KANNUR UNIVERSITY

(Abstract)

M.Sc. Applied Zoology Programme in the Department of Zoology, Mananthavady Campus - Revised Scheme and Syllabus (I st semester only) - Approved- Implemented w.e.f. 2023 admission--Orders issued

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ACADEMIC C SECTION

ACAD C/ACAD C1/494/2024 Dated: 24.01.2024

Read:-1. U. O. No. ACAD C/ACAD C3/22373/2019 dtd.12.09.2023

2. Circular No. dated ACAD C/ACAD C3/22373/2019 dated 12/09/2023

3. Email dated 08.01.2024 from the Head, Department of Zoology, Mananthavady Campus.

4. Remarks furnished by the subject expert, Dr P Girish Kumar, Scientist, Zoological Survey of India.

5. Minutes of the meeting of the Department Council held on 11.10.2023

ORDER

1.The revised Regulations for Post Graduate Programmes under Choice Based Credit and Semester System in the University Teaching Departments/Schools were implemented w.e.f. 2023 admissions vide paper read(1) above.

2. As per paper read (2) above, Heads of all Teaching Departments were requested to submit the revised Syllabus in accordance with the approved regulations along with a copy of the Department Council Minutes

3. As per paper read (3) above, the Head, Department of Zoology, Mananthavady Campus submitted the Scheme & Syllabus (I st semester only) of M. Sc. Applied Zoology Programme, verified by the subject expert (Paper read 4) for approval.

4. Department Council vide the paper read (5) above approved the aforementioned Scheme & Syllabus of M. Sc. Applied Zoology programme to be implemented in the Department of Zoology of the University w. e. f. 2023 admission.

5.The Vice Chancellor after considering the matter in detail, and in exercise of the powers of the Academic Council conferred under section 11(1), Chapter III of Kannur University Act 1996, approved the **Scheme & Syllabus(I st semester only) of M.Sc. Applied Zoology Programme and accorded sanction to implement the same in the Department of Zoology, Mananthavady Campus of the University w.e.f. 2023 admissions, subject to report to the Academic Council.**

6.The Scheme & Syllabus (I st semester only) of M. Sc. Applied Zoology Programme, under Choice Based Credit Semester System implemented in the Department of Zoology, Mananthavady Campus w. e. f. 2023 admission, is appended and uploaded in the University Web Site.(www.kannuruniversity.ac.in)

7.Orders are issued accordingly.

Sd/-

Narayanadas K

DEPUTY REGISTRAR (ACAD)

For REGISTRAR

To: 1.The Head, Department of Zoology, Mananthavady Campus.

2. Convener, Curriculum Committee.

Copy To: 1. The Examination branch (through PA to CE)
2. PS to VC/ PA to PVC/PA to R
3. DR/AR1/AR II (Acad), EXCI, EP IV
4. Web Manager (for uploading in the website)
5. Computer Programmer
6.SF/DF/FC

Forwarded / By Order

SECTION OFFICER

KANNUR UNIVERSITY
CNH STATION P.O.
KANNUR
Pin-670 002
THAVAKKARA

KANNUR UNIVERSITY

DEPARTMENT OF ZOOLOGY

CURRICULUM AND SYLLABI FOR
M. Sc. APPLIED ZOOLOGY PROGRAMME

Choice-Based Credit and Semester System (CBCSS)

(w. e. f. 2023 Admission)

KANNUR UNIVERSITY
DEPARTMENT OF ZOOLOGY

Vision: Envisions inculcating the highest values of life, science education, respect for nature and concern for ethical values among students through good scientific educational practices.

Mission: The Mission of the Department of Zoology is to impart education to graduates in Zoology to equip them to:
interpret the ecosphere around local communities and students.
apply themselves meaningfully in any activity requiring zoological expertise
solve the problems in conservation biology.
and to combine theoretical knowledge and practical skills to equip the students to take up active research in the areas of conservation Biology.

