St. Aloysius College (Autonomous), Jabalpur
Department of Zoology
M.Sc. ZOOLOGY - I Semester
Choice Based Credit System (CBCS)
Scheme of Examination (Session 2021-22)

Course No.	Course Title	Credits	Marks	
			Max. Marks	Min. Marks For Passing
CORE COURSES				
ZC -101	Biosystematics, Taxonomy and Evolution	4	40	14
ZC -102	Structure and function of Invertebrates	4	40	14
ZC -103	Quantitative Biology, Biodiversity and Wild Life	4	40	14
ZC -104	Biomolecules and structural Biology	4	40	14
ELECTIVE COURSE – (Any 01)				
ZE -105	• Wild life conservation • Entomology	4	40	14
INTERNAL ASSESSMENT				
ZI - 106	CCE-Written test (Based on core and elective courses ZC - 101, 102 ,103,104 & ZE-105) (Each test of 10 marks)	0	50	20 (04 in each Test)
ZI - 107	Project / Seminar	1	25	09
PRACTICALS				
ZP - 108	Practical- I Based on Courses ZC -101. & ZC -102.	2	50	18
ZP - 109	Practical- II Based on Courses ZC -103, ZC -104 & ZE -105.	2	50	18
SKILL BASED COURSE				
ZS-110	Skill Based Course	1	10	4
Total Credits & Total Marks		**26**	**385**	**139**

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CORE COURSE

Paper-1

Biosystematics, Taxonomy and Evolution

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MM: 40

Unit I - Definition and basic concepts of biosystematics taxonomy and classification.

- History of classification.
- Theories of classification, hierarchy of categories.
- Trends in biosystematics: Chemotaxonomy, Cytotaxonomy and Molecular Taxonomy
- Taxonomic categories wsr Species ,Genus , Order ,Class and Phyla category
- Subspecies and other infra- specific categories.
- Species concepts: different species concepts.
- Types of speciation: Allopatric, Sympatric, Parapatric and Peripatric
- Origin, patterns and mechanism of reproductive isolation.

Unit II- Taxonomic procedures

- Taxonomic Characters.
- Taxonomic collections, preservation, curating, process of identification.
- Taxonomic keys: different types of keys, their merits and demerits.
- Rules of International code of Zoological Nomenclature (ICZN):

Unit III - Evaluation of biodiversity indices

- Evaluation of Shannon-Weiner Index.
- Evaluation of Dominance Index.
- Similarity and Dissimilarity Index.
- Elementary idea of Metapopulations

Unit IV – Population Genetics and Evolution -

- Concepts of evolution and theories of organic evolution with an emphasis on Lamarckism, Darwinism, Neo Darwinism and Modern Synthetic Theory
- Population genetics:
  - Hardy-weinberg law of genetic equilibrium.
  - A detailed account of Natural selection as a destabilizing force in Hardy-Weinberg law of equilibrium.
  - Mutation as a destabilizing force in Hardy-weinberg law of equilibrium.
  - Genetic Drift as a destabilizing force in Hardy-weinberg law of equilibrium.
  - Migration as a destabilizing force in Hardy-weinberg law of equilibrium.
  - Meiotic Drive.
- Molecular Evolution
  - Gene evolution (molecular clock)
  - Evolution of gene families (beta globin clusters)

Unit V - Origin and Evolution -

- Origin of Higher categories-
  - Phylogenetic gradualism and punctuated equilibrium.
  - Major trends in the origin of higher categories
  - Micro and macroevolution.
- Molecular Phylogenetics -
  a) Phylogenetic tree
  b) Pattern of changes in nucleotide and amino acid sequence.
  c) Ecological significance of molecular variations (genetic polymorphism)
- Biological mechanism of genetic incompatibility
- Origin and Evolution of economically important animal - Horse.

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 Statisical Methods of affiliated –East–West Press,New Delhi.
8. Murry J.D. Mathematical Biology-Springer, Verlag, Berlin.
9. Taxonomy – V.C Kapoor

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CORE COURSE

Paper-II

Structure and Function of Invertebrates

MM: 40

Unit. I - Origin and organization of Invertebrates

- Origin of Metazoa.
- **Organization of Coelom -**
  a) Acoelomates b) Pseudocoelomates 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, Book lungs and Trachea
  b) Respiratory pigments of different phylogenic groups
  c) Mechanism of Respiration wsr Prawn, Scorpion and Cockroach.

Unit . III - Excretion

a) Excretion in Lower invertebrates: Simple diffusion, Contractile vacuole, and Protonephridia.
b) Excretion in Higher invertebrates : Coelom, Coelomoduct , Metanephridia , Coxal gland, Malphighian tubules, Organ of Bojanus and Green gland.

