FYUGP-CBCS

NOWGONG COLLEGE

(Autonomous)

SYLLABUS

Department of Zoology

Learning Outcome-based Curriculum Framework (LOCF) of

Four Year Undergraduate Programme

Choice-based Credit System with flexibility

Effective from Academic Year 2023-24

Syllabus is approved in Academic Council, Nowgong College (Autonomous)

Dated: 30th June, 2023

Course and Credit Structure

Semester	Major (Maj)	Minor (Min)	Inter-Disciplinary	AEC	SEC	VAC (Any Two in each Semseter)		Research project/ Dissertation/ Internship	Total
I	ZOOL-MAJ-1014 (Non Cordates)	ZOOL-MIN-1014 (Non Cordates)	ZOOL-IDC-1014 (Non Cordates)	ASSA/HIND/BENG-AEC-1012 Jugajogmulok Axomiya/ Vyakaran Evam Vyavaharik Hindi/Byowohari c Bangla – I Business English: Networking (Online)	ZOOL-SEC-1014 (Ornamental fish & fisheries)	UNIN-VAC-1012 (Understanding India) ENSC-VAC-1012 (Environmental Science) NASS-VAC-1012 (National Service Scheme) Online Courses: 1. OUFU-VAC-1012 Our Energy Future 2. PHSR-VAC-1012 Philosophy, Science and Religion 3. MOTH-VAC-1012 Model Thinking (Any Two)		Students exiting the program after securing 44 credits will be awarded UG certificate in the relevant discipline/ subject provided they secure additional 4 credits in work based Vocation Courses offering during summer term for internship/ apprenticeship in addition to 6 credits from Skill based Courses earned during 1st & 2nd	22
II	ZOOL-MAJ-2014 (Chordates)	ZOOL-MIN-2014 (Chordates)	ZOOL-IDC-2014 (Chordates)	**Offline Courses:** ENGL-AEC-2012 (English and Mass Communication	ZOOL-SEC-2014 (Non-mulberry sericulture) **Online Courses:** Fundamental Skills on Python	**Offline Courses:** DITS-VAC-2012 (Digital Technological Solutions) YOMH-VAC-2012 (Yoga and Mental Health) NACC-VAC-2012 (National Cadet Corps)			22

				) **Online Courses:** Business English: Management and Leadership (Infosys Springboard)	Programming & IoT (Infosys Springboard)	**Online Courses:** Fundamental of Artificial Intelligence (Infosys Springboard) **(Any Two)**		Semester	
Certificate after 1 year (Total Credit = 44)									
III	ZOOL-MAJ-3014 (Principles of Ecology) ZOOL-MAJ-3024 (Animal cell structure and organelles)	ZOOL-MIN-3014 (Principles of Ecology)	ZOOL-IDC-3014 (Principles of Ecology)	ASSA/HIND/BENG -AEC-3012 Byowoharic Axomiya/ Karyalayi Hindi /Byowoharic Bangla – II	XXXX-SEC-3014	----------		Students exiting the program after securing 88 credits will be awarded UG Diploma in the relevant discipline/ subject provided they secure additional 4 credits in Skill based Vocation Courses offered 2nd year summer	22
IV	ZOOL-MAJ-4014 (Comparative anatomy of vertebrates) ZOOL-MAJ-4024 (Theories and Principle of Genetics) ZOOL-MAJ-4034 (Animal Physiology)	ZOOL-MIN-4014 (Comparative anatomy of vertebrates)		ENGL-AEC-4012 (Academic Writing)	----------	----------			22

	ZOOL-MAJ-4044 (Developmental biology)							term.	
Diploma after 2 years (Total Credit = 88)									
V	ZOOL-MAJ-5014 (Wildlife conservation and management) ZOOL-MAJ-5024 (Fundamentals of Biochemistry) ZOOL-MAJ-5034 (Molecular Biology) ZOOL-MAJ-5034 (Molecular Biology)	ZOOL-MIN-5014 (Physiology and Biochemistry)	--------	----------	----------	----------		ZOOL – INTE-5012 (Internship)	22
VI	ZOOL -MAJ-6014 (Immunology) ZOOL -MAJ-6024 (Biochemistry and Metabolic process) ZOOL -MAJ-6034 (Animal Behavior and Chronobiology) ZOOL -MAJ-6044 (Evolutionary Biology and Bioinformatics) ZOOL-MAJ-6052 (Project/ Dissertation)	ZOOL-MIN-6014 (Genetics)	----------	----------	----------	----------		----------	22
Degree after 3 years (with Major/Minor) (Total Credit = 132)									