Programme Outcome

PO1: Generate an interest in the subject and help students explore the new developments in Biochemistry
PO2: Analyze the different type of data using appropriate statistical software. Demonstrate a good understanding of descriptive statistics and graphical tools
PO3: Understand and analyse the ecological and evolutionary significance of different taxa of animals .
P04: Study and involve in biodiversity conservation programs; understand the concepts and approaches in conserving biodiversity
PO5: Identify key threats to biodiversity. Develop appropriate policy options for conserving biodiversity through research and field studies.
PO6: Effectively apply basic principles of the natural and social sciences to current issues of natural resources and the environment
PO7: Students will be able to apply knowledge to solve problems related to conservation biology and Biodiversity conservation and management

PROGRAMME SPECIFIC OUTCOMES

PSO1: Prepare students to have a good understanding of cellular and organism. Gain Biochemistry practical skills animal structures, taxonomy and Biosystematics.

PSO2: Equip students to identify Biological taxa of Western Ghats and involve them in doing research in different different aspect related to animal biodiversity conservation and management

PSO3: Students will be able to identity, classify and differentiate major groups of organisms and understand their phylogenetic relationships.

PSO4: Students will be able to relate the physical features of ecology and environment to the structure of population, communities and ecosystems. This will make them recognize the dire and urgent need to conserve the ecosystems and its components worldwide.

PSO5: The students will get wide range of bio statistical skills, including problem solving, project work and presentation; they may enable to take prominent roles in a wide spectrum of employment and research

PSO6: Developed knowledge and understood of living organisms at several levels of Zoological and Biological

organization from the molecular, through to cells and whole organisms and ecosystems all organs of evolutionary perspectives.

ELIGIBILITIES: ▪ B.Sc. Degree in Zoology with 50% marks.

ADMISSION: ▪ The selection of the candidate is based on Admission test. The admission test will cover the topics in Zoology at the undergraduate level.

SEMESTER WISE DISTRIBUTION OF COURSE, MARKS, CONTACT HOURS AND CREDITS

First Semester

COURSE CODE	COURSE TITLE	Contact Hrs/Week			Marks			Credits
	Course details/marks	L	T/S	P	End Sem	Internal	Total	
Discipline Specific Core Courses (DSC)								
MSZOO01DSC01	Chemistry for Biologists	4	1	4	60	40	100	4
MSZOO01DSC02	Physics for Biologists and Statistics for Biologists	4	1	4	60	40	100	4
MSZOO01DSC03	Biosystematics, Taxonomy and Ethology	4	1	4	60	40	100	4
MSZOO01DSC04	Practical – I (Biochemistry)	6			60	40	100	3
MSZOO01DSC05	Practical – II (Biophysics & Biostatistics)	6			60	40	100	3
Discipline Specific Elective Courses (DSE)								
MSZOO01DSE01	Philosophy of Science and History of Biology	4	1	4	60	40	100	3
	Total				360	240	600	21

Second Semester

COURSE CODE	COURSE TITLE	Contact Hrs/Week			Marks			Credits
	Course details/marks	L	T/S	P	End Sem	Internal	Total	
Discipline Specific Core Courses (DSC)								
MSZOO02DSC06	Molecular Biology and Bioinformatics	4	1	4	60	40	100	4
MSZOO02DSC07	Biotechnology & Microbiology	4	1	4	60	40	100	4
MSZOO02DSC08	Comparative Animal Physiology	4	1	4	60	40	100	4
MSZOO02DSC09	Practical – III (Molecular Biology and Bioinformatics, Biotechnology & Microbiology)	6			60	40	100	3
MSZOO02DSC10	Practical – IV (Animal Physiology and Parasitology)	6			60	40	100	3
Discipline Specific Elective Courses (DSE)								
MSZOO02DSE02	Immunology	4	1	4	60	40	100	3
Ability Enhancement Course (AEC) offered for other departments								
MSZOO02AEC01 MSZOO02AEC02 MSZOO02AEC03	Science Communication and Popularization Dietetics Intellectual Property Right	2	1	-	60	40	100	2
Ability Enhancement Course (AEC) To be obtained from other departments								

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Skill Enhancement Course (SEC) offered for other departments								
MSZOO02SEC 01 MSZOO02SEC 02 MSZOO02SEC 03	Public Health and Hygiene Preventive medicine Bee keeping	2	1	-	60	40	100	2
Skill Enhancement Course (SEC) To be obtained from other departments								
----		2	1	-	60	40	100	2
	Total				480	320	800	25

