Tripura University

(A Central University)

Suryamaninagar

West Tripura, Tripura – 799022

Syllabus for

Four Year Under Graduate Programme

Subject: Zoology

(Major)

Revised Syllabus

12/12/2023

(NEP – 2020)

Year – 2023

Tripura University
(A Central University)

Course Structure of Zoology (UG Programme)
As per NEP-2020 under Tripura University

ZOOLOGY MAJOR

Year	Semester	Paper Code	Paper No.	Credits	Marks	Paper Name
1st Year	I	ZL101C	Paper 1 Theory	4	100 IA=40 + ESE= 60	Non-Chordates
		ZL102C	Paper 2A Theory	2	60 IA=24 + ESE=36	Economic Zoology
			Paper 2B Practical	2	40 IA=16 + ESE=24	Based on Theory Paper 1 & 2A
	II	ZL103C	Paper 3 Theory	4	100 IA=40 + ESE= 60	Chordates
		ZL104C	Paper 4A Theory	2	60 IA=24 + ESE=36	Cell Biology
			Paper 4B Practical	2	40 IA=16 + ESE=24	Based on Theory Paper 3 & 4A
2nd Year	III	ZL201C	Paper 5 Theory	4	100 IA=40 + ESE= 60	Genetics
		ZL202C	Paper 6A Theory	2	60 IA=24 + ESE=36	Developmental Biology
			Paper 6B Practical	2	40 IA=16 + ESE=24	Based on Theory Paper 5 & 6A
	IV	ZL203C	Paper 7 Theory	4	100 IA=40 + ESE= 60	Animal Physiology
		ZL204C	Paper 8A Theory	2	60 IA=24 + ESE=36	Endocrinology and Reproductive Biology
			Paper 8B Practical	2	40 IA=16 + ESE=24	Based on Theory Paper 7 & 8A
3rd Year	V	ZL301C	Paper 9 Theory	4	100 IA=40 + ESE= 60	Evolutionary Biology and Chronobiology
		ZL302C	Paper 10A Theory	2	60 IA=24 + ESE=36	Adaptation and Zoogeography

			Paper 10B Practical	2	40 IA=16 + ESE=24	Based on Theory Paper 9 & 10A
		ZL303C	Paper 11 Theory	4	100 IA=40 + ESE= 60	Ecology
		ZL304C	Paper 12A Theory	2	60 IA=24 + ESE=36	Parasitology and Basic Microbiology
			Paper 12B Practical	2	40 IA=16 + ESE=24	Based on Theory Paper 11 & 12A
	VI	ZL305C	Paper 13 Theory	4	100 IA=40 + ESE= 60	Basics of Systematic and Biostatistics
		ZL306C	Paper 14A Theory	2	60 IA=24 + ESE=36	Biochemistry
			Paper 14B Practical	2	40 IA=16 + ESE=24	Based on Theory Paper 13 & 14A
		ZL307C	Paper 15 Theory	4	100 IA=40 + ESE= 60	Molecular Biology
		ZL308C	Paper 16A Theory	2	60 IA=24 + ESE=36	Applied Entomology and Pest Management
			Paper 16B Practical	2	40 IA=16 + ESE=24	Based on Theory Paper 15 & 16A
4th Year	VII	ZL401C	Paper 17 Theory	4	100 IA=40 + ESE= 60	Tools and Methods in Biology
		ZL402C	Paper 18A Theory	2	60 IA=24 + ESE=36	Biophysics
			Paper 18B Practical	2	40 IA=16 + ESE=24	Based on Theory Paper 17 & 18A
		ZL403C	Paper 19 Theory	4	100 IA=40 + ESE= 60	Computational Biology and Biotechnology
		ZL404C	Paper 20A Theory	2	60 IA=24 + ESE=36	Aquaculture
			Paper 20B Practical	2	40 IA=16 + ESE=24	Based on Theory Paper 19 & 20A
	VIII	ZL405C	Paper 21 Theory	4	100 IA=40 + ESE= 60	Microbiology and Immunology
		ZL406C	Paper 22A Theory	2	60 IA=24 + ESE=36	Medical Zoology

			Paper 22B Practical	2	40 IA=16 + ESE=24	Based on Theory Paper 21 & 22A
		ZL407C	Paper 23 Theory	4	100 IA=40 + ESE= 60	Global Environmental Issues and Biodiversity and Conservation
		ZL408C	Paper 24A Theory	2	60 IA=24 + ESE=36	Research Methodology and Animal Ethics and Intellectual property right (IPR)
			Paper 24B Practical	2	40 IA=16 + ESE=24	Based on Theory Paper 23 & 24A

1st Year
Semester-I
Paper 1: NON-CHORDATES
Paper Code: ZL101C
Total Marks: 100 (IA = 40 + ESE = 60) Credit = 04

Unit - I **(Credits – 04)**

Contribution of National Scientists in Zoology

Salim Ali, Vishwa Gopal Jhingran, Hiralal Chaudhuri, Gopal Ch Bhattacharya, Ramdeo Mishra, Hargobind Khorana, Lalji Singh, Radha D Kale, M K Chandra Sekheran, C. R. Narayan Rao, M. C. Dash, Valmik Thapar.

Phylum - Protozoa
- General Characteristics and classification of sub-kingdom Protozoa upto Phylum.
- Locomotion in *Amoeba*
- Reproduction in *Paramecium*

Phylum - Parazoa
- General characteristics and classification of Porifera upto classes
- Histology & body wall of *Sycon*
- Canal system of *Sycon*

Unit – II

Phylum - Metazoa
- General characteristics and classification of Cnidaria upto classes
- Trimorphism & metagenesis of *Obelia*

Phylum - Platyhelminthes
- General characteristics and classification upto classes
- Life cycle of *Fasciola hepatica*

Phylum - Nemathelminthes
- General characteristics and classification upto classes
- Life cycle of *Ascaris*

Unit – III

Phylum - Annelida
- General characteristics and classification upto classes
- Digestive & excretory system of Earthworm

Phylum - Arthropoda
- General characteristics and classification upto classes
- Digestive system of *Periplaneta*
- Circulation in *Periplaneta*

Unit – IV

Phylum - Mollusca
- General characteristics and classification upto classes
- Respiratory system in *Pila*
- Nervous system in *Pila*

Phylum - Echinodermata
- General characteristics and classification upto classes
- Water vascular system in *Asterias*
- Basic larval form and evolutionary significance

Phylum - Hemichordata
- General characteristics of Hemichordata

Paper 2A: Economic Zoology
Paper Code: ZL102C
Total Marks: 60 (IA = 24 + ESE = 36) Credit = 02

Unit – I
Vermiculture & Vermicomposting
•. Principle of vermicomposting, different ecological categories of earthworm (Epigeic, Endogeic, Anesic), importance of vermicomposting, vermitechnology & management.

Unit – II
Sericulture
- Principle, different types of silk moth and their host plants, rearing methods, diseases of silk moth. Management with special reference to local varieties

Apiculture
- Principle, different types of honey bees, rearing methods, diseases of honey bees. Management with special reference to local varieties

Unit – III
Fresh water pisciculture
- Polyculture
- Induced breeding technology
- Fish seed transportation, fish diseases,
- Management

Unit - IV
Poultry
- Types of breeds
- Methods of rearing
- Diseases and their management

Dairy Farming
- Basics of Dairy farming and management.

Paper 2B: Practical (I)
Paper Code: ZL102C
Total Marks: 40 (IA = 16 + ESE = 24) Credit = 02

1. Identification with reasons
   Paramoecium, Scypha, Obelia, Physalia, Fasciola, Taenia, Ascaris, Metaphire, Hirudinaria, Periplaneta, Limulus, Mite, Pila, Lamellidens, Octopus, Asterias, Balanoglossus.
2. Dissection and display of digestive, reproductive and nervous systems of *Periplaneta.*
3. Mouth parts of *Periplaneta.*
4. Spot identification and economic importance of— *Perionyx, Apis* sp, *Bombyx,* and Carps.
5. Identification of diseases with reasons from the photographs provided of the faunal group.
   - silk moth, fish, poultry.

