B.Sc. (GENERAL) PROGRAMME
ZOOLOGY (ZOOG)
SCHEME OF COURSES

There shall be 12 (twelve) courses; 6 (six) each of theory and practical courses in Botany General Programme. The distribution of courses and marks will be as follows:

Semester-I **100 marks**

ZOOG 101 = Zoology –I (Th) Animal diversity-I, Systematics & Evolution **48End+12IA =**60
ZOOG 102 = Zoology- II (Pr) Based on Course I 32**End+8IA =4**0

Semester-II **100 marks**

ZOOG 201 = Zoology –III (Th) Animal diversity-II and Developmental Biology **48End+12IA =**60
ZOOG 202 = Zoology- IV (Pr) Based on Course III 32**End+8IA =4**0

Semester-III **100 marks**

ZOOG 301 = Zoology –V (Th) Cell Biology and Biochemistry **48End+12IA =**60
ZOOG 302 = Zoology- VI (Pr) Based on Course V 32**End+8IA =4**0

Semester-IV **100 marks**

ZOOG 401 = Zoology –VII (Th) Animal Physiology and Endocrinology **48End+12IA =**60
ZOOG 402 = Zoology- VIII (Pr) Based on Course VII 32**End+8IA =4**0

Semester-V **100 marks**

ZOOG 501 = Zoology –IX (Th) Genetics and Molecular Biology **48End+12IA =**60
ZOOG 502 = Zoology- X (Pr) Based on Course IX 32**End+8IA =4**0

Semester-VI **100 marks**

ZOOG 601 = Zoology –XI (Th) Animal Ecology and Biostatistics **48End+12IA =**60
ZOOG 602 = Zoology- XII (Pr) Based on Course XI 32**End+8IA =4**0

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ZOOG 101
Zoology- I
Animal diversity-I, Systematics & Evolution

48End+12IA =60

Objective of the course: The main objective of this course is to introduce the students with diverse forms of invertebrate animals, their structural morphology of group level and classification; evolutionary lives and events.

ZOOG 102
Zoology- II
(Practical)

Marks: 40(32End+8IA), 10 class hours

PRACTICAL

1. **Dissection:** Leech – Digestive, Excretory and reproductive systems, prawn – Nervous system; Grasshopper/ cockroach– Nervous system, digestive system; *Pila* – Digestive system, nervous system.
2. **Identification:** *Trypanosoma, Leishmania, Entamoeba histolytica, Euglena*, *Noctiluca, Volvox, Grantia*, *Spongila*, Gammules of sponge, Spicules of sponge, L.S. and T.S. of *Sycon*, *Madrepora*, *Porpita*, *Vallela*, *Aurelia*, Sea-anemone, *Corallium, Pennatula, Aleyonium, Obelia* colony with medusa, *Fasciola, Taenia, Ascaris*, Bladder-worm, *Planaria*, Scolex and Proglottid of *Taenia*, *Nereis, Aphordite, Heteronereis, Limulus*, Scorpion, Spider, Centipede, Millipede, *Squilla*, Lobster, Crab, *Balanus, Lepas, Peripatus*, Locust, Mantis, Beetle, Wasp, Termite, *Chiton, Dentallium, Pecten*, Pearl Oyster, *Loligo, Sepia*, one representative from Asteroidea, Holothuroidea and Ophiurioidea.
3. Preparation of permanent slides from suitable materials from invertebrate animals.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs. **Marks: (32+8)=40**

1. Dissection (Non Chordates)	12
2. Preparation of permanent slides	10
3. Spotting including permanent slides (Invertebrate materials)	8
4. Practical record book	5
5. Viva voce	5
Total	**40 marks**

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ZOOG 201
Zoology- III
Animal diversity-II (Chordates) and Developmental Biology

48End+12IA= 60

Objective of the course: The main objective of this course is to introduce the students with diverse forms of vertebrate animals and the major events of embryological aspects.

Animal diversity-II (Chordates) **Marks: (32+8)=40**

Unit –1: Origin and general characters of chordates. 2 class hours
Unit –2: Protochordates – Classification upto orders, interrelationships, structural organisation of hemichordates, urochordates, post-embryonic development of *Amphioxus*. 8 class hours
Unit –3: Fishes: Classification up to orders, respiratory organs and migration. 4 class hours
Unit –4: Amphibia: Classification upto orders, parental care. 2 class hours
Unit –5: Reptiles: Classification upto orders, extinct reptiles, poisonous snakes of India. 3 class hours
Unit –6: Aves: Classification upto super-orders, beaks and claws, perching and flight mechanism, bird migration. 4 class hours
Unit –7: Mammals –Classification upto orders. 2 class hours

Developmental Biology: **Marks: (16+4)=20**

Unit –1: Gametogenesis – spermatogenesis and oogenesis, vitellogenesis, egg membranes. 4 class hours
Unit –2: Fertilization – sperm-egg interactions – biochemical events, post fertilization events; Parthenogenesis. 3 class hours
Unit –3: Types of animal eggs; patterns of cleavage; germ layers, gastrulation, fate maps and cell linage 5 class hours
Unit –4: Extra embryonic membranes, types and physiology of placenta. 3 class hours

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ZOOG 202
Zoology- IV

(Practical)

Marks: 40(32End+8IA), 10 class hours

1. Dissection:
   Scoliodon – External morphology, afferent branchial system, efferent branchial system, internal ear; Goroi fish – Efferent branchial system

2. Identification:
   Balanoglossus, Herdmania, Amphioxus, Doliolum, Salpa, Pristis, Chimera, Labeo, Catla, Puntius, Heteropneustes, Wallago, Cirrhinus, Exocoetus, Hippocampus, Hilsa, Electric ray, *Protopterus, Lepidosiren, Ichthyophis, Cryptobranchus, Necturus, Ambystom*a, Axolotol larva, *Hyla, Chameleon, Gecko*, Wall lizard, Flying lizard, *Mabuiya, Varanus, Typhlops, Hydrophis*, Banded Krait, Pit viper, Russel viper, Fowl Duck, Crow, Dove, Cuckoo, Myna, Owl, Parrot, House Sparrow, Vulture, Bulbul, Kite, Squirrel, Rat, Monkey, Hedgehog, Bat, Loris, Langur, Scaly ant-eater, Fox, Cat, Otter, Porcupine, Mouse.