Third Semester

COURSE CODE	COURSE TITLE	Contact Hrs/Week			Marks			Credits
	Course details/marks	L	T/S	P	End Sem	Internal	Total	
Discipline Specific Core Courses (DSC)								
MSZOO03DSC11	Developmental Biology	4	1	4	60	40	100	3
MSZOO03DSC12	Ecology	4	1	4	60	40	100	3
MSZOO03DSC13	Conservation Biology –I	4	1	4	60	40	100	3
MS ZOO03DSC14	Practical – V (Developmental Biology)	6			60	40	100	3
MS ZOO03DSC15	Practical – VI (Ecology and Conservation Biology)	6			60	40	100	3
Discipline Specific Elective Courses (DSE)								
MSZOO03DSE03	Research Methodology	4	1	4	60	40	100	3
Multidisciplinary Elective (MDC) offered for other departments								
MSZOO03MDC01 MSZOO03MDC02	Statistics for Biologists Health And Nutrition	4	1	4	60	40	100	4
Multidisciplinary Elective (MDC) To be obtained from other departments								
-----		4	1	4	60	40	100	4
FIELD VISIT (FV)								
MSZOO03DSC16	Field study	4	1	4	60	40	100	2
Value Added Course (VAC)								
MSZOO03VAC01 or MOOC Course	Biodiversity conservation							2 (not included in GPA)
	Total				480	320	800	24

Fourth Semester

COURSE CODE	COURSE TITLE	Contact Hrs/Week			Marks			Credits
	Course details/marks	L	T/S	P	End Sem	Internal	Total	
Discipline Specific Elective Courses (DSE)								
MS ZOO04DSE04	Conservation Biology –II	4	1	4	60	40	100	3

MS ZOO04DSE05	Parasitology	4	1	4	60	40	100	3
MS ZOO04DSE06	Primatology	4	1	4	60	40	100	3
MS ZOO04DSE07	Forest Entomology	4	1	4	60	40	100	3
Project (P)								
MS ZOO04DSC17	Project work	4	1	4	60	40	100	12
	Total				180	120	300	18

*****Discipline specific Elective paper - choose any two in fourth semester

FIRST SEMESTER M.Sc. APPLIED ZOOLOGY PROGRAMME

MSZOO01DSC01 - CHEMISTRY FOR BIOLOGISTS 90 hrs

Course outcome: After the completion of this course, the students will be able to:

- Understand the chemistry behind life forms, also connect biochemistry to their own lives on a variety of levels.
- Understand the fundamental biochemical principles thereby get to know how biochemistry works in the body and under different conditions.
- This course features the laws of thermodynamics, concept of enthalpy, entropy and free energy changes and their application to biological systems and reactions.
- Through this course the students learn about the classification, structure and function of biomolecules such as carbohydrates, proteins, lipids etc.
- The students will able to acquire the basic concepts of bioenergetics and oxidative metabolism. Thus become aware with the metabolic pathways of biomolecules, their regulation,and the importance of high energy compounds.
- The students will become aware of the fundamental knowledge on Enzymes and biocatalysis. They may acquire basic principles to analyze the enzyme kinetics and learn to estimate the activity of enzymes. Studying the enzyme inhibition mechanism introduces the area of treatment strategies for various diseases such as cancer and AIDS.
- Students in the Biochemistry will learn the chemical nature and functions of vitamins.
- The students will develop skills to determine the structure and nature of amino acids.
- This course provides the structure, biosynthesis and degradation of nucleic acids. Students will learn about the structure of DNA and RNA.
- The practical biochemistry course acquire through getting knowledge in biochemical techniques and applying biochemical calculations.

- Students will learn the qualitative and quantitative analysis of constituents of biological fluids such as urine, blood and their estimation using standard methods.
- In this course students will undertake experiments and thus understanding the role of enzymes in clinical diagnosis and industrial applications as well.
- At the end of this course students are able to appreciate the importance of biochemistry in living systems.
- This course facilitates in employability in diagnostic sector and R &D institutes.

