SYLLABUS

Zoology

(General & Major)

Year 2014

TRIPURA UNIVERSITY

(A Central University)

Suryamaninagar

799 022

Zoology is the study of Animal Biology in all its aspects, from cells to populations and from neurones to behaviour.

Course Structure as per the syllabus of Tripura University (a Central University)

Year	Semester	Paper	Content	Marks
I[st] Year	Semester I	Paper - 1	U-L Non Chordates I (Without Coelom) U-IL Non Chordates II (With Coelom) U-IIL Chordates 1 (Protochordatcs 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
2[nd] Year	Semester III	Paper-3A	U-I. Taxonomy & Classification, Evolution & Adaptation U-IL Ecology, Ethology, Zoogeography and Biodiversity	50
		Paper-3B	Practical based on theory of Paper -III A	" 50
	Semester-IV	Paper - 4A	U-L Applied Zoology U-IL Genetics and Molecular Biology	' 50
		Paper - 4B	Practical Based on Theory of Paper-IV-A	50
3[rd] Year	Semester- V	Paper-5A	U-L Parasitology and Medical Entomology U-IL 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

Zoology (Major)

Course Structure

-Year	Semester	Paper	Content	Marks
1* Year	Semester I	Paper-1	U-I. Non Chordates I (Without Coelom) U-IL Non Chordates II (With Coelom) U-III. Chordates (Protochoidates to mammals) U-IV. Taxonomy and Classification	100
	Semester II	Paper-2A	U-I. Cell Biology, Histology and Developmental Biology U-IL Applied Zoology	• 60
		Paper - 2B	Practical based on theory of Paper II-A	40
. 2Dd Year	Semester - III	Paper-3A	U-I. Genetics U-IL Ecology	60
		Paper-3B	Practical based on theory of Paper -III-A	40
	Semester-IV	Paper — 4A	U-I. Microbiology, Parasitology & Immunology U-IL 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-IL 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
			Project in Zoology i.. Project Methodology (for internal assessment) 20 iv. Project work - 60 v. Presentation and interaction - 20 Viva-25	100

Syllabus of Tripura University for Zoology (THEORY; GENERAL)

Semester I

Paper-1

Aim and Objectives:

The course is designed to give the student a comprehensive idea of protistan and non-chordate diversity (both with and without coelom), structure and functions. The type studies are intended to provide an understanding of the typical protista and invertebrate body structure, which has a lot in common in the various groups. The syllabus deals with various anatomical and physiological features of both non-chordate and chordate groups. Comparative account of the exoskeletal structure in birds and mammals also been covered.

Outcomes

At the end of the course students should be able to:

- Draw a clear idea regarding the hierarchical classification of the Animal Kingdom.
- Students can have through knowledge regarding the anatomical and physiological features of chordates, protochordates and non chordates.
- Can have a comparative knowledge regarding various mechanism and structures of various animals.

List of Reference book:

1. Modern Text Book of Zoology- Vertebrates , by R. L. Kotpal
2. Modern Text Book of Zoology- Invertebrates, by R. L. Kotpal
3. Introduction to general Zoology, by Chaki, Kundu & Sarkar

Prescribed syllabus of Tripura University for Zoology (THEORY; GENERAL)

Semester I

Paper-1

UNIT I: Non-Chordates (without coelom)

- *Paramecium* sp.: Structure, locomotory organelle and reproduction.
- Sycon; Histology of body wall with special reference to canal system and spicules.
- *Obelia*: Organisation and Life history with special reference to metagenesis.
- Morphology and functional anatomy of *Planaria* & *Fasciola*

UNIT II: Non-Chordates - II (with coelom)

- Mechanism of feeding and structure of digestive system in Earthworm and *Pila*.
- Respiration: Structure and function of: Gills (Prawn). Trachea (Cockroach), Ctenidium and Pulmonary sac (*Pila*).
- Circulation: Open type (Cockroach) and closed type (Earthworm).
- Excretion : Nephridia and its role in Earthworm
- Nervous System: Basic plan of Invertebrates nervous system; Nervous system in. Cockroach and Pila.

UNIT III: Chordata -1 (Protochordates to Pisces)

- Branchiostomata: General Organisation, structure of Pharynx & Nephridia, mechanism of feeding and excretion.
- Ascidia: Structure of Pharynx and mechanism to feeding; The life history with special reference to retrogressive metamorphosis. Evolutionary significance of Ascidian Tadpole.
- Cyclostomata: Petromyzon: Difference between *Petromyzon* and *Myxine*; Respiratory system of *Petromyzon*; *Ammocoetes* larva and its significance.
- Lates: Digestive, Respiratory, Circulatory and Urinogenital system.
- Accessory Respiratory organs in fishes.

