



गोविन्द गुरु जनजातीय विश्वविद्यालय बाँसवाड़ा

चयन आधारित क्रेडिट व्यवस्था की पाठ्यचर्या के अंतर्गत अधिसातक पाठ्यक्रम

(Choice Based Credit System)

विषय नाम: ZOOLOGY

प्रश्न पत्र सूची

प्रथम सेमेस्टर

क्रम	पेपर कोड	प्रकार	प्रश्न पत्र निर्धारण	पेपर नाम	क्रेडिट
1		विषय केन्द्रित अनिवार्य कोर्स (DCC)	1	Biosystematics and Evolution	4
2		विषय केन्द्रित अनिवार्य कोर्स (DCC)	1	Invertebrates: Structure and Function	4
3		विषय केन्द्रित अनिवार्य कोर्स (DCC)	1	Biodiversity, Wildlife Conservation, And Quantitative Biology	4
4		विषय विशिष्ट ऐच्छिक कोर्स (DSE)	1	Metabolism – Concepts and Regulation	4
5		विषय विशिष्ट ऐच्छिक कोर्स (DSE)		Immunology	4
				Total	20


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द्वितीय सेमेस्टर

क्रम	पेपर कोड	प्रकार	प्रश्न पत्र निर्धारण	पेपर नाम	क्रेडिट
1		विषय केन्द्रित अनिवार्य कोर्स (DCC)	1	General and Comparative Animal Physiology and Endocrinology	4
2		विषय केन्द्रित अनिवार्य कोर्स (DCC)	1	Molecular Cell Biology	4
3		विषय केन्द्रित अनिवार्य कोर्स (DCC)	1	Principles of Ecology and Environmental Physiology	4
4		विषय विशिष्ट ऐच्छिक कोर्स (DSE)	1	Developmental Biology	4
5		विषय विशिष्ट ऐच्छिक कोर्स (DSE)	1	Tools and Techniques in Biology	4
Total					20

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तृतीय सेमेस्टर

क्रम	पेपर कोड	प्रकार	प्रश्न पत्र निर्धारण	पेपर नाम	क्रेडिट
1		विषय केन्द्रित अनिवार्य कोर्स (DCC)	1	Comparative Anatomy of Vertebrates and Parasitology	4
2		विषय केन्द्रित अनिवार्य कोर्स (DCC)	1	Animal Behaviour and Eco-Toxicology	4
3		विषय विशिष्ट ऐच्छिक कोर्स (DSE)	1	Structure and Function of Genes	4
4		सामान्य ऐच्छिक कोर्स (GE)	1	Genetics and Cytogenetics	4
5		Dissertation/Project/Field Study (DPR) course. Research Credit Courses (RCC). Seminar etc			4
Total					20


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चतुर्थ सेमेस्टर

क्रम	पेपर कोड	प्रकार	प्रश्न पत्र निर्धारण	पेपर नाम	क्रेडिट
1		(GE)	1	Diversity, Behaviour of Fishes and Aquaculture	4
2		(GE)	1	Fish Physiology	4
3		(GE)	1	Aquatic Resources and their Conservation	4
4		(GE)	1	Limnology	4
5		Dissertation/Project/Field Study (DPR) course. Research Credit Courses (RCC). Seminar etc.	1	Stream Limnology and Fish Biology	4
				Total	20

Abbreviations

- ❖ DCC: Discipline Centric Compulsory
- ❖ DSE: Discipline-Specific Elective
- ❖ GE: Generic Elective
- ❖ OJT: On Job Training
- ❖ CEE: Community Enhancement Experience
- ❖ RCC: Research Centric Course
- ❖ DPR: Dissertation/Project/Field Report
- ❖ SEM: Course Seminar


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GOVIND GURU TRIBAL UNIVERSITY BANSWARA

M.Sc.

Two Year Post Graduate Course

Semester I

ZOOLOGY

DCC

Paper I: BIOSYSTEMATICS AND EVOLUTION

Unit:I

- Definition and basic concepts of biosystematics, History of classification, Theories of biological classification, Taxonomic categories, hierarchy categories, Cytotaxonomy, Chemotaxonomy and Molecular taxonomy. Taxonomic characters, Reproductive Isolation, Taxonomic collection, Preservation, Curation and the process of identification. International code of zoological nomenclature, Taxonomic Keys, different types of keys, their merits, and demerits.