VII	ZOOL -MAJ-7014 (Biostatistics and genetic Engineering) ZOOL -MAJ-7024 (Insect Vector and	ZOOL-MIN-7014 (Evolutionary Biology)	----------	----------	----------	REET-VAC-7012 (Research Ethics)		REME - MAJ-7044 (Research Methodology)	22

	Diseases) ZOOL -MAJ-7034 (Endocrinology)								
VIII	ZOOL -MAJ-8014 (Instrumentation and techniques in Biology)	ZOOL-MIN-8014 (Wildlife Conservation and Management)	----------	----------	----------	INPR-VAC-8012 (Intellectual Property Right)		ZOOL-DISS-80112 (Dissertation) (Those who are undertaking Research Project or Dissertation) OR ZOOL-MAJ -8024 (Aquatic Biology) ZOOL-MAJ -8034 (Reproductive Biology) ZOOL-MAJ -8044 (Entomology) (Those who are not undertaking Research Project or Dissertation)	22
Degree after 4 years (with Honours/ by Research) (Total Credit = 176)									176

N.B.: 1. 4 credit papers = 100 marks (60T+20IA+20P)
2. 2 credit papers (except AEC) = 50 marks (30T+10IA+10P)

3. 2 credit papers (Only AEC) = 50 marks (40T+10IA)

Question Pattern:

- For 100 marks papers [1 marks x 7 (no option) , 2 marks x 4(no option) , 5 marks x 3 (5 options), 10 marks x 3 (5 options)]
- For 50 marks papers [1marks x 4 (no option), 2 marks x 3 (no option), 5 marks x 2 (4 options), 10 marks x 1 (2 options)]
- For AEC 50 marks papers [1 marks x 4 (no options) , 2 marks x 3 (no options), 5 marks x 2 (4 options), 10 marks x 2 (4 options)]

Details of Semester-Wise Courses

Major Course (MAJ) papers

ZOOL-MAJ-1014 - Non-Chordates (Theory+ Practical)
ZOOL-MAJ-2014 - Chordates (Theory+ Practical)
ZOOL-MAJ-3014 - Principles of Ecology (Theory+ Practical)
ZOOL-MAJ-3024 - Animal cell structure and organelles (Theory+ Practical)
ZOOL -MAJ-4014 - Comparative anatomy of vertebrates (Theory +Practical)
ZOOL-MAJ-4024 – Theories and Principle of Genetics (Theory+ Practical)
ZOOL -MAJ-4034- Animal Physiology (Theory+ practical)
ZOOL-MAJ-4044 - Developmental biology (Theory+ Practical)
ZOOL -MAJ-5014 - Wildlife conservation and management (Theory+ Practical)
ZOOL -MAJ-5024 - Fundamentals of Biochemistry (Theory+ Practical)
ZOOL -MAJ-5034 - Molecular Biology (Theory+ Practical)
ZOOL -MAJ-5044 - Parasitology (Theory+ Practical)
ZOOL -MAJ-6014 - Immunology (Theory+ Practical)
ZOOL -MAJ-6024 - Biochemistry and Metabolic process (Theory+ Practical)
ZOOL -MAJ-6034 - Animal Behavior and Chronobiology (Theory+ Practical)
ZOOL -MAJ-6044 - Evolutionary Biology and Bioinformatics (Theory+ Practical)
ZOOL-MAJ-6052 – Project
ZOOL -MAJ-7014 - Biostatistics and genetic Engineering (Theory+ Practical)
ZOOL -MAJ-7024 - Insect Vector and Diseases (Theory+ Practical)
ZOOL -MAJ-7034 - Endocrinology (Theory+ Practical)
REME-MAJ-7044 –Research Methodology
ZOOL -MAJ-8014 -Instrumentation and Techniques in Biology (Theory+ Practical)

ZOOL-DISS-80112 - Dissertation (Work+ Presentation) (Those who are undertaking Research Project or Dissertation)

ZOOL-MAJ -8024 - Aquatic Biology (Theory+ Practical) (Those who are not undertaking Research Project or Dissertation)

ZOOL-MAJ -8034 - Reproductive Biology (Theory+ Practical) (Those who are not undertaking Research Project or Dissertation)

ZOOL-MAJ -8044 - Entomology (Theory+ Practical) (Those who are o not undertaking Research Project or Dissertation)

