DEBRAJ ROY COLLEGE (AUTONOMOUS) FOUR YEARS UNDER GRADUATE PROGRAM (F.Y.U.G.P.)

SYLLABUS

FOR

Undergraduate Program in Zoology (NEP)

FYUGP 2024-25



Department of Zoology

Debraj Roy College

(An Autonomous College under Dibrugarh University)

Circuit House Road, Golaghat- 785621 (Assam)

VISION:

- To develop the Department as an interdisciplinary centre for learning, research, and innovation
- To develop the Department into a hub of Core Zoology and Biodiversity related research while making the surrounding a natural laboratory

MISSION:

- To provide a better understanding of Zoological Sciences through interaction with the natural environment and sensitizing the students about their social responsibilities
- To expose the learners to recent advances in Zoology and to provide high quality education with an emphasis on learning and research.

Objectives:

Students pursuing a B.Sc. (Major) in Zoology will gain a thorough understanding of discipline as well as associated biological sciences. They should have skills at the end of their graduation that will provide them a competitive advantage in pursuing higher education in India or overseas, as well as careers in academia, research, or industry.

PSO1: Acquire detailed knowledge on the extensive diversity of organisms, to identify, classify, and distinguish various life forms on earth. as well as understand the complexity of the various life-systems operating in these organisms.

PSO2: To explain the economic, ecological, and medical importance of different animals in human life and recognize the importance of conservation and encourage designing effective strategies to

address present conservation issues with preference to sustainable development.

PSO3: To acquire basic experimental skills in genetics, molecular biology, biotechnology, qualitative and quantitative microscopy, enzymology, and analytical biochemistry and to acquire skills in handling scientific instruments as part of practical courses, thereby warranting all-around growth.

PSO4: To gain the knowledge and skills to start their own businesses and apply the knowledge for self-sustenance allowing them to become successful entrepreneurs.Build foundations for novel thinking through application-based studies such as sericulture, apiculture and aquarium fish keeping

PSO5: To identify essential aspects in the management of wild animals as well as different approaches for estimating, remote sensing, and global positioning. PSO6:

Programme Outcomes

PO 1:Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more other disciplines that form a part of an undergraduate programme of study, and apply theoretical notions into practice in different forms

PO 2: Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, recognize the social structures underlying our society and engage with their social surroundings, problematize and raise questions based on academic inquiry

PO 3: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Develop soft skills

PO 4:Social Interaction: Ability to work effectively and respectfully with diverse teams; function as a collaborating member/leader in teams in multidisciplinary settings and facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause.

PO 5: Effective Citizenship: Act with an informed awareness of issues and engage in initiatives that encourage equity and growth for all

PO 6: Moral and Ethical Awareness: Ability to embrace moral/ ethical values in conducting one's life, possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

PO 7: Environment and Sustainability: Understand the issues of environmental contexts and sustainable development. And engage with their socio-cultural contexts along with environmental needs and concerns

PO 8: Self-directed and Life-long Learning: Acquire the ability to engage in independent and life- long learning and work on career enhancement and adapt to changing professional and societal needs

PO 9: Information and Digital Literacy: Capability to use ICT in a variety of learning situations. Demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.

PO 10: Research related skills: Ability to apply one's learning to real life situations. Ability to recognize cause and affect relationships, define problems, formulate hypotheses, interpret and draw conclusions

ANIMAL TAXONOMY & DIVERSITY OF NON-CHORDATES/ ZOOC101 (MAJOR)

Total Credits: 04 (3-0-1) Distribution of Marks: 60 (End Sem) + 40 (In-Sem) Theory 3 credits = 45 hours of Teaching Practical 1 credit = 30 hours of lab

Objective(s)

- 1. To know the general characters and classification of non-chordates and understand the increasing complexity of body forms.
- To acquaint the student with different taxonomic procedures and its application in faunal 2. identification.

Module I: Protista, Parazoa and Metazoa (4 Hours)

General characteristics and Classification up to classes; Study of Euglena, Amoeba and Paramecium, Life cycle and pathogenicity of Plasmodium vivax and Entamoeba histolytica. Module II: Porifera (3 Hours) General characteristics and Classification up to classes; Canal system and spicules in sponges Module III: Cnidaria (4 Hours) General characteristics and Classification up to classes, Metagenesis in Obelia, Polymorphism in Cnidaria, Corals and coral reefs. Module IV: Ctenophora (1 Hour) General characteristics and Classification up to Classes. Module V: Platyhelminthes (4 Hours) General characteristics and Classification up to classes. Life cycle and pathogenicity of Fasciola hepatica and Taenia solium Module VI: Nemathelminthes (4 Hours) General characteristics and Classification up to classes. Life cycle, and pathogenicity of Ascaris lumbricoides and Wuchereriabancrofti. Module VII: Annelida (4 Hours) Evolution of coelom and metamerism General characteristics and Classification up to classes. Reproduction, Regeneration, Excretion and Locomotion of Annelida. Module VIII: Arthropoda (4 Hours) General characteristics and Classification up to classes. Metamorphosis in Insects; Social life in bees and termites. Module IX: Onychophora (2 Hours) General characteristics and Classification up to classes, Evolutionary significance Module X: Mollusca (4 Hours) General characteristics and Classification up to classes, Pearl formation in bivalves; Trochophore larva, Torsion and detorsion in Gastropoda