Semester-II

Paper 3: CHORDATES

Paper Code: ZL103C

Total Marks: 100 (IA = 40 + ESE = 60) Credit = 04

Unit – I

Protochordata

- General characteristics of Cephalochordata with special reference to the ciliary mode of feeding in *Branchiostoma/Amphioxus*.
- General characteristics of Urochordata with special reference to retrogressive metamorphosis in *Ascidia*

Unit – II

Cyclostomata

- General characteristics of Cyclostomata
- Differences between *Petromyzon* and *Myxine*

Pisces

- General Characteristics of Chondrichthyes & Osteichthyes
- Accessory respiratory organs in fishes

Unit – III

Amphibia

- General characteristics and classification upto order
- Parental care in Amphibia
- Neoteny & Paedogenesis in Amphibia

Reptilia

- General characteristics and classification upto order
- Heart of Crocodile
- Differences between venomous and non-venomous snakes
- Biting mechanism of snake

Unit – IV

Aves

- General characteristics and classification upto order
- Double mode of respiration

Mammals

- General characteristics and classification upto order
- Comparative account of heart and aortic arch of mammal with those of bird, reptile, amphibian and fish
- Digestive system of ruminant and non-ruminant

Paper 4A: CELL BIOLOGY
Paper Code: ZL104C
Total Marks: 60 (IA = 24 + ESE = 36) Credit = 02

Unit – I
Cell
- The basic concept of Cell (Prokaryotic and Eukaryotic)
- Cell- Cell theory, cell size, the shape of cells, and types of cells
- Structure and function of prokaryotic cell
- Structure and function of eukaryotic cell – special reference to animal and plant cell
- Differences between animal and plant cells

Unit - II
Structure and function of-
- Plasma membrane
- Nucleus
- Mitochondria
- Golgi bodies
- Ribosomes
- Endoplasmic reticulum
- Lysosomes
- Chromosome
- Nucleic acid

Unit – III
- Cell cycle and regulations
- Cell divisions – Mitosis and Meiosis

Unit - IV
Cancer Biology
- Tumor and its type, characteristics of cancer cells,
- Viral and cellular oncogenes, Development of cancer
- Types of cancer, Types of carcinogens,
- Therapeutics of cancer

Paper 4B: Practical (II)
Paper Code: ZL104C
Total Marks: 40 (IA = 16 + ESE = 24) Credit = 02

1. Identification with reasons —*Branchiostoma, Ascidia,Petromyzon, Myxine, Scoliodon, Hippocampus, Channa, Rohu,Dipnoi, Hyla, Calotes, Naja, Columba, Chiroptera, Bandicota/Rattus.*
2. Dissection and display of digestive system, IXth & Xth cranial nerves of *Cirrhinusmrigala/Channa*
3. Study of gill arch, cycloid & ctenoid scales, hyoid & pectin of fowl.
4. Study of Mitotic cell division stages
5. Study of meiotic cell division stages (permanent slide).
6. Study of salivary gland chromosome from larva of *Drosophila*

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Syllabus for

Four Year Under Graduate Programme

Revised Syllabus

12/12/2023

Subject: Zoology

(Minor)

(NEP – 2020)

Year – 2023

Tripura University
(A Central University)

Course Structure of Zoology (UG Programme)
As per NEP-2020 under Tripura University

ZOOLOGY MINOR

Year	Semester	Paper Code	Paper No.	Credit	Marks	Paper Name
1st Year	I	ZL101M	Paper -1A Theory	3	60 IA=24 + ESE= 36	Non-Chordates and Economic Zoology
			Paper -1B Practical	1	40 IA=16 + ESE=24	Based on Theory Paper -1A
	II	ZL102M	Paper -2A Theory	3	60 IA=24 + ESE= 36	Chordates and Cell Biology
			Paper -2B Practical	1	40 IA=16 + ESE=24	Based on Theory Paper 2A
2nd Year	III	ZL201M	Paper -3A Theory	3	60 IA=24 + ESE= 36	Genetics and Developmental Biology
			Paper -3B Practical	1	40 IA=16 + ESE=24	Based on Theory Paper -3A
	IV	ZL202M	Paper -4A Theory	3	60 IA=24 + ESE= 36	Animal Physiology, Endocrinology and Reproductive Biology
			Paper -4B Practical	1	40 IA=16 + ESE=24	Based on Theory Paper 4A
3rd Year	V	ZL301M	Paper -5A Theory	3	60 IA=24 + ESE= 36	Evolutionary Biology, Adaptation and Zoogeography
			Paper -5B Practical	1	40 IA=16 + ESE=24	Based on Theory Paper -5A

	VI	ZL302M	Paper -6A Theory	3	60 IA=24 + ESE= 36	Ecology, Parasitology, Microbiology and Basics of Systematics
			Paper -6B Practical	1	40 IA=16 + ESE=24	Based on Theory Paper 6A
4th Year	VII	ZL401M	Paper -7A Theory	3	60 IA=24 + ESE= 36	Applied Entomology and Aquaculture
			Paper -7B Practical	1	40 IA=16 + ESE=24	Based on Theory Paper -7A
	VIII	ZL402M	Paper -8A Theory	3	60 IA=24 + ESE= 36	Biochemistry, Molecular Biology and Immunology
			Paper -8B Practical	1	40 IA=16 + ESE=24	Based on Theory Paper 8A

1st Year
Semester-I
Paper 1A: NON-CHORDATES AND ECONOMIC ZOOLOGY
Paper Code: ZL101M
Total Marks: 60 (IA = 24 + ESE = 36) Credit - 03

Non-Chordates

Unit - I

Contribution of National Scientists in Zoology—

Salim Ali, Vishwa Gopal Jhingran, Hiralal Chaudhuri, Gopal Ch Bhattacharya, Ramdeo Mishra, Hargobind Khorana, Lalji Singh, Radha D Kale, M K Chandra Sekheran, C. R. Narayan Rao, M. C. Dash, Valmik Thapar.

Phylum – Protozoa

- Classification up to class
- General Characteristics
- Locomotion in *Amoeba*

Phylum – Parazoa

- Classification up to class
- General characteristics
- Canal system of *Sycon*

Phylum – Metazoa

- Classification up to class
- General characteristics
- Trimorphism & metagenesis of *Obelia*

Unit - II

Phylum – Platyhelminthes

- Classification up to class
- General characteristics
- Life cycle of *Fasciola hepatica*

Phylum – Nemathelminthes

- Classification up to class
- General characteristics
- Life cycle of *Ascaris*

Phylum – Annelida

- Classification up to class
- General characteristics
- Digestive system of Earthworm

Unit - III

Phylum – Arthropoda

- Classification up to class
- General characteristics
- Digestive system of *Periplaneta*

Phylum – Mollusca

- Classification up to class
- General characteristics
- Respiratory system in *Pila*

Phylum – Echinodermata
- Classification up to class
- General characteristics
- Water vascular system in *Asterias*

Phylum – Hemichordata
- Classification up to class
- General characteristics of Hemichordata

Unit – IV - ECONOMIC ZOOLOGY

Vermiculture & Vermicomposting
•. Principle of vermicomposting, different ecological categories of earthworm (Epigeic, Endogeic, Anesic), importance of vermicomposting, vermitechnology & management.

Sericulture
- Principle, different types of silk moth and their host plants, rearing methods, diseases of silk moth . Management with special reference to local varieties

Apiculture
- Principle, different types of honey bees, rearing methods, diseases of honey bees. Management with special reference to local varieties

Fresh water pisciculture
- Polyculture
- Induced breeding technology
- Fish seed transportation, fish diseases,
- Management

Poultry
- Types of breeds
- Methods of rearing
- Health, diseases and their management

Basics of Dairy farming and management.

Paper 1B: PRACTICAL - 1
Paper Code: ZL101M
Total Marks: 40 (IA = 16 + ESE = 24) Credit - 01

PRACTICAL – I

1. Identification, Systematic position, and Specimen Characters
   Paramoecium, Scypha, Obelia, Physalia, Taenia, Ascaris, Metaphire, , Hirudinaria, Periplaneta, Pila, Octopus, Asterias,
2. Dissection and display of digestivesystems of *Periplaneta*
3. Mouth parts of *Periplaneta*
4. Spot identification and economic importance of— *Perionyx, Apis* sp, *Bombyx* and some major Carps (Rohu, Catla, Mrigal).

Semester-II
Paper 2A: CHORDATES AND CELL BIOLOGY
Paper Code: ZL102M
Total Marks: 60 (IA = 24 + ESE = 36) Credit - 03

Chordates

Unit - I

Protochordata
- General characteristics of Cephalochordata with special reference to ciliary mode of feeding in *Branchiostoma/Amphioxus*.
- General characteristics of Urochordata with special reference to retrogressive metamorphosis in *Ascidia*

Cyclostomata
- General characteristics of Cyclostomata
- Differences between *Petromyzon* and *Myxine*

Pisces
- General Characteristics of Chondrichthyes & Osteichthyes
- Accessory respiratory organs in fishes

Unit - II

Amphibia
- General characteristics and classification upto order
- Parental care in Amphibia

Reptilia
- General characteristics and classification upto order
- Differences between venomous and non-venomous snakes

Unit - III

Aves
- General characteristics and classification upto order
- Double mode of respiration

Mammals
- General characteristics and classification upto order
- Digestive system of ruminant and non-ruminant

Unit – IV - CELL BIOLOGY

1. Structure and function of—
   - Plasma membrane
   - Nucleus
   - Mitochondria
   - Golgi bodies
   - Ribosomes
   - Endoplasmic reticulum
   - Lysosomes
2. Cell cycle and regulations
3. Cell divisions
4. Cancer cell and its characters

Paper 2B: PRACTICAL -II
Paper Code: ZL102M
Total Marks: 40 (IA = 16 + ESE = 24) Credit - 01

PRACTICAL – II

1. Identification, systematic position, and specimen characters —*Branchiostoma, Ascidia, Petromyzon, Scoliodon, Channa, Rohu, Hyla, Naja, Columba, Chiroptera.*
2. Dissection and display of digestive system *Cirrhinus mrigala/Channa sp.*
3. Study of Mitotic cell division stages
5. Study of meiotic cell division stages (permanent slide).