- Mechanism of Osmoregulation with special reference 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 Minor phyla –

- **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.,NewYork
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. Mc.GrawHill Co.,NewYork.
5. Hyman, L.H. The Invertebrates.Vol. 8.Mc.GrawHill 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., NewYork.
9. Read, C.P. Animal Parasitism. Parasitism.prentice Hall Inc., NewJersey.
10. Sedgwick, A. A. Student textbook of Zoology. Vol.I,II andIII. Central Book Depot, Allahabad.
11. Parker, T. J.,Haswell W.A. Textbook of Zoology, Macmillan Co., London.
12. Kotpal R.L. : Invertebrate Zoology
13. Jordan E.L & Verma P.S – Invertebrate Zoology

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CORE COURSE

Paper-III

Quantitative Biology, Biodiversity and Wildlife

MM: 40

Unit I

- Central tendencies- mean, mode and median
- Measures of dispersion : range, mean deviation, standard deviation and coefficient of variation
- Chisquare test
- Normal distribution
- Experimental designing and sample method
- Basic mathematics for biologists wsr Matrices

Unit II

- Probability: distribution, properties and probability theory
- Randomized block design.
- Analysis of Variance[ANOVA]
- Co-relation- types of correlation
- Analysis of Co-efficient of correlation
- Linear Regression.
- Elementary idea of Duncan's Multiple Range test (DMRT)

Unit III

- Concept and principles of biodiversity
- Causes for the loss of biodiversity
- Biodiversity conservation methods wsr Ex-Situ and In- Situ Conservation.
- Intellectual property right (IPR) with special reference to India.
- Medicinal uses of forest plant (any five)
- Biodiversity hot spots.

Unit IV

- Wildlife of India according to ecological zones
- Values of wildlife: positive and negative
- Wildlife protection Act and its major amendments
- Endangered and threatened species
- Wildlife corridors and wildlife translocation.
- Animal ethics- Introduction, concept, organizations and their functions
- Origin of pandemic diseases wsr SARS,MERS and COVID -19

Unit V

- National Parks and Sanctuaries
- Biospheres Reserves
- Tiger Reserve and Project Tiger
- Project Gir Lion and Crocodile breeding project in state and India
- Wildlife in M.P. with references to Reptiles, Birds and Mammals
- Study of state bird – Paradise fly catcher (Dudhraj) and State Animal -Swamp Deer (Barasingha)- *Cerves duvaucelli*

Suggested Reading Materials:

1. Batschelet. E. Introduction to mathematics for site scientist springer-verlag,berling
2. Jorgenserr,S.E. Fundamental of Ecological modeling E. sevier NewYork
3. Lenderen D.Modelling in behavioral ecology. Chapman & Hall London U.K.
4. Sokal,R.R.and F.J.Rohit Biometry Freeman SanFrancisco
5. Snedecor, G.W.andW.G. cochran, statiscal methods, Affiliated East,WestPress New Delhi (Indianed.)
6. Muray,J.D. Methamatical Biology,Springer Verlag Berlin
7. Pelon,E.C. The Interpretation of Ecological Data: A promer on classification and ordivation.
8. Wild life Management –Hossetti
9. A.Lewis.Biostatics
10. B.K. Mahajan Methods in Biostatics
11. V.B. Saharia wildlife in India
12. S.K.Tiwari Wildlife in Central India
13. J.D.Murrey Mathematical Biology
14. Georgs & Wilians Statical method
15. R.K.Tandon Biodiversity Taxonomy & Ecology
16. M.P.Arora An Introduction to Prevantology
17. P.C. Kotwal Biodiversity and Conservation

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CORE COURSE

Paper-IV

Biomolecules and Structural Biology

Unit . I **MM: 40**

- Chemical foundation of biology -
  pH, pK, acids, Bases, Buffers, Weak bonds (Hydrogen bond, Vander waals force, Hydrophobic effects , Electrostatic force) .
- Resonance and Isomerisation - Sterioisomerisation- taking glucose as an example
- Acid soluble pool of living tissue – General idea of Amino acids, Monosaccharides , Oligosaccharides, Nucleotides and Peptides.
- Nanoparticles and its Biological Relevance.
- Elementary knowledge of Biomaterials.

Unit . II

- Primary, Secondary, Tertiary and quaternary structures of proteins, protein folding and denaturation.
- DNA and RNA : Double helical structure of DNA, Structure of RNA
- Role of RNA in gene expression, protein synthesis in eukaryotes.
- DNA replication, recombination and repair, Human disease-DNA repair failure
- Membrane channels -Voltage gated and Non- gated ion Channels
- Sodium – Potassium Pump.

Unit . III

- Basic concept of metabolism: coupled and interconnecting reactions of metabolism (intermediary metabolism), cellular high energy resources and ATP synthesis.
- Glycolysis and Gluconeogenesis
- Citric acid cycle.
- Oxidative phosphorylation.
- Fatty acid metabolism : degradation of fatty acids : Beta oxidation, Brief idea of alpha and omega oxidation

Unit . IV

- RNA splicing
- m-RNA stability.
- Biosynthesis of Nonessential amino acids (glutamate & aspartate) from amphibolic compounds.
- Biosynthesis of Purines and Pyrimidines
- Biosynthesis of Cholesterol
- Lipid storage and its functional importance wsr to mobilization of fats from adipose tissue

Unit .V

- Enzymes : Terminologies, classification and basics of enzyme kinetics
- Mechanism of enzyme catalysis
- Regulation of enzyme reaction
- Concept of free energy and thermodynamic principles in biology.
- Energy rich bonds, compounds and biological energy transducers
- Factors affecting mechanism of enzyme action
- Elementary knowledge of Ribozyme.