Module XI: Echinodermata (3 Hours) General characteristics and Classification up to classes, Water-vascular system in Asteroidea,

Larval forms in Echinodermata

Module XII: Animal taxonomy (8 Hours)

Concept of taxonomy and Nomenclature, stages of taxonomy, Significance of taxonomy, Concept of Species (Typological, Biological, Nominalistic, Evolutionary & recognition), Kinds of species - sibling, sympatric, allopatric, syntopic, ring species, polytypic and monotypic species; Intraspecific groups (variety, morphs, subspecies, temporal subspecies, race and clines),

Taxonomic Classification; components, procedure (phenetic & cladistic), Taxonomic hierarchy; Different approaches of taxonomy viz. Morphotaxonomy, Cytotaxonomy, Chemotaxonomy, Numerical taxonomy, Molecular taxonomy, Taxonomic keys – types and their significance; Nomenclature (Bionomial and Trinomial Nomenclature); International code of Zoological Nomenclature (ICZN); Process of typification and Zoological types.

Note: Classification to be followed from "Ruppert and Barnes (2006) Invertebrate Zoology, 8th edition, Holt Saunders International Edition" for NEP, FYUGP Undergraduate Program in Zoology.

Suggested Readings:

- 1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition
- 2. Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
- 3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
- 4. Blackwelder, R.E. (1967): Taxonomy. John Willey & Sons Inc., New York.
- 5. Kapoor, V.C (2008): Theory and Practice of Animal Taxonomy. Oxford & IBH Publishing Co. Pvt Ltd
- 6. Mayer, E. (1991): Principles of Systematic Zoology. Tata Mc Graw Hill Publishing Co. Ltd., USA: New Delhi
- 7. Quicke, D.L.J. (1992): Principles and techniques of Contemporary taxonomy. Blackie Academic and Professional, London
- 8. Simpson, G. G. (2012): Principle of animal taxonomy. Scientific Publisher (India)

Online Tools and Web Resources:

1. Animal Diversity (<u>https://swayam.gov.in/courses/5686-animal-diversity</u>), Advances in Animal diversity, Systematics and Evolution (<u>https://swayam.gov.in/courses/5300-zoology</u>) Swayam (MHRD) Portal

2. ePGPathshala (MHRD) Module 184 of the paper on taxonomy (https://epgp.inflibnet.ac.in/ahl.php?csrno=35)

3. International Commission on Zoological Nomenclature (<u>https://www.iczn.org/the-code/the-code-online/</u>)

ANIMAL TAXONOMY & DIVERSITY OF NON-CHORDATES/ ZOOMIN101 (MINOR)

Total Credits: 04 (3-0-1) Distribution of Marks: 60 (End Sem) + 40 (In-Sem) Theory 3 credits = 45 hours of Teaching Practical 1 credit = 30 hours of lab

Objective(s)

- 3. To know the general characters and classification of Non-chordates and understand the increasing complexity of body forms.
- 4. To acquaint the student with different taxonomic procedures and its application in faunal identification.

Module I: Protista, Parazoa and Metazoa (4 Hours) General characteristics and Classification up to classes; Study of Euglena, Amoeba and Paramecium, Life cycle and pathogenicity of Plasmodium vivax and Entamoeba histolytica. Module II: Porifera (3 Hours) General characteristics and Classification up to classes; Canal system and spicules in sponges Module III: Cnidaria (4 Hours) General characteristics and Classification up to classes, Metagenesis in Obelia, Polymorphism in Cnidaria, Corals and coral reefs. Module IV: Ctenophora (1 Hour) General characteristics and Classification up to Classes. Module V: Platyhelminthes (4 Hours) General characteristics and Classification up to classes. Life cycle and pathogenicity of Fasciola hepatica and Taenia solium Module VI: Nemathelminthes (4 Hours) General characteristics and Classification up to classes. Life cycle, and pathogenicity of Ascaris lumbricoides and Wuchereriabancrofti. Module VII: Annelida (4 Hours) Evolution of coelom and metamerism General characteristics and Classification up to classes. Reproduction, Regeneration, Excretion and Locomotion of Annelida. Module VIII: Arthropoda (4 Hours) General characteristics and Classification up to classes. Metamorphosis in Insects; Social life in bees and termites. Module IX: Onychophora (2 Hours) General characteristics and Classification up to classes, Evolutionary significance

