FACULTY OF LIFE SCIENCES

Syllabus

for

Master of Science (Zoology)

(Under Continuous Evaluation System)

(SEMESTER: III-IV)

Examinations: 2022-23

Kanya Maha Vidyalaya, Jalandhar

(Autonomous)

The Heritage Institution

Master of Science (Zoology) (Session 2022-23)

Program Specific Outcomes

1. Understand and analyse ecological and evolutionary principles such as evidences of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life and their economic importance. They will be able to use specific examples to explicit how descent with modification has shaped animal morphology, physiology, life history and behaviour.
2. Understanding of fundamental concepts of various branches of zoology and efficiency in computational tools, numerical methods relevant to zoology.
3. Acquire proficiency in experimental techniques, data analysis and drawing conclusions in zoology.
4. Ability to critically evaluate scientific literature, synthesize information from multiple sources and apply scientific reasoning to solve problems in zoology and related fields.
5. Demonstrate knowledge to acquire, articulate, retain and employ practical skills relevant to fundamentals of computer, molecular techniques and statistical tools.
6. Students will be able to apply their knowledge of zoology to address real world challenges in areas such as animal ecology, wildlife management, biotechnology, applied zoology and taxonomy.
7. Demonstrate adaptability to emerging technologies and tools relevant to the field of zoology and enhance communication skills for effectively presenting scientific findings and collaborating within interdisciplinary teams.
8. Understand how the chemistry and structure of the major biological macromolecules, including nucleic acids to know their biological properties and determine relationship of variations in phenotypic expression of genome and their genome wide interactions with other organisms.

Scheme of Studies and Examination

Master of Science (Zoology)
Session: 2022-23
(SEMESTER III)

Master of Science (Zoology) Semester III							
Paper No.	**Course Name**	**Course Type**	**Marks**				**Examination time (in Hours)**
			Total	**Ext.**		**CA**	
				L	**P**		
MZOL-3481	Research Techniques and Methodology	C	100	80	-	20	3
MZOL-3482	Developmental Biology	C	100	80	-	20	3
MZOL-3483	General Biochemistry	C	100	80	-	20	3
MZOL-3484	Applied Zoology-II (Vertebrates)	C	75	60	-	15	3
MZOP-3485	Practical -V (Research Techniques & Applied Zoology-II)	C	50	-	40	10	3
MZOP-3486	Practical VI (Developmental Biology & Biochemistry)	C	50	-	40	10	3
	Total		**475**				

Master of Science Zoology
Session 2022-23
(Semester–III)
Course Code: MZOL-3481
RESEARCH TECHNIQUES AND METHODOLOGY(THEORY)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understanding of the theoretical principles of centrifugation and chromatography techniques and the scope of their applications.
- CO2 Understanding of the theoretical principlesofspectroscopictechniques, microscopy and their applications.
- CO3 Explain various types of electrophoresis techniques.
- CO4 Understanding of Radioisotopic techniques.

Master of Science Zoology
Session 2022-23
(Semester–III)
Course Code: MZOL-3481
RESEARCH TECHNIQUES AND METHODOLOGY(THEORY)

Time: 3hrs. **Max. Marks: 100**
Theory: 80
CA: 20

Instructions for the Paper Setter:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

Centrifugation: Basic principles, theory and applications of preparative and analytical centrifugation, rotor types, sedimentation co-efficient and care of rotors.

Chromatography: Theory, principle and application of column, paper, thin layer, ion-exchange, affinity chromatography, GLC and HPLC.

Unit–II

Spectroscopy: Lambert Beer's law, Principle and applications of UV/Visible spectroscopy, NMR, ESR and Mass spectroscopy. Visualization of Cells and sub cellular components by light microscopy, Scanning and Transmission Electron microscopy. Freeze fracture methods for electron microscopy. Image processing methods in microscopy.

Unit–III

Electrophoresis: Theory and application SDS-PAGE and Agarose Gel electrophoresis. Introduction to IEF, (Iso-electric focusing). Introduction to gene amplification techniques. Phage DNA detection of plasmid separation of DNA molecules. Southern, Northern and Western techniques.

Unit–IV

Radioisotopic Techniques: Basic concepts of radioisotopy, theory and applications of Geiger-Muller tube. Introduction of radio isotopes in biological tissues and cells. Safety rules for radioisotopic studies. Biological applications.

Books:

1. Slater, R.J. (1990). Radioisotopes in Biology- A Practical Approach, Oxford University Press, NY.
2. Wilson, K and Goulding, K.H. (1991). Biologist's Guide to Principles and Techniques of Practical Biochemistry. 3rd., Edward Arnold, London.
3. Sawhney, S.K. and Singh, R. (2001). Introductory Practical Biochemistry, Narosa Publishing House, New Delhi.
4. Tinoco Kenneth Saur and J.C. Wang. Physical Chemistry: Principles and Applications in Biological Sciences, 3rd edition.

