Electrophoresis: Principles, types and applications PAGE and agarose gel electrophoresis.
- Principles of centrifugation, Ultra centrifuge, Organelle separation by centrifugation wsr Density gradient

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. Enzyme linked immunosorbent assay (ELISA) technique and its applications
4. Monoclonal antibody technology (Hybridoma technology)
5. Surgical techniques.
   - Organ ablation (eg. Ovariectomy, Adrenalectomy)

14/7/23

- Perfusion techniques
- Stereotaxy
- Indwelling catheters
- Parabiosis

6. Biosensors.

Unit .IV

1. Histological techniques
   a. Complete process of Microtomy
   b. Histochemistry wsr staining methods of Protein, carbohydrates and nucleic acids
2. Cell culture techniques.
   -Design and functioning of animal tissue culture laboratory
   -Culture media, essential components and Preparation
   -Cell toxicity and Cell viability testing.
3. Elementary idea of animal cell line.

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
   - Fluorescent in situ hybridization [FISH]
   - Restriction banding
3. Molecular biology techniques
   - Southern hybridization
   - Northern hybridization
   - DNA Sequencing
   - Polymerase chain reaction (PCR)
     RT-PCR

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. GouldingElBSEdn.
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.
10. Robert Braun. Introduction to instrumental analysis. McGraw Hill

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M.Sc. Zoology II Semester
Session 2023-24
CORE COURSE
Paper-IV
Molecular Cell Biology and Genetics

MM: 40

Unit.I

- Biomembrane wsr 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

- G- Protein coupled cell surface receptors
- Cell-Cell signaling wsr G-protein and protein kinases mediated signaling.
- Target cells and effector organs.
- Second messenger system
- Cell cycle & Cyclin dependent kinases

Unit . III

- Cell-Cell adhesion and communication wsr :
  a) Ca++ dependent homophilic cell -cell adhesion –cadherin
  b) Ca++ independent heterophilic cell-Substratum adhesion – integrin
  c) Ca++ independent heterophilic cell-cell adhesion –Immunoglobulin super family molecules
- Gap junctions and connexins
- Hierarchy in Genome organization.
- Chromosomal organization of genes in coding and non-coding DNA
- Mechanism of Apoptosis
- Biology of Aging.

Unit .IV

- Sex determination in drosophila
- Sex determination in mammals
- Basic concept of dosage compensation
- Cytogenetics of human chromosomes
- Sex differentiation.

Unit . V

- General idea of human Genetic Diseases
  - Monogenic human Genetic Diseases – Chronic myeloid leukaemia
  - Chromosomal human Genetic Diseases – Cystic fibrosis, Thalassemia, Down's syndrome
- Human gene therapy
- Prenatal diagnosis & genetic counseling

- Genetic screening.
- Structural Genomics – Study of structure of genome (cytological and genetic mapping of chromosomes, RFLP mapping, Contig mapping, STS mapping)
- Functional Genomics – RNA and protein assay of genome function by study of expressed sequences through hybridization assay and gene chips
- 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 origin of species
- Bengt A. Kihlman actions of chemicals of dividing cells
- Snustad- principles of genetics
- Gardner-principles of genetics

M.Sc. Zoology II Semester
Session 2023-24
ELECTIVE COURSE
Environment & Biodiversity Conservation

MM : 40

Unit I –

- Scope of Environmental Science
- Environmental monitoring and impact assessment.
- Water conservation wsr rain water harvesting and water shed management.
- Soil Problem in India and its management.

Unit II -

- Agriculture pollution
- Effects of Agricultural Practices on Biodiversity
- Basic concepts of Bioaccumulation.
- Environmental legislation.

Unit III

- Impact of global warming wsr acid rains and ozone depletion, green house effect.
  Control measures of global warming wsr (a) Afforestation (b) reduction in the use of CFCS.
- Disaster management wsr floods, earthquake and landslides.

Unit IV

- Use and over exploitation of Natural Resources wsr forests and water.
- Integrated forest management programmes in India
- Dams- benefits and problems
- Environmental effect of extracting and using mineral resources

Unit V

- World food problem wsr Role of genetic modified food as solution
- Using of alternate energy sources
- Biodiversity crisis wsr habitat degradation and poaching of wild life.
- Role of National Bureau of Animal Genetic Resources (NBAGR) in conservation of indigenous livestock biodiversity.