Module X: Mollusca (4 Hours)

General characteristics and Classification up to classes, Pearl formation in bivalves; Trochophore larva, Torsion and detorsion in Gastropoda

Module XI: Echinodermata (3 Hours)

General characteristics and Classification up to classes, Water-vascular system in Asteroidea, Larval forms in Echinodermata

Module XII: Animal taxonomy (8 Hours)

Concept of taxonomy and Nomenclature, stages of taxonomy, Significance of taxonomy, Concept of Species (Typological, Biological, Nominalistic, Evolutionary & recognition), Kinds of species – sibling, sympatric, allopatric, syntopic, ring species, polytypic and monotypic species; Intraspecific groups (variety, morphs, subspecies, temporal subspecies, race and clines), Taxonomic Classification; components, procedure (phenetic & cladistic), Taxonomic hierarchy; Different approaches of taxonomy viz. Morphotaxonomy, Cytotaxonomy, Chemotaxonomy, Numerical taxonomy, Molecular taxonomy, Taxonomic keys – types and their significance; Nomenclature (Bionomial and Trinomial Nomenclature); International code of Zoological Nomenclature (ICZN); Process of typification and Zoological types. Note: Classification to be followed from "Ruppert and Barnes (2006) Invertebrate Zoology, 8th edition, Holt Saunders International Edition" for NEP, FYUGP Undergraduate Program in Zoology.

Suggested Readings:

- 1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition
- 2. Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
- 3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
- 4. Blackwelder, R.E. (1967): Taxonomy. John Willey & Sons Inc., New York.
- 5. Mayer, E. (1991): Principles of Systematic Zoology. Tata Mc Graw Hill Publishing Co. Ltd., USA: New Delhi
- 6. Quicke, D.L.J. (1992): Principles and techniques of Contemporary taxonomy. Blackie Academic and Professional, London
- 7. Simpson, G. G. (2012): Principle of animal taxonomy. Scientific Publisher (India)

Online Tools and Web Resources:

1. Animal Diversity (<u>https://swayam.gov.in/courses/5686-animal-diversity</u>), Advances in Animal diversity, Systematics and Evolution (<u>https://swayam.gov.in/courses/5300-zoology</u>) Swayam (MHRD) Portal

2. ePGPathshala (MHRD) Module 184 of the paper on taxonomy (https://epgp.inflibnet.ac.in/ahl.php?csrno=35)

3. International Commission on Zoological Nomenclature (<u>https://www.iczn.org/the-code/the-code-online/</u>)

NATURAL RESOURCE MANAGEMENT/ ZOOGEC101 (Generic Elective Course)

Total Credits: 03 (3-0-0) Distribution of Marks: 60 (End Sem) + 40 (In-Sem) Theory 3 credits = 45 hours of Teaching **Objective(s)**

- 1. To provide knowledge to the students onimportance, sustainable utilization, conservation and management of natural resources.
- 2. To acquaint the student about the causes and control measures of contemporary global environmental issues with special reference to North East India.

Module I: Natural resources(5 Hours)

Definition and types. Naturalresources of NE India. Renewable and non-renewablesources of energy. Causes and consequences of resource depletion.

Module II: Sustainable utilization of land and water resources(7 Hours)

Soil degradation and management; water resources (Freshwater, marine, estuarine) wetlands;Threats and management strategies and their management.

Module III: Biodiversity(6 Hours)

Definition, types, Components of Biodiversity, significance, threats, management strategies; Concept, policies, strategy and practices (ex-situand in-situ conservation), CBD, Bioprospecting

Module IV: Contemporary practices in resource management (7 Hours)

EIA, GIS, Participatory Resource Appraisal, questionnaire survey, Ecological Footprint with emphasis on carbonfootprint, Resource Accounting; Waste management.National and international efforts in resourcemanagement and conservation, Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA)

Module V: Global Environmental Issues (10 Hours)

Global warming and climate change; environmental pollution, light pollution; natural resource depletion; wastedisposal; deforestation; biodiversity loss; ozone layer depletion; ocean warming and acidification; genetically modified organisms; nuclear hazards; migration; agriculture and environment; environmental management strategies.

Module VI: Environmental Issues of North East India(10 Hours)

Changes in forest cover, issues and concerns related to sacred forests and sacred groves; issues andproblems associated with shifting agriculture; industrialization; coal and lime stone mining,quarrying of sand from hills and rivers; environmental and socio-economic implications of megahydroelectric projects; floods, landslides and earthquakes.