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Syllabus for

Four Year Under Graduate Programme

Subject: Fundamental Zoology

(Interdisciplinary Course)

(NEP – 2020)

Year – 2023

Tripura University
(A Central University)

Course Structure of Fundamental Zoology (UG Programme)
As per NEP-2020 under Tripura University

FUNDAMENTAL ZOOLOGY

(INTERDISCIPLINARY COURSE)

Year	Semester	Paper Code	Paper No.	Credits	Marks	Paper Name
1st Year	I	ZL001C	Paper 1 Theory	3	100 IA = 40 + ESE = 60	Animal Diversity
2nd Year	III	ZL002C	Paper 2 Theory	3	100 IA = 40 + ESE = 60	Economic Zoology
	IV	ZL003C	Paper 3 Theory	3	100 IA = 40 + ESE = 60	Genetic Disorders and Pathogenic Diseases

DETAILED COURSE CONTENT OF

Interdisciplinary Course

[FUNDAMENTAL ZOOLOGY]

1st year
Semester – I
Paper - 1 (Theory)
ZL001: Animal Diversity
Marks: 100 (IA=40 + ESE= 60) Credit 03

Non-chordates

Unit - I

Classification (up to class)

Important features of the phylum with examples

Protozoa, Porifera, Cnidaria, Helminths,

Unit – II

Classification (up to class)

Important features of the phylum with examples

Annelida, Arthropoda, Mollusca, and Echinodermata

Chordates

Unit - III

Classification (up to class)

Important features with examples -

Hemichordates, Cephalochordates, Urochordates,

Unit – IV

Classification (up to class)

Important features with examples -

Vertebrates – Cyclostomes, Pisces, Amphibia, Reptilia, Aves, and Mammalia

Books Recommended:

- Invertebrates – L.H. Hyman
- Biology of Animals Vol-I by Ganguly, Sinha & Adhikari, New Central Book Agency, Kolkata
- Modern Text Book of Zoology: Invertebrates by R.L. Kotpal, Rastogi Publications
- Invertebrate Zoology by E.L. Jordan & P.S. Verma, S. Chand & Company Ltd.
- Biology of Animals Vol-II by Ganguly, Sinha & Adhikari, New Central Book Agency, Kolkata
- Modern Text Book of Zoology: Vertebrates by R.L. Kotpal, Rastogi Publications
- Vertebrate Zoology by E.L. Jordan & P.S. Verma, S. Chand & Company Ltd.

Interdisciplinary Course (Fundamental Zoology)

Semester – III

Paper – 2 (Theory)

ZL002: Applied Zoology

Marks: 100 (IA=40 + ESE= 60) Credit 03

Vermiculture & Vermicomposting
Principle of vermicomposting, different ecological categories of earthworm (Epigeic, Endogeic, Anesic), importance of vermicomposting, vermitechnology & management.

Sericulture
Principle, different types of silk moth and their host plants, rearing methods, diseases of silk moth. Management with special reference to local varieties

Apiculture
Principle, different types of honey bees, rearing methods, diseases of honey bees. Management with special reference to local varieties

Fresh water pisciculture
Polyculture
Induced breeding technology
Fish seed transportation, fish diseases,
Management

Poultry
Types of breeds
Methods of rearing
Health, diseases, and their management

Basics of Dairy farming and management

Books Recommended:

- Economic Zoology by Shukla and Upadhyay
- Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac Culture. By Jabde, P.V.,
- Applied Zoology by T.K.Banerjee, New Central Book Agency, Kolkata
- A Hand Book of Economic Zoology by J. Ahsan & bS.P.Sinha, S.Chand & Company Ltd.
- Kenchor Jeeban Baichitra O Kencho Prajukti by Priya Sankar Chaudhuri, Gyan Bichitra Prakashani, Agartala.
- Comprehensive Sericulture Vol. II: Silkworm Rearing and Silk Reeling by Ganga, G. Oxford and IBH, New Delhi. (2003)
- Elementary Applied Zoology by Debjyoti Chattopadhyay, Book Syndicate Pvt. Ltd.
- Livestock production management by Shastry and Thomas

Interdisciplinary Course (Fundamental Zoology)

Semester – IV

Paper – 3 (Theory)

ZL003: Genetic Disorders and Pathogenic Diseases

Marks: 100 (IA=40 + ESE= 60) Credit 03

Genetic Disorders

Structure and function of chromosome

ABO Blood groups

Concept on –

Haemophilia, colour-blindness, albinism, thalassemia, sickle cell anaemia, Down's syndrome, Turner's syndrome, Klinefelter's syndrome

Pathogenic Disease

Concept of host and parasite

Life cycle and control measures of –

Plasmodium, Entamoeba, Giardia, Liver fluke, Tape worm, Round worm, and *Ascaris*

Books Recommended:

- Genetics by M. W. Strickberger, Pearson Education India Ltd.
- Principles of Genetics by E. J. Gardner, M. J. Simmons & D.P. Snustad, Wiley Publishers
- Principle of Genetics, B. D. Singh. Kalyani Publications
- Genetics by P. K. Gupta, Rastogi Publications, Meerut
- Genetics by Verma & Agarwal, S. Chand & Company Ltd.
- Parasitology by K.D. Chatterjee,
- Text Book of Medical Parasitology by P. Chakraborty, New Central Book Agency
- Paniker's Text Book of Medical Parasitology by Paniker, C.K.J., Ghosh, S. Jaypee, New Delhi.
- Medical Parasitology by Dey, N.C., Dey, T.K. and Dey Sinha M. New Central Book Agency, Kolkata (2010)

Syllabus for Vermiculture and Vermicomposting
(UG Course)

Unit – I
(Vermiculture)

1. About Earthworm:
   Basic body structure of earthworm (General body plan, Prostomium, Peristomium, Metamerism, Cuticle, Setae, Different body pores, Clitellum, Digestive system).

2. Earthworm Ecology:
   Distribution; Food habit and habitat; Ecological requirements: moisture, temperature, pH, organic matter etc.; Ecological categories: Epigeic, Endogeic and Anecic earthworms; Ecosystem services i.e. role played by earthworms in soil ecosystem.

3. Reproduction:
   Hermaphroditism, Copulation and cocoon formation, Cocoon structure, Incubation period of cocoon in vermicomposting earthworm, Fecundity in surface dwelling (epigeic) and soil dwelling (endogeic and anecic) earthworm.

4. Vermiculture:
   Definition, Difference between vermiculture and vermicomposting, Selective features of earthworms for vermiculture and vermicomposting, Method of vermiculture of phytophagous and geophagous earthworm, Utility of vermiculture (protein source for pisciculture, poultry farming, piggery etc., application in vermicomposting).

Unit – II
(Vermicomposting)

1. Vermicomposting:
   Definition, Habitat of vermicomposting earthworms, Scientific names of native and exotic vermicomposting earthworms (Native Indian earthworms: *Perionyx excavatus*, *Perionyx ceylanensis*, European earthworms: *Eisenia fetida*, *Eisenia andrei*, South African earthworms: *Eudrilus eugeniae*), Selective features of earthworm species for vermicomposting.

2. Principle of vermicomposting, Components of the vermicomposting system (Appropriate species of earthworms with suitable population characteristics, proper substrate, optimum environmental factors under Indian condition, Design and operations to be implemented).

3. Methods of vermicomposting – (a) Low cost floor beds, (b) Tank system; Management during vermicomposting; Products of vermicomposting: earthworm biomass (vermiprotein) and vermicompost.

4. Definition of vermicompost; Physicochemical features of vermicompost; Role of earthworm and vermicompost in growth of plants; Vermiwash and its utility in agriculture.