UNIT IV: Chordata -II (Amphibia to Mammals)

- Digestive system: Functional anatomy of stomach in *Collumba* and Cow.
- Respiratory System: Lungs and mode of respiration in Amphibia, Birds and Mammals.
- Circulatory system: Comparative anatomy of Heart and aortic arches in Amphibia, Reptiles, Birds and Mammals.
- Nervous system: Structure of Brain in Toad and Guinea pig; Cranial Nerves-Origin, distribution and function; Difference between Sympathetic and Para- Sympathetic Nervous system.
- Difference between poisonous and non-poisonous snakes
- Exoskeletal structure in birds and mammals

Syllabus of Tripura University for Zoology (THEORY; MAJOR)

Semester I

Paper-1

Aim and Objectives:

This course examines the anatomical similarities and disparities among major vertebrate and invertebrate classes. The type studies are intended to provide an understanding of the typical protista and invertebrate body structure, which has a lot in common in the various groups. The syllabus deals with various anatomical and physiological features of both non-chordate and chordate groups. Comparative account of the exoskeletal structure in birds and mammals also been covered. Larval evolutionary significance is one of the most important part of this course.

Learning Outcomes:

Upon successful completion of this course, students should be able to:

1. Understand the evolution of vertebrates, including their phylogeny and the modifications of key innovations and homologous structures among taxa
2. Identify and describe the defining characteristics of the major vertebrate classes as well as hemi- and protochordates
3. Describe the major architectural features of the integumentary, skeletal, nervous, muscular, digestive, respiratory, circulatory, excretory and reproductive systems
4. Understand the basics of systematics and the use of anatomy/morphology in determining evolutionary relationships
5. Develop an understanding of the application of comparative anatomy in current scientific methods/literature

List of Reference books/ WEBS:

1. Modern Text Book of Zoology- Vertebrates , by R. L. Kotpal
2. Modern Text Book of Zoology- Invertebrates, by R. L. Kotpal
3. Invertebrate Zoology, by Jordan & Verma
4. Text Book of Zoology, by Durgadas Mukherji
5. College Zoology, B. K. Lahiri

Prescribed syllabus of Tripura University for Zoology (THEORY; MAJOR)

Semester I

Paper-1

UNIT I: Non-chordates-I (without Coelom):

- Protozoa: Locomotion in protozoa [Amoeboid *(Amoeba),* Cilliary *(Paramoecium),*
- Flagellar *(Euglena);* Morphology and reproduction in *Paramoecium* .
- Porifera: *Sycon*- skeletal and canal system.
- Cnidarla: Polymorphism in Siphonophora; Coraf and Coral reef formation
- Helminthes: Excretory and Nervous system in *Helminthes.*

UNIT II: Non-Chordates-II (With Coelom)

- Coelom: origin, types and function
- Nature, origin and significance of metamerism
- Morphology, Digestive and excretory system of leech
- Morphology, digestive, respiratory, excretory and reproductive system of cockroach
- Morphology, digestive, respiratory and nervous system of *Pila*
- Morphology and water vascular system *of Asterias*
- Echinodenn larvae and their evolutionary significance

UNIT III: Chordates (Protochordate to Mammals):

- Protochordata: Structural organization, ciliary mode of feeding and excretion in *Branchiostomai* Life history of *Ascldia &* and evolutionary significance of Ascidean tadpole; Affinities & evolutionary position of *Balanogtossus.*
- Cyclostomata: Comparative Study of *Petromyzon* & *Myxtne;* Amocoetes larva and evolutionary significance.
- Pisces: Difference between osteichthyes and chondrtchthyes; *Labeoi* Morphology,
- Respiratory & Reproductive system; Scales and fins in fishes; Accessory respiratory organs; General characters, distribution, affinities and evolutionary significance of Dipnoi.
- Amphibia -Neoteny and Pedomorphosis
- Comparative anatomy of heart and aortic arches in vertebrates
- Poisonous and Non-Poisonous Snake (Comparative account), Poison apparatus, mechanism of feeding and biting in snakes
- Functional anatomy of lungs in Birds and Mammals
- Specialization of digestive system in ruminant and non-ruminant mammals ■ Integuments and its derivatives in birds and mammals