Master of Science Zoology
Session 2022-23
(Semester–III)
Course Code: MZOL-3482
DEVELOPMENTAL BIOLOGY

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 To develop detailed understanding of essential events of developmental biology through proper explanation of gametogenesis, fertilization, as part of early embryonic development and to impart knowledge regarding in-vitro fertilization.
- CO2 To impart knowledge regarding basic concepts of parthenogenesis, cleavage and gastrulation to the students.
- CO3 Describe induction, metamorphosis and regeneration.
- CO4 To make the students aware about genetic control of development.

Master of Science Zoology
Session 2022-23
(Semester–III)
Course Code: MZOL-3482
DEVELOPMENTAL BIOLOGY

Time: 3 hrs. **Max. Marks: 100**
Theory: 80
CA: 20

Instructions for the Paper Setter:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

Gametogenesis and Fertilization
Spermatogenesis, oogenesis, vitellogenesis
Egg and sperm interaction, fertilization
Natural and artificial parthenogenesis
In vitro fertilization and embryo transplantation

Unit–II

Cleavage, Gastrulation & Differentiation
Cleavage and its patterns Biochemical changes during cleavage
Gastrulation and morphogenetic movements
Morphogenesis of germ layers
Morphogenetic field
Differentiation
Determination, transdetermination

Unit–III

Induction
Induction, competence and inductive response, hierarchies of induction, principles of reciprocal action
Metamorphosis and Regeneration Morpho physiology and metamorphosis in insects andamphibians
Regeneration in Platyhelminthes and Coelenterates
Histomorphological changes in regeneration of tail in Amphibians and Reptiles, limb in amphibians
Vertebrate lens regeneration

Unit–IV

Genetic Control of Development

Nuclear determination of developmental events
Molecular basis of early embryonic development
Influence of extrinsic factors on genetic control
Nucleus and cytoplasmic interactions during development
Concept of growth at cellular, subcellular and organ level

Suggested Readings:-

1. Balinsky, B.I. (1981). An Introduction to Embryology, Saunders, Philadelphia.
2. Bellairs, R. (1971). Development Processes in Higher Vertebrates, University of Miami Press, Miami.
3. Berrill. N.J. (1971): Developmental Biology. McGraw Hill, New Delhi.
4. Dawnpart, Developmental Biology.
5. Gilbert, F. (1985, 95 & 2000): Developmental Biology, Sinaur.
6. Goel, S.C. (1984): Principles and Animal Developmental Biology, Himalaya, Bombay.
7. Grant, P. (1978): Biology of Developing System.
8. Spratt, N.T. Jn. (1971): Developmental Biology, Wordsworth, Belmont, Co.
9. Waddigton CH. (1966): Principles of Development and Differentiation. MacMillan, New York.
10. Miller, W.A. (1997). Developmental Biology Springer Verlag, New York.

Master of Science Zoology
Session 2022-23
(Semester–III)
Course Code: MZOL-3483
GENERAL BIOCHEMISTRY

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Explain Enzyme kinetics
- CO2 Describe Glycolysis.
- CO3 Reactions and regulation of citric acid cycle
- CO4 Oxidation of fatty acids and amino acids.

Master of Science Zoology
Session 2022-23
(Semester–III)
Course Code: MZOL-3483
GENERAL BIOCHEMISTRY

Time: 3 hrs. **Max. Marks: 100**
Theory: 80
CA: 20

Instructions for the Paper Setter:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

Biomolecules
Structure and function of biomolecules: Amino acids, Carbohydrates, Lipids, Proteins and Nucleic acids
Enzymes: As catalyst specificity, enzyme substrate complex, active sites. Michaelis – Menton kinetics, Vmax and Km and their significance.. Reversible and Irreversible inhibition, Regulatory enzymes.

Unit–II

Brief introduction to Bioenergenetics and thermodynamics
Phosphoryl group transfer and ATP
Glycolysis
Fates of glycolysis
Fates of pyruvate under aerobic and anaerobic conditions
Gluconeogenesis and the carbohydrate catabolism
Pentose phosphate pathway

Unit–III

Citric acid cycle
Oxidation of pyruvate, production of acetate
Reactions of citric acid cycle
Regulation of citric acid cycle
Glyoxylate cycle

Unit–IV

Oxidation of fatty acids and amino acids

Metabolism and transport of fats

Oxidation of fatty acid

Generation reactions and metabolism of amino acids acids

Oxidative phosphorylation

Electron transport reactions in mitochondria

Shuttle system in mitochondria

Regulation of oxidative phosphorylation

Suggested Reading Material:-

1. Lehninger A.D. Nelson D.L. & Cox M.M. (1993) & (2000), Principles of Biochemistry, 2nd and 3rd ed. Worth Publishers, New York.
2. Lehninger, A (2000). Principles of Biochemistry. 3rd Edition.
3. Fischer, J. and Arriold, J.R.P. (2001). Instant notes in Chemistry for Biologists Viva Books Pvt. Ltd.
4. Harper, H.A. (2000): Harper's Biochemistry 25th ed.
5. Morris, H. Best, L.R., Pattison, S., Arerna, S. (2001). Introduction to General Organic Biochemistry. 7th Ed. Wadsworth Group.
6. Sheehon, D (2000). Physical Biochemistry: Principles and Applications – John Wiley & Sons Ltd., England.