TRIPURA UNIVERSITY

(A Central University)
Suryamaninagar- 799022
West Tripura

Four Years Undergraduate Programme

(As per NEP- 2020)

Ability Enhancement Compulsory Courses:

1. Understanding and connecting with Environment
2. Communicative Bengali
3. English Communication
4. Personal Communication Skill

30/5/2023

Prof. B.H. Datta
संकायाध्यक्ष / Dean
विज्ञान संकाय
Faculty of Science
त्रिपुरा विश्वविद्यालय
Tripura University

ABILITY ENHANCEMENT COMPULSORY COURSE (AECC)

Syllabus for Undergraduate 1st Semester

Under NEP 2020

Understanding and Connecting with Environment

(Number of Theory Credits -2)

Total marks-100

Unit 1 : Introduction to Environmental Studies and Natural Resources (Renewable and Non---renewable Resources)

- Multidisciplinary nature of environmental studies;
- Scope and importance; the need for environmental education. Concept of sustainability and sustainable development
- Land resources and landuse change; Land degradation, soil erosion and desertification.
- Forest resources: Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water resources: Use and over---exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter---state).
- Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs

Unit 2 : Ecosystems and Biodiversity Conservation

- What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food pyramids, food webs and ecological succession.
- Levels of biological diversity : genetic, species and ecosystem diversity; Biogeographic zones of India; global biodiversity hot spots
- India as a mega---biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity : Habitat loss, poaching of wildlife, man---wildlife conflicts, biological invasions; Conservation of biodiversity : In---situ and Ex---situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Unit 3 : Environmental Pollution and Environmental Policies & Practices

- Environmental pollution : types, causes, effects and controls; Air, Water, Soil and Noise pollution
- Nuclear hazards and human health risks
- Solid waste management: Control measures of urban and industrial waste.
- Climate change, global warming, ozone layer depletion, acid rain

- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).

Unit 4 : Human Communities and the Environment

10 hrs

- Human population growth: Impacts on environment, human health and welfare.
- Traditional Wisdom, Indigenous/traditional Communities and Livelihood Security
- Disaster management: floods, earthquake, cyclones and landslides.
- Environmental movements: Chipko, Silent valley, NBA, Bishnois of Rajasthan.
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Suggested Readings:

1. Bharucha, E. (2015). Textbook of Environmental Studies.
2. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
3. Gadgil, M., & Guha, R.1993. *This Fissured Land: An Ecological History of India*. Univ. of California Press.
4. Gleeson, B. and Low, N. (eds.) 1999.*Global Ethics and Environment*, London, Routledge.
5. Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
6. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll.*Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
7. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. *Science,* 339: 36---37.
8. McCully, P. 1996. *Rivers no more: the environmental effects of dams*(pp. 29---64). Zed Books.
9. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
10. Odum, E.P., Odum, H.T. & Andrews, J. 1971.*Fundamentals of Ecology*. Philadelphia: Saunders.
11. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
12. Rao, M.N. & Datta, A.K. 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
13. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012.*Environment*. 8th edition. John Wiley & Sons.
14. Rosencranz, A., Divan, S., & Noble, M. L. 2001. *Environmental law and policy in India. Tripathi 1992*.

15. Sengupta, R. 2003. *Ecology and economics*: An approach to sustainable development. OUP.
16. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.
17. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. *Conservation Biology*: *Voices from the Tropics*. John Wiley & Sons.
18. Thapar, V. 1998. *Land of the Tiger*: *A Natural History of the Indian Subcontinent*.
19. Warren, C. E. 1971. *Biology and Water Pollution Control*. WB Saunders.
20. Wilson, E. O. 2006.*The Creation: An appeal to save life on earth*. New York: Norton.
21. World Commission on Environment and Development. 1987.*Our Common Future*. OxfordUniversity Press.

TRIPURA UNIVERSITY
SEMESTER – I
Zoology (Major)
Paper – I

Revised

Full Marks – 100
(80+20)

Unit I : Invertebrata – 1 (Protozoa to Annelida)

Periods – 15

- **Protozoa:** a) Locomotion - Amoeboid (*Amoeba*), Ciliary (*Paramoecium*) and Flagellar (*Euglena*), b) Morphology and Reproduction in *Paramoecium*.
- **Porifera:** Histology of body wall; Spicules, its kinds & formation. and Canal system of *Sycon*.
- **Cnidaria:** Polymorphism in Siphonophora; structure and function of nematocyst
- **Helminthes:** a) Excretory System of Helminthes; b) General Organization and Life cycle of *Ascaris lumbricoides*; Pseodocoelom –its origin and structure in *Ascaris*
- **Annelida:** a) Coelom: Origin, Types and Function: b) Metamerism: Nature. Origin and Significance, c) *Hirudinaria* – Morphology; Digestive and Excretory Systems, medicinal importance

Unit II : Invertebrata – 2 (Arthropoda to Protochordata)

Periods -15

- **Arthropoda:** *Periplaneta* - Morphology. Digestive. Respiratory.\Circulatory and Reproductive Systems.
- **Mollusca:** *Pila* - Morphology. Digestive. Respiratory and Nervous Systems. mantle cavity, torsion in development
- **Echinoderm:** a) *Asterias* **External** Morphology and Water Vascular System. b) Larvae and their evolutionary significance.
- **Notochord:** Its origin, structure and significance
- **Hemichordata:** *Balanoglossus* - Structural organisation and evolutionary position.
- **Protochordata:** a) *Ascidia* - Life history and evolutionary significance of Ascidian tadpole, b) *Branchiostoma* - Structural organisation: Pharyngeal structure and Ciliary mode of feeding; Nephridia and its role in excretion.

Unit III : Vertebrata (Cyclostomata to Mammalia)

Periods -15

- **Cyclostomata:** a) Comparative study of *Petromyzon* and *Myxine*: b) Amocoetes larva and evolutionary significance;Importance of cartilaginous structure and lack of air bladder in cyclstome fishes
- **Pisces:** a) Difference between **Osteichthyes** and **Chondrichthyes**; b) Scales. Fins and tails in Fishes; c) Accessory Respiratory organs in *Amphipnus*, *Anabas*, *Clarias*, *Heteropneustes* and *Ophicphalus*, *d) Dipnoi* - General featuers and geographic distribution.; importance of air bladder in bony fishes
- **Amphibia:** Concept of Heterochrony, Paedomorphosis. Progenesis and Neoteny (with examples of some Salamanders, eg. *Ambystoma, Necturus & Triturus*).
- **Reptilia:** a) Difference between Poisonous and Non-poisonous Snakes: b) Poison Apparatus and Biting Mechanism of snakes.
- **Aves & Mammalia:** a) Basic difference in the pattern of Air-flow and Respiratory structures; b) Heart and Aortic Arches, mentioning advanced features over Reptilian Condition; c) Structure and Function of Ruminant stomach.

Unit IV : Taxonomy and Classification

Periods -15

- **Taxonomy:** Principles, importance in understanding biodiversity
- **Definitions & Concepts:** a) Classification, Phenon, Taxon, Category with examples; b) Binomial & Trinomial Classifications with examples: c) Important Rules of Zoological Nomenclature.
- **Zoological Classification:** Kinds and Components of Classification. Linnean Hierarchy.
- **Species Concept** Biological and Evolutionary concepts
- **General Characteristics and Classification up to Sub Class:** a) Invertebrates (up to Sub Class): Porifera, Cnidaria and Annelida: b) Vertebrates (up to Order): Amphibia. Reptilia and Mammalia.

Note: Internal Assessment of 20 marks based on the above syllabus.

TRIPURA UNIVERSITY
SEMESTER – I
Zoology (General)

Revised

Paper – I

Full Marks – 100
(80+20)

Unit I : Invertebrata – 1

Periods - 15

- *Paramoecium* : Structure. Food and feeding. Locomotor organelle and Reproduction.
- *Sycon* : Histology of body wall with special reference to Canal System and Spicules. Feeding and Intracellular digestion.
- *Obelia* : Organisation and Life History with special reference to Metagenesis.
- *Fasciola* : Morphology and Life Cycle of *F. hepatica*.

Unit II : Invertebrata – 2

Periods - 15

- **Digestive System:** a) Structure and Function of Digestive System in *Metaphire (Pheretima)*;
  b) Structure and Function of Digestive System in *Pila*.
- **Respiratory System:** a) Structure and function of Trachea in Cockroach; b) Structure and function of Ctenidium and Pulmonary Sac in *Pila*.
- **Circulatory System:** a) Open type system in Cockroach; b) Closed type system in Earthworm.
- **Excretory System:** Structure and function of Nephridia in Earthworm.
- **Nervous System:** a) plan in Invertebrates; b) Nervous System in *Pila*.

Unit III : Chordata – 1 (Protochordates to Pisces)

Periods - 15

- *Branchiostomata* : General Organisation. Structure of Pharynx and Nephridia. Mechanism of feeding and excretion.
- *Ascidia* : Structure of Pharynx and mechanism to feeding;life history with special reference to retrogressive metamorphosis, Evolutionary significance of Ascidian Tadpole.
- *Petromyzon* : a) Difference with *Myxine*. b) Respiratory system. c) Ammocoetes larva and its significance.
- *Lates* : Digestive, Respiratory and Circulatory systems; gas exchange between gills and blood

Unit IV : Chordata – 2 (Amphibia to Mammalia)

Periods - 15

- **Digestive System:** Functional anatomy of stomach in *Columba* and *Bos*.
- **Respiratory System:** Structure of Lungs in *Columba*.: gas exchange between alveoli and capillaries.
- **Circulatory System:** a) Anatomy of Heart in *Cavia*. b) Aortic Arches in Vertebrates (Reptiles. Birds and Mammals).
- **Nervous System:** a) Structure of Brain in *Bufo*. b) Cranial Nerves - Origin. distribution and function. c) Difference between Sympathetic and Para-Sympathetic N[illegible]
- **Exoskeletal System:** Exoskeleton in *Columba*.