UNIT IV: Taxonomy and Classification

- Taxonomy, its history and relationship with systematics .
- Definition: Classification, Phenon, Taxon, Category, Binomial and trinomial classification with examples, Rules of Zoological nomenclature.
- Kinds of Zoological Classification: Components of Classification, Linnaean hierarchy
- Concept of Species: Typological, Nominalistic, Biological and Evolutionary
- General Characteristics and Classification up to sab class: a) Porifera, Annelida, Arthropoda, Mollusca and Echinodermata and Order in b) Pisces, Amphibia, Reptilia and Mammalia
  Basic Concept of Six Kingdom Classification

Syllabus of Tripura University for Zoology (THEORY; GENERAL)

Semester II

Paper-2A

Aims and Objectives:

Cell biology is increasingly important in all life sciences. Many of the advancements in modern science are the result of a better understanding of cellular components and their functions. An understanding of cell biology is an asset in the work place and more valuable than we may think.

The syllabus is well covered on histological structures of various organs. Also the present syllabus deals with the biochemical mechanism of animal body, hormonal control in various physiological processes.

Outcomes:

After completion of the course,

1. Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles

3. Students will understand the cellular components underlying Mitotic & Meiotic Cell Divisions.

4. Students can brief the concept of Animal tissue, origin and distributions.

5. Students will be familiar with the histological structures of various organs.

6. Students can gain complete knowledge related to the physicchemical events during fertilization and stepwise events during development.

7. Students will understand regarding various types of biomolecules in animals, their mode of nutritions, and hormonal functions in body.

Reference books:

1. Cell Biology, by Dr C B Powar
2. General Microbiology, Vol. I & Vol. II, Powar & Daginawala
3. Introduction to general Zoology, by Chaki, Kundu & Sarkar
4. Text Book of Zoology, by Chatterjee, Chakraborty & Ghosh
5. Cell Biology, Cytology, Biomolecules and Molecular Biology, by Verma & Agarwala
6. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology, by Verma & Agarwala
7. Verma and Agarwal : Chordate Embryology; S.Chand.

Prescribed syllabus of Tripura University for

SEMESTER II Zoology (General) Theory

Paper 2A

- **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-11: 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, Ureoteiic 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.

SEMESTER II Zoology (General) Practical Paper 2B

Aims:

The practical syllabus of second semester Zoology (General) is well covered with hand on programme on the studies of various specimens belonging to chordate and non chordates and identification with reasons. Chick embryology is also included. Cell division to be mounted in a slide. Fundamental hands-on practices will be made regarding of staining and mounting, determination of pH.

Learning objectives:

- Students can easily identify various zoological specimens following systematic position and adaptations.
- Students will get a clear concept regarding phages of Mitosis Cell Division.
- Histological structures of various animal organs will be well understood.
- Biomolecules can be easily identify by test procedures.
- By the end of this Unit you should be able to: • list the components of normal blood.
- Students will be able to maintain a laboratory note book with minimum errors.

Reference books:

1. Practical Zoology- Part I, II & III, By Chatterjee, Chakraborty & Ghosh
2. Practical Zoology, Vertebrate, by S. S Lal
3. Practical Vertebrate Zoology, Gupta & Malik
4. Advanced Practical Zoology, by Sinha, Chatterjee & Chattopadhay

Prescribed syllabus of Tripura University for

SEMESTER II Zoology (General) Practical

Paper 2B

Total Marks = 50

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

a) Paramoecium, *Sycon, Obleiia,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/BSood film . Preparation of buffer, determination of pH. **5x2 = 10**

4. Laboratory Note Book Submission & Viva Voce

5+5=10

Prescribed syllabus of Tripura University for

SEMESTER II Zoology (Major) Theory

Paper 2A

Aims:

The syllabus for second semester zoology (Major) is designed to have a detailed idea regarding Cell Biology, Developmental Biology and Economic Zoology. Also histological studies of various mammalian organs are nicely framed.

Outcomes :

1. Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
2. Students will understand how these cellular components are used to generate and utilize energy in cells.
3. Students will understand the cellular components underlying mitotic and meiotic cell division.
4. Various types of animal tissues, their origin and distribution and functions can be fully understood.
5. Be familiar with the events that lead up to and comprise the process of fertilization. Be able to discuss the critical contributions of the sperm and the egg to the zygote, and how structure informs function. Be able to describe the mechanism of the acrosomal reaction and understands its function. Be able to describe the mechanisms responsible for the fast block and slow block to polyspermy during fertilization in sea urchins; know the mammalian equivalent mechanisms. Economic zoology deals with the culture and farming of various live stocks.