3. Preparation of permanent slides from suitable materials from vertebrate animals.
4. Study of chick embryo development up to 72 hrs. by permanent slides.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs. **Marks:(32+8)=40**

1. Dissection (Chordates)	12
2. Spotting/Identification including vertebrate slide	10
3. Preparation of permanent slides using suitable chordates material	8
4. Practical record book	5
5. Viva voce	5
Total	**40**

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ZOOG 301
Zoology- V

Cell Biology and Biochemistry

48End+12IA=60

Objective of the course: The main objective of this course is to introduce the students with structure and function of animal cell and biochemical aspects of macromolecules.

Cell Biology: **Marks:(24+6)=30**

Unit –1: General structure and function of prokaryotic and eukaryotic cells. 6 class hours
Unit –2: Structure and function of cell organelles (plasma, membrane, mitochondria, Golgi bodies; endoplasmic reticulum, nucleus, chromosomes). 8 class hours
Unit –3: Cell cycle and cell division (mitosis & meiosis). 6 class hours

Biochemistry: **Marks:(24+6)=30**

Unit –1: Basic principles of biochemistry, acid, base, pH and buffer; Osmosis, diffusion, osmosis and active transport. 6 class hours
Unit –2: Nature and function of enzymes; Vitamins their sources and functions. 4 class hours
Unit –3: Types of carbohydrates, proteins, fats and nucleic acids. 4 class hours
Unit –4: Biological oxidation, electron transport system, synthesis of ATP, glycolysis and Krebs cycle. 6 class hours

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ZOOG 302
Zoology- VI

(Practical)

Marks: 40(32End+8IA), 10 class hours

3. Study of mitosis and meiosis with the help of permanent slides.
4. Preparation of slide for the study of mitosis and meiosis with suitable materials.
5. Preparation of normal and molar solution
6. Qualitative test of carbohydrate, protein and fat.
7. Qualitative test of salivary amylase.

SCHEME OF THE PRACTICAL EXAMINATION:
Time: 4 hrs. **Marks: (32+8)=40**

1. Cell Biology Experiment	10
2. Biochemical Experiment-I	10
3. Biochemical Experiment-II	5
4. Spotting	5
5. Practical record book	5
6. Viva voce	5
Total	**40**

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ZOOG 401
Zoology- VII

Animal Physiology and Endocrinology

48End+12IA =60

Objective of the course: The main objective of this course is to introduce the students with the major events of animal physiology and endocrinology.

Animal Physiology **Marks: (24+6)=30**

Unit –1: Digestion and absorption of carbohydrate, proteins and fats; balanced diet. 4 class hours
Unit –2: Physiology of respiration and excretion in mammals. 5 class hours
Unit –3: Composition and constituents of blood groups and Rh factor, Blood coagulation. 5 class hours
Unit –4: Neurons and conduction of nerve impulse. 3 class hours
Unit –5: Drug addiction and its impact on society. 3 class hours

Endocrinology **Marks: (24+6)=30**

Unit –1: A brief outline of the organization of endrocrine system in mammals; anatomy of pituitary, thyroid, pancreas and adrenal gland 6 class hours
Unit –2: General character of hormones, feedback mechanism 4 class hours
Unit-3: Functions of hormones of pituitary, thyroid, pancreas and adrenal. 6 class hours
Unit –4: Neuroendocrine system in insects. 4 class hours

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ZOOG 402
Zoology- VIII

(Practical)

Marks: 40(32End+8IA), 10 class hours

1. Preparation of haemin crystals.
2. R.B.C. and W.B.C. counting by haemocytometer.
3. Kymographic recording of heart beat.
4. Display pituitary and thyroid gland of frog/toad.
5. Study of permanent slides of endocrine glands

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs. **Marks: (32+8)=40**

1. Physiological Experiment	12
2. Endocrinological Experiment	8
3. Spotting/Identification	4
4. Preparation of slide	6
4. Practical record book	5
5. Viva voce	5
Total	**40**

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ZOOG 501
Zoology- IX

Genetics and Molecular Biology

48End+12IA =60

Objective of the course: The main objective of this course is to introduce the students with the structure, function and transmission of genetic materials from generation to generation and the basic concepts of molecular biology.

Genetics — Marks: (24+6)=30

Unit –1: Principles of heredity; linkage and crossing over; non-chromosomal inheritance. 9 class hours
Unit –2: Concept of gene, sex chromosome and sex determination; 7 class hours
Unit-3: Mutation and mutagenesis. 4 class hours

Molecular Biology — Marks: (24+6)=30

Unit-1: Nucleic acids, DNA as genetic material, structure of DNA, types of RNA 8 class hours
Unit-2: Concept of central dogma, genetic code, basic steps of translation 8 class hours
Unit-3: Cloning and genetic engineering. 4 class hours

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ZOOG 502
Zoology- X

(Practical)

Marks: 40(32End+8IA), 10 class hours

1. Mendelian problems
2. Ball and stick model for nucleotides
3. Theoretical problems in molecular biology
4. Preparation of slides for study of meiosis using suitable material

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs. **Marks: (32+8)=40**

1. Mendelian problems	10
2. Ball and stick model for nucleotides	5
3. Theoretical problems in molecular biology	5
4. Preparation of slides for study of meiosis	10
5. Practical record book	5
6. Viva voce	5
Total	**40**

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ZOOG 601
Zoology- XI
Animal Ecology and Biostatistics

48End+12IA =60

Objective of the course: The main objective of this course is to introduce the students with the structural and functional aspects of animal communities with respect to their environment and the basic concepts of application of statistics in biology.