Unit:II


- Phylogenetic, gradualism, and punctuated equilibrium, Modes of speciation (allopatry & sympatry), Evaluation of biodiversity indices, Evaluation of Shannon-Weiner Index, Evaluation of Dominance Index, Similarity and Dissimilarity Index.
- Concepts of evolution and theories of organic evolution. Neo Darwinism, and population genetics: (A) Concepts of population genetics, Hardy - Weinberg law of genetic equilibrium, (B) detailed account of destabilizing forces: Natural selection, mutation, genetic drift, Meiotic drive and migration.

Unit: III

- Trends of evolution: Molecular Evolution a) Gene evolution b) Evolution of gene families c) Assessment of molecular variation and its significance, Genetic polymorphism, Modes of speciation, Micro and Macro Evolution. Theories of Evolution, Gene Evolution, Geological time scale and fossil.

SUGGESTED READING MATERIAL

1. M. Koto-The. Biology of biodiversity-Springer.
2. E.O. Wilson-Biodiversity-Academic Press Washington.
3. G.G.-Simpson-Principle of animal taxonomy Oxford I.B.H. Publication company.
4. E-Mayer-Elements of Taxonomy.
5. Bastchelet-F-Introduction to mathematics for life scientists Springer Verlag, Berling.
6. Skoal R.R. and F.J.Robill' Biometry-Freeman, San-Francisco.
7. Sneedor, G.W. and W.G. Cochran Statistical Methods of affiliated-EastWest Press, New Delhi.
8. Murry J.D. Mathematical Biology-Springer, Verlag, Berlin.


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Semester I

ZOOLOGY

DCC

INVERTEBRATES: STRUCTURE AND FUNCTION

UNIT -I

- Origin of metazoan, Organization of Coelom: Acoelomates, Pseudocoelomates, Coelomates.
- Locomotion in Protozoa (amoeboid flagellar and ciliary movement), Hydrostatic movement in Coelenterates annelids and Echinoderms. Feeding and digestion: Patterns of Feeding and digestion in lower metazoa (Mollusca & Annelida), Filter feeding in Polychaeta,

UNIT-II

- Organs of respiration in a lower and higher invertebrate, Mechanism of respiration in lower and higher invertebrates, Excretion in lower invertebrates, Excretion in higher invertebrates, Mechanism of osmoregulation, Osmoregulation in freshwater and marine invertebrates.

UNIT-III

- Primitive and advanced nervous systems of invertebrates, Larvae, and their importance: larval forms of Echinodermata, larval forms of crustaceans and larval forms of molluscs and helminths. Structure, affinities, and life history of minor phyla: Rotifera, Entoprocta, Ectoprocta, Phoronida.


SUGGESTED READING MATERIAL

1. Hyman, L.H. The invertebrates, Vol. I. Protozoa through Ctenophora, McGraw Hill Co., New York.
2. Barrington, E.J. W. Invertebrate structure and function. Thomas Nelson and Sons Ltd., London.
3. Jagerstein, G. Evolution of Metazoan life cycle, Academic Press, New York & London.
4. Hyman, L.H. The Invertebrates. Vol. 2. McGraw Hill Co., New York..
5. Hyman, L.H. The Invertebrates. Vol. 3, McGraw Hill Co., New York, and London.
6. Parker and Haswell, Text Book of Zoology, Vol. I, (Invertebrata), A.Z.T.B.S. Publishers and Distributors, New Delhi- 110051.

7. Ismail, S.A., Vermicology: The Biology of Earthworms, Orient Longman, India.
8. Kotpal, R.L. Agarwal and Khetrapal: Modern Text Book of Zoology: Invertebrates, Rastogi Publications, Meerut. (English and Hindi Editions)
9. Storer, T.I. and Usinger, K.L.: General Zoology, Tata McGraw- Hill Publishing Co., New Delhi.
10. Simpson, GG: Principles of Taxonomy, Oxford and I.B.H. Publisher Co. New Delhi.
11. Barnes, R.D. Invertebrates Zoology, III edition. W.B. Saunders Co. Philadelphia.
12. Russel-Hunter, W.D. A biology of higher invertebrates, the Macmillan Co.Ltd., London.
13. Hyman, L.H. The Invertebrates smaller coelomate groups, Vol. V.Mc.Graw Hill Co., New York.
14. Read, C.P. Animal Parasitism. Parasitism. Prentice Hall Inc.. New Jersey.
15. Sedgwick, A.A. Student textbook of Zoology. Vol. I, II and III. Central Book Depot, Allahabad.
16. Parker, T.J., Haswell W.A. Textbook of Zoology, Macmillan Co., London.
17. Hickman C.P.Jr., F.M. Hickman and L.S. Roberts, Integrated Principles of Zoology, Mosby College Publication. St. Louis.
18. Ayyar, E.K., and T.N. Ananthakrishnan, Manual of Zoology, Vol.1 (Invertebrata), Parts I and II. S. Viswanathan (Printers and Publishers) Pvt. Ltd., Madras.
19. Jordan, E.L. and P.S. Verma, Invertebrate Zoology, S.Chand & Co. Ltd., Ram Nagar, New Delhi. (English and Hindi Editions).