Module outcome
The intended subject specific learning outcomes.
On successfully completing the module students will be able to:
Demonstrate an understanding of the principles of the protein structure/folding and an ability to explain their functions in general.
Describe the key principles of static enzyme Biochemistry, enzyme classification and basic principles of enzyme functioning.
Explain the basic principles of the nucleic acid structure and their disparate cellular roles and its practical applications.
Explain the principles of carbohydrate Biochemistry and the biological functions of the carbohydrates.
Demonstrate a knowledge of the principles of lipid classification, structure and functions.
Understand basic mechanisms of static integration of biologically active compounds into biological membranes.
Demonstrate an ability to link this knowledge to everyday activities in the bioscience workplace.

MODULE I: **21 hrs**

1. **Introduction:** **6hrs**

Biochemistry and organization of cells
Molecular logic of life
Chemical unity and biological diversity
Biopolymers
The physical roots of the biochemical world
Laws of thermodynamics in biological system: entropy, enthalpy and concept of free energy

2. Carbohydrates: **6hrs**

Structure of monosaccharides, disaccharides, oligosaccharides and polysaccharides (chitin, bacterial cell wall and glycogen)
Physical and chemical properties of monosaccharides

3. Lipids: **9hrs**

Classification of lipids, classification of fatty acids
Physical and chemical properties of lipids
Structural lipids in membranes; Phospholipids, sphingolipids and cholesterol.
Prostaglandins

MODULE II: **12 hrs**

4. Amino acids and proteins: **12hrs**

Structure of different amino acids in proteins. Classification of amino acids. Peptide bonds; Zwitter ions.

Classification of proteins; glycoproteins and proteoglycans
Structure of proteins; Ramachandran plot
Nitrogen excretion and urea cycle

MODULE III: **30 hrs**

5. Bioenergetics & oxidative metabolism: **30hrs**

Introduction to metabolism

Carbohydrate metabolism- Glycolysis; fate of pyruvate; gluconeogenesis; HMP pathway; glycogenolysis; glycogenesis, Regulation of glycogen metabolism. Citric acid cycle; electron transport chain; oxidative phosphorylation; redox potential; chemi-osmotic hypothesis; uncouplers; inhibitors of electron transport chain. High-energy compounds; role of ATP in the biological system

Lipid metabolism- Oxidation of fatty acids (saturated, unsaturated and odd carbon).

Ketone bodies; Biosynthesis of fatty acids; biosynthesis of cholesterol; Regulation of cholesterol biosynthesis.

Amino acid metabolism- transamination, decarboxylation and deamination reactions in the biological system; inborn errors in metabolism.

MODULE IV **27 hrs**

6. Enzymes: **13hrs**

Introduction- Classification and nomenclature. Specificity, various factors influencing velocity of enzyme catalyzed reactions

Michaelis-Menten equation & Kinetics, Line weaver-Burk plot

Enzyme inhibition-reversible and irreversible (competitive and non-competitive) with examples.

6.4 Regulatory enzymes-Allosteric enzymes

6.5. Zymogens, isozymes

7. Nucleic acids: **8hrs**

Chemistry, biosynthesis and degradation of nucleic acids
Structure of DNA and RNA.

8. Vitamins: **6hrs**

Chemical nature and functions of vitamins

Role of B-complex vitamins as coenzymes.

Chemistry for biologists (References)

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13. Guptha, R C and S. Bhargav, 2006. Practical Biochemistry (4th ed.). CBS Publ.
14. Jayaraman, J 2007. Lab. Manual in Biochemistry, New Age International Publ.
15. Jermy M Berg, John L Tymoczko, LubertStryer, 2007, Biochemistry. (6th ed.)Freeman Publ.
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23. Rober K murrey, Daryl K Granner, Victor W Rodwell, 2006. Harpers IllustratedBiochemistry (27th ed) McGraw Hill.
24. S P Singh, 2007. A Text Book of Biochemistry (4th ed) CBS.
25. Stryer, L. (1995) Biochemistry, IV Ed. Freeman & Co., NY.
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27. Westhead, D.R., and Parish, J.H (1998) *Instant Notes* in Biochemistry, Bios ScientificPublishers Ltd., U.K.
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29. William J Marshal, Stephan K Bangert, 2008. Clinical Biochemistry, Metabolic &Clinical Aspects (2nd ed). Churchil Livingstone.
30. William J Marshal, Stephen K Bangert, 2008. Clinical Biochemistry (6th ed)

MSZOO 01DSC02 - PHYSICS FOR BIOLOGISTS & STATISTICS FOR BIOLOGISTS

90 hrs

Course outcome: After the completion of this course, the students will be able to:

- Understand the methods of analysis of biomolecules using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy
- Know the processes of determination of the structure of biomolecules using spectroscopic methods.