Animal Ecology **Marks: (24+6)=30**

Unit –1: Basic concept of ecosystem; Brief account of abiotic and biotic factors in grassland and aquatic ecosystem 4 class hours
Unit-2: Food chain and energy flow, food web. 4 class hours
Unit-3: Environmental pollution; Types, sources, causes control and prevention of air and water pollution; biogeochemical cycles (Carbon and Nitrogen) green house effect, Ozone layer depletion and its impact 6 class hours
Unit-4: Basic concept of wildlife and wildlife habitat, forest types of NE India, endangered fauna of NE India and its conservation. 6 class hours

Biostatistics **Marks: (24+6)=30**

Unit –1: Sampling of data; graphic presentation of data; histogram, bar diagram and oogive. 6 class hours
Unit –2: Mean, median, and mode; Mean deviation and standard deviation. 8 class hours
Unit –3: Significance test (Chi-square, students't-test, F-test). 6 class hours

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ZOOG 602
Zoology- XII
(Practical)

Marks: 40(32End+8IA), 10 class hours

1. To find out the abundance and density of soil fauna by quadrate method.
2. Find out the biotic components of a grassland/pond ecosystem and make probable food chain and food web.
3. Simple biostatistical calculation involving mean, median, mode and standard deviation.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs. **Marks: (32+8)=40**

1. Ecological Experiment-I	10
2. Ecological Experiment-II	10
3. Biostatistical calculation	10
4. Practical record book	5
5. Viva voce	5
Total	**40**

BOOKS RECOMMENDED:

1. A Text book of invertebrate Zoology: S.N. Prasad, Kitab Mahal, Allahabad, 1977.
2. A Manual of Zoology Part I: B. Ayyar.
3. Text Book of Zoology Vol. I: A. J. Marshall , S.W.D. Williams.
4. Invertebrates: English Language Book Society, Madras, 7th Edn. 1947.
5. Fundamentals of Ecology: B.P. Odum., W.R. Saunders, Toflan co. Tokyo, 1971.
6. Biological Chemistry: H.F. Mahler & B.H. Cords Gapper & Raw, N.Y. 1971.
7. Cell Biology: B.D. Roberts, W. Newinski & F. Sacz, W.B. Saunders Co. London, 1975.
8. Cell Physiology: A.C. Giese, Boxwood, 1975.
9. Principle of Genetics: B.J.Gardener, John Willey N.Y. 1972. .
10. Genetics: A.M. Winestler, Oxford & IBH, Calcutta 1971.
11. Introduction of Evolution: P.A. Mody, Harper & Raw, N.Y. 1964.
12. Evolution, Process & Products: B.O. Dedson, Rginhold Publication, C.N.Y.
13. Organic Evolution: R.S. Lull, Revised Indian Edn. By Light & Life Publishers, New Delhi, 1976.
14. Chordate Zoology: S.N. Prasad, Kitab Mahal, Allahabad.
15. A Manual of Zoology Part II: B. Ayyar.
16. Text Book of Zoology: T. J. Parker and B.A. Haswell.
17. Vol. II Vertebrates: English Language Book Society, Madras, Feb. Edn. 1974.
18. Text Book of Physiology: B.K. Annand and S.K. Manchand, TATA McGraw Hill, New Delhi, 1976.
19. General Endocrinology: C.D. Turner and J.I. Bangara, W.B. Saunders Co. 1971.
20. An Introduction to Embryology: B.I. Balinsky, W.B. Saunders Co. 1976.
21. Histology: Bailey.
22. Prani Bigyan: Dibrugarh University.
23. Biochemistry: K. Trehan, Wiley Eastern Ltd. New Delhi.
24. Statistical Method in Biology: N.T.J. Bailey, REBS Publishers, New Delhi.
25. Text Book of Vertebrate and Invertebrates: P.L. Ketpal.

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B.Sc. (MAJOR) PROGRAMME
ZOOLOGY (ZOOM)

SCHEME OF COURSES

There shall be 28 (twenty eight) courses 14(fourteen) each of theory and practical courses for TDC Botany Major programme. The distribution of courses and marks will be as follows:

SEMESTER- I

ZOOM 101: Zoology Major I: (Theory)	48End+12IA
ZOOM 102: Zoology Major II: Practical based on Zoology Major-I	32End+8IA

SEMESTER- II

ZOOM 201: Zoology Major III: (Theory)	48End+12IA
ZOOM 102: Zoology Major IV Practical based on Zoology Major-III	32End+8IA

SEMESTER- III

ZOOM 301: Zoology Major V: (Theory)	48End+12IA
ZOOM 302: Zoology Major VI Practical based on Zoology Major-V	32End+8IA
ZOOM 303: Zoology Major VII: (Theory)	48End+12IA
ZOOM 304: Zoology Major VIII: Practical based on Zoology Major-VII	32End+8IA

SEMESTER- IV

ZOOM 401: Zoology Major IX: (Theory)	48End+12IA
ZOOM 402: Zoology Major X Practical based on Zoology Major-IX	32End+8IA
ZOOM 403: Zoology Major XI: (Theory)	48End+12IA
ZOOM 404: Zoology Major XII Practical based on Zoology Major-XI	32End+8IA

SEMESTER- V

ZOOM 501: Zoology Major XIII: (Theory)	48End+12IA
ZOOM 502: Zoology Major XIV Practical based on Zoology Major-XIII	32End+8IA
ZOOM 503: Zoology Major XV: (Theory)	48End+12IA
ZOOM 504: Zoology Major XVI Practical based on Zoology Major-XV	32End+8IA
ZOOM 505: Zoology Major XVII: (Theory)	48End+12IA
ZOOM 506: Zoology Major XVIII Practical based on Zoology Major-XVII	32End+8IA
ZOOM 507: Zoology Major XIX: (Theory)	48End+12IA
ZOOM 508: Zoology Major XX: Practical based on Zoology Major-XIX	32End+8IA

