

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for M.Sc., Zoology effective from the year 2025-2026

<i>Sem</i>	<i>Category</i>	<i>Course Code</i>	<i>Course Title</i>	<i>Hours</i>	<i>Credits</i>	<i>Int. Marks</i>	<i>Ext. Marks</i>	<i>Max. Marks</i>
III	CC Theory	P24MZL301	Animal Physiology	75	5	25	75	100

Objectives: To derive a unified knowledge of the physiology of animals and their adaptation to environment

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Demonstrate the physiological mechanisms of digestion.	K1
CO2	Describe the physiology of digestive and respiratory systems of animals.	K2
CO3	Explain the blood composition, types, groups and circulatory system.	K3
CO4	Interpret the physiology of excretory system, nervous system and receptors.	K4
CO5	Appreciate the mechanism of hormone secretion and function.	K5

Cognitive Levels (K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create)

Unit – I Physiology of Digestion

(15 Hours)

Feeding methods in animals. Digestive system: Structure and function of alimentary canal-Role of salivary glands, liver, pancreas & intestinal glands in the process of digestion. Digestion and Absorption of proteins, carbohydrates and lipids and its hormonal regulation. Energy balance and BMR. Diabetes and Obesity and its control (self-study).

Unit – II Physiology of respiration and circulation

(15 Hours)

Respiratory system: Comparison of respiration in different species, transport and exchange of gases. Circulatory system: Type of circulation, formed elements of blood (Composition of blood), Coagulation of blood and theories of coagulation. Haemoglobin-structure and function. Cardiovascular system: Comparative anatomy of vertebrate heart structure, myogenic heart. Cardiovascular response to exercise. ECG – its principle and significance. Cardiac cycle and its regulation (self-study).

Unit – III Physiology of muscle, nervous and sensory system

(15 Hours)

Physiology of muscle: Muscle types, structure of myofilament-contraction of sarcomeres-muscle adaptation in jumping (frogs), swimming (fishes), sound production (insects) and flying (birds). Nervous system: Neuron and its types, transmission of signals in single and between neurons (synapses and neurotransmission), animal electricity, role of ion channels-resting and action potential. Sensing the environment: general properties of sensory reception-the chemical senses (taste and smell)-mechanoreception-electroreception-thermoreception-photoreception.

Unit – IV Physiology of osmoregulation and excretion

(15 Hours)

Problems of osmoregulation: Osmoregulation in water breathing animals and air breathing animals, Anatomy of mammalian kidney and urine formation. Non-mammalian vertebrate kidneys- salt glands and fish gills in vertebrates-invertebrate osmoregulatory organs-classification of animals based on excretory products.

Unit – V Physiology of Reproduction and thermoregulation

(15 Hours)

Reproduction: the cost of reproduction-male and female reproductive system of Mammals. Endocrine glands: Structure and functions of Pituitary gland, Thyroid gland, Parathyroid gland and Adrenal gland. Endocrine glands of crustaceans and fishes. Hormones and color changes in crustaceans and Fishes. Thermoregulation of ectotherms, heterotherms and endotherms. Dormancy (specialized

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metabolic states: sleep, Torpor, Hibernation and winter sleep, estivation). Stress and adaptation (self-study).

_____ # Self-Study Component for Seminar/Assignment:

(Questions should not be asked from self-study component in the End Semester Examinations)

Text Books:

1. Randall, D., W. Burggren, K. French and R. Eckert. 2002, Animal Physiology Mechanisms and Adaptations, New York: W.H. Freeman and Co., pp-
2. Prosser C. L. 1991, Comparative Animal Physiology. Part A: Environmental and Metabolic Animal Physiology. Wiley-Liss Publishers, pp-592
3. Hoar, S.W. 1983, General and Comparative Physiology, Prentice Hall Publication, pp-928.
4. Nelson K. S. 1997. Animal Physiology: Adaptation and Environment, Cambridge University Press, pp- 617.

Reference Books:

1. Hainsworth, F.R. 1981. Animal Physiology: Adaptation in function, Addison Wesley Longman Publishers, pp-669.
2. Gordon, M.S. *et al.*, 1977. Animal Physiology: Principles and Adaptation, New York, Third Edition.
3. Ahearn, G.A. *et al.*, 1988. Advances in Comparative and Environmental Physiology – 2, Springer Publishers, pp-252.
4. Hill, R.W. 1976. Comparative Physiology of Animals: Environmental Approach, Longman Higher Education Publisher, pp-656.

e-Resources

1. https://swayam.gov.in/nd1_noc20_bt42/preview
2. <https://www.classcentral.com/course/swayam-animal-physiology-12894>
3. https://swayam.gov.in/nd1_noc20_hs33/preview

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme specific outcomes			Mean
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3
Mean	3	3	3	3	3	3	3	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	BOS Coordinator	Verified by
Dr. A. Abdul Zahir, Dr. G. Taju, Dr. S. Abdul Majeed, Dr. K. Kadharsha	Dr. M. Feroz Khan	Dr. R. Rafi Mohamed

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<i>Sem</i>	<i>Category</i>	<i>Course Code</i>	<i>Course Title</i>	<i>Hours</i>	<i>Credits</i>	<i>Int. Marks</i>	<i>Ext. Marks</i>	<i>Max. Marks</i>
III	CC Theory	P24MZL302	Immunology	75	4	25	75	100

Objectives: To impart conceptual understanding of functional organization of immune system and its responsiveness in health and disease

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Define the structure of immune cells and its role in immune response	K1
CO2	Illustrate the various method of cellular immune system	K2
CO3	Apply the techniques of antigen and antibody reaction	K3
CO4	Examine the various antigen and antibody reactions of humoral immune response	K4
CO5	Evaluate the immunological responses in various disease and its diagnosis method	K5

Cognitive Levels (K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create)

Unit – I Types of immunity (15 Hours)

Immunology: Definition and Scope of immunology. External (first line/innate) defense system: components, distribution, salient functions. Internal (second line/acquired) immune system: cellular and humoral immune components- distribution, salient functions-primary and secondary immune responses; Immune tissues/organs: types, anatomical location, structure and development; lymphocyte traffic during development; Types of immunity: innate and acquired - types, functional features; concept of adaptive immunity.