Minor Papers (MIN) to be offered to other Departments/Disciplines

ZOOL-MIN-1014 - Non-Chordates (Theory+ Practical)
ZOOL-MIN-2014 - Chordates (Theory+ Practical)
ZOOL-MIN-3014 - Principles of Ecology (Theory+ Practical)
ZOOL-MIN-4014 - Comparative anatomy of vertebrates (Theory +Practical)
ZOOL-MIN-5014 – Physiology and Biochemistry (Theory+ Practical)
ZOOL-MIN-6014 - Genetics (Theory+ Practical)
ZOOL-MIN-7014 – Evolutionary Biology (Theory+ Practical)
ZOOL-MIN-8014 - Wildlife Conservation and Management (Theory+ Practical)

Inter-Disciplinary Paper (IDC)

ZOOL-IDC-1014 - Non-Chordates (Theory+ Practical)
ZOOL-IDC-2014 - Chordates (Theory+ Practical)
ZOOL-IDC-3014 - Principles of Ecology (Theory+ Practical)

Skill Enhancement Course (SEC)

ZOOL-SEC-1014 - Ornamental fish & fisheries (Theory+ Practical/Presentation)
ZOOL-SEC-2014 - Non-mulberry sericulture (Theory+ Practical/Presentation)

SEMESTER: I
Course Code: ZOOL-MAJ-1014
Course Paper: NON-CHORDATES
Paper Credit: 04 (3T+1P)

Total No. of Lectures: 45L + 15P **Total Marks=100 (T60 + IA20 + P20)**

Objectives:

The course would provide an insight to the learner about the existence of different life forms on the Earth and appreciate the diversity of animal life. It will help the student to understand the features of Kingdom Animalia and systematic organization of the animals based on their evolutionary relationships, structural and functional affinities along with basic concept of taxonomy. The course will also make the students aware about the characteristic morphological and anatomical features of diverse animals;

Learning Outcome:

Upon completion of the course, students should be able to:

- Learn about the importance of systematic, taxonomy, nomenclature, biological classification, and structural organization of invertebrate animals.
- The diversity of non-chordates living in varied habit and habitats.
- Understand evolutionary history and relationships of different non-chordates through functional and structural affinities.
- Critically analyze the organization, complexity, and characteristic features of non-chordates making them familiarize with the morphology and anatomy of representatives of various animal phyla.

CONTENT:

Theory:

UNIT 1:

Protista, Parazoa, and Metazoa: General characteristics and Classification up to classes, Study of Euglena, Amoeba, and Paramecium, Life cycle and pathogenicity of *Plasmodium vivax* and *Entamoeba histolytica.* Locomotion and Reproduction in Protista Evolution of symmetry and segmentation of Metazoa

UNIT 2:

Porifera: General characteristics and Classification up to classes. Canal system in sponges.

Cnidaria: General characteristics and Classification up to classes, Metagenesis in Obelia, Polymorphism in Cnidaria, Corals, and coral reefs, General characteristics of Ctenophora and its evolutionary significance.

UNIT 3:

Helminthes: General characteristics and Classification of Platyhelminthes and nemathelminthes up to classes, Parasitic adaptations in helminthes.

Annelida: General characteristics and Classification up to classes, Coelomoducts, and Nephridia in Annelids.

Arthropoda: General characteristics and Classification up to classes, Metamorphosis in Insects.

UNIT 4:

Mollusca: General characteristics and Classification up to classes. Respiration in Mollusca, Torsion, and detorsion in Gastropoda, Pearl formation in bivalves.

Echinodermata: General characteristics and Classification up to classes. Affinities of Echinodermata with Chordates.

Practical/ Presentation

Study of whole mount of *Euglena, Amoeba,* and *Paramecium,* binary fission and conjugation in *Paramecium.*

Study of *Sycon* (T.S. and L.S.), *Hyalonema, Euplectella, Spongilla.*

Study of *Obelia, Physalia, Millepora, Aurelia, Tubipora, Corallium, Alcyonium, Gorgonia, Metridium, Pennatula, Fungia, Meandrina,Madrepora, Beroe.*

Study of adult *Fasciola hepatica, Taenia solium* and *Ascaris lumbricoides.*

Annelids- *Aphrodite, Nereis, Heteronereis, Sabella, Serpula, Chaetopterus, Pheretima, Hirudinaria.*

Arthropods - *Limulus*, *Palamnaeus, Palaemon, Daphnia*, *Balanus*, *Sacculina*, *Cancer*, *Eupagurus*, *Scolopendra*, *Julus*, *Bombyx*, *Periplaneta,* Termites and Honey bees, Onychophora – (*Peripatus*).