SEMESTER- VI

ZOOM 601: Zoology Major XXI: (Theory)	48End+12IA
ZOOM 602: Zoology Major XXII Practical based on Zoology Major-XXI	32End+8IA
ZOOM 603: Zoology Major XXIII: (Theory)	48End+12IA
ZOOM 604: Zoology Major XXIV Practical based on Zoology Major-XXIII	32End+8IA
ZOOM 605: Zoology Major XXV: (Theory)	48End+12IA
ZOOM 606: Zoology Major XXVI Practical based on Zoology Major-XXV	32End+8IA
ZOOM 607: Zoology Major XXVII: (Theory)	48End+12IA
ZOOM 608: Zoology Major XXVIII: Practical based on Zoology Major-XXVII	32End+8IA

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ZOOM 101
Zoology Major- I
Animal Diversity-I and Systematics

48End+12IA= 60

Objective of the course: The main objective of this course is to introduce the students with the diverse forms and structures and taxonomic groups of the invertebrate animals.

Animal Diversity-I (Non-chordates) **Marks: (32+8)= 40**

Unit-1: Protozoa- General characters and classification upto orders with examples; locomotion, nutrition and reproduction in protozoa, Porifera- General characters and classification upto orders with examples; skeletal, canal system and reproduction in *Sycon;* Coelentrata: General characters and classification upto orders with examples; polymorphism and defensive mechanism in coelentereta; coral reefs and their formation. 8 class hours

Unit-2: Helminthes: General characters and classification upto orders with examples; Annelida: General characters and classification upto orders with examples; excretion, reproduction and importance of *Pheretima*; coelom and metamerism in annelids. 6 class hours

Unit-3: Arthropoda: General characters and classification upto orders with examples; mouth parts of insects; larval forms in crustacea; digestion, excretion and vision in arthropoda; affinity of Onychophora. 6 class hours

Unit-4: Mollusca: General characters and classification upto orders with examples; digestive, respiratory and excretory system of *Pila*; shell diversity, torsion and detorsion in molllusca. 5 class hours

Unit-5: Echinodermata: General characters and classification upto orders with examples; water vascular system in starfish, echinoderm larvae and their affinities; affinities of Rotifera and Sagitta. 5 class hours

Systematics **(16+4)=20**

Unit-1: Systematics: Systematics and classification, form and hierarchy of classification; Modern species concept; nomenclature – rules of zoological nomenclature. 5 class hours

Unit-2: Modern concept in taxonomy (Molecular, chemotaxonomy, numerical taxonomy & cytotaxonomy). 5 class hours

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ZOOM 102
Zoology Major- II

(Practical)

Marks: 40(32End+8IA), 15 class hours

1. Dissection of the following invertebrate system:
   Earthworm: Urinogenital system.
   Pila/ *Acatina*: Nervous system.
   Cockroach: Digestive, nervous system and reproductive system.
2. Identification of following invertebrates with reason:
   Paramaecium, Trypanosoma, Giardia, Trichomonous, Sycon, Trychympha, Globigerina, Porpita, Taenia solium, Ancylostoma duodenale, Wechereria bancrofti, Chalinid sponge, *Spongilla*, Sea-anemone, Madrepora, *Gorgonia*, coral, *Fungia, Pleurobranchia, Oxuris*, Rotifer, Brachipid, *Heteronereis, Chaetopterus, Pentobdella, Glycera, Limulus*, *Megascolex, Tubifex, Glossiphonia, Echiurus, Argulus, Ligia, Neptunus, Branchipus, Apus, Nauplius, Zoea, Megalopa*, Millipede, *Gryllus, Gryletalpa*, Termites, Ephemerid, Larvae, Dragonfly larva, aphid, *Ranatra, Bellostoma*, Lady bird, Beetle, Ants, Rice-bug, *Peripatus, Nautilus*, Pearl Oyster, *Mytilus, Limax, Solen*, Planorbird, Heart -Urchin, Cake-Urchin, Brittle Star, Leaf insect, Stick insect.
3. Preparation of permanent slides & mounting of minimum five suitable non-chordate specimens and their submission.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs. **Marks: (32+8)=40**

1. Dissection	10
2. Preparation of permanent mounting	4
5. Identification	8
6. Slide submission	3
7. Practical record book	5
8. Viva voce	10
Total	**40**

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ZOOM 201
Zoology Major- III

Animal Diversity-II and Comparative Anatomy

48End+12IA= 60

Objective of the course: The main objective of this course is to introduce the students with the diverse forms and structures of vertebrate animals and their comparative anatomical study.

Animal Diversity-II (Chordates) **Marks: (36+9)=45**

Unit –1: General characters of Chordata and classification upto class; Classification of protochordata up to orders; general characters of hemichordata, urochordata and cephalochordata; structure and post embryonic development of larval forms and their significance in chordate phylogeny; affinities of protochordates. 6 class hours

Unit –2: Distinctive characters of Petromyzontia, Chondrichthyes & Dipnoi; Classification of Osteichthyes upto orders with examples; Ammocoete larva and its importance in evolution; structures of gills, accessory, respiratory organs and swim bladders of fish; sense organs; locomotion, migration and parental care in fish. 6 class hours

Unit –3: Distinctive characters and classification of Amphibia upto orders with examples; parental care, metamorphosis and neoteny in amphibia; distinctive characters and classification of Reptilia upto orders with examples; anatomical peculiarities and affinities of *Sphenodon*; poisonous snakes of India; biting mechanisms of poisonous snakes. 6 class hours

Unit –4: General characters and classification of Aves upto super orders with examples; mechanisms of bird flight; perching mechanism; flight adaptation in bird; migration in birds. 6 class hours