Suggested Readings:

- 1. Vasudevan, N. (2006). Essentials of Environmental Science. Narosa Publishing House, New Delhi.
- 2. Singh, J. S., Singh, S.P. and Gupta, S. (2006). Ecology, Environment and ResourceConservation. Anamaya Publications, New Delhi.
- 3. Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008). An Introduction to Sustainable Development.Prentice Hall of India Private Limited, New Delhi.
- 4. Singh OP (2006). Environment and Natural Resources, Regency Publications, NewDelhi
- 5. Singh OP (2005). Mining Environment. Regency Publications, New Delhi
- 6. Saxena KG, Liang L and Rerkasem K (2007). Shifting Agriculture in Asia, BS MPSDehradun
- 7. Agarwal, K.M., Sikdar, P.K., Deb., S.C. 2005. A Text Book of Environment. Macmillan India Limited.
- 8. Klee, G.A. 1991. Conservation of Natural Resources. New Jersey: Prentice Hall Publ. Co
- 9. Nalini, K.S. 1993. Environmental Resources and Management. Anmol Publishers.

Online Tools and Web Resources:

- 1. Swayam (MHRD) Portal<u>https://onlinecourses.nptel.ac.in/noc22_ag10/preview</u>
- 2. ePG Pathshala (MHRD)<u>https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000014ER/P0</u> 00274/M026142/ET/1515492481Paper4module32_etext.pdf

FRESHWATER AQUACULTURE AND FISHERIES / ZOOSEC101 (Skill Enhancement Course)

Total Credits: 03 (2-0-1) Distribution of Marks: 60 (End Sem) + 40 (In-Sem) Theory 3 credits = 45 hours of Teaching Practical 1 credit = 30 hours of lab Objective(s)

1. To introduce the concept of freshwater aquaculture.

- 2. To understand the technique of fish rearing, transportation and the technique of induced breeding.
- 3. To explain the maintenance of fish health.

Module I: Introduction to Aquaculture(7 Hours)

Basic concept of extensive, intensive aquaculture, Fresh water bodies, Fresh water culture systems, Semi-closed culture system, monoculture, polyculture and integrated farming.

Module II: Culture of carp and cat fishes (8 Hours)

Rearing of carps, Carp hatchery system. Traditional and Chinese hatcheries, feed preparation for carps and catfishes, Live food culture, Transportation of fish seeds and brooders.

Module III: Induce breeding (8 Hours)

Concept of induced breeding, ornamental fish, Captive breeding of carp, catfishes, Diagnostic characters of brood fishes and ornamental fishes, Breeding of carps and catfishes

Module IV: Care and Maintenance(7 Hours)

Fish preservation and by-products, Fish diseases and their prophylactic measure, Fish quarantine

Practical

- 1. Collection and identification of locally available fishes and weeds
- 2. Study of fishing gears
- 3. Basic symptoms of fish diseases
- 4. Analysis of physico-chemicalparameters of pond
- 5. Demonstration of Induced Breeding

Suggested Readings:

- 1. D. Kapoor, R. Dayal and A.G. Ponniah: Fish Biodiversity of India, NBFGR Publication, Lucknow.
- 2. R.H. McConnell: Ecological Studies in Tropical Fish Communities, Cambridge University Press.
- 3. Packer B. (2014) Aquaponics System: A Practical Guide to Building and Maintaining Your Own Backyard Aquaponics.
- 4. Matty: Fish Endocrinology.
- 5. T.K. Govindan: Fish Processing Technology, Oxford & IBH, New Delhi
- 6. Fish and Fisheries S.S. Khanna
- 7. Fresh Water Aquaculture Rath
- 8. Hand Book of fish and Fisheries ICAR
- 9. Singh, N.P. & B. Santosh. Handbook of freshwater aquaculture. New India Publishing Agency
- 10. Arumugam, N. Aquaculture & Fisheries, Saras Publication
- 11. Christenson, K. Aquaculture: Introduction to Aquaculture for Small Farmers. Createspace Independent Publishing Platform

NEP, FYUGP II SEMESTER

DIVERSITY OF CHORDATES/ ZOOC201 (MAJOR)

Total Credits: 04 (3-0-1) Distribution of Marks: 60 (End Sem) + 40 (In-Sem) Theory 3 credits = 45 hours of Teaching Practical 1 credit = 30 hours of lab

Objective(s)

1. To know the Diversity of Chordata from lower to higher Chordates and their geographical distribution

- 2. To distinguish the unique characteristics as well as life functions of different chordate subphylum.
- 3. To evaluate the varied morphological, anatomical and physiological complexity in selected chordate organisms.
- 4. To analyse the various theories of animal distribution and their geographical realms.

Module I: Introduction to Chordates (3 Hours)

General characteristics and outline classification

Module II: Hemichordataand Protochordata(8 Hours)

General characteristics and classification of Hemichordata up to classes; Study of Balanoglossus.