Master of Science Zoology
Session 2022-23
(Semester–III)
Course Code: MZOL-3484
APPLIED ZOOLOGY-II (VERTEBRATES)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understand the concept of Fish culture, poultry, dairy farming, and wool industry.
- CO2 Understand fur industry and wool industry.
- CO3 know about dairy farming and leather industry including their management, housing, processing.
- CO4 gain skilled knowledge about piggery.

Master of Science Zoology
Session 2022-23
(Semester–III)
Course Code: MZOL-3484
APPLIED ZOOLOGY-II (VERTEBRATES)

Time: 3hrs **Max. Marks: 75**
Theory: 60
CA: 15

Instructions for the Paper Setter:
Eight questions of equal marks (12 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

Pisciculture

Economically important fresh water and marine fishes
Aims and evolution of Fish culture
Fish Farming Technologies
Factors affecting fish culture
Problems of seed collection from natural resources (in brief)
Induced breeding methods
Products and by products from pisciculture.

Poultry

Nomenclature and breeds of poultry birds
Egg structure and quality, nutritive values, abnormalities in eggs, factors affecting size and egg processing
Broilers, meat processing
Poultry Rearing / Farming
- Nutritional Requirements
- Housing and equipment
- Poultry diseases

Poultry products and by products

Unit–II

Fur and wool Industry

Fur producing animals
Fur farming, dressing, processing and dyeing
Fur industry in India
Animals of wool industry
Types, structure and physicochemical properties of wool
Processing of wool: shearing, clearing, drying, bleaching, dyeing, spinning and twisting

Unit–III

Dairy Farming

Milching animals, Breeds, Housing, raising and Tools of management
Artificial insemination and IVF for improvement of stock
Milk composition and dairy products

Leather Industry

Animals of leather industry
Processing of skin: flaying, Curing, salting and tanning during
Enemies of skin industry

Unit–IV

Piggery

Characteristics of swine and important breeds
Breed selection, management and housing and nutritional needs
Products (Pork, Bristles, Lard, Sausages) and by products
Diseases of Pigs

Other Utilities of Animals

Pharmaceuticals from animals (in brief)
Use of animals in vaccine production

Suggested Reading Material:

1. Banarjee, G.C. (1991), Text book of Animal Husbandry. Oxford and IBH Pub, New Delhi.
2. Jawal, P.L. (1977), Handbook of Animal Husbandry, I. C. A. R., Pub. New Delhi.
3. Jhingaran, V.G. (1991), Fish and Fisheries of India, Hindustan Pub. Co. India.
4. Mustafa, S. (1990), Applied and Industrial Zoology, Rastogi publications, Meerut.
5. Sarkar, K. T. (1991), Theory and Practice of Leather manufacture. The Author, Madras.
6. Shami, Q. J. and Bhatnagar, S. (2002) Applied Fisheries . Agrobios India.
7. Shukla, G. S. & Upadhaya, V. B. (1991-92), Economic Zoology, Rastogi Publications, Meerut.
8. Toor, H. S. and Kaur, K. (1996), Fish Culture Manual. PAU, Ludhiana.
9. Yadav, M. (2003) Economic Zoology, Discovery Publication House, New Delhi.

Master of Science Zoology
Session 2022-23
(Semester–III)
Course Code: MZOL-3485
PRACTICAL V (RESEARCH TECHNIQUES & APPLIED ZOOLOGY-II)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understand centrifugation techniques.
- CO2 Gain practical knowledge about chromatographic techniques.
- CO3 Estimate protein content, DNA/RNA with the help of spectroscopic techniques.
- CO4 Understand various electrophoretic techniques.

Master of Science Zoology
Session 2022-23
(Semester–III)
Course Code: MZOL-3485
PRACTICAL V (RESEARCH TECHNIQUES & APPLIED ZOOLOGY-II)

Time: 3 hrs **Max. Marks: 50**
Practical: 40
CA: 10

Centrifugation:
-Sedimentation using Swing out Rotor and Angle Rotor -Differential centrifugation

Chromatography Techniques: (for separation of macromolecules)
- Paper chromatography
- Thin layer chromatography
- Gel permeation chromatography

Spectrophotometric Techniques:
- Preparation of standard curve of BSA, DNA, RNA
- Measurement of transmission of light through different solutions or substances at different wavelengths of light.
- Estimation of DNA/RNA

Electrophoresis Techniques:
-Preparation of native polyacrylamide gel.
-Gel separation of proteins by native PAGE.
-Preparation of SDS-polyacrylamide gels
-Separation of proteins by SDS-PAGE.
-Direct and Indirect ELISA

Vist to a fish farm/poultry form/pig farm/sheep or goat farm/meat processing industry/leather industry/wool industry and preparation of report.