Unit –5: General characters and classification of Mammalia upto orders with examples; affinities of monotremata and marsupilia; dentition in mammals; echo-location in bats; adaptation of aquatic mammals. 6 class hours

Comparative anatomy **Marks: (12+3)=15**

Unit –1: Integument, pectoral and pelvic girdles, cranial nerves of vertebrates. 4 class hours

Unit–2: Comparative account of circulatory, respiratory, alimentary and urinogenital system among reptiles, birds and mammals. 6 class hours

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ZOOM 202
Zoology Major- IV

(Practical)

Marks: 40(32End+8IA), 15 class hours

1. Dissection of the following vertebrate system.
   Scoliodon: Efferent branchial vessels, internal ear, 9^{th} and 10^{th} cranial nerves;
   Carp/ Goroi Fish: 5^{th}, 7^{th}, 9^{th} and 10^{th} cranial nerves, Efferent branchial system; Weberian ossicles of carp.
2. Identification of vertebrates with reasons:
   Pyrosoma, Salpa, Doliolum, Oikopleura, Myxine, Sting ray, Hammer headed shark, *Pristis*, Electric ray, Tiger shark, Pipe fish, *Protopterus*, *Hemiramphus*, Ribbon fish, Sucker fish, *Mugil*, Eel, *Belepthalamus, Ichthyophis*, *Colisa, Scatophagus*, *Amphipneus, Glossogobius, Mystus, Harpodon, Tetraodon, Cryptobranchus, Axolotol* larva, *Ambystoms, Necturus, Amphiuma, Typhlops*, Krait, Viper, Pit viper, *Hydrophis, Drayophis, Natrix*, Sea Snake, *Tryonix, Chelone*, Leathery, Turtle, *Echidna*, Platypus.
3. Preparation of permanent slides & mounting of minimum five suitable slides of vertebrate's exoskeleton (scale, feather etc.)
4. Study of vertebral column of mammals; pectoral and pelvic girdle of reptiles, bird and mammals.
5. Demonstration of digestive, circulatory, respiratory and urinogenital system of reptiles, bird and mammals through electronic media

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs. **Marks: (32+8)=40**

1. Dissection	10
2. Identification of museum specimens and bones	8
3. Submission of slides (vertebrate material)	3
4. Preparation of slides	4
5. Practical record book	5
6. Viva voce	10
Total	**40**

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ZOOM 301
Zoology Major- V

Biochemistry

48End+12IA =60

Objective of the course: The main objective of this course is to introduce the students with the basic knowledge of biochemistry with special reference to macromolecules.

Biochemistry

Unit -1: Laws of thermodynamics and their application in biochemistry; free energy change in biochemical systems; ATP and other high-energy phosphates as energy carrier; concept of redox systems Basic principles of biological chemistry; water, acid, base, p^H and buffers. 10 class hours

Unit-2: Structure and classification of carbohydrates, proteins, amino acids and lipids. 7 class hours

Unit -3: General concept of metabolism- Glycolysis; Krebs cycle; electron transport system (ETS) and ATP synthesis; β-oxidation of fatty acids 7 class hours

Unit-4: Enzymes- nomenclature, IUB classification, kinetics and mechanism of action; enzyme inhibition. 6 class hours

Unit-5: Vitamins (source and functions) and co-enzymes 3 class hours

Unit -6: Structure and forms of DNA and RNA; DNA as genetic material 7 class hours

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ZOOM 302
Zoology Major- VI
(Practical)

Marks: 40(32End+8IA), 14 class hours

1. Qualitative test for carbohydrate to identify the common monosaccharides and disaccharides (Glucose, fructose, sucrose, maltose, galactose, mannose, starch and glycogen).
2. Extraction and estimation of enzyme urease/ peroxidase by titrimatric method.
3. Estimation of ascorbic acid in lemon/milk.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs. **Marks: (32+8)=40**

1. Qualitative test		13
2. Estimation		12
3. Practical record book		5
4. Viva voce		10
	Total	**40**

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ZOOM 303
Zoology Major- VII

Bioinstrumentation and Biostatistics

48End+12IA = 60

Objective of the course: The main objective of this course is to introduce the students with the tools and techniques used in biological study with special reference to instruments & statistics.

Bioinstrumentation **Marks: (24+6)=30**

Unit-1: Chromatography- basic concept of paper, ion exchange and thin layer chromatography; 5 class hours

Unit-2: Microscopy- basic principle and applications of light, phase contrast and electron microscope. 5 class hours

Unit-3: Photometry- principle and uses of colourimeter and spectrophotometer. 5 class hours

Unit-4: Principles and uses of kymography and microtomy 4 class hours

Unit-5: Principles and practices of centrifugation 3 class hours

Biostatistics **Marks: (24+6)=30**

Unit-1: Scope and utility of statistics in Bioscience; Sampling, collection and graphical representation of data 5 class hours

Unit-2: Measures of statistical average; mean deviation and standard deviation 5 class hours

Unit-3: Probability tests; Correlation and regression; Significance tests (t, F and X^2 tests) 8 class hours

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ZOOM 304
Zoology Major- VIII
(Practical)

Marks: 40(32End+8IA), 10 class hours

1. Separation of amino acids by paper chromatography
2. Demonstration of instruments as prescribed in syllabus
3. Statistical calculation of central tendency, deviations, correlation, regression & t test

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs.		**Marks: (32+8)=40**
1. a. Statistical calculation (central tendency/ deviation)		5
b. Graphical representation/ correlation		5
2. Separation technique		10
3. Spotting (instrument)		5
4. Practical record book		5
5. Viva voce		10
	Total	**40**

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ZOOM 401
Zoology Major- IX

Cell Biology, Histology and Histochemistry

48End+12IA= 60

Objective of the course: The main objective of this course is to provide fundamental knowledge of structural and histochemical analysis of animal cell & tissues.