Note: Internal Assessment of 20 marks based on the above syllabus.

TRIPURA UNIVERSITY

(A Central University)
Suryamaninagar-799022

Syllabus

For

Semester – II

Zoology (Major & General)

Year 2014

Department of Zoology
Tripura University (A Central University)
B. Sc Zoology (Honours)
Proposed Syllabus (Under semester system) 2014

Year	Semester	Paper	Content	Marks
1st Year	Semester I	Paper -1	U-I. Non Chordates I (Without Coelom) U-II. Non Chordates II (With Coelom) U-III. Chordates (Protochordates to mammals) U-IV. Taxonomy and Classification	100
	Semester II	Paper-2A	U-I. Cell Biology, Histology and Developmental Biology U-II. Applied Zoology	60
		Paper - 2B	Practical based on theory of Paper II-A	40
2nd Year	Semester - III	Paper-3A	U-I. Genetics U-II. Ecology	60
		Paper-3B	Practical based on theory of Paper -III-A	40
	Semester-IV	Paper – 4A	U-I. Microbiology, Parasitology & Immunology U-II. Tools and Techniques in Biology	60
		Paper – 4B	Practical Based on Theory of Paper –IV-A	40
3rd Year	Semester- V	Paper-5A	U-I. Adaptation, Zoogeography and Ethology U-II. Comparative Animal Physiology U-III. Biodiversity and Conservation U-IV. Biostatistics	100
		Paper-5B	Practical Based on Theory of Paper-V-A	100
	Semester-VI	Paper – 6A	U-I. Evolutionary Biology U-II. Biochemistry U-III. Endocrinology and Reproductive Biology U-IV. Molecular Biology and Genetic Engineering	100
		Paper – 6B	Practical based on Theory of Paper VI-A	100

Semester – II

Paper 2A

Unit –I: Cell Biology, Histology and Developmental Biology

- Concept of Prokaryotic & Eukaryotic cells.
- Ultrastructure and functions of plasma membrane, mitochondria, Golgi complex, Endoplasmic Reticulum, ribosome, centrioles & lysosomes.
- **Chromatin:** Organization of euchromatin & heterochromatin; **Chromosome:** Morphology, primary & secondary constrictions, satellite bodies; classification on the basis of position of centromere, Polytene chromosome & Lampbrush chromosome.
- Nucleosome model of chromosome ultrastructure.
- **Cell cycle:** Phases & regulation, Mitosis, Meiosis, Synaptonemal complex.
- **Cancer:** Characteristics of cancer cells, classification according to tissue types; common carcinogens.
- Outline classification of animal tissue & their distribution, histology of skeletal muscle.
- Histology & functions of skin, liver, kidney & spleen in mammals.
- Gametogenesis, ultrastructure of sperm and ovum
- Physicochemical events in fertilization
- Eggs types, cleavage and fate maps
- Gastrulation in chick upto formation of three germinal layers
- Extraembryonic membrane in chick- formation and function
- Placenta : types, formation (rabbit) and function

Unit-II: Applied Zoology

- **Pisciculture:** Indian major carps, Exotic carps, composite fish culture- Principles & methods: Advantages & Disadvantages, Common fish diseases and their control.
- **Prawn culture:** Indian prawns of commercial value- Penaeid & Non-Penaeid group; Fresh & Brackish water Prawn culture.
- **Poultry:** Types of breeds, rearing and deep litter system- Advantages and disadvantages: Poultry Diseases & their control.
- **Apiculture:** Species of honey bee in India, social organization and life history of *Apis indica*, Modern methods of Apiculture, Bee products and their uses
- **Sericulture:** Species of Silkworm, Host plants and silk varieties in India, Life history and rearing of Mulberry silkworm, harvesting and processing of cocoon, reeling and extraction of silk; diseases of *Bombyx mori* and control measures
- **Vermiculture:** a) vermicomposting species [*Perionyx excavatus* (Indian), *Eudrilus eugeniae* (South Affrican), *Eisenia fetida* & *Eisenia andrei* (Europian)] and their selective features, b) Principle, methods and importance of vermicomposting
- **Pollinators and Pest:** a) Types of pollinators and pollination, importance of pollinators b)Definition of term pest, types of pest, importance of pest control, biological control of pest, pesticides and their hazards, integrated pest management, c) pest complexes of paddy, stored grains and brinjal; biology nature of damage and control of *Scirpophaga incertulus*, *Scitophilus oryzae* and *Leucinodes orbonalis*.

TRIPURA UNIVERSITY

SYLLABUS OF ZOOLOGY, 2014

2nd Semester

PAPER – II B

MAJOR **Total Marks = 50**

1. Identification with reasons (Any 4) 4x4 =16

   Group –A : Amoeba, Sycon, Oblelia, Taenia, Ascaris ,Leech , Perionyx excavatus (dung earthworm), Horse shoe crab , Macrobrachium rosenbergii, Pila, Starfish
   Group – B : Branchiostoma, Ascidia,Petromyzon, Scoliodon, Sea Horse, Icthyophis, Axolotl larva, Naja, Pigeon, Chiroptera.

2. A. Identification of Mammalian T.S. of : Skin, Spleen, small intestine, Liver , Pancreas, Kidney, Thyroid, Testes, Ovary (any one)
   B. Chick Embryo : 24 hrs, 48 hrs , 72 hrs (any one)
   C. Preparation and staining of skeletal muscle, Squamus epithelium & blood film (Human) 3+3+6 = 12

3. Preparation of onion root tips for chromosomal study, Preparation of buffer and determination of pH; Identification of Stages of Mitosis. 10

4. Submission of field report on the basis of Farm/field visit. 4

5. Submission of laboratory Note Book & Viva Voce 4+4=8

Department of Zoology
Tripura University (A Central University)
B.Sc. Zoology (Elective)
Proposed Syllabus (Under Semester System)

Year	Semester	Paper	Content	Marks
1st Year	Semester I	Paper -1	U-I. Non Chordates I (Without Coelom) U-II. Non Chordates II (With Coelom) U-III. Chordates I (Protochordates to fish) U-IV. Chordates II (Amphibia to mammals)	100
	Semester II	Paper-2A	U-I. Cell Biology, Histology and Developmental Biology U-II. Biochemistry, Animal Physiology and Endocrinology	50
		Paper – 2B	Practical based on theory of Paper II-A	50
2nd Year	Semester - III	Paper-3A	U-I. Taxonomy & Classification, Evolution & Adaptation U-II. Ecology, Ethology, Zoogeography and Biodiversity	50
		Paper-3B	Practical based on theory of Paper -III-A	50
	Semester-IV	Paper – 4A	U-I. Applied Zoology U-II. Genetics and Molecular Biology	50
		Paper – 4B	Practical Based on Theory of Paper –IV-A	50
3rd Year	Semester- V	Paper-5A	U-I. Parasitology and Medical Entomology U-II. Microbiology and immunology	50
		Paper-5B	Practical Based on Theory of Paper-V-A	50
	Semester-VI	Paper – 6	**Project in Zoology** i. Project Preparation (literature review, field work/lab work) – 50 ii. Presentation – 25 iii. Viva – 25	100

Semester – II

Paper – 2.A

Unit –I: Cell Biology, Histology and Developmental Biology

- Ultra-structure and function of different cell organelles-Plasma membrane, Golgi complex, Mitochondria& Endoplasmic Reticulum.
- Ultra-structure of Chromosome with special reference to Nucleosome model.
- Cell cycle, Mitotic & Meiotic Cell Divisions.
- Outline classification, distribution and functions of Animal tissues.
- Histology and Functions of Skin, Liver, Pancreas, Thyroid, Testis and Ovary in mammals.
- Gametogenesis, Ultra structure of sperm and ovum in mammals.
- Physico-chemical events in fertilization. Egg Types, Cleavage and Blastulation in Amphibians. Role of Yolk in Cleavage.
- Fate Map and Gastrulation in frog
- Extra-embryonic Membrane: Formation and Function in Chick Embryo.
- Placenta : Types , Formation (Rabbit) and Function

Unit-II: Biochemistry, Animal Physiology and Endocrinology

- Classification, structure and function of carbohydrates
- Classification, structure and function of Protein
- Classification, structure and function of lipids
- Structure and function of Nucleic acid
- Concept of pH and buffer and their biological significance
- Enzymes – General properties, coenzymes, isoenzymes, allosteric enzymes, Mechanism of enzyme action, Factors affecting enzyme reaction
- Heterotrophic Nutrition ; Intracellular digestion in Protozoa, Extracellular digestion in general, Cellular digestion in Termite, Cattle and Horse
- Exchange of Gases: Respiratory pigments and their advantages, Oxygen and Carbon dioxide transport.
- Excretion and Osmo-regulation: Urine formation in mammals; Nitrogen excretion in Ammonotelic, Ureotelic and Uricotelic animals, Osmo-regulation in Fresh Water and Marine Vertebrates
- Physiology of Nerve Impulse conduction , Synaptic Transmission
- Brief outline of organization and functions of endocrine system in mammals with special reference to: Pituitary, Thyroid and Gonads.
- Reproductive Cycle (estrous cycle) and its hormonal control.