Molluscs - *Chiton, Dentalium, Pila, Doris, Helix, Unio, Ostrea, Pinctada, Sepia, Octopus, Nautilus.*

Echinodermates- *Pentaceros /Asterias, Ophiura, Clypeaster, Echinus, Cucumari a*and *Antedon.*

Mount of mouth parts and dissection of digestive system and nervous system of *Periplaneta.*

Note: Classification to be followed from "Ruppert and Barnes (2006) *Invertebrate Zoology*, 8th edition, Holt Saunders International Edition" and Young, J. Z. (2004)

Suggested Readings:

Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.

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.

Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson.

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SEMESTER: 2
Course Code: ZOOL-MAJ-2014
Course Paper: CHORDATES
Paper Credit: 04 (3T+1P)
Total No. of Lectures: 45L + 15P **Total Marks=100 (T60 + IA20 + P20)**

Objectives:

The course would provide an insight to the learner about the existence of different life forms on the Earth, and appreciate the diversity of animal life. It will help the student to understand the features of Kingdom Animalia and systematic organisation of the animals based on their evolutionary relationships, structural and functional affinities. The course will also make the students aware about the characteristic morphological and anatomical features of diverse animals;

Learning Outcome:

Upon completion of the course, students should be able to:

- Learn about the importance of systematics and structural organization of animals.
- Appreciate the diversity of chordates living in varied habit and habitats.
- Understand evolutionary history and relationships of different chordates through functional and structural affinities.
- Critically analyse the organization, complexity and characteristic features of chordates making them familiarize with the morphology and anatomy of representatives of various animal phyla.

CONTENT:

Theory

UNIT 1:

Chordata: General characteristics and outline classification of Chordata, Dipleurula concept of origin of chordate, General characteristics and classification of Protochordata. (Hemichordata, Urochordata and Cephalochordata); Retrogressive metamorphosis in Urochordata, Affinities of Hemichordata.

UNIT 2:

Agnatha: General characteristics and classification of cyclostomes up to class.

Pisces: General characteristics of Chondrichthyes and Osteichthyes, classification up to order, Migration, Parental care in fishes.

UNIT 3:

Amphibia: Origin of Tetrapoda, General characteristics and classification up to order; Parental care in Amphibians.

Reptilia: General characteristics and classification up to order; Affinities of Sphenodon; Poison apparatus and biting mechanism in snakes.

UNIT 4:

Aves: General characteristics and classification up to order, Archaeopteryx- a connecting link; flight mechanism, Perching mechanism, flight adaptations and air sacs in birds.

Mammals: General characters and classification up to order; affinities of Prototheria.

Practical/ Presentation

Study of following specimens:

Protochordata: *Balanoglossus, Herdmania, Branchiostoma,* Colonial Urochordata Sections of *Balanoglossus*, *Amphioxus.*

Agnatha: *Petromyzon, Myxine.*

Fishes: *Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes,Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetrodon, Anabas,* Flat fish.

Dissection*:* Mount of weberian ossicles of *fish.*

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.

Mammalia: *Sorex*, Bat (Insectivorous and Frugivorous), *Funambulus, Loris, Herpestes, Erinaceous.*

Note: Classification to be followed from "Ruppert and Barnes (2006) *Invertebrate Zoology*, 8th edition, Holt Saunders International Edition" and Young, J. Z. (2004)

Suggested Readings

Young, J.Z.(2004).The Life of Vertebrates. III Edition. Oxford university press.

Pough H. Vertebrate life, VIII Edition, Pearson International.

Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.

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SEMESTER: I
Course Code: ZOOL-MIN-1014
Course Paper: NON-CHORDATES
Paper Credit: 04 (3T+1P)

Total No. of Lectures: 45L + 15P **Total Marks=100 (T60 + IA20 + P20)**

Objectives:

The course would provide an insight to the learner about the existence of different life forms on the Earth and appreciate the diversity of animal life. It will help the student to understand the features of Kingdom Animalia and systematic organization of the animals based on their evolutionary relationships, structural and functional affinities along with basic concept of taxonomy. The course will also make the students aware about the characteristic morphological and anatomical features of diverse animals;

Learning Outcome:

Upon completion of the course, students should be able to:

- Learn about the importance of systematic, taxonomy, nomenclature, biological classification, and structural organization of invertebrate animals.
- The diversity of non-chordates living in varied habit and habitats.
- Understand evolutionary history and relationships of different non-chordates through functional and structural affinities.
- Critically analyze the organization, complexity, and characteristic features of non-chordates making them familiarize with the morphology and anatomy of representatives of various animal phyla.