Cell Biology **Marks: (32+8)=40**

Unit-1: Overview of prokaryotic and eukaryotic cells; structure and functions of cell organelles- mitochondria, endoplasmic reticulum, lysosome, ribosome, Golgi bodies, nucleus, structure and functions of plasma membrane (lipid bilayer model); extra nuclear matrix; receptor mediated endocytosis 8 class hours

Unit-2: Structure and functions of chromosome; polytene and lamp brush chromosomes; chromatin- molecular organization, nucleosome, DNA packaging in prokaryotes and eukaryotes, heterochromatin and euchromatin; models of chromosomal movements. 7 class hours

Unit-3: Cell cycle- molecular events in different phases, regulation of cell cycle; normal and abnormal cell growth; concept of apoptosis; cell division (mitosis and meiosis) 5 class hours

Unit-4: Basic concept of cell signalling (endocrine, paracrine and autocrine signalling); function of cell surface receptors- G protein-coupled receptors. 5 class hours

Histology and Histochemistry **Marks: (8+2)+ (8+2)= 20**

Unit –1: Animal tissues- types, structure and function; histological structure of muscles, epithelium, bone, cartilage, lung, kidney, liver, stomach, intestine and pancreas of mammals. 5 class hours

Unit –2: Histological methods- basic principles of fixation, dehydration, embedding, sectioning and spreading 5 class hours

Unit-3: types of staining; vital staining; classification and properties of dyes; metachromatic dyes and staining 5 class hours

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ZOOM 402
Zoology Major- X
(Practical)

Marks: 40(32End+8IA), 12 class hours

1. Study of mitosis in tadpole tail, onion root tip
2. Meiosis in testes of grass hopper or cockroach
3. Histochemical localization of following:
   a. General lipid by Sudan black B method.
   b. Metachromatic substances by Toludine blue method.
4. Histological preparation and submission of the following tissues: liver, stomach, intestine, kidney, pancreas, testes and ovary of vertebrates.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs.		**Marks: (32+8)=40**
1. Cell division		10
2. Preparation of histological slide		5
3. Spotting (histological slide)		6
4. Submission of histological slide		4
5. Practical record book		5
6. Viva voce		10
	Total	**40**

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ZOOM 403
Zoology Major- XI

Developmental Biology

48End+12IA =60

Objective of the course: The main objective of this course is to provide exposer to the students on the fundamentals of embryology of animals.

Unit-1: Gametogenesis- formation of gametes (spermatogenesis; oogenesis); structure, maturation and growth of sperm and ovum; vitellogenesis. 8 class hours

Unit-2: Fertilization- types and mechanism of fertilization; mono and polyspermy; parthenogenesis. 8 class hours

Unit-3: Cleavage and gastrulation- cleavage pattern, blastulation and gastrulation in chick; fate maps; fate of germ layers; primary organisers, induction, property and mechanism of action of inductive substances. 10 class hours

Unit-4: Organogenesis – development of sense organs (eyes and ears). 6 class hours

Unit -5: Extra embryonic membranes in birds and placentation in mammals. 8 class hours

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ZOOM 404
Zoology Major- XII

(Practical)

Marks: 40(32End+8IA), 20 class hours

1. Study of permanent slides of different embryonic stages of frog/toad.
2. Study of permanent slides of developmental stages in chick embryo.
3. Submission of permanent stained preparation of (at least two stages up to 72 hrs. development stages) chick embryo.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs. **Marks:(32+8)=40**

1. Embryological slide preparation		10
2. Spotting (embryological slide)		10
4. Submission of slide		5
5. Practical record book		5
6. Viva voce		10
	Total	**40**

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ZOOM 501
Zoology Major- XIII

Genetics and Evolution

48End+12IA= 60

Objective of the course: The main objective of this course is to introduce the students with the fundamentals of genetic principles and evolutionary trends.

Genetics **Marks: 40**

Unit-1: Mendel's law of inheritance and their critical analysis; gene and allele concept 2 class hours

Unit-2: Physical basis of heredity; interaction of genes, incomplete dominance, complementary factors, supplementary factors, epistasis, inhibitory factors, lethal factors; Quantitative genetics. 6 class hours

Unit-3: Linkage and crossing over; basic knowledge of gene mapping 2 class hours

Unit-4: Determination of sex, sex-linked inheritance; cytoplasmic inheritance. 5 class hours

Unit-5: Concept of gene and their fine structures; chromosomal (numerical and structural) and gene mutation, types, genetic significance of mutation and practical implications. 6 class hours

Unit-6: Human genetics: human as a genetic material, autosome and sex chromosomes, recessive and dominant trades, inborn error in metabolism, human chromosome, human genome project. 6 class hours

Evolution **Marks: 20**

Unit-1: Evidences and theories of evolution- palaeo-biological and molecular evidences; Lamarckism, Darwinism, Neo Darwinism, Mutation theory and Modern Synthetic theory. 3 class hours

Unit-2: Origin of life (chemical and biological origin); variation- types and sources; isolation; speciation (sympatric, allopatric and peripatric); fossil and fossilization. 5 class hours

Unit-3: Concept of population- gene pool and gene frequency (Hardy- Weinberg law); change in gene frequency (genetic drift, gene flow, genetic load). 5 class hours

Unit-4: Continental drift; parallel, divergent and convergent evolution; endemism and adaptive radiation 4 class hours

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ZOOM 502
Zoology Major- XIV

(Practical)

Marks: 40(32End+8IA), 15 class hours

1. Polytene chromosome of chironomus or Drosophila larvae.
2. Simple calculation based on Mendel's monohybrid/dihybrid cross/test cross.
3. Study of chromosomal slides of suitable materials.
4. Study of materials/organisms of evolutionary significance (rocks, fossils and connecting links)

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs. **Marks: (32+8)=40**

1. Slide preparation of chromosome	10
2. Simple genetic calculation	5
3. Spotting (chromosomal slides & materials of evolutionary importance)	10
4. Practical record book	5
5. Viva voce	10
Total	**40**

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ZOOM 503
Zoology Major- XV

Mammalian Physiology

48End+12IA =60

Objective of the course: The main objective of this course is to provide knowledge on the physiological mechanisms of mammals.