Unit – II Features of antigen-antibody (15 Hours)

Antigens: Definition, characteristic features and classification; Antigenicity versus immunogenicity; Adjuvants: definition, types and applications. Detection of antigen-antibody reaction- Immunochromatography, Radioimmunoassay and ELISA.

Unit – III Components of cellular immune system (15 Hours)

Major effector components of cellular immune system: Lymphocytes - types, morphology, clones; sub-populations, distribution, B and T cell receptors, B and T cell epitopes, Toll-like receptors; Antigen presenting cells: antigen processing and presentation, MHC molecules and their immunologic significance.

Unit – IV Components of humoral immune system (15 Hours)

Major effector components of humoral immune system: Antibodies - Primary structure, classification, variants and antigen-antibody interactions; Structural and functional characteristics of various antibody classes; Generation of diversity; Monoclonal antibodies: definition, production and applications; Cytokines - Definition and salient functional features; Interleukins: definition, types (lymphokines and monokines) and functions. Interferons - Origin, types and functions

Unit – V Immune response to diseases (15 Hours)

Diseases and immune responses: Hypersensitivity: definition, Types I to IV and immune manifestations; Auto-immune diseases and major immune responses; Immunodeficiency diseases: types including SCID and consequences; Viral (HIV), bacterial (tuberculosis) and parasitic (malaria) diseases: etiology, host immune responses and evasion by pathogens; Vaccines: types, preparations, efficacies and recent developments.

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_____ # Self-Study Component for Seminar/Assignment:

(Questions should not be asked from self-study component in the End Semester Examinations)

Text Books:

1. Kuby, J. 1997. Immunology. W. H. Freeman & Co., New York, pp-670.
2. Male, D. J. Brostoff, D. B. Roth and I. Roitt. 2006. Immunology (7th edition), Mosby / Elsevier, Philadelphia, pp-472
3. Coica, R. Sunshine, G. 2015. Immunology (Seventh Edition), Wiley Blackwell, UK, pp-406.

Reference Books:

1. Janeway, C. A and P. Travers. 1997. Immunology, Garland Publ. Inc., London, pp-904
2. Peakman, M and D. Vergani. 1997. Basic and Clinical Immunology, Churchill Livingstone, London, pp-366
3. Parham, P. 2009. The Immune System (Third Edition), Garland Science, USA, pp-506

e-Resources

1. NPTEL :: Biotechnology - NOC:Immunology
2. Immunology – Simple Book Publishing
3. eGyanKosh: Block-1 Introduction to Immunology

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

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CO4	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3
Mean	3	3	3	3	3	3	3	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	BOS Coordinator	Verified by
Dr. Ajaz Haja Mohideen, Dr. KGMT Ansari, Dr. Nazeer Basha, Dr. K. Kadharsha	Dr. M. Feroz Khan	Dr. R. Rafi Mohamed

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III	CC Practical	P24MZLP31	Practical III - Lab Course in Animal Physiology and Immunology	75	4	25	75	100

Objectives: To derive a unified practical knowledge of the functions of animal's organs, their adaptation and immunity

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Demonstrate the physiological mechanisms of osmoregulation	K1
CO2	Describe the physiology of blood.	K2
CO3	Explain the instruments used for physiological experiments.	K3
CO4	Interpret the structure and function of immune system	K4
CO5	Appreciate the techniques of studying immune biology	K5

Cognitive Levels (K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create)

ANIMAL PHYSIOLOGY

1. Salt loss with reference to hypotonic & hypertonic condition using estuarine fish (15th Minute up to 1 hour)
2. Salt gain with reference to hypotonic & hypertonic condition using estuarine fish (15th Minute up to 1 hour)
3. Study of Respiratory Quotient (RQ) of a fish with reference to temperature
4. Estimation of total carbohydrate and protein in fish muscle tissue by standard graph (demo)
5. Estimation of Blood urea (DAM) and Cholesterol (ZAK'S) using commercially available kit.
6. Blood Clotting time, bleeding time, Preparation of haemin crystal, Estimation of Hemoglobin and ESR.
7. Principles and application of Sphygmomanometer, Kymograph, Haemoglobinometer, ESR.
8. Field Visit to various ecosystems and observe the animal adaptations (Mandatory)

Immunology

1. Identification of various immune tissues and organs in rat (demo)
2. Detection of IgG by precipitation ring test (Chart)
3. Detection of IgG by Ouchterlony double immuno-diffusion test (chart)
4. Detection of reactivity of IgG with fractionated antigens by immune – electrophoresis (chart)
5. Identification of histological slides of spleen, thymus, lymph node and bone marrow
6. Demonstration of RIA, ELISA and western blotting
7. Visit to Immunological laboratory/research institute of national importance (Mandatory)

Text Books:

1. Prosser C. L. 1991, Comparative Animal Physiology. Part A: Environmental and Metabolic Animal Physiology. Wiley-Liss Publishers, pp-592
2. Hoar, S.W. 1983, General and Comparative Physiology, Prentice Hall Publication, pp-928.
3. Randall, D., W. Burggren, K. French and R. Eckert. 2001, Animal Physiology Mechanisms and Adaptations, New York: W.H. Freeman and Co., pp-
4. Nelson K. S. 1997. Animal Physiology: Adaptation and Environment, Cambridge University Press, pp- 617.