PRACTICAL :

- 1 Verma, PS, A manual of practical Zoology S.Chand and Co. Ltd., Ram Nagar, New Delhi (English and Hindi Editions).
- 2 Lal, SS: Practical Zoology , Invertebrates, Rastogi Publication, Meerut (English and Hindi Editions).


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M.Sc.

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Semester I

ZOOLOGY

DCC

BIODIVERSITY, WILDLIFE CONSERVATION, AND QUANTITATIVE BIOLOGY

Unit – I

- Concept and the principle of biodiversity: Causes for the loss of biodiversity, Biodiversity conservation methods, Medicinal uses of various parts of animals. Habitat degradation: Fragmentation and destruction, Climate change, Poaching of wildlife and man-wildlife conflicts., Overexploitation and overabundance, Environmental impact assessment.

Unit - II

- Values of wildlife: National Biodiversity status of India (vertebrates), positive and negative, Wildlife Protection Act. Conservation of wildlife in India, Endangered and threatened species, Conservation categories of taxa, according to I.U.C.N., CITES, and W.P.A.
- In-situ and Ex-situ conservation: National Parks and Sanctuaries, Project Tiger, Project Gir and Crocodile breeding project, Wildlife in Rajasthan with references to reptiles, birds, and mammals.

Unit –III

- Mean -Definition & Calculation. Median - Definition and calculation, Mode - Definition and calculation, Standard deviation (SD) -Definition and Calculation; Ground and remote sensing methods for habitat characterization; collection of data and their presentation such as Graphs, Graphs (Graphs, Bar diagrams, Histograms, Line diagrams and Pie diagrams) including application. Sampling theory, Experimental designing: Completely randomized design and randomized block design, Variance and analysis. Co-relation. types of correlation, Karl persones coefficient correlation, T-test, Chi-square test.

SUGGESTED READING MATERIAL

I. Jorgenserr, S.E. Fundamental of Ecological modeling Elsevier New York.

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2. Lenderen D. Modelling in behavioral ecology. Chapman & Hall London U.K.
3. Sokal, R.R., and F. J. Rohit Biometry Freeman San Francisco.
4. Snedecor, G.W., and W.G. Cochran, statistical methods, Affiliated East, West Press New Delhi (Indian ed.).
5. Pelon, E.e. The interpretation of ecological data: A primer on classification and ordination.
8. V.B. Saharia wildlife in India.
9. S.K. Tiwari wildlife in central India.
10. Georgs & Wilians statistical method.
- 11 R.K. Tondon Biodiversity Taxonomy & Ecology.
12. M.P. Arora An Introduction to perinatology.
13. P.C. Kotwal Biodiversity and conservation.
14. M. Koto: The Biology of Biodiversity. Springer.
15. E. O. Wildon: Biodiversity. Academic Press Washington.
16. G.G. Simpson: Principles of Animal Taxonomy. Oxford I.B.H. Publication Company.
17. E. Mayer: Elements of Taxonomy.
18. Dobzhansky: Biosystematics.
19. Oallela and Sharma: Animal Taxonomy and Museology.
20. Dobzhansky: The Genetics and origin of species. Columbia University Press.
21. Futuyama OJ. Evolutionary Biology. I.N.C. Publishers Dunderland.
22. Jha A.P.: Genes and Evolution - John Publication, New Delhi.
23. Odum : Ecology (Amerind).
24. Odum : Fundamentals of Ecology (Saunders).
25. Ricklefy : Ecology (W.H.Freeman).



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M.Sc.

Two Year Post Graduate Course

Semester I

ZOOLOGY

DSE / GE

Metabolism – Concepts and Regulation

Unit- I

- Energetics and Design of Living Systems: The living state, metabolism as the defining characteristic of living organisms, molecular approach to understanding life forms and living processes, Energetics (second law of thermodynamics, Free Energy and standard free energy change), Reducing power and Redox potential, Nernst equation, synthesis of ATP, structure and function of the electron transport chain and synthesis of ATP through Fo-F1 ATP synthase.