CONTENT:

Theory:

UNIT 1:

Protista, Parazoa, and Metazoa: General characteristics and Classification up to classes, Study of Euglena, Amoeba, and Paramecium, Life cycle and pathogenicity of *Plasmodium vivax* and *Entamoeba histolytica.* Locomotion and Reproduction in Protista Evolution of symmetry and segmentation of Metazoa

UNIT 2:

Porifera: General characteristics and Classification up to classes. Canal system in sponges.

Cnidaria: General characteristics and Classification up to classes, Metagenesis in Obelia, Polymorphism in Cnidaria, Corals, and coral reefs, General characteristics of Ctenophora and its evolutionary significance.

UNIT 3:

Helminthes: General characteristics and Classification of Platyhelminthes and nemathelminthes up to classes, Parasitic adaptations in helminthes.

Annelida: General characteristics and Classification up to classes, Coelomoducts, and Nephridia in Annelids.

Arthropoda: General characteristics and Classification up to classes, Metamorphosis in Insects.

UNIT 4:

Mollusca: General characteristics and Classification up to classes. Respiration in Mollusca, Torsion, and detorsion in Gastropoda, Pearl formation in bivalves.

Echinodermata: General characteristics and Classification up to classes. Affinities of Echinodermata with Chordates.

Practical/ Presentation

Study of whole mount of *Euglena, Amoeba,* and *Paramecium,* binary fission and conjugation in *Paramecium.*

Study of *Sycon* (T.S. and L.S.), *Hyalonema, Euplectella, Spongilla.*

Study of *Obelia, Physalia, Millepora, Aurelia, Tubipora, Corallium, Alcyonium, Gorgonia, Metridium, Pennatula, Fungia, Meandrina,Madrepora, Beroe.*

Study of adult *Fasciola hepatica, Taenia solium* and *Ascaris lumbricoides.*

Annelids- *Aphrodite, Nereis, Heteronereis, Sabella, Serpula, Chaetopterus, Pheretima, Hirudinaria.*

Arthropods - *Limulus*, *Palamnaeus, Palaemon, Daphnia*, *Balanus*, *Sacculina*, *Cancer*, *Eupagurus*, *Scolopendra*, *Julus*, *Bombyx*, *Periplaneta,* Termites and Honey bees, Onychophora – (*Peripatus*).

Molluscs - *Chiton, Dentalium, Pila, Doris, Helix, Unio, Ostrea, Pinctada, Sepia, Octopus, Nautilus.*

Echinodermates- *Pentaceros /Asterias, Ophiura, Clypeaster, Echinus, Cucumari a*and *Antedon.*

Mount of mouth parts and dissection of digestive system and nervous system of *Periplaneta.*

Note: Classification to be followed from "Ruppert and Barnes (2006) *Invertebrate Zoology*, 8th edition, Holt Saunders International Edition" and Young, J. Z. (2004)

Suggested Readings:

Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.

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.

Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson.

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SEMESTER: 2
Course Code: ZOOL-MIN-2014
Course Paper: CHORDATES
Paper Credit: 04 (3T+1P)
Total No. of Lectures: 45L + 15P **Total Marks=100 (T60 + IA20 + P20)**

Objectives:

The course would provide an insight to the learner about the existence of different life forms on the Earth, and appreciate the diversity of animal life. It will help the student to understand the features of Kingdom Animalia and systematic organization of the animals based on their evolutionary relationships, structural and functional affinities. The course will also make the students aware about the characteristic morphological and anatomical features of diverse animals;

Learning Outcome:

Upon completion of the course, students should be able to:

- Learn about the importance of systematics and structural organization of animals.
- Appreciate the diversity of chordates living in varied habit and habitats.
- Understand evolutionary history and relationships of different chordates through functional and structural affinities.
- Critically analyze the organization, complexity and characteristic features of chordates making them familiarize with the morphology and anatomy of representatives of various animal phyla.

CONTENT:

Theory

UNIT 1:

Chordata: General characteristics and outline classification of Chordata, Dipleurula concept of origin of chordate, General characteristics and classification of Protochordata. (Hemichordata, Urochordata and Cephalochordata); Retrogressive metamorphosis in Urochordata, Affinities of Hemichordata.

UNIT 2:

Agnatha: General characteristics and classification of cyclostomes up to class.

Pisces: General characteristics of Chondrichthyes and Osteichthyes, classification up to order, Migration, Parental care in fishes.

UNIT 3:

Amphibia: Origin of Tetrapoda, General characteristics and classification up to order; Parental care in Amphibians.

Reptilia: General characteristics and classification up to order; Affinities of Sphenodon; Poison apparatus and biting mechanism in snakes.