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Reference Books:

1. Shepherd, G. M. 1994. Neurobiology, OUP USA Publisher, pp-774.
2. Hainsworth, F.R. 1981. Animal Physiology: Adaptation in function, Addison Wesley Longman Publishers, pp-669.
3. Gorden, M.S. *et al.*, 1977. Animal Physiology: Principles and Adaptation, New York, Third Edition.
4. Ahearn, G.A. *et al.*, 1988. Advances in Comparative and Environmental Physiology – 2, Springer Publishers, pp-252.
5. Hill, R.W. 1976. Comparative Physiology of Animals: Environmental Approach, Longman Higher Education Publisher, pp-656.

e-Resources

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CO2	3	3	3	3	3	3	3	3	3	3
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CO4	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3
Mean	3	3	3	3	3	3	3	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	BOS Coordinator	Verified by
Dr. M. Feroz Khan & Dr. K. Jahir Hussain	Dr. M. Feroz Khan	Dr. R. Rafi Mohamed

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III	DSEC Theory	P24EZL301	<i>Stem Cell Biology (Elective - V)</i>	75	3	25	75	100

Objectives: Understand the basic knowledge of stem cells, their origin and application

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Define the origin and types of embryonic stem cell	K1
CO2	Describe the characterization and differentiation of Embryonic stem cell	K2
CO3	Explain the application of adult stem cells	K3
CO4	Summarize the role of stem cells in ageing and regeneration	K4
CO5	Appreciate the Stem cell therapy	K5

Cognitive Levels (K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create)

Unit – I Properties of Stem cells

(15 Hours)

Introduction to stem cell biology: Stem cell definition, origin and hierarchy, stem cell properties, Identification and Characterization, potency and differentiation, niche of stem cell, overview of different stem cell types (embryonic stem cells, adult stem cells and induced pluripotent stem cells).

Unit – II Embryonic stem cells

(15 Hours)

Embryonic stem (ES) cell: Characterization and properties of ES cells, pluripotency and self-renewal of ES cells; molecular mechanisms regulating pluripotency and maintenance of the stem state, progressive differentiation of ES cells into ectoderm lineage organs (skin, brain and nerve), mesoderm lineage organs (heart, kidney, muscle, bone and blood), and endoderm lineage organs (lung, liver, stomach, pancreas and intestine).

Unit – III Adult stem cells

(15 Hours)

Adult stem cells: Mesenchymal stem cells (MSCs) - sources, properties (plasticity, homing and engraftment), potency and characterization; Hematopoietic stem cells (HSCs) - sources, properties, potency and characterization; steps involved in production of induced pluripotent stem cells (iPSCs); role of Yamanaka factor in iPSCs.

Unit – IV Stem cell and Ageing

(15 Hours)

Stem cell and aging: aging theory; cell cycle; telomere and telomerase; senescence of stem cell; role of stem cell in aging; tissue repair and regeneration of adult stem cell.

Unit – V Application of Stem cells

(15 Hours)

Current stem cell therapies: Advantages and disadvantages of ES cells and adult stem cells (MSCs and HSCs) therapy; Ethical concern on stem cell therapy; current stem cell therapy for various diseases; clinical outcome of stem cell therapy; state of clinical trials in adult stem cells for various diseases.

_____ # Self-Study Component for Seminar/Assignment:

(Questions should not be asked from self-study component in the End Semester Examinations)

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Text Books:

1. Kiessling, A.A. 2006. Human Embryonic Stem Cells (Second Ed.), Jones & Barlett Publishers.
2. Lanza, R. and A. Atala. 2005. Essentials of Stem Cell Biology. Academic Press, pp-712.
3. Turksen, K. 2004. Adult Stem Cells. Humana Press, Inc, pp-429.
4. Lanza, R. *et al.* 2004. Handbook of Stem Cells: Embryonic/Adult and Fetal Stem Cells (Vol. 1 & 2). Academic Press, pp-1626.
5. Institute of Medicine, 2002. Stem cells and the future of regenerative medicine. National Academy Press, pp-112.

Reference Books:

1. Quesenberry, P.J., G.S. Stein, B. Forget and S. Weissman. 2001. Stem Cell Biology and Gene Therapy, Wiley Publishers, pp-584.
2. Sell, S. and Totowa, N.J. 2004. Stem Cells Handbook, Humana Press, pp-534.
3. Sullivan, S., C. A. Cowan and K. Eggan. 2007. Human Embryonic Stem Cells: The Practical Handbook, Wiley Publishers, pp-424.
4. Battler, A., and Leo, J. 2007. Stem Cell and Gene-Based Therapy: Frontiers in Regenerative Medicine, Springer Publication, pp-422.

e-Resources

1. [Topic: Stem Cell Biology - Wiley Science and Engineering Content Hub](#)
2. [The Cell Biology of Stem Cells | SpringerLink](#)
3. [lebt109.pdf](#)
4. [isscr_coreconceptsinstemcellbiology_november2020.pdf](#)

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme specific outcomes			Mean
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3
Mean	3	3	3	3	3	3	3	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	BOS Coordinator	Verified by
Dr. S. Abdul Majeed, Dr. G. Tajju, Dr. Ajaz Haja Mohideen	Dr. M. Feroz Khan	Dr. R. Rafi Mohamed

C. Abdul Hakeem College (Autonomous), Melvisharam.

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<i>III</i>	<i>DSEC Theory</i>	<i>P24EZL302</i>	<i>Human Reproductive Technology (Elective - V)</i>	<i>75</i>	<i>3</i>	<i>25</i>	<i>75</i>	<i>100</i>

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Sem	Category	Course Code	Course Title	Hours	Credits	Int. Marks	Ext. Marks	Max. Marks
III	SEC Theory	P24SZL301	Apiculture (SBS - II)	75	2	25	75	100

Objectives: To understand the biology of honey bees and its byproducts, and to promote entrepreneurial skills

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Recall the morphology, life cycle, characteristics of honey bee keeping.	K1
CO2	Explain management of bee colony and manufacturing products.	K2
CO3	Illustrate harvesting, preserving and processing of bee products	K3
CO4	Analyze the local availability and needs of honey and other by-products	K4
CO5	Create skill and importance of bee keeping among entrepreneurs	K5

Cognitive Levels (K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create)

Unit – I Biology of Bees

(6 Hours)

Historical background of apiculture, Taxonomy and biology of honey bees (*Apis cerana indica*, *Apis mellifera*, *Apis dorsata*, *Apis florea*, *Melipona* sp.), social organization of bee colony, behavioral patterns (bee dance, swarming).