Unit- II

- Catalysis and its Regulation: Nature of enzymes – kinetics, reaction mechanism of chymotrypsin and lysozyme, Inhibition of Enzyme activity, regulation of enzyme activity. Metabolic Pathways and its Network: A broad outline of metabolic pathways and their linkage, metabolism of primary metabolites – monosaccharides, lipids, essential amino acids, and nucleotides.

Unit- III

- Metabolic Reprogramming: Dynamic state of body constituents, experimental approaches to study metabolism, Metabolic basis of nutrition, metabolic basis of specialized tissue function, metabolic disorders, metabolic basis of diagnostics, metabolism, and adaptation with one example, regulation of metabolism at molecular, cellular, and organismic levels, enzymes and receptors as drug targets.

SUGGESTED READING MATERIAL

1. Voet, D., and J.G. Voet. Biochemistry John Wiley & Sons.
2. Freifelder, D. Physical Biochemistry W.H. Freeman & Co.
3. Segal, I.H. Biochemical calculations John Wiley and Sons.
4. Creighton, T.E. Protein Structure, and Molecular Properties W.H. Freeman & Co.
5. Freifelder, D. Essentials of Molecular Biology.
6. Wilson, K. and K.H. Goulding A Biologists Guide to Principles and Techniques of Practical Biochemistry.
7. Cooper, T.G. Tools of Biochemistry.

8. Hawk, Practical Physiological Chemistry
9. Garret, R.H., and C.M. Grisham. Biochemistry. Saunders College Publishers.
- 10 Fundamentals of Biochemistry 3rd edition by D. Voet, JG Voet, C.W. Pratt, John Wiley & Sons.
- 11 Principles of Biochemistry 5th edition by Nelson, Cox, and Lehninger, WH Freeman & Company.
- 12 Molecular Cell Biology by Lodish, Berk, Kaiser, Kreiger, Scott, Zipursky, Darnell.
- 13 Biochemistry with clinical correlations by TJ Devlin, Wiley Leiss.
- 14 Biochemistry by Zubey, Macmillan Publishing Company, New York.
- 15 Biochemistry by CK Mathews, KE Van Holde. The Benjamin-Cummings Publishing Company, Melano Park.


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M.Sc.

Two Year Post Graduate Course

Semester I

ZOOLOGY

DSE / GE

IMMUNOLOGY

UNIT I

- Overview of the immune system: Components of the immune system, principles of innate and adaptive immunity, antigen and immunogenicity, clonal selection theory; Evolution of immune system. Antigen recognition by immune cells: Innate Immunity- Pattern recognition in the innate immune system, TLRs and their role in innate immune response; Adaptive immunity-Antibody structure, antigen recognition by B lymphocytes; molecular mechanism behind BCR formation; B lymphocyte development and survival.

UNIT-II

- Structure and function of MHC complex: antigen processing cells, antigen processing and presentation to T lymphocytes, MHC restriction. TCR structure and function: T-cell receptor gene rearrangement; T lymphocyte development and survival; Antigen recognition by T-cells, signalling through TCR and T-cell activation, co-receptors and their role in T-cell functioning; co-stimulation.

UNIT: III

- Effector mechanisms and regulation of immune responses: Induced innate response to infection, Innate memory, Complement system, NK and NKT cell functions, Humoral immune response, Production of effector T- cells, cytotoxic T- cell effector mechanisms. Regulation of immune response: Leukocyte activation and migration, Cytokines, innate regulation of the immune response, T-cell mediated. **Immunity in health and disease:** Allergy and hypersensitivity, Autoimmunity, Immunodeficiency diseases, Immunity and Infection, Tumour-immunology, Transplantation, Vaccines.

Recommended Books

1. Kuby Immunology, Richard, Thomas, Barbara, Janis , W. H. Freeman and Company [Latest edition].
2. Immuno Biology- The immune system in health and disease, Janeway, Travers, Walport and Shlomchik, Garland Science Publishing [Latest edition].

3. Essentials of Immunology, David, Brostoff and Roitt, Mosby & Elsevier Publishing [Latest edition].
4. Fundamentals of Immunology by William E. Paul, Lippincott Williams & Wilkins Publishing [Latest edition].
5. Cellular and Molecular Immunology by Abul K. Abbas, Andrew H. Lichtman, Shiv Pillai, Elsevier Publishing [Latest edition].