Suggested Reading Materials

- Voet, D. and J. G. Voet. Biochemistry John Wiley and Sons
- Freifelder, D. Physical Biochemistry W.H. Freeman and Co.
- Segal, I. H. Biochemical calculations John Wiley and Sons
- Creighton, T. E. Protein Structure and molecular properties W.H. Freeman and Co.
- Freifelder D. Essentials of molecular biology
- Wilson, K. and K.H. Goulding: A biologists guide to Principles and techniques of practical biochemistry
- Cooper, T. G., Tools of Biochemistry
- Hawk, Practical physiological chemistry
- Garret, R.H. and C.M. Grisham, biochemistry, Saunders College Publishers
- Nelson, D.L. & Cox, M.M. (2017) Lehninger Principles of Biochemistry Worth
- Harper's Biochemistry
- G. P Talwar, Text book of Human Biology and Biochemistry
- Stryer, Textbook of Biochemistry
- M.C Pant - Biochemistry

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ELECTIVE COURSE

Entomology

MM : 40

Unit. I

1. Outline classification of Class-Insecta upto orders according to Imms
2. General characteristic of all orders with common examples.
3. Collection and preservation of Insects.

Unit II

1. Insect head types and modification as per their habit and habitat
2. Modification of mouth parts and feeding behavior of insects
3. Structure types and function of antennae of insects
4. Sound Production in insect

Unit . III

1. Structure of cuticle and pigment of insects
2. Structure of alimentary canal and physiology of digestion in Cockroach.
3. Malphighian tubules – Anatomical organization and transport mechanism

Unit . IV

1. Respiratory system in Cockroach.
2. Circulatory system of Cockroach.
3. Cellular elements in the haemolymph
4. Neuroendrocrine system in insects.

Unit . V

1. Structure of compound eye and physiology of vision
2. Structure and function of endocrine glands wsr corpora cardiaca and corpora allata
3. Pheromones

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

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ELECTIVE COURSE

Wild Life Conservation

MM : 40

Unit-1
1. Causes of depletion of wild life habitats.
2. Habitat analysis, Evaluation and management of wild life -
   (a) Physical parameters - Topography, soil and water.
   (b) Biological Parameters – Food, cover and browse estimation.

Unit-2
1. Population estimation.
   (a) Fertility schedules and sex ratio computation.
   (b) Faecal analysis of ungulates and carnivores
   (c) Hair profile study and Pug mark method.
2. Objectives of National Organization.
   (a) Indian Board of Wild life.
   (b) Bombay Natural History Society.

Unit-3
1. Estimation of carrying capacity in protected areas.
2. Eco tourism / wild life tourism in forests.
3 Concept of climax persistence.

Unit-4
1. Bio- telemetry in wildlife management
2. Elementary idea of Quarantine.
3. Common diseases of wild animal.
4. Care of injured and diseased animal

Unit-5
1. Protected areas of M.P wsr National parks & Sanctuaries
2. Tiger reserve in M.P.
3. Management challenges in Tiger Reserve.

Suggested Readings:

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

10. Negi S.S : Wildlife conservation (Natraj Publishers)

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Practical -I

1	Spotting- Classification and identification of various phyla (5 spots)	10 marks
2	Spot related with adaptation and evolution, homologies, analogies and modification of mouth parts	4 marks
3	One major dissection of various system of invertebrates- – (Any 01) • Prawn • Other cultured animals	8 marks
4	One minor dissection – (Any 01) • Mouth parts / salivary gland of cockroach • Mouth parts of Honey bee	5 marks
5	Mounting material- Permanent balsam mount - Mouth parts of mosquito	4 marks
6	(Any 01) • Estimation of gene and genotype frequencies in light of Hardy Weinberg law • Study of human facial traits	5 marks
7	Study of polytene chromosome	4 marks
8	Viva-voce	5 marks
9	Practical records/collection	5 marks
Total		**50**

Practical -II

1	Spotting- (any 6)	10 marks
2	Exercise on mean, median and standard deviation	08 marks
3	Problem based on biodiversity and wild life	08 marks
4	Elective Course Practical – Any 01 • Study of total haemocytes count in haemolymph of insects. • Dissection of Insect (Any 01) • Identification and comments upon wild animals of M.P. (any 05) • Survey and preparation of checklist of Local Fauna.	04 marks
5	Demonstration of enzyme actions	05 marks
6	Estimation of pH.	05 marks
7	Viva-voce	05 marks
8	Practical records/collection	05 marks
Total		**50**