Reference Books:

1. Invertebrate Zoology, by Jordan & Verma
2. Text Book of Zoology, by Durgadas Mukherji
3. College Zoology, B. K. Lahiri
4. Cell Biology, by Dr C B Powar
5. General Microbiology, Vol. I & Vol. II, Powar & Daginawala
6. Introduction to general Zoology, by Chaki, Kundu & Sarkar
7. Text Book of Zoology, by Chatterjee, Chakraborty & Ghosh

8. Ayyar, T.V.R. 1963. Hand Book of Economic Entomology for South India – Govt. Press, Madras.
9. David, B.V. and M.C. Muralirangan and M. Meera. 1992. Harmful and Beneficial Insects – Popular Book Deport, Madras, 304 p.
10. David, B.V. and T. Kumaraswami. 1982. Elements of Economic Entomology – Popular Book Depot, Madras, 536 p.
11. Dhaliwal, G.S. and B. Singh. 1998. Pesticides – The ecological impact in developing countries– Commonwealth Publishers, New Delhi.
12. Dhaliwal, G.S. and E.A. Heinrichs. 1998. Critical issues in pest management – Commonwealth Publishers, New Delhi, 287 p.
13. Dhaliwal, G.S. and Ramesh Arora. 1998. Principles of Insect Pest Management – Kalyani Publishers, New Delhi, 297 p.
14. Grout, R.A. 1963. The Hive and the Honey Bee – Dadant and Sons Inc, Hamilton, Illinois, 556p.
15. Metcalf, C.K. and W.P. Flint. 1970. Destructive and Useful Insects : Their Habits and Control– Tata McGraw Hill Pub. Co., New Delhi 1074p.
16. Pradhan, S. 1983. Agricultural Entomology and Pest Control – Indian Council of AgriculturalResearch, New Delhi, 267 p.
17. Singh, S. 1975. Bee Keeping in India – Indian Council of Agricultural Research, New Delhi,214p.
18. Srivastava, K. P. 2003. A text book of Applied Entomology. Vol. II. Kalyani Publishers,Ludhiana, pp. 497.

Prescribed syllabus of Tripura University for

SEMESTER II Zoology (Major) Theory

Paper 2A

Unit-I: Cell Biology, Histology and Developmental Biology

- Concept of Prokaryotic & Eukaryotic cells.
- Uitrastructure 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, Polytenc 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
- Extraetnbryonic 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 mdica.* Modem 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 *Leueinodes orbonalis.*

SEMESTER II Zoology (Major) theory Paper 2B

Aims:

The practical syllabus of second semester Zoology (General) is well covered with hand on programme on the studies of various specimens belonging to chordate and non chordates and identification with reasons. Chick embryology is also included. Cell division to be mounted in a slide. Fundamental hands-on practices will be made regarding of staining and mounting, determination of pH.

Learning objectives:

- Students can easily identify various zoological specimens following systematic position and adaptations.
- Students will get a clear concept regarding phages of Mitosis Cell Division.
- Histological structures of various animal organs will be well understood.
- Biomolecules can be easily identify by test procedures.
- By the end of this Unit you should be able to: • list the components of normal blood.
- Students will be able to maintain a laboratory note book with minimum errors.

Reference books:

1. Functional Histology, by Asim K. Datta
2. Practical Zoology- Part I, II & III, By Chatterjee, Chakraborty & Ghosh
3. Practical Zoology, Vertebrate, by S. S Lal
4. Practical Vertebrate Zoology, Gupta & Malik
5. Advanced Practical Zoology, by Sinha, Chatterjee & Chattopadhay

Prescribed syllabus of Tripura University for

SEMESTER II Zoology (Major) Practical

Paper IIB

FULL 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, Scoiiodon, 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**

Syllabus of Tripura University for Zoology (THEORY; GENERAL)

Semester III

Paper-3A

Aim of the course:

This course will cover taxonomy, focusing on classical and modern means of classification and providing a broad survey of animal phyla, including some of their shared features and unique characteristics. It will also introduce to the comparative anatomy and physiology of animals. Finally, the course will address animal ecology: the interaction of animals with one another and with their environment. This course will prepare for further study in any biological field that involves animals, including ecology, wildlife management, evolution, animal physiology, animal behavior, and even human biology

Learning objectives of the course:

Upon successful completion of this course, the student will be able to:

- have a comprehensive knowledge of zoology and its relationship with other fields of biology;
- compare and contrast anatomical and physiological characteristics of vertebrates and invertebrates;
- answer specific questions about zoogeography, geologic time scale, animal evolution, and paleontology;
- define, identify, and describe the different body systems; and
- apply this knowledge for further study in any biological fields that involves animals related to adaptation.