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Semester I

ZOOLOGY

Core Practicals

Paper-I to V Paper:

Practical based on paper Paper I to IV Paper:

1. Spotting – Classification and identification of various phylum. (10)05
2. One major dissection of various systems of invertebrates – 04
Squilla, Prawn, Sepia, Loligo.
3. One minor dissection- Grasshopper, Honeybee, Echinus, Starfish, Aplysia. 03
4. Mounting material - permanent mount 03
- 5 Spotting related with Adaptation. homologies, analogies, and modification of mouth parts 03
6. Problem based on Biodiversity and wild life. Mammals and Fishes group 03
Practical Records & Viva – Voce 04

-
1. Estimation of gene and genotype frequency in the light of Hardy Weinberg Law based on facial traits, blood group (ABO), and P.T.C.
 2. Visit Rajasthan's natural habitats and protected areas and wetlands for a detailed study: Students should submit a report on the study covering major fauna, flora, and geography.
 3. Locating the hotspots and biosphere reserves on the map of the world.
 4. Determination of population density of animals, species dominance, and frequency using the quadrant/plot method.
 5. Analysis of species diversity using diversity indices.
 6. Identification and comments on spots of endangered species: Leatherback sea turtle, gharial, great Indian bustard, long-billed vulture, Siberian crane, Nilgiri langur, Royal Bengal tiger, Asian elephant, blue whale, Indian Rhinoceros.
 7. Problem-based on biodiversity and wildlife. (Mammals and Fishers group (Spots 5+5))
 8. Effect of pH and temperature on the rate of enzyme reaction


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Two Year Post Graduate Course

Semester II

ZOOLOGY

DCC

General and Comparative Animal Physiology and Endocrinology

UNIT: I

- **Internal Transport and Gas Exchange:** Respiratory pigments through different phylogenic groups, Systems of circulation, Peripheral circulation, Regulation of heartbeat and blood pressure, Transport and exchange of gases, Neural and chemical regulation of respiration, Gas transfer in air and water, Gas exchangers, Circulatory and respiratory responses to extreme conditions, Acid-base balance, Regulation of body pH.
- Comparative physiology of digestion, Feeding Patterns, Behaviour, mechanisms and their control, effect of starvation. Thermoregulation- Heat balance in animals, Adaptations to temperature extremes, torpor, Aestivation and hibernation, Counter current heat exchangers.

UNIT II

- **Sensing the Environment & Coordination:** Neuroanatomy and integrated function of the nervous system; Photoreception, Chemoreception, Mechanoreception; Echolocation, Endogenous and exogenous biological rhythms; Chromatophores- Types and Functional Modifications vis-a-vis different animals (Invertebrates & Vertebrates) & control; Behavioural significance and its application; Bioluminescence- Phenomenon dynamics (Luciferin-Luciferase reaction); Occurrence in different groups of the animal kingdom, Types (Blue & Red), functional significance and its application in mankind.
- Physiology of pregnancy, placental hormones, pregnancy diagnosis tests, parturition and breast and lactation (human being).

UNIT: III


- **Adaptations to Stress:** basic concept of environmental stress, acclimation, acclimatization, avoidance and tolerance, stress, and hormones. Osmoregulation- Osmoregulation in aquatic and terrestrial environments, Extra-renal osmoregulatory organs, Patterns of nitrogen excretion.


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- **Hormones:**chemical nature and their classification, Mechanisms of hormone action (a) proteinous Hormones, (b) steroidal Hormones, Structure and function of pituitary, pancreas, adrenal and thyroid,
- Phylogeny of endocrine glands (pituitary, pancreas, adrenal, thyroid), Ontogeny of endocrine glands
- Neuroendocrine system in vertebrates, Hormone receptors, signal transduction mechanisms
- Hormones and reproduction a. Seasonal breeders b. Continuous breeders.