Unit – II Rearing of Bees

(6 Hours)

Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth; Bee Pasturage; Success of bee species in India with reference to *Apis cerana indica* and *Apis mellifera*. Methods of extraction of honey (Indigenous and Modern), equipment's & processing; Apiary management - Honey flow period and lean period, effects of pollutants on honeybees.

Unit – III Bee diseases & enemies

(6 Hours)

Diagnosis of honeybee diseases: Protozoan diseases, Bacterial diseases, Viral diseases -symptoms, nature of damage and control. Identification of honeybee enemies: Predators-Insects and non-insects. Colony collapse disorder and its management.

Unit – IV Bee economy

(6 Hours)

Products of apiculture industry (Honey, Bees Wax, Propolis, Royal jelly, Pollen etc.) and their uses; Modern methods in employing artificial Beehives for cross pollination in horticultural gardens-stationary and migratory bee keeping-mass queen rearing.

Unit – V Entrepreneurship in Apiculture & Field study

(6 Hours)

Bee keeping industries – Recent advancements, employment opportunities, economics in small and large-scale beekeeping, scope for women entrepreneurs in beekeeping sector, study of development programs and organizations involved in beekeeping in India. Role of National Bee Board (NBB), Central Bee Research & Training institute (CBRTI), Khadi and Village Industries Commission (KVIC). All India Coordinated Research Project on Honey Bees and Pollinators (AICRP-ICAR) in India (Self-study).

_____ # Self Study Component for Seminar/Assignment:

(Questions should not be asked from self-study component in the End Semester Examinations)

- Visit to Apiary or Honey Museum (Mandatory)

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Text Books:

1. Singh, D., Singh, D. Pratap. 2006. A Handbook of Beekeeping. AGROBIOS (INDIA)
2. Sharma P.L. and Singh, S.H. Book of Bee keeping.
3. Cherian and Ramanathan, S. Bee keeping in south India.
4. Prospective in Indian Apiculture - R.C. Mishra.

Reference Books:

1. Caron, D.W. 2013 (revised from 1999). Honey Bee Biology and Beekeeping. Wicwas Press. Cheshire, CT, 368 pp.
2. Kaspar, R., C. Cook, and M. D. Breed. 2018. Animal Behaviour 142: 69-76.
3. Hendriksma, H. P., A. L. Toth, and S. Shafir. 2019. Individual and Colony Level Foraging decisions of Bumble Bees and Honey Bees in Relation to Balancing of Nutrient Needs. Frontiers in Ecology and Evolution 7: 177.

e-Resources:

1. https://agritech.tnau.ac.in/farm_enterprises/fe_apiculture_home.html
2. <http://ecoursesonline.iasri.res.in/course/view.php?id=166>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

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CO4	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3
Mean	3	3	3	3	3	3	3	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	BOS Coordinator	Verified by
Dr. R. Rafi Mohamed and Dr. K. Jahir Hussain	Dr. M. Feroz Khan	Dr. R. Rafi Mohamed

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<i>IV</i>	<i>CC Theory</i>	<i>P24MZL401</i>	<i>Ecology</i>	<i>90</i>	<i>6</i>	<i>25</i>	<i>75</i>	<i>100</i>

Objectives: To understand the fundamentals of ecology of living organisms.

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Define the structure of biotic and abiotic environment	K1
CO2	Explain the role of population in an ecosystem	K2
CO3	Illustrate species and communities of an ecosystem	K3
CO4	Analyze energy flow in different ecosystem	K4
CO5	Appreciate the principles of environmental impact assessment	K5

Cognitive Levels (K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create)

Unit – I Types of Environments

(16 Hours)

The Environment: Physical environment; biotic environment; biotic and abiotic interactions. Habitat and niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.

Unit – II Ecology of Populations

(16 Hours)

Population ecology: Characteristics of a population; population growth curves; population regulation; life history strategies (*r* and *K* selection); concept of metapopulation-demes and dispersal, interdemec extinctions, age structured populations -action taken to control population explosion.

Unit – III Species interaction

(16 Hours)

Species interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis. Community ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones. Ecological succession: Types; mechanisms; changes involved in succession; concept of climax.

Unit – IV Energy flow and Biogeography

(16 Hours)

Ecosystem: Structure and function; energy flow and mineral cycling (CNP); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, estuarine). Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.

Unit – V Environmental Impact Assessment

(16 Hours)

Environmental pollution: Water, Air, Soil, radioactive, particle and heavy metal pollution. Global climate change-causes, effects, adaptation and mitigation measures. Environmental monitoring-concepts and significance. EIA-types, methods, processes, developmental projects that needs EIA, Draft and final EIA statements.

_____ # **Self-Study Component for Seminar/Assignment:**

(Questions should not be asked from self-study component in the End Semester Examinations)

Text Books:

1. Sharma, P.D. 2009. Ecology and Environment, Rastogi Publication, India, pp-616.
2. Calabrese, E.J. 1978. Pollutants and High-Risk Groups, John Wiley, pp-286.
3. Raven, P.H. and L.R. Berg, G.B. Johnson, 1993. Environment, Saunders College Publishing, pp-579.

C. Abdul Hakeem College (Autonomous), Melvisharam.

4. Cunningham, W. P. and B. W. Saigo, 1999. Environmental Science, McGraw Hill Boston, 5th Edition.

Reference Books:

5. Odum, E.P. 1893. Basic Ecology, Saunders & Co., Philadelphia, pp-383.
6. Barthwl, R.R. 2002. Environmental Impact Assessment, New Age International Publishers, New Delhi, India, pp-425.
7. United Nations Environment Programme (UNEP). 1995. Global Biodiversity Assessment, Cambridge University Press, pp-1140.

e-Resources

1. Online courses nptel.ac.in/noc19-ge23/preview
2. Class [central.com/course/swayam-ecology - and environment – 14021](http://central.com/course/swayam-ecology-and-environment-14021).

