

St. Aloysius College (Autonomous), Jabalpur
Department of Zoology
M.Sc. ZOOLOGY - I Semester
Choice Based Credit System (CBCS)
Scheme of Examination (Session 2020-21)

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	<ul style="list-style-type: none"> • 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

Biosystematics, Taxonomy and Evolution

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 Statistical Methods of affiliated –East–West Press,
New Delhi.
8. Murry J.D. Mathematical Biology-Springer, Verlag, Berlin.

M.Sc. Zoology I Semester
Session 2020-21
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, Malpighian 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. McGrawHill Co.,NewYork.
5. Hyman, L.H. The Invertebrates.Vol. 8.McGrawHill 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, theMacmillanCo.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.prenticeHall Inc., NewJersey.
10. Sedgwick, A. A. Student textbook of Zoology. Vol.I,II andIII. CentralBook Depot, Allahabad.
11. Parker, T. J.,Haswell W.A. Textbook of Zoology, Macmillan Co., London.

M.Sc. Zoology I Semester
Session 2020-21
CORE COURSE
Paper-III
Quantitative Biology, Biodiversity and Wildlife

Unit I

MM: 40

- 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

Unit V

- National Parks and Sanctuaries
- Biospheres Reserves
- Tiger Reserve and Project Tiger
- Project Gir Lion and Crocodile breeding project
- 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)- *Cervus 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 New York
3. Lenderen D. Modelling in behavioral ecology. Chapman & Hall London U.K.
4. Sokal,R.R.and F.J. Rohit Biometry Freeman San Francisco
5. Snedecor, G.W. and W.G. Cochran, statistical methods, Affiliated East, West Press New Delhi (Indian ed.)
6. Muray, J.D. Mathematical Biology, Springer Verlag Berlin
7. Pelon, E.C. The interpretation of ecological data: A promer on classification and ordination.
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 Startical method
15. R.K. Tondon Biodiversity Taxonomy & Ecology
16. M.P. Arora An Introduction to preva ntology
17. P.C. Kotwal Biodiversity and conservation

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 Aminoacids, 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
- Lehninger's Biochemistry
- Harper's Biochemistry
- G. P Talwar, Text book of Human biology and biochemistry
- Stryer, Text book of biochemistry

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. Malpighian 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. Cell mediated immunity.

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

- 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 and Quarantine.
 2. Common diseases of wild animal.
 3. 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 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)

M.Sc. Zoology I Semester**Session 2020-21****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) <ul style="list-style-type: none">• Prawn• Other cultured animals	8 marks
4	One minor dissection – (Any 01) <ul style="list-style-type: none">• 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) <ul style="list-style-type: none">• 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 <ul style="list-style-type: none">• Study of total haemocytes count in haemolymph• 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

St. Aloysius College (Autonomous), Jabalpur
Department of Zoology
M.Sc. ZOOLOGY - II Semester
Choice Based Credit System (CBCS)
Scheme of Examination (Session 2020-21)

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	<ul style="list-style-type: none"> • 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 2019-20

CORE COURSE

Paper-I

General and Comparative Animal Physiology and Endocrinology

Unit I

MM: 40

1. Respiratory pigments wsr Haemoglobin
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 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
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 -
 - 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, Barrington, 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 2020-21

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

3. 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 to fishes.
4. Eco-physiological adaptations to marine environments wsr to 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 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, VanNostrandCo., 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.
8. Schmidt and Neilson- Adaptations and animal physiology

M.Sc. Zoology II Semester
Session 2020-21
CORE COURSE
Paper-III
Tools and techniques in Biology

MM: 40

Unit. I

- 1 Microscopy, principle & applications
 - Light microscope and phase contrast microscope
 - Fluorescence microscope
 - Electron microscope
 - Confocal microscopy
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 to 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)
 - 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)

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. GouldingEIBSEdn.
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

M.Sc. Zoology II Semester
Session 2020-21
CORE COURSE
Paper-IV
Molecular Cell Biology and Genetics

Unit . I

MM: 40

- 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, Thalassaemia, 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 2020-21

ELECTIVE COURSE

Applied Entomology

MM : 40

Unit. I

Modern concept of Pest management wsr:

1. Biological control of pests
3. Genetic control of pests
4. 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.

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 2020-21
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
- 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. Wetzel : Limnology
18. Welch : Limnology Vols. I-II

M. Sc. Zoology II Semester

Session 2020-21

Practical –I

1	Experiment on hematology: Detection of Human Blood groups. Total differential count.	5 marks
2	Demonstration of Chromatography	10 marks
3	Problem based on demography -- Study of human fingerprints	05marks
4	<ul style="list-style-type: none"> • Detection of protein , carbohydrate, fats. • Detection of nitrogenous wastes 	10 marks
5	<ul style="list-style-type: none"> • 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	<p>Comments upon the structure and application of analytical instruments -</p> <ul style="list-style-type: none"> • Colorimeter • Spectrophotometer • Ultracentrifuge • ESR and NMR spectrometer/Gel Electrophoresis/SDS-PAGE • Microtome • Biochemical Analyzer 	10 marks
2	<p>Elective Course practical – Any 01</p> <ul style="list-style-type: none"> • Taxonomic identification of pests of vegetables and stored grains of Jabalpur district (Any 05) • Study and identification of local Birds 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