- Gain knowledge in the field of radio isotopy, its related techniques and instruments.
- Learn about biophysical and electrophysiological methods used mainly for medical applications
- Gain insights into biostatistics, data collection and representation
- Apply and use descriptive, inferential and correlational statistics.
- Learn about probability theory, and identify and recognize theoretical probability distributions.

MODULE-1

1. Biophysical methods:
Analysis of biomolecules using UV/visible, fluorescence, circular dichroism, NMRand ESR spectroscopy.
Structure determination using X-ray diffraction and NMR, analysis using lightscattering;
Different types of mass spectrometry and surface plasma resonance methods.
Laser and its application in Biology

2. Radiation biology:
Properties of different types of radioisotopes normally used in biology, their detection and measurement.
Autoradiography,
G.M. counter
Incorporation of radioisotopes in biological tissues and cells
Applications of tracer techniques.
Radiation protection and therapy; safety guidelines.

3. Bioacoustics:
Physical basis of hearing
Physical aspects of sound transmission in the ear;
Echocardiography
Ultrasonography.

4. Biophysics of vision:
Eye as an optical instrument;
Formation of image.

MODULE-2

1. Electrophysiological methods for biophysics:
Single neuron recoding
Patch clamp recording
ECG
EEG
PET
MRI

CAT

2. Biophysical methods and their applications:

Microscopy
Bright field
Phase contrast
Fluorescence
SEM
TEM
STEM
Colorimetry;
Spectrophotometry
Flow cytometry
Gel-filtration
TLC
HPLC
Gel electrophoresis
Centrifugation
Differential
Density gradient
Ultracentrifugation.

MODULE-3

1. Introduction to biostatistics

Data
Collection of Data
Classification of data
Tabulation of data

2. Diagrammatic and graphical presentation of data:

Bar diagram
Pie diagram
Histogram
Frequency polygon
Frequency curve

3. Measures of central tendency:

Mean
Median
Mode.

4. Measures of dispersion:

Range
Mean deviation
Standard deviation
Quartile deviation

MODULE-4

1. Probability:
Basic concepts
1.2.Laws of probability
Probability distributions
Binomial distribution
Poisson distribution
Normal distribution

2. **Statistical inference**:
Testing of hypothesis
Null and alternate hypotheses
Testing of significance
Z-test
t-test
X2 test

3. Analysis of variance (ANOVA):
One way analysis
Two way analysis

4. Correlation analysis
Kinds of correlation
Pearson coefficient of correlation
Scatter plots

5. Regression analysis
Regression equations
Regression lines

REFERENCES
Module-1 and 2
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Module-3 and 4

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MODULE-1

Module outcomes

- Describe the methods of analysis of biomolecules using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy
- Distinguish the processes of determination of the structure of biomolecules using spectroscopic methods.

- Explain the field of radio isotopy, compare its related techniques and identify functioning of instruments.
- To identify safety guidelines associated with radio isotopes.

MODULE-2

Module outcomes

- Describe electrophysiological methods used mainly for medical applications
- Describe biophysical methods used mainly for biological applications

MODULE-3

Module outcomes

- Practice biostatistics, data collection and representation
- Apply and use descriptive statistics

MODULE-4

Module outcomes

- Apply and use correlational statistics
- Apply regression for ecological modelling
- Decribe probability theory, and identify and recognize theoretical probability distributions.
- To identify statistical tests, given a data, and analyse and interpret it.
- Apply statistics using statistical software's

MSZOO 01DSC03 – BIOSYSTEMATICS, TAXONOMY & ETHOLOGY (90 hrs)

Course outcomes

After successful completion of this course, students will be able to:

- Develop acknowledge base in the field of Animal Behavior especially of basic terms, key concepts, principles and comprehensive themes in animal behavior
- Develop skills in observing behavior of various groups of animals
- Understand and identify behaviors in a variety of taxa
- Understand fascinating range and complexity of behaviors in animals
- Recognize the relevance of animal behavior, both as a biologist and a human being
- Become familiar with the approaches used in the laboratory and field settings to obtain knowledge about animal behavior
- Understand the importance of fixed and plastic behaviors
- Competently discuss the basic ecological and evolutionary processes that shape various animal behaviors
- Learn to reason scientifically and learn to interpret and design studies in animal behavior and cognition.