Master of Science Zoology
Session 2022-23
(Semester–III)
Course Code: MZOL-3486
PRACTICAL VI (DEVELOPMENTAL BIOLOGY AND BIOCHEMISTRY)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 study different larval forms across animal kingdom and developmental stages of chick.
- CO2 study developmental stages of frog and metamorphosis.
- CO3 study spermatogenesis, oogenesis, testis and ovaries.
- CO4 do quantitative analysis of proteins, lipids and carbohydrates.

Master of Science Zoology

Session 2022-23(Semester–III)

Course Code: MZOL-3486

PRACTICAL VI (DEVELOPMENTAL BIOLOGY AND BIOCHEMISTRY)

Time: 3hrs. **Max. Marks: 50**

Practical: 40

CA: 10

-Study of different larval forms across the animal Kingdom using charts/models/videos.

-Developmental stages of chick and frog through slides/charts.

-Metamorphosis through charts/audio video means in frog and insect.

-Study of Gametes through permanent slides:-

a) Spermatogenesis in rat/frog/grasshopper
b) Study of testis (rat/frog/grasshopper)
c) Study of Ovary(rat/frog/grasshopper)
d) Oogenesis in rat / frog/fish

-Quantitative analysis of proteins by Lowry/ Bradford method.

-Estimation of Lipids

-Estimation of Carbohydrates

Master of Science (Zoology)
Session-2022-23
(SEMESTER-IV)

Master of Science (Zoology) Semester IV							
Paper No.	**Course Title**	**Course Type**	**Marks**				**Examination time (in Hours)**
			Total	**Ext.**		**CA**	
				L	**P**		
MZOL-4481	Animal Behaviour and WildlifeConservation	C	100	80	-	20	3
MZOL-4482	Animal Genetics and Biotechnology	C	100	80	-	20	3
MZOL-4483	Concepts of Immunology	C	100	80	-	20	3
MZOL-4484	Biosystematics	C	50	40	-	10	3
MZOP-4485	Practical –VII (Animal Behaviour and Wildlife Conservation)	C	50	-	40	10	3
MZOP-4486	Practical - VIII (Genetic and Biosystematics)	C	50	-	40	10	3
MZOD-4487	Project Report	C	-	Satisfactory/not-satisfactory			
	Total	C	**450**				

Master of Science (Zoology) Semester–IVSession-2022-23

Course Code: MZOL-4481

Course Title: Animal Behaviour and Wildlife Conservation

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Demonstrate knowledge of key concepts in animal behavior, its patterns, and analysis. It will also enable the students to understand the proximate controls of behavior including the role of hormones, the animal's genotype and the animal's environment in the development of behavior.
- CO2 Adaptive significance of behavior, emphasizing social behavior, territoriality, sexual selection, parental care and mating systems
- CO3 Understanding and awareness for wildlife conservation. To impart knowledge regarding conservation of threatened animal species.
- CO4 Understand the significance of various wildlife projects for conservation of threatened species and the status of wildlife in Punjab.

Session-2022-23

Master of Science (Zoology) Semester–IV

Course Code: MZOL-4481

Course Title: Animal Behaviour and Wildlife Conservation

Time: 3hrs **Max. Marks: 100**
Theory: 80
CA: 20

Instructions for the Paper Setter:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

Introduction
Ethology as a branch of biology
Animal Psychology – classification of behavioural patterns, analysis of behaviour (ethogram)

Neural and Hormonal Control of Behaviour
Genetic and environmental components in the development of behaviour

Communication:
Chemical, Visual tactile and Audio communication
Functions of communication
Song specificity in birds
Evolution of language (primates)
Host-parasite relations

Unit–II

Social Behaviour
Aggregations-schooling in fishes, flocking in birds, herding in mammals, Advantages and disadvantages of living in groups
Group selection, kin selection, altruism, reciprocal altruism, inclusive fitness Social organization in insects and primates

Reproductive Behaviour
Evolution of sex.
Mating and Courtship behaviour
Sperm competition
Sexual selection and Parental care

Learning and Memory
Conditioning, Habituation, Associative learning, Reasoning and Cognitive skills

Unit–III

Wild life in India

Wild life as a resource and its value
Causes of depletion of wildlife
Wild life ecology, ecological sub regions, distribution of wildlife in India
Methods of studying wildlife and census of wildlife National and state animals of India
Names, Organization and management of Wildlife sanctuaries, National parks and Biosphere reserves