Suggested Readings :

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

M.Sc. Zoology II Semester

Session 2023-24

ELECTIVE COURSE

Applied Entomology

MM : 40

Unit. I

Modern concept of Pest management wsr:

1. Biological control of pests
2. Genetic control of pests
3. Chemical control of pests

Unit. II

1. Pest of Cotton (e.g., *Dysdercus koenigii)*
2. Pest of stored food grains (e.g., *Sitophilus oryzae)*
3. Pests of citrus fruits (e.g., *Dacus cucurbitae)*
4. Pest of pulse (e.g., *Callosobruchus chinensis)*
5. Pest of Vegetable (e.g., *Pieris brassicae)*

Unit. III

1. Insects in relation to forensic science
2. Insects of medical and veterinary importance
3. Ecological factors affecting development of insects
4. Insect migration, swarming and their hazardous effects in agriculture and forests

Unit . IV

1. Sericulture
2. Apiculture
3. Lac culture
4. Insects as human food and beneficial insects

Unit V

1. Structure of eggs and its types
2. Structure of larva and its types.
3. Structure of pupa and its types.
4. Metamorphosis.

Suggested Readings :

1. The Insect: Structure and function by R.F. Chapman
2. Comparative Insect physiology, Biochemistry and Pharmacology .Vol :1-13. Edited by G.A. Kerkut and L.I. Gilbert.
3. Entomophagous Insect by Clausen
4. Entomology bu Gilbert
5. Principles of Insect Physiology by Wigglesworth.
6. Fundamentals of Entomology by Elzinga
7. Hand book of economic Entomology for South India by Ayyar.
8. Insect cytogenetics by R.E.F.Symposium.
9. Insects and plants by Sting, Lawton and southwood.
10. Insect and hygiene by Busvine.
11. Insect Physiology by Wigglesworth.
12. Insect morphology by Mat Calf and Flint
13. Applied Agricultural Entomology by Dr. Lalit Kumar Jha

M. Sc. Zoology II Semester

Session 2023-24

Practical –I

1	Experiment on hematology: Detection of Human Blood groups, Total differential count, Haemin crystal, cloting time of human blood	5 marks
2	Demonstration of Chromatography	10 marks
3	Problem based on demography — Study of human fingerprints	05marks
4	• Detection of protein, carbohydrate, fats. • Detection of nitrogenous wastes	10 marks
5	• **Endocrinological spots :** T. S. of Pituitary gland , T. S. of Pancreas, T. S. of Thyroid , T. S. of Parathyroid ,T. S. of Thymus, T. S. of Adrenal gland , T. S. of Testis , T. S. of Ovary. • **Comments upon prepared histological slides of mammals :** T. S. of Oesophagus , T.S of Stomach , T.S of Intestine, T. S. of liver, T. S. of lungs, L.S. of Kidney.	10 marks
6	Viva-voce	5 marks
7	Practical records/collection	5 marks
Total		**50**

Practical –II

1	**Comments upon the principle and application of analytical instruments -** • Colorimeter • Spectrophotometer • Ultracentrifuge • ESR and NMR spectrometer/Agarose Gel Electrophoresis/SDS-PAGE • Microtome • Biochemical Analyzer • Elisa Plate Reader	10 marks
2	Elective Course practical – Any 01 • Taxonomic identification of pests of vegetables and stored grains of Jabalpur district (Any 05) • Study and identification of local biodiversity of Jabalpur district (Any 05).[Preparation of album /Scrap book]	04 marks
3	Problems based on genetics- Pedigree analysis - Collection of data on family history of some common genetic traits and preparation of pedigree chart	08 marks
4	Estimation of DNA / RNA	08 marks
5	Squash preparation to study meiosis of Grasshopper testis	5 marks
6	Demonstration of Chromosome Polymorphism, Isozyme Polymorphism in some insect population	5 marks
7	Viva-voce	5 marks
8	Practical records/collection	5 marks
Total		**50**