- Apply knowledge of behavioral theory to new situations
- Exhibit quantitative research skills
- Demonstrate ability to communicate scientific information in both oral and written formats
- Further develop, the ability to apply critical thinking and logic to the solving of biological problems relating to animal behavior
- Understand basic concept of Taxonomy and its relevance.
- Understand the relevance of Biosystematics and its importance in resolving classical and applied research problems.
- Knowledge of the principles of animal nomenclature and terminology
- Acquire the knowledge of various taxa and understand the importance and applications of various species concept in Systematics
- Understand the merit and demerits of various schools of biological classification.
- Become familiar the basic principles of ICZN and their interpretations in resolving various taxonomic problems.

MODULE I

A. Biosystematics and taxonomy (45 hrs)

1. Definition and basic concepts: Systematics and taxonomy its importance and goals; History of Systematics; Levels of taxonomy-alpha, beta and gamma taxonomy **(6 hrs)**

2. Classification: Purpose and functions of classification; Types of classification – Artificial, Natural, Downward, Hierarchial, Phylogenetic, Evolutionary. **(6 hrs)**

3. Species Concepts – Typological, Nominalistic, Biological, Evolutionary; Intraspecific categories-Variety, Race, Cline, Subspecies. **(3 hrs)**

4.Taxonomic Procedure: Collecting, Labeling, Curating, Cataloguing, Identification, Description, Redescription,Taxonomic key-Types of key. **(7 hrs)**

MODULE II

5.Taxonomic Characters: Definition; Diagnostic value of taxonomic characters; Kinds of characters – Morphological, Anatomical, Embryological, Cytological, Ethological, Ecological, Biochemical, Geographical, Molecular. **(7hrs)**

6. Zoological Nomenclature: History of Zoological Nomenclature; International Code of Zoological Nomenclature – Operative principles and important Codes. **(6 hrs)**

7. Current trends in Systematics: Biochemical systematics, Cytotaxonomy, Numerical taxonomy, Molecular systematics, Cladistics. **(6 hrs)**

8. Taxonomic Publications: Form and Style of Taxonomic paper – Title, Authors'name, Abstract, Introduction, Acknowledgements, Methods used and materials studied, Body of the text, Summary. Kinds of taxonomic publications – Description of new taxa, Synopses and Reviews, Catalogues and Checklists,

Revisions, Monographs, Faunal Works, Atlases, Handbooks and Manuals. **(4 hrs)**

MODULE III **(22 hrs)**

B. Ethology

1. Introduction **(3 hrs)**

Definition and concepts; History; Ethology and its relation to other schools studying behaviour- Behaviourism; Proximate and ultimate causes of behaviour.

2. Instinctive and Learning behaviours **(5 hrs)**

Instinctive behavior: Fixed action pattern, Sign stimuli, Types of sign stimuli, Supernormal stimuli. Learning : Categories of learning- habituation, classical conditioning, operant conditioning, latent learning, insight learning, imprinting, social learning.