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme specific outcomes			Mean
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3
Mean	3	3	3	3	3	3	3	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	BOS Coordinator	Verified by
Dr. K.G.M.T. Ansari & Dr. K. Jahir Hussain	Dr. M. Feroz Khan	Dr. R. Rafi Mohamed

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for M.Sc., Zoology effective from the year 2025-2026

<i>Sem</i>	<i>Category</i>	<i>Course Code</i>	<i>Course Title</i>	<i>Hours</i>	<i>Credits</i>	<i>Int. Marks</i>	<i>Ext. Marks</i>	<i>Max. Marks</i>
<i>IV</i>	<i>CC Theory</i>	<i>P24MZL402</i>	<i>Evolution</i>	<i>90</i>	<i>5</i>	<i>25</i>	<i>75</i>	<i>100</i>

Objectives: To comprehend the scientific concepts of animal evolution and behavior through an understanding of its evidences, mechanism and process.

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Define the principles and process of evolution	K1
CO2	Outline the principles of adaptation	K2
CO3	Illustrate different direct and indirect evidences for evolutionary process	K3
CO4	Summarize the adaptive behavior of organisms gained through evolution	K4
CO5	Appreciate the social aspects of animal behavior	K5

Cognitive Levels (K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create)

Unit – I Introduction to Evolutionary biology

(16 Hours)

- Importance of Evolutionary Biology and its application
- Evolution before Darwin and Evolution after Darwin
- Principles of evolutionary change based on systematics
- Evidences for evolution from taxonomy and fossils (self-study)
- Trends and rates of evolution

Unit – II Natural and genetic variations

(16 Hours)

- Variation and its sources
- Hardy-Weinberg principle and its significance
- Genetic variation in natural populations and its estimation
- Origin of Genetic variation-mutation-recombination-karyotype alterations
- External sources of variation-Hybridization, Horizontal gene transfer
- Genetic drifts and Neutral hypothesis

Unit – III Natural selection theory and Species concept

(16 Hours)

- Natural Selection theory-experimental studies and methods of studying Natural selection
- Isolating mechanisms-barriers to gene flow-reproductive isolation-pre and post zygotic isolating mechanisms
- Species concept-modes of speciation (Allopatric, Parapatric, Sympatric, Polyploidy and Hybrid speciation)

Unit – IV Behaviour and sociality

(16 Hours)

- Behavior as phenotypic traits-variation within and among species
- The theory of foraging
- Evolutionary Stable Strategies (ESS)
- Sexual selection-concept-contests-paternity insurance-sperm competition-mate choice
- Social interaction and evolution of cooperation- theories of cooperation and altruism-inclusive fitness and reciprocity
- Interaction among related individuals-evidence for evolution by kin selection

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Unit – V Influence of evolution in animal behavior

(16 Hours)

- Micro-evolutionary and Macro-evolutionary changes in behavior
- Behavior and Adaptive radiation
- Use of phylogeny in studying behavior-Cladistics and Phenetics
- Origin and evolution of sociality in insects, mammals and primates
- Human behavior and Sociobiology- selfish gene and behavior
- Advantages of social behavior (self-study)

_____ # Self-Study Component for Seminar/Assignment:

(Questions should not be asked from self-study component in the End Semester Examinations)

Text Books:

1. Agarwal, V.K., 2012. Animal Behavior (Ethology). S. Chand and Co, New Delhi
2. Futuyma, D.J., 1998. Evolutionary Biology. Sinauer Associates, USA.

Reference Books:

1. Brian K. Hall, Benedikt Hallgrímsson 2013. Strickberger's Evolution. Jones and Bartlett Publishers, Inc; 5th edition (28 February 2013) ISBN-13: 978-1449691929.
2. Mandal F B. 2005. Introduction to Evolutionary biology. Oxford & Ibh (2005). ISBN 13: 9788120417793

e-Resources

1. <https://guides.library.stonybrook.edu/ee>
2. <https://www.evolutionarybiology.org/content/education/resources-for-teachers-and-students.html>
3. <https://nabt.org/Resource-Links-Evolution-6>
4. <https://ecologyandevolution.cornell.edu/resources-ecology-evolutionary-biology-and-related-disciplines>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme specific outcomes			Mean
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3
Mean	3	3	3	3	3	3	3	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	BOS Coordinator	Verified by
Dr. M. Feroz Khan and Dr. A. Nazeer Basha	Dr. M. Feroz Khan	Dr. R. Rafi Mohamed

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for M.Sc., Zoology effective from the year 2025-2026

Sem	Category	Course Code	Course Title	Hours	Credits	Int. Marks	Ext. Marks	Max. Marks
IV	CC Practical	P24MZPL41	Practical IV - Lab Course in Ecology and Evolution	90	4	25	75	100

Objectives: To provide hands-on training to perform specific lab courses in ecology and evolution.

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Recall the various methods of water chemistry	K1
CO2	Describe the principles behind evolution	K2
CO3	Apply various determination techniques in environmental media	K3
CO4	Analyze various environmental parameters from various habitats	K4
CO5	Evaluate various fossils and anatomical structures for the process of evolution	K5

Cognitive Levels (K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create)

Ecology

1. Estimation of Aquatic Primary productivity – Dark and Light bottle method (demonstration only)
2. Estimation of Dissolved Oxygen in water samples
3. Estimation of Dissolved CO₂ in water samples
4. Estimation of Salinity in water samples
5. Estimation of Calcium in water samples
6. Estimation of Alkalinity in water samples
7. Analysis of TDS and TSS in industrial effluent (demo)
8. Demonstration of BOD and COD
9. Estimation of earthworm population (Demonstration)
10. Collection, isolation and identification of planktons
11. Study of fauna in different environments and their adaption
 - a. Sandy shore
 - b. Muddy shore
 - c. Rocky shore
12. Animal Associations – parasitism, mutualism and commensalism
13. Educational Visit to a marine research institute and a field visit to a coastal and marine ecosystem to study the adaptation of fauna inhabiting a Sandy, Muddy and Rocky shore.