Wildlife conservation measures

Role of Zoos, parks and sanctuaries for conservation of some wild animals
Laws, legislation and statuary bodies for protecting wildlife
Red data book, endangered, vulnerable, rare, threatened and intermediate species
Measures for Wildlife conservation

Unit–IV

Status of Wildlife in Punjab

Special projects for Endangered and Threatened Species and concerns

Project Tiger
Project Hangul
Project Rhino
Project Elephant
Gir Lion Sanctuary Project
Project Great Indian Bustard
Crocodile breeding Project
Ecology & Conservation of the Himalayan Musk deer and the Manipur Brow antlered deer

Suggested Reading Material:

1. Aggarwal,. (2000), Biodiversity.
2. Aggarwal,. (2000), Wildlife of India.
3. Alcock, J. (1998), Animal behaviour, An evolutionary approach Sinauer Assoc., Sunderland, Mass, USA.
4. Ali, S. (1971), The Books of Indian Birds, Bombay Natural History Society, Bombay.
5. Burton, L. D. (2003), Fish and Wildlife: Principles of Zoology and Ecology. Delmar Thompson Learning Pb.
6. Dasmann, R. F., (1982), Wildlife Biology, Wiley Eastern, New Delhi.
7. Drickamer, L. C. and Vessey, S. H. (1986), Animal Behaviour - Concepts, Processes and Methods. (2nd ed.), Wordsworth Publ. Co., California.
8. Fulbright, Timothy, E. and Hewitt, D. G. (2008). Wildlife Science: Linking Ecological Theory and Management Applications. CRC Press, Taylor and Francis : BocaRaton, F L.
9. Giles, R. H. (1984), Wildlife Management Techniques, Natraj Publishers, Dehradun.
10. Gopal, R. (1992), Fundamental of Wildlife management Justice Home Allahabad.
11. Goodenough, J., McGurie and Wallace, R. A. (2001), Perspective on animal behaviour. John Wiley & Sons, Inc. New York.
12. Hosetti, B. B. (1997), Concepts in Wildlife Management, Chawla Press, Delhi.
13. Huntingford F. (1984), The study of animal Behaviour, Chapman and Hall, London.
14. Manning, A. and Dawkins, M. S. (1992 & 1998), An Introduction to Animal Behaviour , 4th ed. (Cambridge low price editions). Cambridge University Press, Cambridge.

15. Manning, A. (1979), An Introduction to Animal Behaviour, 3rd Edition . The English Language Book Society and Edward Arnold Publishers Ltd.
16. McFarland, D. (1985 & 1999), Animal Behaviour. Pitman Publishing Ltd. London.
17. Majupuria T. C. (1990), Wildlife Wealth of India (Resources and Management), ISBN, Tecpress Services, Thailand.
18. Moulton, M. P. and Sanderson, J. (1997), Wildlife issues in a changing world. St. Luice Press Florida.
19. Negi, S. S. (1995), Hand Book of National Park, Sanctuaries and Biosphere Reservoirs in India, Indus publishing Co., New Delhi
20. Prater, S. H. (1980), The Book of Indian Animals, Bombay Natural History Society, Bombay.
21. Saharia, V. P. (1982), Wildlife in India, Natraj Publisher, Dehradun.
22. Samways, M. J. (1994), Insect Conservation Biology, Chapman and Hall, New York.
23. Sharma, B. D. (1994), High Altitude Wildlife of India, Oxford IBH, New Delhi.
24. Sharma, B.D. (1999), Indian Wild Life Resources Ecology and Development . Daya Publishing House, Delhi.
25. Sharma, B.D. (2002), Man environment and wildlife animal. IBH Publishing Co., Pvt . Ltd. New Delhi.
26. Teague, R. D. (1987), A manual of Wildlife Conservation, Natraj Publishers, Dehradun.
27. Tikadar, B. K. (1988), Threatened Animals of India, Publications of Zoological Survey of India, Calcutta.
28. Tirvedi, P.R. and Singh, U. K. (1996), Environmental Laws of Wildlife.

Master of Science (Zoology) Semester–IV

Session-2022-23

Course Code: MZOL-4482

Course Title: Animal Genetics and Biotechnology

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 describe structure of DNA and concept of linkage and crossing over.
- CO2 describe gene concept and mutations in detail.
- CO3 describe bacterial and viral genetics.
- CO4 understand recombinant DNA technologies and extranuclear inheritance.