3 Complex Behaviour **(4 hrs)**

Orientation and Navigation in birds
Ritualization
Raw materials for ritualization (Intention movements and Displacement activities)

3 Physiology of behaviour **(5 hrs)**

Neural basis of behaviour
Brain and behaviour
Hormones and behaviour
Hormonal impact on various behavioural patterns

4 Genetics of behavior **(5 hrs)**

Hybridization
Single or multiple gene effect
Gene mutations which influence behavior
Relationship between genes and environment in the control of behavior

MODULE IV **(23 hrs)**

5 Biological Communication **(6 hrs)**

Components of communication system
Functions; Costs and benefits of signaling
Channels for communication (vision, audition, chemical senses, touch and electrical fields)
Complex communication systems (Honey bee dance)

6 Sociobiology **(4 hrs)**

Types of social groups (Pair, Family, Harem, Matriarchy, Oligarchy, Arena and Hierarchy)
Social Dominance
Determinants of dominance
Cost and benefits of dominance
Cost and benefits of subordination

7. Reproductive Behaviour **(9 hrs)**

Evolution of sex and reproductive strategies
Mating systems (Monogamy, Polygamy, Promiscuity)
Sperm competition
Sexual selection

7.5 Parental behavior

7.6.1Types of parental care
General features of parental behavior
Factors affecting parental care
Parent –offspring conflict

8. Evolution of Behaviour **(4 hrs)**

Adaptiveness of behavior
Cultural transmission of behavior
Kin selection and inclusive fitness; Altruism and reciprocal altruism.

Module I
- Identify basic concepts and theories of Taxonomy.
- Apply biosystematics in resolving classical and applied research problems.
- Outline the functions of classification and summarize the merits and demerits of various types of zoological classification
- Explain the knowledge of various taxa and illustrate the importance and applications of various species concept in Systematics
- Practise and apply the steps of taxonomic procedure
- Prepare and construct a simple dichotomous key for the identification of taxa

Module II
- Identify various kinds of taxonomic characters in taxa
- Practice principles of animal nomenclature and terminology
- Compare the merit and demerits of various schools of biological classification.
- Apply the basic principles of ICZN and their interpretations in resolving various taxonomic problems.
- Explain the recent trends in systematics
- Outline the structure of different taxonomic publications

Module III
- Identify the basic terms, key concepts, principles and comprehensive themes in animal behavior
- Practice the skills of observing behavior of various groups of animals
- Classify simple and complex behaviors in animals
- Apply different techniques to study animal behaviour under the laboratory and field settings
- Explain the importance of fixed and complex behaviors
- Explain the neural and hormonal control of various behavioural patterns
- Identify and enlist, what causes differences among individuals (both genetic and environmental factors)

Module IV
- Enlist the adaptive value of various complex behaviors
- Test quantitative research skills in animal behaviour
- Learn to reason scientifically and learn to interpret and design studies in animal behavior and cognition.
- Apply behavioral theories to new situations

- Competently discuss the basic ecological and evolutionary processes that shape

various animal behaviors
- Learn and communicate scientific information in both oral and written formats
- Apply critical thinking and logic to the solving of biological problems relating to animal behavior

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MSZOO01DSC04 - PRACTICAL I (BIOCHEMISTRY)

1. Quantitative estimation of carbohydrates :
   a. Estimation of blood glucose by colorimetric methods (Nelson-Somoyi or Arsenomolybdate or by Folin-Wu method).
   b. Estimation of total carbohydrate by phenol-sulphuric acid method.
2. Quantitative estimation of proteins:
   a. Estimation of serum proteins by colorimetric method (Biuret method).
   b. Estimation of total proteins from liver by Lowry's method.
   c. Isolation of casein from milk.
3. Quantitative estimation of lipids
   a. Estimation of serum cholesterol by Ferric chloride or Carr-Drekter method.
   b. Saponification value of fat.
   c. Estimation of total lipids in the serum (using phosphovanillin method).
4. Enzyme assays
   a. Determination of salivary amylase activity-effect of substrate concentration.
   b. Determination of salivary amylase activity - effect of pH.
5. Buffers and pH:
   a. Comparison of the capacities of two buffers of the same pH.

MSZOO01DSC05 - PRACTICAL II (BIOPHYSICS & BIOSTATISTICS)

Biophysics

1. Absorption spectrum of potassium permanganate.
2. Determination of absorption coefficient and concentration of unknown solutions by calibration as well as by absorption coefficient.
3. Separation of mixtures of sugars and amino acids by paper/thin layer chromatography.
4. Micrometry
5. Phase contrast microscope, camera Lucida, Photomicrography equipment.
6. Determination of coefficient of viscosity.
7. Determination of pH of various biological fluids using pH meter.