Mammalian Physiology

Unit-1: Muscle and its contraction- molecular composition of myofilaments; sarcoplasmic reticulum and T- tubules; mechanism of muscle contraction; characteristic of muscle twitch- isometric and isotonic contractions; summation and tetanus. 6 class hours

Unit-2: Digestion- site and sequence of digestion; digestive secretions and their regulation; mechanism of digestion and absorption of carbohydrates, proteins and lipids; role of gastro-intestinal hormones, balanced diet 6 class hours

Unit-3: Excretion- structure and functions of nephron; renal blood supply; mechanism and regulation of urine formation; renal failure and dialysis 5 class hours

Unit-4: Circulation- coronary circulation; origin and conduction of cardiac impulse; cardiac cycle; cardiac output and its regulation; disorders of cardio-vascular system; haemostasis; respiration- structure and functions of haemoglobin; O_2 and CO_2 transport by blood; regulation of respiration; carbon monoxide poisoning. 10 class hours

Unit-5: Nervous system- neurons, resting membrane potential and its basis, action potential and its propagation in myelinated and non-myelinated nerve fibre; types of synapses and synaptic transmission; neuro-transmitters- their release and action; neuro-muscular junction; types of reflexes; reflex activity; reflex arc; physiology of vision. 10 class hours

Unit –6: Drug addiction and its physiological effects; socio-biological aspects of genesis of drug addiction, stimulants and depressants, physiological and social implications. 6 class hours

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ZOOM 504
Zoology Major- XVI

(Practical)

Marks: 40(32End+8IA), 15 class hours

1. Determination of R.Q. of cockroach/Goroi fish.
2. Recording of heart beat of frog by kymograph.
3. Preparation of haemin crystals.
4. Demonstration of knee jerk reflex.
5. Demonstration of osmosis using toad/frog urinary, bladder/alimentary canal.
6. Recording of muscle twitch.
7. Qualitative test of salivary amylase.
8. RBC and WBC counting by haemocytometer.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs. **Marks: (32+8)=40**

1. Physiological experiment I	10
2. Physiological experiment II (blood)	10
3. Demonstration	5
4. Practical record book	5
5. Viva voce	10
Total	**40**

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ZOOM 505
Zoology Major- XVII

Environmental Biology and Wildlife Biology

48End+12IA=60

Objective of the course: The main objective of this course focuses on the structural and functional interrelationship of animal kingdom with other components of nature and conservation strategies for conservation of wildlife.

Environmental Biology **Marks: (32+8)=40**

Unit-1: Concepts pertaining to ecosystem, species, community, biome and ecotone; biotic and abiotic environmental factors and their effect on animals; trophic relations and energy flow. 8 class hours

Unit-2: Shelfords law of tolerance; concept of productivity; population structure and dynamics; exponential and logistic growth; **r** and **k** strategies and multidimensional niche concept; Lotka-Volterra model; natality and mortality; predation and predator – prey system. 8 class hours

Unit-3: Biogeochemical cycles (carbon, nitrogen, phosphorus and hydrological cycles) 4 class hours

Unit-4: Renewable and non-renewable resources of N.E. India and strategy for their sustainable utilization; basic concept of remote sensing and EIA 6 class hours

Unit-5: Environmental pollution (water, air and soil); bioindicators in pollution studies; ecological succession; ecological backlash; greenhouse effect; ozone layer depletion and its impact. 5 class hours

Wildlife Biology **Marks: (16+4)=20**

Unit-1: Important endangered species of N.E. India - rhinoceros, pangolin, golden langur, dancing deer, river dolphin, pigmy hog and white winged wood duck. 6 class hours

Unit-2: Threats to biodiversity; *ex-situ* and *insitu* conservation strategies; major national parks of NE India; concept of biosphere reserve and biodiversity hot spot; Indian Wildlife Protection Act, 1972. 6 class hours

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ZOOM 506
Zoology Major- XVIII

(Practical)

Marks: 40(32End+8IA), 15 class hours

1. Estimation of the size of the population by capture-recapture method (any vertebrate/invertebrate).
2. Find out the abundance and density of insect pests in some essential food commodities.
3. Determination of dissolved Oxygen/CO_2 /Alkalinity in the water samples.
4. Find out the abundance and densities of terrestrial invertebrates/macrophyte associated fauna by Quadrate method.
5. Study of structural components of an aquatic/ grassland ecosystem
6. Field study: To visit a National park/ Wildlife Sanctuary to study the habitat/ forest types and prepare a full note on it.
7. Project work (to be evaluated in 6^{th} semester)

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs. **Marks: (32+8)=40**

1. Ecological experiment	10
2. Estimation	10
3. Field study	10
4. Practical record book	5
5. Viva voce	5
Total	**40**

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ZOOM 507
Zoology Major- XIX

Endocrinology

48End+12IA=60

Objective of the course: The course focuses on the basic knowledge of endocrine glands of animals and their functions.