Master of Science (Zoology) Semester–IV

Session-2022-23

Course Code: MZOL-4482

Course Title: Animal Genetics and Biotechnology

Time: 3 hrs. **Max. Marks: 100**
Theory: 80
CA: 20

Instructions for the Paper Setter:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

DNA- The genetic material:
DNA: Structure, Properties, Replication and packaging into chromosomes Prokaryote nucleoid structure
Chemical composition of eukaryote chromosomes
Euchromatin, Heterochromation and banding pattern
Repetitive DNA and sequence organization
Protein synthesis

Linkage, Crossing over and Chromosome Mapping
Cytological basis of crossing over
Two factor crosses, Three factor crosses and interference
Somatic Cell hybirdization.

Unit–II

Mutations
Introduction and classification of mutation
Molecular basis of mutation
Radiation and chemical inducted mutation
Correlation between mutagenicity and carcinogenicity
Mutation Frequency
Practical applications of Mutations

Gene Concepts
Classical versus molecular concepts of Gene
Complementation test for functional allelism
Regulation of gene expression in prokaryotes and Eukaryotes

Unit–III

Bacterial Genetics
Transformation, transduction and conjugation.
F mediated sex-duction.
Mechanism of recombination in bacteria.

Plasmid, Episome, IS elements and Transposons.

Genetics of Viruses

Organisation and expression of bacteriophage genomes
Structure and inf ection cycles of Viruses of eukaryotesAnimal viruses and cancer

Unit–IV

Recombinant DNA technology

Gene cloning and Sequencing.
Restriction endonuclease.
Vectors.
cDNA cloning.
Identification of Specific clone with a specific probe.
Techniques: Southern, Northern, Western Blotting, PAGE, PCR, DNA finger printing, DNA foot printing.
In situ hybridization, RFLP.
Practical applications of gene cloning.

Extranuclear inheritance

Criteria for extranuclear inheritance
DNA and drug resistance
Mitochondrial DNA and genetic diseases
Mechanism of Sex determination, Sex differentiation, Sex linked inheritance.

Books Recommended:

1. Ayala, F.J. & Kiger, Jr. J.A. (1980) Modern Genetics. The Benjamin Cummings Publishing Co. Inc.
2. Brown T.A. (1992). Genetics- A Molecular Approach, 2nd ed. Van Nostrand Rainhold (international).
3. De-Robertis, F.D.P. and De-Robertis Jr., E.M.E. (1987). Essentials of Cell and Molecular Biology, Saunders, Philadelphia.
4. De-Robertis, F.D.P. and De-Robertis Jr., E.M.E. (1987). Cell and Molecular Biology, Saunders, Philadelphia.
5. Freifelder, D. & Malacinski. G.M. (1993) : Essentials of Molecular Biology, Jones & Bartlett Publishers, Boston.
6. Gardener, E.J., Simmons, M.T.J. & Sunstad, D.P. (1999) : Principles of Genetics, 8th ed. John Wiley & Sons, New York.
7. Miglani, G.S. (2000). Basic Genetics Narosa Publishing House, New Delhi.
8. Sambrook, J., Fritisch, E.F. and Maniatis, J. (1989). Molecular Cloning. A lab manual.
9. Winter, P.C., Hickey, G.I. and Fletcher, H.L. (1999) Instant notes in Genetics. New Delhi
10. Satson, J.D. et. al. (1987) : Molecular Biology of Gene, 4th ed. Vol. I & II. The Benjamin / Cummings Publishing Co., Inc.
11. Weaver, R.F. and Hedrick, P.W. (1992). Genetics Wm. C. Brown Publishers Dubuque.
12. Zubay. U.G. (1987), Genetics. The Cummings Publishing Co., Inc.

Master of Science (Zoology) Semester–IV

Session-2022-23

Course Code: MZOL-4483

Course Title: Concepts of Immunology

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Describe the basic mechanisms, distinctions and functional interplay of innate and adaptive immunity.
- CO2 define the cellular/molecular pathways of humoral/cell-mediated adaptive responses and understand the cellular as well as molecular aspects of lymphocyte activation, homeostasis, differentiation, and memory.
- CO3 Understand the molecular basis of complex, cellular processes involved in inflammation and immunity, in states of health and disease.
- CO4 Understand immunodiagnostics techniques.

Master of Science (Zoology) Semester–IV

Session-2022-23

Course Code: MZOL-4483

Course Title: Concepts of Immunology

Time: 3 hrs. **Max. Marks: 100**
Theory: 80
CA: 20

Instructions for the Paper Setter:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

Introduction
Types of immunity-innate and adaptive. Features of immune response-memory, specificity and recognition of self and non-self. Terminology and approaches to the study of immune system. Immunity to viruses bacteria, fungi and tumours.

Cells and Organs of the immune system
Lymphoid cells, heterogeneity of lymphoid cells, T-cells, B-cells, Null cells, Monocytes, polymorphs; primary and secondary lymphoid organs-thymus, Bursa of fabricius spleen, lymph nodes, lymphatic system, Mucosa Associated Lymphoid Tissue (MALT), Lymphocytes traffic.