UNIT 4:

Aves: General characteristics and classification up to order, Archaeopteryx- a connecting link; flight mechanism, Perching mechanism, flight adaptations and air sacs in birds.

Mammals: General characters and classification up to order; affinities of Prototheria.

Practical/ Presentation

Study of following specimens:

Protochordata: *Balanoglossus, Herdmania, Branchiostoma,* Colonial Urochordata Sections of *Balanoglossus*, *Amphioxus.*

Agnatha: *Petromyzon, Myxine.*

Fishes: *Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes,Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetrodon, Anabas,* Flat fish.

Dissection*:* Mount of weberian ossicles of *fish.*

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.

Mammalia: *Sorex*, Bat (Insectivorous and Frugivorous), *Funambulus, Loris, Herpestes, Erinaceous.*

Note: Classification to be followed from "Ruppert and Barnes (2006) *Invertebrate Zoology*, 8th edition, Holt Saunders International Edition" and Young, J. Z. (2004)

Suggested Readings:

Young, J.Z.(2004).The Life of Vertebrates. III Edition. Oxford university press.

Pough H. Vertebrate life, VIII Edition, Pearson International.

Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.

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SEMESTER: I
Course Code: ZOOL-IDC-1014
Course Paper: NON-CHORDATES
Paper Credit: 04 (3T+1P)

Total No. of Lectures: 45L + 15P **Total Marks=100 (T60 + IA20 + P20)**

Objectives:

The course would provide an insight to the learner about the existence of different life forms on the Earth and appreciate the diversity of animal life. It will help the student to understand the features of Kingdom Animalia and systematic organization of the animals based on their evolutionary relationships, structural and functional affinities along with basic concept of taxonomy. The course will also make the students aware about the characteristic morphological and anatomical features of diverse animals;

Learning Outcome:

Upon completion of the course, students should be able to:

- Learn about the importance of systematic, taxonomy, nomenclature, biological classification, and structural organization of invertebrate animals.
- The diversity of non-chordates living in varied habit and habitats.
- Understand evolutionary history and relationships of different non-chordates through functional and structural affinities.
- Critically analyze the organization, complexity, and characteristic features of non-chordates making them familiarize with the morphology and anatomy of representatives of various animal phyla.

CONTENT:

Theory:

UNIT 1:

Protista, Parazoa, and Metazoa: General characteristics and Classification up to classes, Study of Euglena, Amoeba, and Paramecium, Life cycle and pathogenicity of *Plasmodium vivax* and *Entamoeba histolytica.* Locomotion and Reproduction in Protista Evolution of symmetry and segmentation of Metazoa

UNIT 2:

Porifera: General characteristics and Classification up to classes. Canal system in sponges.

Cnidaria: General characteristics and Classification up to classes, Metagenesis in Obelia, Polymorphism in Cnidaria, Corals, and coral reefs, General characteristics of Ctenophora and its evolutionary significance.

UNIT 3:

Helminthes: General characteristics and Classification of Platyhelminthes and nemathelminthes up to classes, Parasitic adaptations in helminthes.

Annelida: General characteristics and Classification up to classes, Coelomoducts, and Nephridia in Annelids.

Arthropoda: General characteristics and Classification up to classes, Metamorphosis in Insects.

UNIT 4:

Mollusca: General characteristics and Classification up to classes. Respiration in Mollusca, Torsion, and detorsion in Gastropoda, Pearl formation in bivalves.

Echinodermata: General characteristics and Classification up to classes. Affinities of Echinodermata with Chordates.

Practical/ Presentation

Study of whole mount of *Euglena, Amoeba,* and *Paramecium,* binary fission and conjugation in *Paramecium.*

Study of *Sycon* (T.S. and L.S.), *Hyalonema, Euplectella, Spongilla.*

Study of *Obelia, Physalia, Millepora, Aurelia, Tubipora, Corallium, Alcyonium, Gorgonia, Metridium, Pennatula, Fungia, Meandrina,Madrepora, Beroe.*

Study of adult *Fasciola hepatica, Taenia solium* and *Ascaris lumbricoides.*

Annelids- *Aphrodite, Nereis, Heteronereis, Sabella, Serpula, Chaetopterus, Pheretima, Hirudinaria.*

Arthropods - *Limulus*, *Palamnaeus, Palaemon, Daphnia*, *Balanus*, *Sacculina*, *Cancer*, *Eupagurus*, *Scolopendra*, *Julus*, *Bombyx*, *Periplaneta,* Termites and Honey bees, Onychophora – (*Peripatus*).