Biostatistics

1. Preparation of frequency distribution for the data of a group of people according to height.
2. Diagrammatic presentation of census data in Kerala in the form of bar diagrams and pie diagrams.
3. Graphic presentation of a population distribution according to age in the form of histogram, frequency polygon and frequency curve.
4. Computation of measures of central tendency and dispersion in anthropometric data of school children.
5. Simulation of binomial and poison distributions.
6. Estimation of population of birds in the University campus.
7. Design an experiment for the comparison of efficacy of diets of different types animals by the method of ANOVA.
8. Regression analysis and correlation analysis of a data of heights and weights of a group of students.
9. Estimation of organisms in water by Dilution Method.

MSZOO01DSE01 - Philosophy of Science and History of Biology

Course outcome: After the completion of this course, the students will be able to:

Understand what science is and in what ways science differs from non science and pseudoscience subjects.

Get a clear picture about what philosophy science is.

Understand the different methods of reasoning in Science.

Get an idea about the modes of scientific explanations.

Understand the role of paradigm shifts in various branches of scientific research; also get an idea about the scientific revolutions in various branches of science

Understand the value, its acceptance and the criticism to Science.

Understand the historical milestones in the evolution of scientific thoughts and research.

Distinguish between different centuries with respect to growth of science and scientific thoughts.

Understand the ups and downs in the history of science, pace of scientific research during 17^{th} to 20^{th} Centuries and contributions made by scientists in the past centuries.

Module-specific outcomes:
After the completion of Module I, the students will be able to:
Understand what science is.
In what ways science differs from non science and pseudoscience subjects.
Get a clear picture about the role of philosophy in science and scientific research.
Understand the different methods of reasoning in Science.
Understand why do science still follow inductive reasoning.
Get an idea about the modes of scientific explanations.
After the completion of Module II, the students will be able to:
Understand the role of paradigm shifts in various branches of scientific research.
Get an idea about the scientific revolutions and their frequencies in science.
Understand the significance of historic learning systems.
Understand the value, its acceptance and the criticism to Science.
After the completion of Module III, the students will be able to:
Understand the historical milestones in the evolution of scientific thoughts and research.
Distinguish between different centuries with respect to growth of science and scientific thoughts.
After the completion of Module IV, the students will be able to:
Understand the ups and downs in the history of science, pace of scientific research during 17th to 20th Centuries.
Contributions made by scientists in the past centuries.
Frequency of scientific revolutions in different centuries.

A. Philosophy of science 50 hrs

MODULE I :

What is Science? 5 hrs
Origins of modern science.

Philosophy of Science- definition, scope.
Science and pseudo-science.

Scientific Reasoning 9 hrs
Deduction and induction
Hume's problem
Probability and induction

1. Explanation in science **12 hrs**
Hempel's covering law model of explanation
The problem of symmetry
Explanation and causality
Can science explain everything?
Explanation and reduction

MODULE II :

Scientific Change and Scientific Revolutions 11 hrs
Logical positivist philosophy of science
The structure of scientific revolutions
Incommensurability and theory ladenness of data
Kuhn and the rationality of science

2. Philosophical problems in Biology **4 hrs**
The problem of biological classification

Science and its Critics 9 hrs
Scientism.
Science and religion
Is Science value free?

B. History of biology 40 hrs

MODULE III:

An account on history of science 3 hrs
Ancient Greek philosophers.
History of biology:
History of Biology during Seventeenth century: Anatomists, Microscopists 5 hrs
History of Biology during Eighteenth century: Great chain of being; Carl Linnaeus; Lamarck; Precursors to modern evolutionary theory. 8 hrs

MODULE IV: **12 hrs**

History of Biology during Nineteenth century: Birth of associations and societies to promote science; Charles Darwin; Pre-Darwinian evolution; Origin of species; The emergence of biological disciplines; Experimental physiology; Cell theory, cell pathology and germ theory**.**
History of Biology during twentieth century: 12 hrs

First half of 20th century: Growth of microbiology and Biochemistry; Genetics and heredity

Second half of 20th century: The architects of life - proteins, DNA and RNA; The origins and borderlines of

life; Growth of genetic engineering; Growth of Biotechnology; Growth of Genomics; Growth of Recombinant DNA.

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