Unit–II

Humoral Immunity*:*
Antigen-antibody interactions, affinity and avidity, high and low affinity anti-bodies. Immunoglobulins, classes and structure. Molecular mechanism of generation of antibody diversity. Complement fixing antibodies and complement cascade.

Cell Mediated Immunity
T-cell subset and surface markers. T-dependent and T-independent antigens, recognition of antigens by T-cells and role of MHC, structure of
T – cell antigen receptors.

Immunological Disorders

Unit–III

Types of Hypersensitivity reactions, autoimmune disorders, their underlying molecular mechanism, actiology, diagnostic, prognostic and prophylactic aspects, Immunodeficiency disorders, Aids

Immuno biotechnology:

Hybridoma Technology

Immunization of animals, isolation of stimulated spleen cells, Myeloma cell lines used as fusion partners. Fusion methods, Detection and applications of monoclonal antibodies, Vaccines: conventional vaccines, Viral vaccines, Bacterial vaccines, peptide vaccine genetically engineered vaccines, Production and application of lymphokines.

Unit–IV

Immunodiagnostic Procedures

Various types of Immunodiffusion and immunoelectrophoretic procedures, Immunoblot, ELISA, RIA, Agglutination of pathogenic bacteria, haemagglutination and inhibition.

Books Recommended:

1. Kuby, J., Immunology W. H. Freeman and Company, New York, (1992).
2. Roitt, I. M. Brostoff, J and Male, D., Immunology, 2nd edition, Gover Medical Publishing, New York. (1989).
3. Roitt, I. M., Essential Immunology, 6th edition, Blackwell Scientific Publications, Oxford. (1988).
4. Paul, W.E., Fundamental Immunology, 2nd edition, Raven Press, New York. (1989).
5. Playfair, J.H.L.: Immunology at a glance, 5th edition, Blackwell Scientific Publications, Oxford. (1992).
6. Paul, W.E.: Immunology; recognition and response. W.H. Freeman, New York. (1991).

Master of Science (Zoology) Semester–IV

Session- 2022-23

Course Code: MZOL-4484

Course Title: Biosystematics

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 evaluate the taxonomic characters and apply this for the identification and classification of living things.
- CO2 Apply the various taxonomic procedures for collection, preservation and identification of living organisms.
- CO3 Knowledge of different types of publications
- CO4: Knowledge about major and minor phyla

Master of Science (Zoology) Semester–IV

Session- 2022-23

Course Code: MZOL-4484

Course Title: Biosystematics

Time: 3 hrs. **Max. Marks: 50**
Theory: 40
CA: 10

Instructions for the Paper Setter:
Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

Introduction
Terms / Definitions
History/ Development of theories / kinds of classification
Importance of Biosystematics

Material basis of Biosystematics

Different attributes or evidences

Character kinds

Character weighing

New aspects of Biosystematics:

Cytotaxonomy

Chemotaxonomy

Molecular taxonomy

Unit–II

Taxonomic Procedures Taxonomic collections Preservation Identification
Taxonomic keys (Different kind, salient features, merits and demerits)
International Code of Zoology/ Cal Nomenclature
Nomenclature Principles, important rules, their interpretation and application in scientific nomenclature.

Unit–III

Taxonomic Publications
The Scientific publications
Systematic publications
Contents of publications

Taxonomic Hierarchy

Species category and various concepts of species
Hierarchy of categories
Lower and higher categories
Subspecies and other sub specific categories
Decision at species and sub species level

Unit–IV

History of kingdom systems (resume of whittakar's system and other recent systems of classification)

An outline of classification of kingdom Animalia
Salient features of minor phyla.

Suggested Reading Material:

1. Gote, H.E. (1982), Animal Taxonomy, Edward Arnold.
2. Jaffery, C. (1973), Biological Nomenclature, Edward Arnold.
3. Kapoor, V.C. (1987), Theory and Practice of Animal Taxonomy, IPH Pb. New Delhi.
4. Mayer, E. (1969), Principle of Systematic Zoology, McGraw Hill Book Co. London.
5. Mayer, E. & Aschhok (1991), Principles of Systematics, McGraw Hill Book Co. London.
6. Minell, A. (1993), Biological Systematics, The State of Art. Chapman & Hall, London.
7. Quicke, D.L.J, (1996), Principles & Techniques of Contemporary Taxonomy, Blacky Academic & Professional, London, New York, Madras.
8. Kitching, I.J., Forey, P.L. Humpheries, C.J. & William, D. 1998. Cladistics: Theory and Practice of Parsimony Analysis, Oxford University Press.
9. Sebuh, Randall T. 2000, Biological Systematics: Principles & Applications Cornell University Press 256 pp.
10. Winston, J. 1999. Describing Species Practical Taxonomic Procedure of Biologists. Columbia University Press, Lincoln, R.J. Dictionary of Ecology, Evolution and Systematics.