Suggested Reading Material

1. EJW Barrington-General & Comparative Endocrinology-Oxford, Clarendon Press
2. R.H. Williams-Text Book of Endocrinology-W.B. Saunders
3. C.R. Martin- Endocrine Physiology-Oxford University Press.
4. Molecular Cell Biology-J. Darnell, H. Lodish and D. Baltimore-Scientific American Book USA
5. Molecular Biology of the cell-B. Alberts, D-Bray, J.Lewis, M. Raff, K. Roberts and J.D. Watson, Garland Pub. New York.
6. General and Comparative Animal Physiology, Hoar W. S. (ed.), Prentice Hall, India.
7. Comparative Physiology (Handbook of Physiology): Vol. 1, 2, Dantzler, W.H. (ed.) Oxford University Press, New York, USA.
8. Animal Physiology: Adaptation and Environmental, Nelson K. S. (ed.) Cambridge University Press, Cambridge, UK.
9. Comparative Animal Physiology, Prosser, C.L. & Brown Jr., F.A. (ed.), Saunders.
10. Eckert: Animal Physiology 5th Ed by Randall, David, Burggern, Warren, French, Kathleen (2001).


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GOVIND GURU TRIBAL UNIVERSITY BANSWARA

M.Sc.

Two Year Post Graduate Course

Semester I

ZOOLOGY

DCC

Molecular Cell Biology

UNIT: I

- **Cytoskeleton in eukaryotic cell architecture and function** - Recapitulation of the structure of the eukaryotic cell with emphasis on how it functions as a unit of life; Structure and dynamics of microfilaments; Organization of the cortical cytoskeleton; Actin cytoskeleton in cell shape, intracellular motility, and cell locomotion; Microtubule structure, organization and dynamics; Role of microtubules in cell shape and mitosis; Structure and function of intermediate filaments.

UNIT: II

- **Biology of Cell membranes** - Recapitulation of the plasma membrane; Mechanism of diffusion, facilitated diffusion, active transport with suitable examples; Movement of water; Ion movements and cell function: Acidification of cell organelles and stomach; transepithelial transport; Maintenance of cellular pH; Cell excitation; Bulk transport: Receptor-mediated endocytosis; Protein sorting and targeting to organelles; Targeting of proteins to lysosomes for degradation; Molecular mechanism of the secretory pathway; Secretion of neurotransmitters.

UNIT: III

- **Organization of cells into tissues and cellular communication** - Extracellular matrix; Cell-cell and cell-matrix adhesion; Cell junctions; Intercellular communication: Key concepts in cellular signalling mechanisms; Second messenger systems; G-protein coupled receptors; Receptor tyrosine kinases; MAP kinase cascade; Desensitization of receptors; Survival and death pathways.

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- **Life cycle of a cell** - Cell cycle and its regulation; Commitment to cell division; Entry into and exit from the cell cycle; Checkpoints in the mammalian cell cycle; Turnover of cellular components; Degradation of cytosolic proteins; Mammalian cell culture and cytotoxicity.

Suggested Reading Material:

1. Molecular Cell Biology, Lodish et al., W.H. Freeman and Company (8th Ed. 2016)
2. Molecular Biology of the Cell, Alberts et al., W.W. Norton and Company (6th Ed. 2014)
3. Molecular Biology, Weaver R. F., McGraw-Hill Education (5th Ed. 2011).

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GOVIND GURU TRIBAL UNIVERSITY BANSWARA

M.Sc.

Two Year Post Graduate Course

Semester II

ZOOLOGY

DCC

Principles of Ecology and Environmental Physiology

UNIT: I

- **Concept of Ecology** - Introduction to ecology, evolutionary ecology, environmental concepts – laws and limiting factors, ecological models. Characteristics of population, population size and exponential growth, limits of population growth, population dynamics, life history pattern, fertility rate and age structure. Competition and coexistence, intra-specific and inter-specific interactions, scramble and contest competition model, mutualism and commensalism, and prey-predator interactions.

UNIT: II

- **Ecosystem** - Nature of ecosystem, production, food webs, energy flow through ecosystem, bio-geochemical cycles, resilience of ecosystem, ecosystem management. The biosphere, biomes, and impact of climate on biomes.
- **Climate change** - Environmental Stresses and their management, global climatic pattern, global warming, atmospheric ozone, acid, and nitrogen deposition, coping with climatic variations. **Adaptations:** Levels of adaptations, Significance of body size and adaptation, Eco-physiological adaptations to freshwater environments, Eco-physiological adaptations to terrestrial environments, and Physiological adaptation to parasitic habitats.

UNIT: III

- **Bioremediation** - Major classes of contaminants. Uptake, biotransformation, detoxification, elimination and accumulation of toxicants. Factors influencing bioaccumulation from food and trophic transfer. Pesticides and other chemical in agriculture, industry and hygiene and their disposal, Impact of chemicals on biodiversity of microbes, animals, and plants. Bioindicator and biomarkers of environmental health. Biodegradation and bioremediation of chemicals.
- Concept of homeostasis, Endothermic and physiological mechanism of regulation of the body temperature, Physiological response to oxygen-deficient stress.