TRIPURA UNIVERSITY

SYLLABUS OF ZOOLOGY, 2014

2nd Semester

PAPER – II B

MINOR **Total Marks = 50**

1. Identification with reasons (Any five) 4x5 = 20

a) Paramoecium, Sycon, Oblelia,Fasciola,Ascaris,Earthworm,Cockroach, Pila, Starfish, Branchiostoma, Ascidia,Petromyzon, Scoliodon, Labeo, Toad, Snake (Naja), Pigeon, Rat, Chiroptera.

b) Identification of Cell division stages (Mitosis) with reasons. (Any one) 1x4=4

2. a) Identification with characters of mammalian T.S. of Liver , Pancreas, Kidney, Thyroid, Testes, Ovary (any one)

b) Chick Emryo : 24 hrs, 48 hrs & 72 hrs (any one) 3+3 = 6

3. Biochemistry : Identification of Glucose, Starch & Protein.

Animal Physiology : Staining & Mounting of Human Squamous Epithelial tissue/Blood film .

Preparation of buffer, determination of pH. 5x2 = 10

4. Laboratory Note Book Submission & Viva Voce 5+5=10

TRIPURA UNIVERSITY

(A Central University)
Suryamaninagar-799022

Syllabus
OF

Zoology
(General & Major)

Semester – III

2014

Tripura University
Semester-III
ZOOLOGY (GENERAL)
Paper - 3A

Full Marks: 50
(40+10)

Unit - I
Taxonomy & Classification, Evolution & Adaptation

Period 20

1. Definition, Systematics, Taxonomy, Classification, Phenon, Taxon, Category, Binomial and Trnomial nomenclature
2. Taxonomy Hieracrhy
3. Biological species concept
4. General characteristics and classification
   (i) Porifera, Cnideria & Annelida – up to subclass
   (ii) Amphibia & Reptilia – up to order
5. Darwinism and post Darwinian synthetic theory of evolution
6. Selection: stabilizing, directional and disruptive selection with example: evolutionary significance of each kind of selection
7. Isolating mechanism and speciation (allopatric, sympatric and parapatric)
8. Morphological and physiological adaptation of – i. Camel, ii. Whale, and iii. Bat.
9. Animal colouration and mimicry

Unit - II
Ecology, Ethology, Zoogeography & Biodiversity

Period - 20

1. Ecosystem: Definition, components, energy flow, food chain, food web, ecological pyramids.
2. Population ecology: properties and growth form; population regulation
3. Community ecology: Species diversity, stratification of forest, trophic structures, habbit and niche concept
4. Community succession: characteristics, types and causes of ecological succession
5. Social insects (termites and honey bee) and their behavior
6. Types of animal distribution: cosmopolitan, discontinuous, endemism, bipolar
7. Barriers and their roles in animal distribution
8. Zoogeographical realms: geographical range, physical features, faunal characteristics
9. Concept of biodiversity, causes of depletion of biodiversity: strategies of biodiversity conservation- *exsitu* and *insitu* methods.

Note: Internal assessment of 10 marks based on the above syllabus.

TRIPURA UNIVERSITY
SEMESTER – III
Zoology (Major)
Paper – 3A

Full Marks – 60
(48+12)
Periods - 24

Unit I: Genetics

- DNA as genetic material.
- Concept of Alleles and Multiple Alleles (ABO - Blood Group).
- Linkage -Types & Gene Mapping.
- Crossing over and Recombination – Molecular basis and Significance.
- Sex Determination in *Drosophila* (Gynandromorphism, Genic Balance Theory & Dosage Comensation).
- Sex Determination in Human (Role of Y-Chromosome or *Sry* gene, citing examples of Turner's & Klienfelter's Syndromes).
- Mode of Inheritance of Autosomal Chromosome (Albinism & Thalassaemia) and Sex-Linked Chromosome (Colour Blindness and Haemophilia).
- Mutation : Types, Agents, Induction and Detection of mutation (CIB Method).
- Method of detecting Biochemical Mutants; Metabolic Blockage of Arginine pathways in *Neurospora*.
- Human genetic disorders: a) Phenylalanine pathway (Alkaptonuria and Phenylketonuria), b) Tyrosine pathway (Albinism), c) Sickle Cell Anaemia.
- One Gene – One Polypeptide Hypothesis – present status.

Unit II: Ecology

Periods - 24

- **Basic concept:** a) Biotic and Abiotic Factors, b) Energy Flow in Ecosystems (Lindemann Model), implications of thermodynamic laws c) Interspecific Interactions in Ecosystem (Commensalism, Mutualism and Parasitism).
- **Population Ecology:** a) Attributes of natural Populations b) Population dynamics - Growth form and growth equations; c) Demography, life table types and survivorship cuves
- **Community Ecology:** a) Species Diversity, Relative Abundance and Species Dominance, b) Stratification of Forest, c) Trophic Structure, d) Multidimensional Concept of Ecological Niche, e) Principles of Competitive Exclusion and species co-existence.
- **Community Succession:** Characteristics, Types and Causes of Ecological Succession a) Autogenic and Allogenic Succession, (b) Primary and Secondary Successions, d) Ecotone - features and formation, e) Edge Effect.
- **Behavioral Ecology:** Migration in birds
- **Environmental Pollution:** a) Air and Water (Sources and kinds), b) Acid rain, CFC and Ozone Depletion, c) Greenhouse effect and Global warming,) Bio-magnification and Eutrophication – Causes and Signicance with examples, e) Human Population Growth and its impact on environment;
- **Conservation of threatened wild life:** National and International Initiatives i) Indian Wildlife Protection Act 1972, ii) WWF, iii) IUCN, iv) Indian Biodiversity Act 2002.

- **Note: Internal Assessment of 12 marks based on the above syllabus.**

Tripura University

Semester-III

ZOOLOGY (GENERAL)

Paper – 3B

Practical

Full Marks 50
(40 +10)

Time : 4 hours

1 Study of biotic community (Soil & Water) and their significance (any two)	3x2=6
2. Determination of Population Density by Quadrate method	6
3. Estimation of Dissolved Oxygen in water and determination of pH	6+2=8
4. Adaptive features of Physallia, Fasciola, Ascaris, Hirudinaria, Octopus, Exocoetus Tree frog, Hemidactylus, Chiroptera. (any three)	3x2=6
5. Field visit and submission of Field Note Book	6
6. Practical Note Book	4
7. Viva Voce	4

Note: Internal assessment of 10 marks based on the above syllabus.

TRIPURA UNIVERSITY
SEMESTER – III
Zoology (Major)

Practical - Paper – 3B

Marks 40 (32 + 8)

TIME : 4 Hours

1) Preparation and identification of Polytene Chromosome of *Drosophila* Larvae. (5)
2) Pedigree analysis of common human traits (4)
3) Identification of meiotic cell division (any stage) (2)
4) Estimation of population by Capture – Recapture method by Hypothetical beads population. (5)
5) Estimation of Dissolved Oxygen (4)
6) Spot Identification and role of biotic community of soil and water :
(Any Two) a)Soil Mite b) Termite c) Collembola d) Ants
e) Earthworm f) Daphnia g) Cyclops (3+3=6)
7) Laboratory Note Book (3)
8) Viva voce (3)

NOTE : Internal Assessment of 8 Marks based on the above syllabus

TRIPURA UNIVERSITY

(A Central University)
Suryamaninagar-799022

Syllabus

OF

Zoology
(General & Major)

Semester - IV

2014

Semester – IV (Honours / Major)

Paper 4A Theory 60 (48 + 12)

Unit I: Microbiology, Parasitology and Immunology

1) General characters and major classification of microbes.
2) Microbes in human and animal welfare.
3) Common microbial diseases (Cholera and Amoebiosis), their treatment and control.
4) Life cycle, pathogenecity, clinical features and control measures of *Plasmodium vivax*, *P. falciparum*, *Wuchereria bancrofti* and *Anchylostoma duodenale*.
6) Host-parasitic interaction with reference to helminthes (*Taenia* sp. and roundworms) diseases.
7) Major cells types and organs of immune system; primary and secondary lymphoid organs; types of immune system: Cell mediated immune system & humoral immune system; Concept of antigens and types of antibodies

Unit II: Tools and techniques in Biology **(15 lectures) 12x2 = 24**

1) Principle and applications of pH meter, ii) colorimeter, and iii) Centrifuges
2) Principle and applications of i) Chromatography ii) Electrophoresis
3) Principle and application of i) Light microscope (Bright-field and Phase Contrast) and Electron microscope (SEM & TEM)
4) Micro-techniques: Fixation, dehydration, embedding, block-making, microtomy, Principle of staining, acid and basic stains, Single & double staining methods

N.B: Internal assessment of 12 marks based upon above syllabus.