EVOLUTION

1. Observation of forelimbs or hind limbs of vertebrates (Amphibian, reptiles, aves and Mammal) to demonstrate the common pattern of pentadactyl limb and common ancestry of vertebrates.
2. Preparation of Cladogram based on the specimens provided (at least five museum specimen) (OR software programmes can be used for construction with a greater number of specimens).
3. Observation of fossils for paleontological evidences of evolution.
4. Observation of leaf insects and stick insects in the museum to demonstrate adaptation by cryptic coloration and natural selection.
5. Observation of Monarch and Viceroy butterflies to demonstrate Batesian mimicry.
6. Behavioral study or activity pattern of any two organism (insects, fish, reptile, birds, mammals) based on field observation with respect to diurnal and seasonal.
7. Visit to a natural history/paleontology museum (compulsory).

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Reference Books

1. Griffiths, A. J. F., H. J. Muller, D. T. Suzuki, R. C. Lewontin and W. M. Gelbart. 2012. An Introduction to Genetic Analysis. 11th Edition, W. H. Greeman. New York.
2. Snustad, D.P., Simmons, M.J. 2015. Principles of Genetics, John Wiley Publications, pp-784.
3. Watson, J. D., T. A. Baker, S. P. Bell, Alexander Gann, Michael Levine, Richard Lonick. 2003. Molecular Biology of the Gene, (5th Edition). Cold Spring Harbor Laboratory Press, pp-912.
4. Strick Berger. M. W. 2000. Evolution. Third Edition, Jones Bartlett Publishers, pp-722.
5. Hall B. K. and B. Hallgrimsson. 2014. Strick Berger's Evolution. Fifth Edition, Bartlett Learning, An Ascend Learning Company, pp-642.
6. Barton, N.H., D. Briggs, J.A. Eisen David, D.B. Goldstein and N.H. Patel. 2007. Evolution. Cold Spring Harbor Laboratory Press, pp-833.
7. Sharma, P.D. 2009. Ecology and Environment, Rastogi Publication, India, pp-616.
8. Calabrese, E.J. 1978. Pollutants and High-Risk Groups, John Wiley, pp-286.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme specific outcomes			Mean
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3
Mean	3	3	3	3	3	3	3	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	BOS Coordinator	Verified by
Dr. K. Jahir Hussain & Dr. K.G.M.T. Ansari	Dr. M. Feroz Khan	Dr. R. Rafi Mohamed

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for M.Sc., Zoology effective from the year 2025-2026

<i>Sem</i>	<i>Category</i>	<i>Course Code</i>	<i>Course Title</i>	<i>Hours</i>	<i>Credits</i>	<i>Int. Marks</i>	<i>Ext. Marks</i>	<i>Max. Marks</i>
IV	DSEC Theory	P24EZL401	Marine Fisheries Management (Elective - VI)	75	3	25	75	100

Objectives: The main objective of this paper is to expose students to acquire knowledge on marine fisheries and its management.

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Define the scope of marine fisheries	K1
CO2	Describe the fishery resources of India	K2
CO3	Explain various fishing methods	K3
CO4	Interpret the regulation of fishing	K4
CO5	Appraise the fish preservation methods	K5

Cognitive Levels (K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create)

Unit – I Introduction to Marine fisheries

(15 Hours)

Present status and scope of marine fisheries in India and World. Fishery potential of the EEZ of south-east coast (Tamil Nadu) and south-west coast (Kerala)- Problems and prospects of Marine fisheries in India-Role of Fishery Survey of India (FSI)-ICAR- CMFRI, CIFT, CIBA-CIFE and NFDB.

Unit – II Fishery Resources

(15 Hours)

Classification of marine fisheries (pelagic, demersal, coastal)-Important commercial finfish resources: Oil sardine, mackerel, seer fishes and tuna. Important commercial shellfish resources: penaeid (*Penaeus monodon*) and non-penaeid prawns (*Acetes indicus*), lobster, crabs and cephalopods. Trash fishery resources and its utilization (self-study). GIS in Fishery resources management.

Unit – III Fisheries and Fishing methods

(15 Hours)

Marine fisheries exploitation-major crafts (mechanized, motorized and non-mechanized) and gears (trawl nets, magnets, gillnets, seines and hooks and lines). Principles of sustainable fisheries- Fisheries co-management (self-study). Illegal Unreported and Unregulated (IUU) fishing - national and international status.

Unit – IV Regulations for craft and gears

(15 Hours)

Concept of Responsible Fisheries; Monsoon trawl ban, closed season, mesh size regulations, juvenile fishing, Exclusive Economic Zone (EEZ) of India (map), Coastal Regulation Zone (CRZ), Integrated Coastal Zone Management (ICZM). MSY, MEY, Over fishing, Recruitment over fishing, Aqua-ranching. Indian fisheries Act. Coast Guard Act. Maritime zones of India Act (self-study).

Unit – V Post-Harvest Management

(15 Hours)

Post-harvest management for finfish and shellfishes- Principles of different methods of chilling, Freezing, canning, salt-curing, pickling and smoking. Fishery Byproducts: Fish silage, Fish hydrolysate, Fish meal, bone meal, fish oil, surgical sutures from intestine, chitin and chitosan. Value added products- role of EIA, MPEDA and Fast-Moving Goods (FMG).

_____ # Self-Study Component for Seminar/Assignment:

(Questions should not be asked from self-study component in the End Semester Examinations)

Experiential Learning: Visit to research institute/Universities related to marine fisheries (Mandatory)

C. Abdul Hakeem College (Autonomous), Melvisharam.

Text Books:

1. Athithan, S. (2021). Coastal Aquaculture and Mariculture. CRC Press.
2. David, A. Bengtson (2003). Status of Marine aquaculture in relation to live prey: past, present and future. Blackwell publishing.
3. Gerwick Jr., B. C. (2007). Construction of Marine and Offshore Structures, 3rd Eds. CRC press, NewYork. Holmer, M., Black, K., Duarte, C. M., Marba, N., Karakassis, I. (2008). Aquaculture in the Ecosystem. Daya Publ. House.
4. ICAR (2006). Handbook of Fisheries and Aquaculture. ICAR.