References:

1. Introduction to general Zoology, by Chaki, Kundu & Sarkar
2. Text Book of Zoology, by Chatterjee, Chakraborty & Ghosh
3. Modern Text Book of Zoology- Vertebrates , by R. L. Kotpal
4. Modern Text Book of Zoology- Invertebrates, by R. L. Kotpal
5. Invertebrate Zoology, by Jordan & Verma
6. Text Book of Zoology, by Durgadas Mukherji

Prescribed syllabus of Tripura University for Zoology (THEORY; GENERAL)

Semester III

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 Taxonomical 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, babbit 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, fauna 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.

Syllabus of Tripura University for Zoology (THEORY; MAJOR)

Semester III

Paper-3A

Aim of the course:

The aim of the syllabus is to produce graduates that understand fundamental genetic principles and apply that understanding to analyze and manipulate traits in living organisms. From the ecological point of view, the syllabus is well covered related to the study of interactions that organisms have with each other, other organisms, and with abiotic components of their environment.

Learning objectives of the course:

Upon successful completion of this course, the student will be able to:

- explain Mendel's principles of inheritance and apply these to problems of inheritance
- describe the different forms of inheritance patterns and identify these in genetic data
- use and interpret probabilities and statistics in the gathering, predicting, and analysis of genetic data
- describe various types of genetic crosses and indicate when/why they would be used by a geneticist
- explain more complex modes of inheritance and how sex influences the inheritance and expression of genes (e.g. sex-influenced traits, cytoplasmic inheritance, genomic imprinting)
- use this information in predicting genetic outcomes and the analysis of genetic data.
- Describe the local and geographical distribution and abundance of organisms (habitat niche, community, bio-geography).
- Notice the temporal changes in the occurrence, abundance and ac-tivities of organisms (seasonal, annual, successions).
- The inter-relationship between organism in population and communities (population ecology).
- Describe the structural adaptations and functional adjustment of organisms to their physical environment.
- Gain knowledge regarding the conservation and management of natural resources and pollution.

References:

1. Text Book of Zoology, by Durgadas Mukherji
2. College Zoology, B. K. Lahiri

3. Cell Biology, by Dr C B Powar
4. General Microbiology, Vol. I & Vol. II, Powar & Daginawala
5. Introduction to general Zoology, by Chaki, Kundu & Sarkar
6. Text Book of Zoology, by Chatterjee, Chakraborty & Ghosh
7. Problems on Genetics, Molecular Genetics and Evolutionary Genetics, by Pranob K. Banerjee
8. Cell Biology, Cytology, Biomolecules and Molecular Biology, by Verma & Agarwala
9. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology, by Verma & Agarwala
10. Parasitology, by Chatterjee

Prescribed syllabus of Tripura University for Zoology (THEORY; MAJOR)

Semester III

Paper-3A

Full Marks: 60 (48 + 12)

UNIT I GENETICS **Periods :24**

- 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 ol Turner's & Klienfeltef s Syndromes).
- Mode of Inheritance of Autosomal Chromosome (Albinism & Thalassaemia) and Sex-I.inked Chromosome (Colour Blindness and Haemophilia).
- Mutation : Types, Agents, Induction and Detection of mutation (C1B 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, cl) Ecotone -

features and formation, e) Edge Effect.

- Behavioral Ecology: Migration in birds 3
- 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) 1UCN, iv) Indian Biodiversity Act 2002.

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

Syllabus of Tripura University for Zoology (PRACTICAL; GENERAL)

Semester III

Paper-3B

AIMS:

The syllabus is aimed to make students quite familiar with hand-on experience to identify various biotic community of soil and water. Calculation of population density is to be covered. Analysis of physicochemical parameters of aquatic ecosystems (pH and Dissolved Oxygen) is framed in the course. To gain an ideas related to the adaptation made by various animals for proper survival is well covered. Also students will have a field survey to get an research exposure.

Outcomes:

Through the framed practical sessions students will have thorough knowledge of the soil and aquatic fauna. Students can have an idea of a healthy water body in terms of Ph and Dissolved oxygen. Students will be familiar by the adaptive features of various animals for proper survival. A field based research work will be beneficial for young researchers.

Prescribed syllabus of Tripura University for Zoology (PRACTICAL; GENERAL)

Semester III

Paper-3B

FULL MARKS: 50 (40 + 10)

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.