Paper 4B **Practicals (based on theory paper)** **40 (28 + 12)**

1) Spot identification of parasites: *Entamoeba sp., Ascaris sp., Anchylostoma sp., Taenia sp.*
2) Adaptive features of: *Fasciola hepatica, Ascaris lumbricoides, Taenia solium, Anchylostoma duodenale, Hirudinaria sp.*
3) Gram staining of bacteria
4) Collection and preparation of gut parasites of cockroach and fowl
5) Double staining method (H-E) of liver, kidney and testis tissues
6) Lab note book
7) Viva voce

N.B: Internal assessment of 12 marks based upon above syllabus.

Semester – IV (Pass / Minor)

Paper 4A Theory **50 (40 + 10)**

Unit I: Applied Zoology II

1. Sericulture: Species of silk worms, food plants and silk varieties in India; Life history and rearing method of *Bombyx mori,* its diseases and control measures.
2. Apiculture: Species of honey bees in India; Life history and rearing methods of *Apis indica*; Bee products and their uses.
3. Vermiculture: Major vermicomposting species in India; Principle, method and importance of vermicomposting.
5. Prawn culture: Indian prawns of commercial value – Penaeid and non-penaeid groups, Prawn culture and hazards in prawn farming.

Unit II: Genetics and Molecular Biology

1. Mendelian principle of segregation and independent assortment
2. Linkage, Recombination, Cytoplasmic inheritance
3. Concepts of alleles and multiple alleles
4. Sex determination in *Drosophila* and man; Sex chromatin or Barr body and its significance
5. Congenital chromosomal abnormalities: Down, Turner and Klinefelter syndrome
6. Mode of inheritance of autosomal and sex-linked genes with reference to albinism and colour blindness
7. DNA as a genetic material – experimental proof
8. Replication, Transcription and Translation in prokaryotes

Paper 4B Practical

50 (40 + 10)

A. Applied Zoology

1. Spotting and economic importance of the following specimens (Any three)

a. ~~*Triporhiza sp.*~~ Tryporyza sp.
b. *Sitophilus sp.*
c. *Bandicoota sp.*
d. *Bombyx sp.*
e. *Apis sp.*
f. *Perionyx sp.*
g. *Macrobrachium sp.*

B. Genetics

2. Preparation and staining of cell division (onion root tip)
3. Identification of Mitotic / Meiotic division stages
4. Studies of Barr body in man.

C. Viva Voce

D. Lab Note Book

TRIPURA UNIVERSITY

(A Central University)
Suryamaninagar-799022

Syllabus

OF

Zoology (General & Major)

Semester – V

2014

(2)

TRIPURA UNIVERSITY

Semester – V (Theory)

Zoology (Major)

Paper: 5A **Total Marks 100 (80+20)**

Unit-I: Adaptation, Zoogeography & Ethology (15 lectures)

1. Convergent and divergent adaptation and adaptive radiation in placental mammals with reference to teeth & limbs.
2. Morphological, anatomical and physiological adaptations in Pigeon, Camel and Whale.
3. Colouration - Cryptic & Warning.
4. Mimicry - Protective, Aggressive and Warning (Batesian and Mullerian).
5. Continental Drift theory and Discontinuous distribution of animals.
6. Zoogeographical realms (geographical composition, climate and faunal characteristics) - i) Ethiopian, ii) Oriental and iii) Australian.
7. Basics of animal behaviour; Innate and Learned behaviours (characteristics, differences, classification & examples).
8. Communication in animals with reference to pheromone and its role in territory marking, courtship and mating.

Unit-II: Animal Physiology (15 lectures)

1. Physiology of digestion in mammals.
2. Transport of O_2 and CO_2 in the blood of mammals, Bohr Effect, Chloride Shift.
3. Respiration in i) Lata, ii) Shark, iii) Pigeon and iv) Human
4. Excretion: i) Nitrogen excretion in vertebrates (fish, bird, mammal), ii) Hypertonic urine formation in mammals.
5. Osmoregulation in fresh water fish and marine fish.
6. Generation of action potential and transmission of nerve impulse; mechanism of synaptic transmission.

Unit-III: Biodiversity and Conservation (15 lectures)

1. Concept of Biodiversity; Types: Hierarchical levels (Genetic diversity, Species diversity), Community and Ecosystem diversity (alpha, beta and gamma diversity).
2. Biodiversity as a resource; changes/depletion of biodiversity and its causes.
3. Hot spots of biodiversity, Strategies for conservation of biodiversity (*ex-situ* and *in-situ* methods).
4. IUCN threatened categories: Endangered, Critically endangered, Vulnerable and Rare species.
5. Wild-life conservation with reference to Tiger and Rhino.
6. Protected area, Wildlife protection act, Biosphere reserves, National park and Sanctuaries; CITES.

Unit-IV: Biostatistics (15 lectures)

1. Concept of mean, mode and median; their relationship.
2. Elementary concepts of probability and distribution

   (a) Standard deviation (b) Standard error (c) Variance (d) t-test

   (e) Simple-correlation coefficient, (f) Chi-square test.

3. Representation of statistical data:
   a) Bar diagram
   b) Histogram
   c) Frequency Polygon
   d) Line graph
   e) Pie chart

Internal assessment of **20 marks** based on the above study material

TRIPURA UNIVERSITY

Semester – V (Practical)

Zoology (Major)

Paper: 5B **Practical paper** **100 (80 + 20)**

1. Morphological , behavioural and other adaptive features - *Anabas sp., Exocoetus sp., Amphipnous sp. Hyla sp* (Tree frog)., *Axolotl of Ambystoma sp., Chamaeleo sp., Gekko sp., Naja sp., Columba sp., Psittacula sp.* (Parrot*), Pteropus sp., Bandicoota sp.*(any five). 4x5=20

2. Studies on Zoogeography: placement of 5 specific/ endemic/ characteristic animals in their respective zoogeographical realm. 5+3= 8

3. Principle, procedure, display, drawing and labelling (any two of the followings) 7x2=14

   a) Studies on human blood group.
   b) Studies on haemin crystals in human
   c) Preparation of human blood film; identification of WBC.

4. Problems on Chi-square test and t-test: Principle, calculation, result and inference (any one). 2+10+3=15

5. Observation on water/soil/terrestrial animal biodiversities (local fauna) and submission of field study report. 10
6. Laboratory note book. 7
7. Viva. 6

Internal assessment of **20 marks** based on the above study material

TRIPURA UNIVERSITY

B.Sc. Zoology (General)

Semester V

Paper: 5A **50**

Unit-I: Parasitology and Medical Entomology (15 lectures)

1. Life cycle, pathogenicity, clinical features and control measures of –
   (a) *Plasmodium vivax*
   (b) *Entamoeba histolytica*
   (c) *Ascaris lumbricoides*
2. Parasitic adaptations in helminthes with reference to *Ascaris lumbricoides* and *Taenia solium*
3. Common insect vectors related to public health: their features and the disease (s) caused by these vectors -
   a) Mosquitoes (*Anopheles, Culex, Aedes)*
   b) House fly *(Musca sp.)*
   c) Bed bug (*Cimex sp.*)
   d) Head louse (*Pediculus sp.*)

Unit-II: Microbiology and Immunology (15 lectures)

1. Types of Microbes and their important features.
2. Disease causing Microbes with reference to Cholera and Tuberculosis, mode of transmission.
3. Microbes in human gut and their beneficial role; concept of Probiotics.
4. Immune system – cells and organs of immune system, types of immune responses.
5. Antibodies types and its modal structure; antigen and antibody interaction.