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Suggested Reading Material:

1. Field Sampling: Principles and Practices in Environmental Analysis. 2004. Conklin, A.R. Jr. CRC Press.
2. Principles and Standards for Measuring Primary Production. 2007. Fahey, T.J. and Knapp, A.K. Oxford University Press, UK.
3. Ecological Modeling. 2008. Grant, W.E. and Swannack, T.M., Blackwell.
4. Fundamental Processes in Ecology: An Earth system Approach. 2007. Wilkinson, D.M. Oxford University Press, UK.
5. Principles of Terrestrial Ecosystem Ecology. 2011. Chaplin, F.S., Matson, P.A. and Vitousek, P.M. Springer.
6. Environmental Chemistry. 2010. Stanley and Manahan, E. CRC, Taylor & Francis. London.
7. Freshwater Ecology: A Scientific Introduction. 2004. Closs, G., Downes, B. and Boulton, A. Wiley-Blackwell publisher, Oxford.

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GOVIND GURU TRIBAL UNIVERSITY BANSWARA

M.Sc.

Two Year Post Graduate Course

Semester II

ZOOLOGY

DSE / GE

Developmental Biology

UNIT: I

- **Basic concepts of developmental biology:** cell division, cell differentiation, signalling, patterning, Evolution of developmental patterns. **Model systems:** vertebrates model organism- *Xenopus laevis*, chicken, mammals, zebrafish; invertebrate model organism- *Drosophila melanogaster*, Sea urchin, *Caenorhabditis elegans*.
- **Early embryonic development of vertebrates and invertebrates:** structure of the gametes- the sperm, the egg; cleavage and gastrulation; axes and germ layers. **Programmed cell death:** apoptosis, autophagy, and necrosis.

UNIT: II

- **Morphogenesis:** cell adhesion, cleavage and formation of blastula, gastrulation, neural tube formation, cell migration. Early development and axis specification in insect (*Drosophila*).
- **General concepts of organogenesis:** Development and patterning of vertebrate limb, homeobox genes in patterning, signalling in patterning of the limb; Insect imaginal discs-organizing center in patterning of the leg and wing, the homeotic selector genes for segmental identity; insect compound eye.


UNIT: III

- **Postembryonic development:** Growth, cell proliferation, growth hormones; aging- genes involved in alteration in timing of senescence. **Regeneration-** Epimorphic regeneration of reptile (salamander) limb; Morphallaxis regeneration in hydra; embryonic stem cells and their applications.
- **Medical implications of developmental biology:** genetic errors of human development- the nature of human syndromes- pleiotropy, genetic heterogeneity, phenotypic variability, mechanism of dominance; gene expression and human disease- inborn errors of nuclear RNA processing, inborn errors of translation; teratogenesis.


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Suggested Reading Material:

1. Developmental Biology: Scott F Gilbert [Latest edition].
2. Essentials of Developmental Biology: JMW Slack [Latest edition] .
3. Principles of Development: Louis Wolpert [Latest edition].
4. Principles of Developmental Genetics, Moody, Elsevier, 2007
5. Principles of Development, 2nd Ed., Wolpert, Oxford 2002
6. The Cellular & Molecular Biology of Pattern Formation, Stocum & Karr 1990
7. Langman's Medical Embryology, 10th Ed., Sadler, LMW, 2006
8. Human Embryology and Teratology O'Rahilly and Muller Wiley 1992
9. An introduction to Embryology, B.L. Bilinsky


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Semester II

ZOOLOGY

DSE / GE

Tools and Techniques in Biology

UNIT:- I

- Principle and Applications of Light Microscope, Principle and Applications of Phase Contrast Microscope, Principle and Applications of Confocal microscope, Principle and Applications of Electron microscope, Spectrophotometer, Types and application of Centrifuge, Cryopreservation and Freeze-drying techniques, Column chromatography, Thin Layer Chromatography.

UNIT:- II

- Gel Electrophoresis, HPLC, Radioisotope techniques in biology, Types and application of Microtome, Tissue fixation and complete procedure for staining, Biosensor and its application, Essential component and preparation of culture media, Sterilization, Inoculation & Microbial identification (bacteria, fungi).

UNIT:- III

- Organ ablation (ovariectomy, and adrenalectomy), Chromosome banding techniques, Human Karyotype preparation and its significance, Southern Blotting, Northern Blotting and Western Blotting, Polymerase Chain Reaction, DNA sequencing, Tissue culture techniques.