Syllabus of Tripura University for Zoology (PRACTICAL; MAJOR)

Semester III

Paper-3B

AIMS:

The syllabus is aimed to make students quite familiar with hand-on experience to identify various biotic community of soil and water. Calculation of population density is to be covered. Analysis of physicochemical parameters of aquatic ecosystems (pH and Dissolved Oxygen) is framed in the course. To gain an ideas related to the adaptation made by various animals for proper survival is well covered. Also students will have a field survey to get an research exposure. Principles of heredity in assessment of pedigrees to identify genotypes of family members is also covered. The syllabus will also make a detailed observations on the various stages of meotic cell divisions.

Learning outcomes:

- Students will get exposure regarding the giant chromosomes.
- Students can identify different steps of meiotic cell divisions.
- Students can have knowledge related to the identification of some soil and aquatic fauna.
- Students will be able to estimate population size.
- Students will be able to apply principles of heredity in assessment of pedigrees to identify genotypes of family members, conclude the mode of inheritance for a trait, and predict mating outcomes.

Prescribed Syllabus of Tripura University for Zoology (PRACTICAL; MAJOR)

Semester III

Paper-3B

FULL MARKS 40 (32 + 08)

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 :
7. (Any Two) a)Soil Mite b) Termite c)-Collembola d) Ants e) Earthworm f) Daphnia g) Cyclops (3+3=6)
8. Laboratory Note Book (3)
9. Viva voce (3)

Syllabus of Tripura University for Zoology (THEORY; GENERAL)

Semester IV

Paper-4A

Aims:

The syllabus details the aim of the study of sericulture, apiculture, vermiculture, prawn culture techniques. The course will also cover the fundamental genetic principles and how to apply that understanding to analyze and manipulate traits in living organisms.

Learning outcomes:

By completing their studies, students of 4^{th} semester are expected to have achieved the following skills and capabilities.

- Comprehensive, detailed understanding of the chemical basis of heredity
- Comprehensive and detailed understanding of genetic methodology and how quantification of heritable traits in families and populations provides insight into cellular and molecular mechanisms.
- Understanding of how genetic concepts affect broad societal issues including health and disease.
- Knowledge regarding successful culture of various live stocks.

REFERENCE BOOKS:

Ayyar, T.V.R. 1963. Hand Book of Economic Entomology for South India – Govt. Press,Madras.

David, B.V. and M.C. Muralirangan and M. Meera. 1992. Harmful and Beneficial Insects –Popular Book Deport, Madras, 304 p.

David, B.V. and T. Kumaraswami. 1982. Elements of Economic Entomology – Popular BookDepot, Madras, 536 p.

Dhaliwal, G.S. and B. Singh. 1998. Pesticides – The ecological impact in developing countries– Commonwealth Publishers, New Delhi.

Dhaliwal, G.S. and E.A. Heinrichs. 1998. Critical issues in pest management – Commonwealth Publishers, New Delhi, 287 p.

Dhaliwal, G.S. and Ramesh Arora. 1998. Principles of Insect Pest Management – Kalyani Publishers, New Delhi, 297 p.

Grout, R.A. 1963. The Hive and the Honey Bee – Dadant and Sons Inc, Hamilton, Illinois, 556p.

Metcalf, C.K. and W.P. Flint. 1970. Destructive and Useful Insects : Their Habits and Control– Tata McGraw Hill Pub. Co., New Delhi 1074p.

Pradhan, S. 1983. Agricultural Entomology and Pest Control – Indian Council of Agricultural Research, New Delhi, 267 p.

Singh, S. 1975. Bee Keeping in India – Indian Council of Agricultural Research, New Delhi,214p.

Srivastava, K. P. 2003. A text book of Applied Entomology. Vol. II. Kalyani Publishers, Ludhiana, pp. 497.

Prescribed syllabus of Tripura University for Zoology (THEORY; GENERAL)

Semester IV

Paper-4A

FULLMARKS (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 or' 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

Syllabus of Tripura University for Zoology (THEORY; MAJOR)

Semester IV

Paper-4A

Aims:

The course aimed to stimulate and foster a sense of excitement in Parasitology as an approach to understanding living organisms. Fundamental microbiology is well framed. The objective of this course is also to learn about the structural features of the components of the immune system as well as their functions. Principle and applications of various laboratory equipments is well covered.