Reference Books:

1. John E. Bardach (1997). Sustainable Aquaculture. John Wiley & Sons Inc., New York.
2. Korringa, P. (2017). Farming Marine Fishes and Shrimps. United Book Print.
3. Mcvey, J. P., (1993). Handbook of Mariculture. 2nd Eds. CRC Press.
4. Pillay, T. V. R. (1972). Coastal Aquaculture in the Indo – Pacific Region. Fishing News (Book) Ltd., London.
5. Pillay, T.V. R., Kutty, M. N. (2012). Aquaculture Principles and Practices. 2nd Eds. Wiley India.
6. Robert R. Stickney (2000). Encyclopedia of Aquaculture. John Wiley & Sons, Inc., New York.
7. US Fish, Wildlife Service (1982). Fish Hatchery Management. University Press of the Pacific.
7. Wedemeyer, G. (2002). Fish Hatchery Management. 2nd Eds. CABI Publishing.

e-Resources

1. <http://ecoursesonline.iasri.res.in/course/view.php?id=411>
2. https://eprints.cmfri.org.in/16047/1/MFIS_251.pdf
3. <https://www.tandfonline.com/journals/umcf20>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme specific outcomes			Mean
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3
Mean	3	3	3	3	3	3	3	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	BOS Coordinator	Verified by
Dr. M. Feroz Khan and Dr. K. Kadharsha	Dr. M. Feroz Khan	Dr. R. Rafi Mohamed

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for M.Sc., Zoology effective from the year 2025-2026

<i>Sem</i>	<i>Category</i>	<i>Course Code</i>	<i>Course Title</i>	<i>Hours</i>	<i>Credits</i>	<i>Int. Marks</i>	<i>Ext. Marks</i>	<i>Max. Marks</i>
<i>IV</i>	<i>DSEC Theory</i>	<i>P24EZL402</i>	<i>Inland Fisheries (Elective - VI)</i>	<i>75</i>	<i>3</i>	<i>25</i>	<i>75</i>	<i>100</i>

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for M.Sc., Zoology effective from the year 2025-2026

<i>Sem</i>	<i>Category</i>	<i>Course Code</i>	<i>Course Title</i>	<i>Hours</i>	<i>Credits</i>	<i>Int. Marks</i>	<i>Ext. Marks</i>	<i>Max. Marks</i>
<i>IV</i>	<i>DSEC Theory</i>	<i>P24EZL403</i>	<i>Molecular Genetics (Elective - VII)</i>	<i>75</i>	<i>3</i>	<i>25</i>	<i>75</i>	<i>100</i>

Objectives: Understanding the molecular gene structure and application of molecular genetics for human welfare.

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Define the basic structural properties of gene	K1
CO2	Demonstrate the chromosomal basis of Mendelism	K2
CO3	Explain the molecular structure of chromosomes	K3
CO4	Analyze the techniques behind molecular genetics	K4
CO5	Appraise molecular genetics in human welfare	K5

Cognitive Levels (K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6>Create)

Unit – I Introduction to Molecular Genetics

(15 Hours)

Three Great Milestones in Genetics (Mendel, Watson & Crick and the human genome project). Genetics in the World: Applications of Genetics to Human Endeavors (Agriculture, medicine and society). Mendelian Principles in Human Genetics-Extensions of Mendelism-Allelic Variation and Gene Function.

Unit – II The chromosomal basis of Mendelism

(15 Hours)

The Chromosome Theory of Heredity. Variation in Chromosome Number and Structure: Human karyotype and cytogenetic variation-polyploidy-aneuploidy-Amniocentesis and Chorionic Biopsy-Rearrangements of Chromosome Structure -Cytogenetic Mapping.

Unit – III Molecular structure of Chromosomes

(15 Hours)

Functions of the Genetic Material-The Structures of DNA and RNA-Chromosome Structure in Prokaryotes and Viruses-Chromosome Structure in Eukaryotes-the genome project. Transfer of Genetic Information: The Central Dogma-Transcription in Prokaryotes & eukaryotes. The Genetic Code, Protein Synthesis: Translation, One Gene—One Colinear Polypeptide concept.

Unit – IV The Techniques of Molecular Genetics

(15 Hours)

Discovery of restriction endonucleases-production of rDNA molecules *in-vitro*-amplification of rDNA molecules in vectors-cloning large genes and segments in BACs, PACs, and YACs-amplification of genes using PCR. Construction and Screening of genomic and cDNA Libraries. Analysis of DNA by southern blot, and RNA by northern blot hybridization and RT-PCR-analysis of proteins by western blot techniques.

Unit – V Application of Molecular genetics

(15 Hours)

Molecular Diagnosis of Human Diseases-Huntington's disease-cystic fibrosis-Human Gene Therapy-DNA Profiling for paternity and forensics-Production of Eukaryotic Proteins in Bacteria-Transgenic Plants and Animals. Reverse Genetics: knockouts, T-DNA and Transposon, RNA interference. Transposable Elements in Humans.

_____ # Self-Study Component for Seminar/Assignment:

(Questions should not be asked from self-study component in the End Semester Examinations)

C. Abdul Hakeem College (Autonomous), Melvisharam.

Text Books:

1. Gardner, E. J., M. J. Simmons and D.P. Snustad. 2006. Principles of Genetics. 8th Edition, John Wiley & Sons. INC. New York, pp-740.
2. Brooker, R. J. 2014. Genetics: Analysis and Principles. 5th Edition, McGraw Hill Publisher, pp-880.
3. Russell, P.J. 2005. Genetics: A Molecular Approach (2nd Edition). Pearson/Benjamin Cummings, San Francisco, pp-850.