SUGGESTED MATERIAL

1. Introduction to instrumental analysis-Robert Braun-McGraw Hill.
2. A biologist Guide to principles and Techniques of Practical Biochemistry- K, Wilson and K.H. Goulding EIBSEdn.
3. Clark & Swizer. Experimental Biochemistry. Freeman, 2000.
4. Locquin and Langeron. Handbook of Microscopy. Butterwaths, 1983
5. Boyer. Modern Experimental Biochemistry. Benjamin, 1993


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6. Freifelder. Physical Biochemistry. Freeman, 1982.
7. Wilson and Wlaker. Practical Biochemistry. Cambridge, 2000.
8. Cooper. The Cell-A Molecular Approach. ASM, 1997
9. John R.W. Masters. Animal Cell culture- A practical approach. IRL Press.
10. Robert Braun. Introduction to instrumental analysis. McGrawHill

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Semester II

ZOOLOGY

Core Practicals 2

Paper-I to V Paper:

Animal Physiology and endocrinology

1. Differential leucocytes/ erythrocytes counting in blood
2. Determination of blood groups (ABO and Rh factor)
3. Determination of haemoglobin percentage in blood of rat/man.
4. Determination of clotting time of rat/human blood.
5. Determination of erythrocytes sedimentation rate of rat/human blood.
6. Demonstration of salivary digestion.
7. Detection of urea/uric acid: ammonia in the given sample.
8. Detection of abnormal constituents in urine.
9. Demonstration of endocrine glands in rat/mouse.
10. Demonstration of pregnancy through commercial kit (HCG).
11. Demonstration of insulin level in diabetic patients.
12. Preparation and study of histological slides of various endocrine glands.

Developmental Biology

1. Study of embryological slides.
2. Study of fate maps
3. Study of different stages of spermatogenesis and oogenesis
4. Study of electron micrograph of spermatogenesis and oogenesis.
5. Study of life cycle and developmental stages of *Drosophila melanogaster*. Study of Homeotic gene mutations and its effect on patterning (Four-winged fly).
6. Study of life cycle and developmental stages of Zebrafish.
7. Study of life cycle and developmental stages of *C. elegans*.
8. Study of tissue and developmental stage-specific expression of *Drosophila* developmental genes like engrailed, vestigial, wingless etc. by UAS/GAL4 system.
9. A study of patterning of *Drosophila* adult wing and demonstration of the effect of cell death on the patterning of the adult wing.
10. Identification and study of larval and prepupal wing, leg and eye antennal imaginal discs of *Drosophila*.
11. A study of polarity and regeneration in Hydra.
12. Study of developmental stages of chick embryo.


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13. Study of the Histological structure of different types of mammalian placenta
14. Study of placental development during foetal development in Humans by ultrasound scans
15. Study of testis and ovary of Rat
16. Studies on chick embryo using prepared slides.
17. Study of prepared slides of the developmental stages of Frog

Molecular cell biology

1. Practical based on membrane transport
2. Study of electron micrograph of cell organelles (Nucleus, Nucleolus, Ribosome, Endoplasmic reticulum, Mitochondria, Chloroplast, Microtubules, Micro filament)
3. Preparation of blood smear and identification of different type of cells.
4. Cell viability assay (Triple blue exclusion method).

Principle of ecology and Environmental physiology

A. Habitat studies:

1. Physical and chemical characteristics of soil.
2. Physico-chemical properties of water.

B. Community/ecosystem studies:

1. Assessment of density, frequency and abundance of plants/ animals in a community using various techniques, i.e. transect, quadrat etc.
2. Decomposition of various organic matters and nutrient release mechanisms/role of arthropods and other micro- and macro-fauna in decomposition.
3. Understanding ecosystem succession by studying various stages of vegetation/community assemblages' development.
4. Application of molecular techniques in ecological study.
5. Insect diversity in soil.
6. Identification of aquatic organisms of different trophic levels and construction of food chain and food web.
7. Different types of adaptation.

C. Landscape studies:

1. Principles of GIS, GPS and RS technology.
2. Interpretation (visual and automated) of remote sensing information for landscape differentiation.

Tools and Techniques in Biology

Comments upon the structure and application of Analytical Instruments

- i) Colorimeter
- ii) Spectrophotometer
- iii) Ultracentrifuge
- iv) ESR and NMR Spectrometer
- v) Microtome
- vi) HPLC


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