Learning outcomes:

1. The knowledge of microbiology helps the students to understand the beneficial and harmful microbes that play a significant economic role in the society.
2. An interesting topic on immunology makes the students realise the defense mechanism of the animals against harmful infections.
3. Immunology has great applied value in future especially those willing to persue pharmacology or any other higher studies in the fiels.
4. Ample scope of research is available with microbes and immune system categorically.
5. On learning the tools and techniques students are able to understand the usage of lab equipments more efficiently.
6. Future research work becomes easier for the students acquiring such knowledge.

Reference books:

1. General Microbiology, Vol. I & Vol. II, Powar & Daginawala
2. Introduction to general Zoology, by Chaki, Kundu & Sarkar
3. Text Book of Zoology, by Chatterjee, Chakraborty & Ghosh
4. Parasitology, by Chatterjee

Prescribed syllabus of Tripura University for Zoology (THEORY; GENERAL)

Semester IV

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 bancrofii 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./

Prescribed syllabus of Tripura University for Zoology (PRACTICAL; GENERAL)

Semester IV

Paper-4B

FULL MARKS: 50 (40+10)

A. Applied Zoology

Spotting and economic importance of following specimens (any three)

- *Triporyza* sp.
- *Sitophilus* sp.
- *Bandicoota* sp.
- *Bombyx* sp.
- *Apis* sp.
- *Perionyx* sp.
- *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

Prescribed syllabus of Tripura University for Zoology (PRACTICAL; MAJOR)

Semester IV

Paper-4B

FULL MARKS: 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*, *Hirudimria* 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.

Prescribed syllabus of Tripura University for Zoology (THEORY; GENERAL)

Semester V

Paper-5A

Aims

This course is designed to introduce a very important applied aspect of biology, which has a direct bearing on human health and well being. At the end of the course, the student should have a clear understanding of the various causative organisms and factors and also how and what preventive measures can be adopted against these. Adaptive features achieved by helmiths for a successful parasitic life is also covered. Common disease spreading vectors are also well studied. Fundamental knowledge covering microbiology and immunology is also nicely covered in the present course.

Learning objectives.

After completion of the course:

- Students can describe the parasitic life of various protozoans and helminthes.
- Adaptive features of some helminth parasite can be clearly understood.
- Students will be familiar with some disease spreading arthropod vectors.
- Microbial flora of human gut can well understood.
- Students can describe regarding the immunological properties of human body.

Reference books:

1. Parasitology, by Chatterjee
2. Invertebrate Zoology, by Jordan & Verma
3. Text Book of Zoology, by Durgadas Mukherji
4. College Zoology, B. K. Lahiri

Prescribed syllabus of Tripura University for Zoology (THEORY; GENERAL)

Semester V

Paper-5A

FULL MARKS: 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-11: **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

Prescribed syllabus of Tripura University for Zoology (THEORY; MAJOR)

Semester V

Paper-5A

Aims & Objectives:-

1. It aims at understanding adaptation, zoogeography and ethology of animal kingdom
2. Animal physiology teaches various biological systems in the body and their functions
3. Biodiversity and conservation of wildlife is learnt in details
4. Elementary concepts of biostatistics is provided to the students

Learning Outcomes:

1. Animal behavior based on their distribution pattern in the world is well understood.
2. The processes of animal communication and their mimicry helps the students to understand the animal kingdom better.
3. Projects based on mimicry and adaptation can be assigned to the students.
4. Animal physiology helps in understanding the systems and functioning of the body of different animals.
5. Concepts of theratend, endangered, vulnerable and rare species is understood properly which helps in conserving wild animals.
6. Biostatistical studies enable students to compete their data collected during any field study while persuing their course.

Prescribed syllabus of Tripura University for Zoology (THEORY; MAJOR)

Semester V

Paper-5A

FULL MARKS: 100 (80+20)

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

1. Convergent and divergent adaptation and adaptive radiation in placenta] 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 0_2 and $C0_2$ 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) Hypersonic 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-Ill: 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

Prescribed syllabus of Tripura University for Zoology (PRACTICAL; GENERAL)

Semester V

Paper-5B

FULL MARKS: 50 (40+10)

1. Identification with reasons: (any two) 5x2=10
   - *a)* *Entamoeba histolytica*
   - *b)* *Giardia intestinalis*
   - *c)* *Plasmodium Sp.*
   - *d)* *A scaris 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

Prescribed syllabus of Tripura University for Zoology (PRACTICAL; MAJOR)

Semester V

Paper-5B

FULL MARKS: 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., *Psittacul*a 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

Syllabus of Tripura University for Zoology (THEORY; MAJOR)

Semester VI

Paper-6A

Aims & Objectives:-

1. Evolutionary biology of the living world is taught to understand the origin of life.
2. Biochemistry of living organisms, the role of enzymes and their mechanism of action is added as basic knowledge to the students.
3. Endocrinology and reproductive biology of the animals are well understood.
4. Molecular and genetic engineering aims at providing the knowledge of DNA replication, transcription, translation.
5. Concept of mutation, cloning and the genetic basis of cancer is taught to the students.
6. Biotechnology in the form of recombinant DNA technology is taught as advanced scientific knowledge.