General characteristics of Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressivemetamorphosis in Urochordata

ModuleIII: Origin of Chordata (3 Hours)

Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata

Module IV: Agnatha (2 Hours)

General characteristics and classification of cyclostomes up to class

Module V: Pisces (5 Hours)

General characteristics of Chondrichthyes and Osteichthyes, classification up to order Migration,Osmoregulation and Parentalcare in fishes

Module VI: Amphibia (5 Hours)

Origin of Tetrapoda (Evolution of terrestrial ectotherms); General characteristics and classification up to order; Parental care in Amphibians

Module VII: Reptilia (5 Hours)

General characteristics and classification up to order; Affinities of Sphenodon; Poison apparatus and Biting mechanism insnakes

Module VIII: Aves (5 Hours)

General characteristics and classification up to order Archaeopteryx- a connecting link; Principles and aerodynamics of flight,Flight adaptations and Migration in birds, Bird Acoustics. **Module IX**: Mammals (5 Hours)

General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotoryAppendages, Dentition and Ageing of Mammals

Module X: Zoogeography (4 Hours)

Zoogeographical realms, Theories pertaining todistribution of animals, Plate tectonic and Continentaldrift theory, distribution of vertebrates in different realms

Suggested Readings:

- 1. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford universitypress.
- 2. Pough H. Vertebrate life, VIII Edition, PearsonInternational.
- 3. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger PubCo.
- 4. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones andBartlett PublishersInc.
- 5. T.C. Majupuria. Introduction to Chordates, Pradeep Publications.
- 6. Zoogeography : the geographical distribution of Animals by

Practical:

Study of the following specimens:

Fishes

Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetrodon/ Diodon, Anabas, Flat fish Dissection of weberian ossicles of Mystus

Amphibia

Ichthyophis/Ureotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra

Reptilia

Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus.

Aves Study of six common birds from different orders. Types of beaks and claws.

Mammal

Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Erinaceous Pecten from Fowl head

DIVERSITY OF CHORDATES/ ZOOMIN201 (MINOR)

Total Credits: 04 (3-0-1) Distribution of Marks: 60 (End Sem) + 40 (In-Sem) Theory 3 credits = 45 hours of Teaching Practical 1 credit = 30 hours of lab

Objective(s)

1. To know the Diversity of Chordata from lower to higher Chordates and their geographical distribution

- 2. To distinguish the unique characteristics as well as life functions of different chordate subphylum.
- 3. To evaluate the varied morphological, anatomical and physiological complexity in selected chordate organisms.
- 4. To analyse the various theories of animal distribution and their geographical realms.

Module I: Introduction to Chordates (3 Hours)

General characteristics and outline classification

Module II: Hemichordataand Protochordata(8 Hours)

General characteristics and classification of Hemichordata up to classes; Study of Balanoglossus.

General characteristics of Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressivemetamorphosis in Urochordata

Module III: Origin of Chordata (3 Hours)

Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata

Module IV: Agnatha (2 Hours)

General characteristics and classification of cyclostomes up to class

Module V: Pisces (5 Hours)

General characteristics of Chondrichthyes and Osteichthyes, classification up to order Migration,Osmoregulation and Parentalcare in fishes

Module VI: Amphibia (5 Hours)

Origin of Tetrapoda (Evolution of terrestrial ectotherms); General characteristics and classification up to order; Parental care in Amphibians

Module VII: Reptilia (5 Hours)

General characteristics and classification up to order; Affinities of Sphenodon; Poison apparatus and Biting mechanism insnakes

Module VIII: Aves (5 Hours)

General characteristics and classification up to order Archaeopteryx- a connecting link; Principles and aerodynamics of flight,Flight adaptations and Migration in birds, Bird Acoustics. **Module IX**: Mammals (5 Hours)

General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotoryAppendages, Dentition and Ageing of Mammals

Module X: Zoogeography (4 Hours)

Zoogeographical realms, Theories pertaining todistribution of animals, Plate tectonic and Continentaldrift theory, distribution of vertebrates in different realms

Suggested Readings:

- 1. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
- 2. Pough H. Vertebrate life, VIII Edition, PearsonInternational.
- 3. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger PubCo.
- 4. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones andBartlett PublishersInc.
- 5. T.C. Majupuria. Introduction to Chordates, Pradeep Publications.
- 6. Zoogeography : the geographical distribution of Animals by
- 7. Darlington, Philip J. (Philip Jackson)

Practical:

Study of the following specimens:

Fishes

Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetrodon/ Diodon, Anabas, Flat fish Dissection of weberian ossicles of Mystus

Amphibia

Ichthyophis/Ureotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra

Reptilia

Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus.