Molluscs - *Chiton, Dentalium, Pila, Doris, Helix, Unio, Ostrea, Pinctada, Sepia, Octopus, Nautilus.*

Echinodermates- *Pentaceros /Asterias, Ophiura, Clypeaster, Echinus, Cucumari a*and *Antedon.*

Mount of mouth parts and dissection of digestive system and nervous system of *Periplaneta.*

Note: Classification to be followed from "Ruppert and Barnes (2006) *Invertebrate Zoology*, 8th edition, Holt Saunders International Edition" and Young, J. Z. (2004)

Suggested Readings:

Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.

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.

Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson.

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SEMESTER: 2
Course Code: ZOOL-IDC-2014
Course Paper: CHORDATES
Paper Credit: 04 (3T+1P)
Total No. of Lectures: 45L + 15P **Total Marks=100 (T60 + IA20 + P20)**

Objectives:

The course would provide an insight to the learner about the existence of different life forms on the Earth, and appreciate the diversity of animal life. It will help the student to understand the features of Kingdom Animalia and systematic organization of the animals based on their evolutionary relationships, structural and functional affinities. The course will also make the students aware about the characteristic morphological and anatomical features of diverse animals;

Learning Outcome:

Upon completion of the course, students should be able to:

- Learn about the importance of systematics and structural organization of animals.
- Appreciate the diversity of chordates living in varied habit and habitats.
- Understand evolutionary history and relationships of different chordates through functional and structural affinities.
- Critically analyze the organization, complexity and characteristic features of chordates making them familiarize with the morphology and anatomy of representatives of various animal phyla.

CONTENT:

Theory

UNIT 1:

Chordata: General characteristics and outline classification of Chordata, Dipleurula concept of origin of chordate, General characteristics and classification of Protochordata. (Hemichordata, Urochordata and Cephalochordata); Retrogressive metamorphosis in Urochordata, Affinities of Hemichordata.

UNIT 2:

Agnatha: General characteristics and classification of cyclostomes up to class.

Pisces: General characteristics of Chondrichthyes and Osteichthyes, classification upto order, Migration, Parental care in fishes.

UNIT 3:

Amphibia: Origin of Tetrapoda, General characteristics and classification upto order; Parental care in Amphibians.

Reptilia: General characteristics and classification up to order; Affinities of Sphenodon; Poison apparatus and biting mechanism in snakes.

UNIT 4:

Aves: General characteristics and classification up to order, Archaeopteryx- a connecting link; flight mechanism, Perching mechanism, flight adaptations and air sacs in birds.

Mammals: General characters and classification up to order; affinities of Prototheria.

Practical/ Presentation

Study of following specimens:

Protochordata: *Balanoglossus, Herdmania, Branchiostoma,* Colonial Urochordata Sections of *Balanoglossus*, *Amphioxus.*

Agnatha: *Petromyzon, Myxine.*

Fishes: *Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes,Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetrodon, Anabas,* Flat fish.

Dissection*:* Mount of weberian ossicles of *fish.*

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.

Mammalia: *Sorex*, Bat (Insectivorous and Frugivorous), *Funambulus, Loris, Herpestes, Erinaceous.*

Note: Classification to be followed from "Ruppert and Barnes (2006) *Invertebrate Zoology*, 8th edition, Holt Saunders International Edition" and Young, J. Z. (2004)

Suggested Readings:

Young, J.Z.(2004).The Life of Vertebrates. III Edition. Oxford university press.

Pough H. Vertebrate life, VIII Edition, Pearson International.

Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.

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Course Code: ZOOL-SEC-1014
Course Paper: ORNAMENTAL FISH & FISHERIES

Paper Credit: 04 (3T+1P)

Total No. of Lectures: 45L + 15P **Total Marks=100 (T60 + IA20 + P20)**

Objectives:

1. To make students learn about the potential of ornamental fish industry
2. To explore taxonomy, management and biology of ornamental fishes

Learning Outcome: Students will be able to-

1. Identify ornamental fishes of the region and set up and maintain aquarium
2. Prepare food and culture of ornamental fishes
3. Explore business opportunities with ornamental fishes from Assam

CONTENTS:
Theory

UNIT 1:

Ornamental Fish Diversity of North East India.

Aquarium plant diversity in the wetland of Assam.

Construction and management of Home Aquarium.

UNIT 2:

Natural feed of Ornamental Fish.

Strategies for maintenance of natural colour of Ornamental Fish.

UNIT 3:

Natural Breeding of Tricogaster species.