Reference Books:

1. Griffiths, A. J. F., H. J. Muller, D. T. Suzuki, R. C. Lewontin and W. M. Gelbart. 2012. An Introduction to Genetic Analysis. 11th Edition, W. H. Greeman. New York.
2. Snustad, D.P., Simmons, M.J. 2015. Principles of Genetics, John Wiley Publications, pp-784.
3. Watson, J. D., T. A. Baker, S. P. Bell, Alexander Gann, Michael Levine, Richard Losick. 2003. Molecular Biology of the Gene, (5th Edition). Cold Spring Harbor Laboratory Press, pp-912.
4. Klug, W. S. and M. R. Cummings, C. A. Spencer. 2005. Concepts of Genetics, Benjamin - Cummings Publishing Company.
5. Harti, D. L. 2002. Essential Genetics, A Genomic Perspective, Jones & Bartlet.
6. Krebs, J. E., E.S. Goldstein, S.T. Kilpatrick. 2018. Lewin's Genes XII, Jones & Bartlet Publisher, pp-613.
7. Watson, J. D., T. A. Baker S. P. Bell, A. Cann, M. Levine and R. Losick, 2014. Molecular Biology of Gene 7th Edition, Pearson Education RH Ltd. India.

e-Resources

1. https://onlinecourses.swayam2.ac.in/cec21_bt02/preview
2. <https://www.khanacademy.org/science/high-school-biology/hs-molecular-genetics/hs-rna-and-protein-synthesis/a/the-genetic-code>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme specific outcomes			Mean
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3
Mean	3	3	3	3	3	3	3	3	3	3

3 – Strong; 2 – Medium; 1 – Low

Prepared by	BOS Coordinator	Verified by
Dr. R. Rafi Mohamed	Dr. M. Feroz Khan	Dr. R. Rafi Mohamed

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for M.Sc., Zoology effective from the year 2025-2026

<i>Sem</i>	<i>Category</i>	<i>Course Code</i>	<i>Course Title</i>	<i>Hours</i>	<i>Credits</i>	<i>Int. Marks</i>	<i>Ext. Marks</i>	<i>Max. Marks</i>
<i>IV</i>	<i>DSEC Theory</i>	<i>P24EZL404</i>	<i>Animal Behavior (Elective - VII)</i>	<i>75</i>	<i>3</i>	<i>25</i>	<i>75</i>	<i>100</i>

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for M.Sc., Zoology effective from the year 2025-2026

<i>Sem</i>	<i>Category</i>	<i>Course Code</i>	<i>Course Title</i>	<i>Hours</i>	<i>Credits</i>	<i>Int. Marks</i>	<i>Ext. Marks</i>	<i>Max. Marks</i>
<i>IV</i>	<i>SEC Theory</i>	<i>P24SZL401</i>	<i>Eco-tourism (SBS - III)</i>	<i>30</i>	<i>2</i>	<i>25</i>	<i>75</i>	<i>100</i>

Objectives: To understand the fundamentals of ecology of living organisms.

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Define the scope of eco-tourism	K1
CO2	Explain the types of eco-tourism	K2
CO3	Illustrate the eco-tourism resources in India	K3
CO4	Application of community participation in eco-tourism development	K4
CO5	Appreciate the international tourism marketing in India	K5

Cognitive Levels (K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create)

UNIT-I: Introduction to Ecotourism

(6 Hours)

History and scope of ecotourism; Components of ecotourism; Principles and characteristics of ecotourism; Ecotourism planning: Site diagnostics, Target groups; Ecotourism industry and its stakeholders; Resources and products of ecotourism; Commercialization of ecotourism (self-study).

UNIT-II: Types of Ecotourism

(6 Hours)

Tourism vs. Ecotourism; Types: Agro-ecotourism, Geo- ecotourism, Cultural- ecotourism – tangible and intangible heritages and tourism, Sensitive areas of ecotourism; Ecotourism management plans.

UNIT-III: Ecotourism resources in India

(6 Hours)

Eco-regions; Vegetation types (self-study); Protected areas; Endemism and biodiversity hotspots; Ramsar wetlands, Historical monuments and historical sites; Adventure ecotourism destinations; Ecotourism potential (case studies) of Tamil Nadu, Kerala, Odisha, Karnataka, Assam, Gujarat.

UNIT-IV: Community participation in ecotourism

(6 Hours)

Present scenario, Future prospects (year-round ecotourism); Sustainability of ecotourism; Ecotourism in developed countries; Community based ecotourism: Joint Forest management, Role of NGOs; Ethical and legal aspects; Eco travel and environmental awareness; Impacts of ecotourism, green report card, Eco-labelling; Environmental sustainability practices.

UNIT-V: Marketing Analysis

(6 Hours)

International and domestic tourism markets, Marketing research and analysis, Tourism forecasting and use of technology in tourism marketing, Airlines, Travel Agency, hotel accommodation, tour packages etc.

_____ # **Self-Study Component for Seminar/Assignment:**

(Questions should not be asked from self-study component in the End Semester Examinations)

Text Books:

1. Mow forth, M., & Munt, I. (2009). Tourism and sustainability (3rd Edition). London, UK: Routledge.
2. Newsome, D., Moore, S.A., & Dowling, R.K (2002). Natural area tourism. Bristol, UK: Channel View. (Publications.
3. Weaver, D. (2008). Ecotourism (2nd Edition). Hoboken, NJ: JS Wiley. Staff: Dr Julian Clifton

C. Abdul Hakeem College (Autonomous), Melvisharam.

Reference Books:

1. Weaver David (2006). "Sustainable Tourism: Theory and Practice", Elsevier Butterworth Heinemann, Oxford.
2. Daly H. (2007). "Ecological Economics and Sustainable Development", Edward Elgar Publishing Limited, UK. §
3. Mowforth M. & Munt I. (2003). "Tourism and Sustainability - New tourism in the Third World", Taylor and Francis e-Library.
4. Roger P., Jalal K., & Boyd J. (2008). "An Introduction to Sustainable Development", Glen Educational Foundation, Inc. Earthscan UK and USA.

e-Resources

1. <https://egyankosh.ac.in/bitstream/123456789/65767/1/Unit-9.pdf>
2. https://www.researchgate.net/publication/249024038_A_Content_Analysis_of_Ecotourism_Definitions
3. <https://www.nccf.in/wp-content/uploads/2019/10/concept-note-ecotourism.pdf>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Programme Outcomes						Programme specific outcomes			Mean
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3
Mean	3	3	3	3	3	3	3	3	3	3

3 – Strong; 2 – Medium; 1 – Low

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