Aves Study of six common birds from different orders. Types of beaks and claws.

Mammal

Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Erinaceous Pecten from Fowl head

WILD LIFE CONSERVATION AND MANAGEMENT/ ZOOGEC201 (Generic Elective Course)

Total Credits: 03 (3-0-0) Distribution of Marks: 60 (End Sem) + 40 (In-Sem) Theory 3 credits = 45 hours of Teaching **Objective(s)**

- 1. To introduce the concept of wildlife and its management
- 2. To explain the importance of wildlife and its conservation
- 3. To understand conservation tools and methods and understand the key issues of Conservation Science and Wildlife Management.

Module I: Introduction to Wildlife (7 Hours)

Basic definition of wildlife, Values of wild life, Threats to Wildlife; impact of climate change on wildlife, Importance of Conservation; Conservation Ethics, World Conservation Strategies.

Module II: Evaluation and Management of habitats (16 Hours)

Evaluation of wild life habitat (Physical and Biological Attributes like Topography, Geology, soil, Water, Food, Cover, Forage and Browse) Habitat, Remote Sensing and GIS in evaluation of wildlife habitat; succession in habitats, Setting back succession; Grazing logging; Mechanical treatment; Advancing the succession process; Cover construction; Preservation of general genetic diversity; Restoration of degraded habitats (Eco-restoration)

Module III: Population estimation (7 Hours)

Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation; Faecal analysis of ungulates and carnivores: Faecal samples, slide preparation, Hair identification, Pug marks and census method, Bio- telemetry.

Module IV: Management and planning of wild life in protected areas (9 Hours)

Concept of Protected area Network: National parks & sanctuaries and Tiger reserves, Community reserve; Important features of protected areas in India with special reference to NE India; Protected Area Management Plan; Estimation of carrying capacity; Eco tourism/wild life tourism in forests, Care of injured and diseased animal; Quarantine; Common diseases of wild animal, Management of invasive species, legal instruments of conservation, wetland protection act, WLPA 1972, Forest and Biodiversity act 2002.

Suggested Readings:

1. Caughley, G., and Sinclair, A.R.E. (1994). Wildlife Ecology and Management. Blackwell Science.

2. Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflictor Coexistence? Cambridge University.

3. Bookhout, T.A. (1996). Research and Management Techniques for Wildlife and Habitats, 5 th edition. The Wildlife Society,

Allen Press.

5. Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). Problem-Solving in Conservation Biology and Wildlife Management:Exercises for Class, Field, and Laboratory. Blackwell Publishing.

6. Wildlife Ecology, Conservation and Management by John M. Frysell

7. Wildlife Conservation and Management By Reena Mathur

8. Textbook of Wildlife Management by SK Singh

9. Hunter Jr ML and Gibbs JP (2007). Fundamentals of Conservation Biology (3rd Edition). Blackwell Publishing

ORNAMENTAL FISH AND AQUARIUM MANAGEMENT/ ZOO SEC201 (Skill Enhancement Course)

Total Credits: 03 (2-0-1) Distribution of Marks: 60 (End Sem) + 40 (In-Sem) Theory 3 credits = 45 hours of Teaching Practical 1 credit = 30 hours of lab

Objectives:

- 1. To introduce the concept of aquarium fish keeping.
- 2. To study ornamental fishes and their importance.
- 3. To learn the technique of fish feed preparation.
- 4. To learn acclimatization of fish.

Module I

(6 Hours)

Introduction: The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes

Module II

(10 Hours)

Studies of common ornamental fishes north-eastern region of India, Marine ornamental fishes (Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish, Botia, Gourami, Channa bleheri, Trichogasterfasciata

Channa barca

Module III

(7 Hours)

Food and feeding: Use of live fish feed organisms. Preparation and composition of formulated fish feeds Live fish transport - Fish handling, packing and forwarding techniques

Module IV

(7 Hours)

Transportation and maintenance: Preparation and General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry, Scope of aquarium fish industry in NE India

Module V

(20 marks)

Practicals

- 1) Preparation and management of aquarium environment
- 2) Collection and identification of ornamental fishes
- 3) Acclimatization of fish
- 4) Preparation of feed and Feeding of aquarium fish

Project Report Submission

- Presentation
- LEARNING OUTCOMES:

After the completion of this course, the learner will be able to:

- Rear fish in aquariums for entrepreneurship.