Health management of Ornamental Fish.

Feed formulation of Ornamental Fish.

UNIT 4:

Development of Biological filtration in Aquarium.

Pure culture of planktons.

Ornamental fish culture and entrepreneurship development**.**

Practical/ Presentation

Identification of Ornamental Fish.

Culture of Indigenous ornamental fish in Aquarium.

Estimation of Physico-chemical characteristics of Aquarium water.

Biological filter for removal of Ammonia from Aquarium.

Culture of Planktons.

Culture of Tubifex.

Suggested Readings:

Handbook of Fisheries and Aquaculture, ICAR, New Delhi.

Ornamental Aquarium Fish of India by Kishori Tekriwal, Andrew Arunava Rao, John Dawes, Kingdom Books.

A Text book of Fish Biology and Fisheries, S.S. Khanna and H.R. Singh, Narendra Publishing House.

Fish and Fisheries of India, V. G. Jhingran, Hindustan pub. Corp.

A Handbook of Fish Biology and Indian Fisheries, R.P. Parihaar, Central Publishing House.

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Course Code: ZOOL-SEC-2014

Course Paper: NON-MULBERRYSERICULTURE

Paper Credit: 04 (3T+1P)

Total No. of Lectures: 45L + 15P **Total Marks=100 (T60 + IA20 + P20)**

Objectives:

1. Learning history and present status of Mulberry and Non-Mulberry Sericulture, varieties of silk.
2. Learning biology, life history, food plants and rearing of non-mulberry silkworms.
3. Acquainting pests and diseases of silkworm.
4. Learning non-mulberry silk products and Entrepreneurship development.

Learning Outcome:

Students will learn about:

1. Non-mulberry silk worm diversity and rearing.
2. Non-mulberry silkworm food plants cultivation.
3. Management of Pests and diseases of non-mulberry silk worm.
4. Various process involved in non-mulberry silk production.

CONTENTS:

Theory

UNIT 1:

Introduction: Sericulture, Definition, history and present status of Mulberry and Non-Mulberry Sericulture; Silk route, Varieties of Silk; Types and distribution of non-mulberry or wild or vanyasericigenous insects in N-E India.

Biology of Non-mulberry Silkworm: Life cycle of silkworm: Eri and Muga. Structure of silk gland and Nature of Silk

UNIT 2:

Rearing of Silkworms (Eri and Muga Silkworm): Food plants of Eri and Muga Silkworm; **Rearing Operation:** Rearing house/Site and rearing appliances. **Disinfectants:** Formalin, bleaching powder. **Rearing technology:** Early age and Late age rearing Environmental conditions in rearing-Temperature, Humidity, Light and Air Types of mountages. Harvesting and storage of cocoons Spinning and Reeling of silk.

UNIT 3:

Pests and Diseases: Pests of eri and muga silkworm, Pathogenesis of eri and muga silkworm diseases: Protozoan, viral, fungal and bacterial;Prevention and control measures of pests and diseases.

UNIT 4:

Entrepreneurship in Non-Mulberry Sericulture: Varieties of Non-Mulberry Silk products

and economics in India, Prospects of Non-Mulberry Sericulture in India: Non-Mulberry Sericulture industry in different states, employment generation and potential.

Practical/ Presentation

Identification of larval and adult stages of different varieties of silkworms.

Study the life history of silkworms (Eri and Muga).

Study the primary and secondary food plants of silkworm (Eri & Muga).

Study the different diseases of silkworm through permanent slide/model/photographs
Study the pest, predator and parasitoids of silkworm.

Study the silk gland of silkworm through model/photographs (Dissection of the silk gland of eri and mulberry silkworm if specimens are available).

Visit to Govt. /Private sericulture farm and preparation of report.

Suggested Readings:

Jolly, M. S., S. K. Sen, T.N. Sonwalkar and G.K. Prashad 1979. Non-Mulberry Sericulture. in: Manual of Sericulture, Rome, FAO, 4 (29).

Chowdhury, S.N. 1981. Muga Silk Industry. Directorate of Sericulture, Govt. of Assam, Guwahati 781005, Assam.

Chowdhury, S.N. 1982. Eri Silk Industry. Directorate of Sericulture, Govt. of Assam, Guwahati 781005, Assam.

Chowdhury, S.N. 1992. Silk and Sericulture. Directorate of Sericulture and Weaving, Govt. of Assam, Guwahati-781005, Assam.

Chutia, B. C., Rajkhowa, R. and Goswami, B. 2020. Non-Mulberry Sericulture, Assam Book Depot (p) ltd. Assam.

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