Internal assessment of **10 marks** based on the above study material

TRIPURA UNIVERSITY

B.Sc. Zoology (General)

Practical paper

Paper: 5B **Practical paper** **50 (40+10)**

1. Identification with reasons: (any two) 5x2 = 10
   a) *Entamoeba histolytica*
   b) *Giardia intestinalis*
   c) Plasmodium Sp.
   d) *Ascaris lumbricoides*
   e) *Culex sp.*
   f) *Musca sp*
   g) *Cimex sp.*
2. Adaptive features in *Fasciola sp., Ascaris sp., Taenia sp.*(any one). 5
3. Collection and preparation of gut fauna in cultivable fishes and fowl. 3+2+3 = 8
4. Submission of life history stages of mosquito in glass bottle & also on drawing sheet. 4+3 = 7
5. Lab Note Book. 5
6. Viva. 5

Internal assessment of **10 marks** based on the above study material

TRIPURA UNIVERSITY

Semester – IV (Major / Theory)

Paper 4A **Theory** **60 (48 + 12)**

Unit I: **Microbiology, Parasitology and Immunology** **(15 lectures)**

1) Types of Microbes and their important features.
2) Microbes in Human welfare and the concept of probiotics.
3) Common microbial diseases (Cholera and Amoebiasis) their treatment and control.
4) Life cycle, pathogenecity, clinical features and control measures of *Plasmodium vivax*, *Plasmodium falciparum*, *Wuchereria bancrofti*, *Ancylostoma duodenale*.
6) Host parasitic interaction with reference to helminthes (*Taenia* sp. and round worm) diseases.
7) Immune system - major cell types and organs of immune system; types of immune response; antigen – antibody reaction; antibody types and its model structure.

Unit II: **Tools and techniques in Biology** **(15 lectures)**

1) Principle and application of i) pH meter ii) colorimeter and iii) Centrifuges
2) Principle and application of i) Chromatography and ii) Electrophoresis.
3) Principle and application of i) Light microscope (Bright-field and phase contrast) and ii) Electron microscope (TEM & SEM).
4) Micro-techniques: Fixation, dehydration, embedding, block-making, microtomy, principle of staining, acid and basic stains, single & double staining method.

N.B: Internal assessment of **12 marks** based upon above syllabus.

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Semester – IV (Major / Practical)

Paper 4B Practical (based on theory paper) **40 (32 + 8)**

1)	Spot identification of parasites: *Entamoeba sp, Ascaris sp, Ancylostoma sp, Taenia sp.(any one)*	3
2)	Adaptive features of: *Fasciola hepatica, Ascaris lumbricoides, Taenia solium, Anchylostoma duodenale, Hirudinaria (any one)*	4
3)	Gram staining of bacteria	4
4)	Collection and preparation of gut parasites of cockroach and fowl	(2+3+2)7
5)	Double staining method (H-E) of liver, kidney and testis tissue	(4+1+2) 7
6)	Lab note book	3
7)	Viva voce	4

Total = 32

N.B: Internal assessment of **8 marks** based upon above syllabus.

reference to albinism and

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Semester – IV (General/ Theory)

Paper 4A Theory

50 (40 + 10)

Unit I: Applied Zoology II

(15 lectures)

1. Sericulture: Species of silk worm, food plants and silk varieties in India. Life history and rearing method of *Bombyx mori* ,its diseases and control measures.
2. Apiculture: species of honey bees in India; life history and rearing methods of *Apis indica*; bee products and their uses.
3. Vermiculture: Major vermicomposting species in India; Principle, method and importance of vermicomposting.
4. Prawn culture: Indian prawns of commercial value; Penaeid and non-penaeid group. Prawn culture and demerits in transportation of prawn seeds.

Unit II: Genetics and Molecular Biology

(15 lectures)

1. Mendelian principle of segregation and independent assortment.
2. Linkage, Recombination, Cytoplasmic inheritance.
3. Concepts of alleles and multiple alleles.
4. Sex determination in *Drosophila* and man; Sex chromatin or Barr body and its significance.
5. Congenital chromosomal abnormalities: Down, Turner and Klinefelter syndrome.
6. Mode of inheritance of autosomal and sex-linked genes with reference to albinism and color blindness.
7. DNA as a genetic material – experimental proof.
8. Replication, Transcription and Translation in prokaryotes.

N.B: Internal assessment of **10 marks** based upon above syllabus.

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Semester – IV (General / Practical)

50 (40 + 10)

Paper 4B (Practical based on theory paper)

A. Applied Zoology

1. Spotting and economic importance of the following specimens (Any three) 3x4=12

a. *Tryporyza sp*
b. *Sitophilus sp*
c. *Bandicoota sp*
d. *Bombyx sp*
e. *Apis sp*
f. *Perionyx sp*
g. *Macrobrachium sp*

B. Genetics

2. Preparation and staining of cell division (onion root tip). (4+4) = 8
3. Identification of Meiotic division stages (any one) 4
4. Studies of Barr body in man (preparation and display) (4+2) = 6

C. Viva Voce 5

D. Lab Note Book 5

Total = 40

N.B: Internal assessment of **10 marks** based upon above syllabus.

TRIPURA UNIVERSITY

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Syllabus

OF

Zoology (General & Major)

Semester – VI

2014

TRIPURA UNIVERSITY

SEMESTER – VI

Zoology (Major)

Paper – 6A (Theory)

(Marks – 100, Total Periods - 60)

Total Marks: 100 (80+20)

Unit I: Evolutionary Biology (15 Lectures)

1. Origin of Life: Experimental evidence in favour of Abiotic synthesis of Basic Biomolecules (Urey-Miller Experiment); origin of organized structure of Protocell or Coacervate.
2. Basic ideas on Geologic time table with major examples of fauna.
3. Neo- Darwinism; Genetic variations and sources of variations in a natural populations.
4. Hardy Weinberg Principle and factors influencing changes in the gene frequency (problems excluded).
5. Types of Natural selections: Stabilizing, Directional, and Disruptive selections with examples.
6. Isolating Mechanisms and importance of Reproductive Isolation.
7. Modes of Speciation: Sympatric, Allopatric and Parapatric processes.

Unit II: Biochemistry (15 Lectures)

1. Concept of pH and buffer and their biological applications.
2. Structures and functions of carbohydrates, lipids proteins and nucleic acids;
3. Enzymes- general properties; definitions and characteristics of coenzymes, isoenzymes and allosteric enzymes with examples;
4. Mechanism of enzyme action; factors affecting reaction rates;
5. Glycolysis , TCA cycle and ATP generation.

Unit III: Endocrinology and Reproductive biology **(15 Lectures)**

1. Histological structures and functions of Pituitary, Thyroid, Pancreas, Testes and Ovary;
2. Endocrine disorders in human with special reference to pituitary and thyroid glands.
3. Types of Hormones : vertebrates and invertebrates with special reference to insects ;
4. Hormonal control of spermatogenesis and oogenesis;
5. Process of ovulation and its hormonal control;
6. Reproductive cycles in mammals with special reference to oestrous cycle in rat.

Unit IV: Molecular Biology and Genetic Engineering **(15 Lectures)**

1. Replication, transcription and translation in prokaryotes;
2. Benzer's rII locus, idea of complementation and non-complementation;
3. Concept of cistron, recon and muton;
4. Genetic regulation in Prokaryotes-*Lac* Operon ;
5. Genetic basis of Cancer:
   a) Proto-oncogenes and viral oncogenes
   b) Transformation of proto-oncogene to oncogene
   c) Functional importance of p53 tumour suppressor gene
   d) Oncogenes in human cancer: *Src, ras, bcr/abl*
6. Recombinant DNA technology and its applications:
   a) Cloning vectors
   b) Types of endonucleases and their roles
   c) Construction of chimeric DNA
   d) Copying mRNA into cDNA clones with desired DNA
   e) Potential benefits and hazards of genetic engineering.

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Syllabus

OF

Zoology

Major – Semester – VI

Paper – VIB (Practical)

(Rectified)

2014

TRIPURA UNIVERSITY
SEMESTER – VI
Zoology (Major)
Paper – VIB (Practical)

Total Marks: 100 (80+20)

1. Identification of bones (comparative aspects): Skull, limb bones (Humerus, Radio-ulna, femur, tibia-fibula) and girdle bones of toad, lizard, pigeon and guinea pig (any one pair of bones representing two different vertebrates). 10 x 1 = 10

2. a) Study of Salivary amylase action. 10x1=10

   b) Quantitaive estimation of Glucose (by titrimetric method).

   (any one to be given in the examination)

3. Identification and charcterization of the histological slides of the following endocrine glands of mammal with drawing, labeling & comments:

   i. Pituitary, ii. Thyroid, iii. Adrenal, iv. Pancreas (Islets of Langerhans), v. Testis &

   vi. Ovary. (slides of any two glands to be given in the examination) 10 x 2 =20

4. Determination of genotype frequency and allele frequency with example (any one to be given in the examination) 10x1=10

5. Identification with characters of Human Syndrome/Disorder from the sample of karyotype provided:

   i) Klienfelter's
   ii) Turner's
   iii) Down's
   iv) Super female

   (any one to be given in the examination) 10x1=10

6. Submission of Laboratory Note book. 10

7. Viva 10

Internal assessment based on practicals (1 to 5 of the above). 20