SUGGESTED READINGS

1. G. Helfman, Bruce B. Collette, D.E. Facey, B. W. Bowen: The Diversity of Fishes: Biology, Evolution, and Ecology, John Wiley & Sons

2. R. J. Wootton: Fish Ecology, Springer

3. W. Vishwanath, W.S. Lakra and U.K. Sarkar: Fishes of North East India, NBFGR Publication, Lucknow

- 4. Handbook of Fisheries and Aquaculture ICAR
- 5. Ornamental Fish culture and Aquarium Maintenance AO Dholakia

CELL BIOLOGY/ ZOOC301 (MAJOR)

Total Credits: 04 (3-0-1) Distribution of Marks: 60 (End Sem) + 40 (In-Sem) Theory 3 credits = 45 hours of Teaching Practical 1 credit = 30 hours of lab **Objective(s)** To make the students familiar with the functioning of the components of the cell the basic unit of life

Module I: Over view of Cells (2 hours)

Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions

Module II: Plasma Membrane (6 hours)

Various models of plasma membrane structure, Transport across membranes: Active and Passive transport, Facilitated transport, Cell junctions: Tight junctions, Desmosomes, Gap junctions

Module III: Endomembrane System (7 hours)

Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes, GERL system, Signal hypothesis

Module IV: Mitochondria, Chloroplast and Peroxisomes (8 hours)

Mitochondria and chloroplast: Structure, Semiautonomous nature, Endosymbiotic hypothesis, Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis, Functions of Chloroplast.

Structure and function of peroxisome

Module V: Cytoskeleton (2 hours)

Structure and Functions: Microtubules, Microfilaments and Intermediate filaments

Module VI: Nucleus (6 hours)

Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleolus, Chromatin: Euchromatin and Hetrochromatin and packaging (nucleosome), Nucleic acids (DNA, RNA)

Module VII: Cell Division (6 hours)

Mitosis, Meiosis, Cell cycle and its regulation, cell cycle inhibitors

Module VIII: Cell Signaling (8hours)

Cell signaling pathways, Intracellular signaling pathways: G protein-coupled receptor (GPCR) signaling, protein kinases and phosphatases, second messengers; Cell -cell recognition and adhesion.

Practical

1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis

- 2. Study of various stages of meiosis.
- 3. Study of polytene and metaphase chromosome

4. Preparation of permanent slide to show the presence of Barr-body in human female blood cells/cheek cells.

- 5. Study of unicellular eukaryotes
- 6. Preparation of permanent slide to demonstrate:

I DNA by Feulgen reaction

ii Mucopolysaccharides by PAS reaction

iii Proteins by Mercuro bromophenol blue/FastGreen

SUGGESTED READINGS

Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons.Inc.

De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.

Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.

Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.

Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008).Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.

COMPARATIVE ANATOMY OF CHORDATES/ ZOOC302 (MAJOR)

Total Credits: 04 (3-0-1) Distribution of Marks: 60 (End Sem) + 40 (In-Sem) Theory 3 credits = 45 hours of Teaching Practical 1 credit = 30 hours of lab

Objective(s)

To introduce and explain the anatomy of different systems in Vertebrates

To analyze the structural modifications in anatomy of different groups

Module I: Integumentary System (7 hours)

Structure, functions and derivatives of integument

Module II: Skeletal system (7 hours)

Overview of axial and appendicular skeleton, Jaw suspensorium, Evolution of Visceral arches

Module III: Digestive System and Urinogenital System (14 hours)

Comparative account of alimentary canal and associated glands in vertebrates, dentition. Succession of kidney, Evolution of urinogenital ducts, Types of mammalian **urinogenital** system

Module IV: Respiratory and Circulatory System (9 hours)

Skin, gills, lungs and air sacs; Accessory respiratory Organs, Comparative account of respiratory organs in fish, amphibians, birds and mammals, General plan of circulation, evolution of heart and aortic arches in vertebrates.

Module V: Nervous System and Sense Organ (8 hours)

Comparative account of brain, Autonomic nervous system, Spinal cord, Cranial nerves in mammals, Classification of receptors, chemoreceptors, mechanoreceptors and magnetoreception, Brief account of visual and auditory receptors in man. Brief account of auditory receptors in human.

Practicals:

Dissection of fish (carp) to study efferent and afferent branchial system (subject to permission)

Study of types scales in fishes (which is available) and preparation of permanent slides.

Study of Disarticulated skeleton of Frog, Varanus, Fowl, Rabbit

Study of carapace, plastron and skull of turtle / tortoise (which is available).

Study of mammalian and avian skulls: One herbivorous and one carnivorous animal

Study of structure of any two organs (heart, lung, kidney, eye and ear) from video recording (may be included if dissection not permitted)

SUGGESTED READINGS:

Kardong, K.V. (2005). Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The

McGraw-Hill Companies

Hilderbrand, M and Gaslow, G.E. Analysis of Vertebrate Structure, John Wiley and Sons Walter, H.E. and Sayles, L.P. Biology of Vertebrates, Khosla Publishing House

MAMMALIAN PHYSIOLOGY / ZOOMIN301 (MINOR)

Total Credits: 04 (3-0-1) Distribution of Marks: 60 (End Sem) + 40 (In-Sem) Theory 3 credits = 45 hours of Teaching Practical 1 credit = 30 hours of lab

Objective(s)

To introduce the concept of various forms of chordates and non-chordates To explain their classification and their structural anatomy.