Master of Science (Zoology) Semester–IV

Session- 2022-23

Course Code: MZOP-4485

Course Title: PRACTICAL-VII (Animal Behaviour and Wild Life Conservation)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 study influence of temperature and food preference
- CO2 understand Geotaxis and humidity preference.
- CO3 study phototaxis in invertebrates.
- CO4 investigate chemosensory responses in *Zaprionus*/*Bactrocera*.

Master of Science (Zoology) Semester–IV

Session- 2022-23

Course Code: MZOP-4485

Course Title: PRACTICAL-VII (Animal Behaviour and Wild Life Conservation)

Time: 3 hrs **Max. Marks: 50**

(Practical: 40, CA: 10)

1. To study the influence of temperature on development and population built up of *Tribolium*/*Rhizopertha*/*Callosobruchus*.

2. To study the food preference in different animals.

a) Tribolium /Rhizopertha
b) Pieris brassicae.

3. To investigate the locomotive, explorative, withdrawal and habituation behaviours in Earthworm and Slug

4. To study the latent and operant learning in rat.
5. To study the thigmotaxis response in *Callosobruchus*/ *Tribolium/ Rhizopertha*

6. To study the Geotaxis Responses in

a) Tribolium
b) Ant
c) *Pieris brassicae* Larvae
d) Slug

7. To study the Humidity Preference in

a) Drosphila / *Zaprionus*
b) Tribolium
c) Callosobruchus
d) *Pieris brassicae* Larvae

8. To study the Phototaxis to Point Source and Different Colours of Light.

a) Earthworm
b) *Zaprionus*.
c) Tribolium
d) Callosobruchus
e) *Pieris brassicae* Larvae

9. Use of videos to Study the

a) Grooming and righting behaviour in cockroach.
b) Tarsal response in butterfly/housefly.
c) Equilibrium study on housefly.
d) Effect of temperature on opercular movement in fish

10. **To Investigate the Chemosensory Responses in *Zaprionus* / *Bactrocera***

11. Study of body rhythms in human beings
12. Animal behaviour patterns using photostat sheets.
13. Assignment on Wildlife project.

Master of Science (Zoology) Semester–IV

Session- 2022-23

Course Code: MZOP-4486

Course Title: PRACTICAL-VIII (Genetics and Biosystematics)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understanding of pedigree analysis and preparation of familycharts
- CO2 Knowledge of isolation of DNA from human blood and buccalcells and cell division.
- CO3 Understanding of inheritance of morphogenetic human characters.
- CO4 Knowledge of collection, preservation and nomenclature ofanimals

Master of Science (Zoology) Semester–IV

Session- 2022-23

Course Code: MZOP-4486

Course Title: PRACTICAL-VIII (Genetics and Biosystematics)

Time: 4 hrs **Max. Marks: 50**
(Practical: 40, CA: 10)

-To prepare and study the karyotype of human cell from meta phase pictures.

-To study the pedigree analysis of a family.

-To study blood groups in human beings.

-Demonstration of Barr body in the oral epithelium of human beings.

-To study different stages of mitosis in root tips of *Allium cepa.*

-To study permanent slides of:-

- Mitosis in bone marrow cells of rat.

-Stages of meiosis in testis of rat/grasshopper/*Allium cepa.*

-Polytene chromosomes in third instar larvae of *Zaprionus paravittiger*.

-To study dermatoglyphics with palms of hands and fingertips.

-To study inheritance of morphogenetic human characters.

-Isolation of DNA from plant tissues.

-Numericals on Mendelian laws of inheritance and linkage.

-Serum extraction from blood.

-ELISA & RIA, Rocket Immuno- electrophoresis.

-Demonstration of various kinds of equipment required for collection and preservation of animals.

-Videos of Methods of collection and preservation.

-Kinds of keys and their use at higher and lower category levels.

Session 2022-23

Master of Science Zoology (Semester – IV)

Course Title: Project

Course Code: MZOD- 4487

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Express their innovative ideas and creativity on any scientific phenomenon & developinterest in research aptitude.
- CO2 Learn how to design an experiment and various research strategies.
- CO3 Review the literature.
- CO4 Explore field work and research work.

Session 2022-23

Master of Science Zoology (Semester – IV)

Course Title: Project

Course Code: MZOD- 4487

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Express their innovative ideas and creativity on any scientific phenomenon & developinterest in research aptitude.
- CO2 Learn how to design an experiment and various research strategies.
- CO3 Review the literature.
- CO4 Explore field work and research work.

Session 2022-23

Master of Science Zoology (Semester – IV)

Course Title: Project

Course Code: MZOD- 4487

In this non credit compulsory course students learn how to design an experiment and what the various research strategies are. Students can opt for any one from the following and will submit a detail report after successful completion:

- Review on a research topic
- Small Research Project
- Hands on Training in any Industry/Research Lab