Outcome:-

1. Knowledge of evolution helps the students to understand the scientific basis of origin of life.
2. Biochemical concepts elucidates the importants of pH and buffer at which enzymes act efficiently to perform the metabolic functions of living organisms.
3. The extrinsic information based on which a cell functions in the body of an organisms is learn through endocrinology.
4. Molecular biology and genetic engineering enables students to understand how genes can be manipulated in the body.
5. Genetic basis of cancer enables students to acquire an in-depth knowledge of how caner is caused.
6. All the above knowledge arouses interests amongst the students to investigate biological phenomena in different organisms.

Reference Books:

1. Introduction to general Zoology, by Chaki, Kundu & Sarkar
2. Text Book of Zoology, by Chatterjee, Chakraborty & Ghosh
3. Cell Biology, Cytology, Biomolecules and Molecular Biology, by Verma & Agarwala
4. Functional Histology, by Asim K. Datta
5. Mange & Mange: Basic Human Genetics; Rastogi Publications

Prescribed syllabus of Tripura University for Zoology (THEORY; MAJOR)

Semester VI

Paper-6A

FULL 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-Miiler 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 rll locus, idea of complementation and non-complementation;

3. Concept of cistron, recon and muton;
4. Genetic regulation in Prokaryotes-Lnc 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.

Prescribed syllabus of Tripura University for Zoology (PRACTICAL; MAJOR)

Semester VI

Paper-6B

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 x1=10

2. a) Study of Salivary amylase action. 10x1=10
   b) Quantitaive estimation of Glucose.
   (any one to be given in the examination)
3. Identification and characterization of the histological slides of the following endocrine glands of mammal with drawing, labeling and comments.
   (i) Pituitary, (ii) Thyroid, (iii) Adrenal, (iv) Pancreas (Islets of Langerhans), (v) Testis & (vi) Ovary.

   10 x2=20

   (Slides of any two glands to be given in the examination)
4. Determination of genotype frequency and allele frequency with examples (any one to be given in the examination)

   10x 1=10

5. Identification with characters of Human Syndrome/Disorders from the samples of karyotypes provided:
   i) Klienfelter's
   ii) Turner's
   iii) Dowm,s
   iv) Super female
   (any one to be given in the examination).

   10x1=10

6. Submission of Laboratory Note book 10
7. Viva voce 10

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

Prescribed syllabus of Tripura University for Zoology

(PROJECT WORK; MAJOR)

Semester VI

Paper-6C

FULL MARKS :100(80+20)

1. Project Methodology (for internal assessment) 20

   A. Tools and Techniques in Biology

   Principles and applications of (i) pH meter (ii) Centrifuge (iii) Microscopy

   Micro techniques : Fixation, dehydration, embedding, block-making, microtomy, principle of staining, acid and basic stains, single and double staining methods.

   B. Basic Methodology of population estimation and sampling methods:

   (i) Line transects methods to count plants, vegetation and animal population, capture recapture method to count mobile animals.

   (ii) Preparation of histological sections, Fixatives, Stains and Standard solutions.

   (iii) Extraction of soil micro arthropods: Tullgren Funnel method.

   (iv) Principles and applications of t-test, correlation test and Chi-square test.

   (v) Preparation of Bar diagram/ Histogram and Pie Chart with examples.

II. Project Work:

Field work/ Lab. Work/ Review work/ Literature survey, etc.

Preparation of Project Report (preferably within 2500 words): submission should contain (i) Title of the project (ii) Introduction (should contain basis of the study) (iii) Review of literature (iv) Methodology (v) Results and Discussions (vi) Conclusion (vii) References (originality should be maintained for each submission of project work)

i) Submission of Project Report 60

ii) Interaction [Presentation (PPT/Chart etc.) and viva] 20

Note: Candidates should preferably write the project in own hand writing

-prepared and submited to Dean, HCC by Dr. Abir Shib, *M.Sc., Ph.D.*