Module I: Digestive System (6 hours)

Structure and function of digestive glands; Digestion and absorption of carbohydrates, fats and proteins

Module II: Tissue systems (12 hours)

Structure, location, classification, function of epithelial tissue, connective tissue, muscular tissue, nervous tissue. Types of bones in human body. Nerve and Muscle: Structure of neuron, Propagation of nerve impulse (myelinated and non-myelinated nerve fibre); Structure of skeletal muscle, Mechanism of muscle contraction (Sliding filament theory.

Module III: Respiratory and Cardiovascular Physiology (9 hours)

Pulmonary Ventilation, External and internal Respiration, Transport of oxygen and carbon dioxide in blood, Factors affecting transport of gases. Structure and anatomy of heart, Coordination of heartbeat, Cardiac cycle, ECG

Module IV: Renal and Reproductive Physiology (9 hours)

Structural anatomy of kidney, Mechanism and regulation of urine formation, Brief account of spermatogenesis and oogenesis, Menstrual cycle

Module V: Endocrine Physiology (9 hours)

Overview of endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas, adrenal; hormones secreted by them and their mechanism of action; Classification of hormones; Mode of hormone action, Placental hormones

Practicals:

Study of histological slides of lung, kidney, thyroid, pancreas, adrenal, testis, ovary

Preparation of temporary mount of Bloodfilm.

Preparation of haemin and haemochromogencrystals.

Estimation of haemoglobin using Sahli'shaemoglobinometer.

Study of permanent histological sections of

Suggested readings

Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition,

John Wiley and Sons, Inc. o Widmaier, E.P., Raff, H. and Strang, K.T. (2008). Vander's Human Physiology, XI Edition, McGraw Hill.

Guyton, A.C. and Hall, J.E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company.

Marieb, E. (1998). Human Anatomy and Physiology, IV Edition, Addison-Wesley. o Kesar, S. and Vashisht, N. (2007). Experimental Physiology, Heritage Publishers.

INSECT VECORS AND DISEASES/ ZOOGEC301 (Generic Elective Course)

Total Credits: 03 (3-0-0) Distribution of Marks: 60 (End Sem) + 40 (In-Sem) Theory 3 credits = 45 hours of Teaching

Course objectives

To understand the general features of insects

To examine the role of different insects in transmission of diseases

Module I: Introduction to insects (2 hours)

General features of insects; Morphological features- Head, Eyes, Antenna, Mouthparts

Module II: Concept of Vectors (5 hours)

Brief introduction of Carrier and Vectors (mechanical and biological vector), Reservoirs, Hostvector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity

Module III: Insect as vectors (8 hours)

Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

Module IV: Dipterans as important insect vectors (12 hours)

Mosquitoes, Sand fly, Houseflies; Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes Study of sand fly-borne diseases – Leishmaniasis, Phlebotomus fever; Control of Sand fly Study of house fly as important mechanical vector, Control of house fly

Module V: Siphonaptera and Siphunculata as disease vectors (10 hours)

Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases – Plague, Typhus fever; Control of fleas. Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louseborne diseases –Typhus fever.

Module VI: Hemiptera as Disease vectors (8 hours)

Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures

Suggested readings:

Imms, A.D. (1977). A General Text Book of Entomology.

Chapman & Hall, UK Chapman, R.F. (1998). The Insects: Structure and Function. IV Edition, Cambridge, University Press, UK

Pedigo L.P. (2002). Entomology and Pest Management. Prentice Hall Publication.

Board of Studies Meeting I

Department of Zoology, Debraj Roy College (Autonomous)

The Department of Zoology, Debraj Roy College (Autonomous), Golaghat, convened its first Board of Studies meeting on 6th July, 2024, to discuss the department's proposed syllabus of the FYUGP and PG courses. The meeting was presided over by Mr. Dhritiman Talukdar, Head of the Department and Chairperson of the Board and attended by VS nominee Dr. Rimen Bordoloi (Retd. Associate prof. Debraj Roy College), three subject experts Mr. Nilabh Bhuyan (J.B. University), Dr. Manuj Kr. Bharali (Gauhati University), Dr. Narayan Sharma (Cotton University), alumni member Dr. Amarendra Nath Dutta and corporate member Mr. Nayanmoni Barua along with the faculty members of the department namely, Dr. Rajeev Basumatary, Dr. Pavitra Chutia, Dr. Khirod Deori and Dr. Samrat Sengupta. The meeting suggested various modifications in the draft syllabus and accepted the modified syllabus of Semester I, II and III.