Unit-1: Comparative anatomy of pituitary, thyroid, adrenal and pancreas in fish, amphibia, birds and mammals and hormones secreted by them. 10 class hours

Unit-2: Hormones secreted by endocrine glands (pituitary, thyroid, adrenal and pancreas) and their functions in human 6 class hours

Unit-3: General characters of hormones; mechanism of action of hormones; regulation of hormone secretion; hypothalamo-hypophysial system; disorders associated with hypo and hyper secretion of hormones 10 class hours

Unit-4: Roles of hormones in reproductive cycle, pregnancy, parturition and lactation; methods of contraception; amniocentesis and IVF. 8 class hours

Unit-5: Neuroendocrine system in insects; role of hormones in growth and development of insects. 6 class hours

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ZOOM 508
Zoology Major- XX

(Practical)

Marks: 40(32End+8IA), 15 class hours

1. Histological preparation of thyroid, adrenal, pancreas and gonads.
2. Dissect and display the following endocrine gland in fish/rat: pituitary, thyroid, adrenal
3. Study of permanent slides of endocrine glands
4. Submission of chart/models related to endocrinology

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs. **Marks: (32+8)=40**

1. Dissect and display of endocrine gland	10
2. Stained slide preparation	5
3. Spotting	6
4. Submission	4
5. Practical record book	5
6. Viva voce	10
Total	**40**

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ZOOM 601
Zoology Major- XXI

Parasitology and Ethology

48End+12IA = 60

Objective of the course: The main objective of this course is to introduce the students with the complex interaction between animals and their social interrelationship.

Parasitology **Marks: (24+6)=30**

Unit-1: Parasitism; types of parasites, hosts and vectors; pasasitic adaptations and effects on hosts. 3 class hours

Unit-2: General organizations and pathogenosity of bacteria & viruses (*Rickettsia, Borrelia,Treponema* & *Leptospira*). 5 class hours

Unit-3: Life history and mode of infection and pathogenicity of *Entamoeba histolytica Trypanosoma* spp*., Leishmania donovanii, Giardia intestinalis, Trichomonas vaginalis & Plasmodium* spp. 8 class hours

Unit-4: Life history, parasitic adaptation and pathogenicity of *Taenia solium, Fasciola hepatica, Ancylostoma duodenale* and *Wuchereria bancrofti.* 5 class hours

Unit-5: Vectors of human diseases- Malaria, Yellow fever, dengue, haemorrhagic fever, filariasis, Japanese B-encephalitis & dengue; measures of control of the vectors. 5 class hours

Ethology **Marks: 25**

Unit-1: Introduction to animal behaviour; brief history of ethology; patterns of behaviour; sense organs and behaviour; genetical and ecological aspects of behaviour. 5 class hours

Unit-2: Different types of orientation and communication in animals. 4 class hours

Unit-3: Comparative aspects of learning, offensive and defensive behaviour; social behaviour in insects. 5 class hours

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ZOOM 602
Zoology Major- XXII
(Practical)

Marks: 40(32End+8IA), 15 class hours

1. Identification of mosquito species causing malaria, encephalitis and dengue fever.
2. Study of protozoan parasites (permanent slides)
3. Study of taxis behaviour of *Paramecium*/earthworm/cockroach.
4. Study of habituation in mosquito larvae.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs. **Marks: (32+8)=40**

1.Parasitology	15
2. Ethology	10
3. Practical record book	5
4. Viva voce	10
Total	**40**

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ZOOM 603
Zoology Major- XXIII

Molecular Biology and Immunology

48End+12IA= 60

Objective of the course: The main objective of this course is to focus on development of molecular aspects and immunological concepts in animal science.

Immunology **Marks: (24+6)=30**

Unit-1. Concept of immunology- types of immunity; cells and organs involved in immunity; antigen-antibody reaction; Lymphoid organs 6 class hours

Unit – 2. Antigens: properties of antigens, adjuvant and haptens, vaccines, vaccinations and immune response. 6 class hours

Unit – 3. .Immunoglobulin: basic structure, classes and functions, clonal selection theory, polyclonal and monoclonal antibodies, major histocompatibility complex: structure and functions 6 class hours

Unit 4. Immune system in health and disease: basic concept of immunodiagnostic techniques (immunodiffusion, RIA and ELISA), immunodeficiency and Autoimmune disorders, AIDS. 5 class hours

Molecular Biology **Marks: (24+6)=30**

Unit – 1. Nucleic Acids, DNA as genetic material, structure and functions of DNA & RNA, Watson & Crick Model of DNA, other forms of DNA (A & Z). 6 class hours

Unit 2.Replication of DNA- prokaryotes and eukaryotes, Transcriptions in prokaryotes and eukaryotes. 5 class hours

Unit 3. Features of genetic code wobble hypothesis, protein biosynthesis in prokaryotes and eukaryotes. 4 class hours

Unit 4. Recombination in Prokaryotes; Transformation, Conjunction and Transduction; Genome organization in prokaryotes and eukaryotes, Concept of Transposons and Plasmids. 4 class hours

Unit 5. Regulation of Gene Epression in Prokaryotes- Operon concept (Lac) 2 class hours

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ZOOM 604
Zoology Major- XXIV

(Practical)

Marks: 40(32End+8IA), 15 class hours

1. Determination of blood group and Rh factor
2.Preparation of ball and stick model of Nucleotides.
3.Detection / estimation of RNA.
4.Immunodiffusion / Blood groping (Ag.Ab. reaction).
5. Study of Blood Cell types in blood smear slides.
6. Histology of Lymphoid organ.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs. **Marks: (32+8)=40**

1.Molecular biology	15
2. Immunology	10
5. Practical record book	5
6. Viva voce	10
Total	**40**

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ZOOM 605
Zoology Major- XXV

Biotechnology and Bioinformatics

48End+12IA= 60

Objective of the course: The main objective of this course is to introduce the students with the basic knowledge of biochemistry & bioinformatics.

Biotechnology **Marks: (24+6)=30**

Unit-1.Introduction, history and scope, basic knowledge of genetic engineering, protoplast fusion and somatic hybridization technique. 4 class hours

Unit –2. Basic principles of recombinant DNA technology, cutting, joining and visualization of DNA fragments, cloning vectors and gene cloning; application of DNA technology in agriculture and health; industrial biotechnology with special reference to production of alcohol and antibiotics. 8 class hours

Unit 3. Introduction of Omics: basic concept of structural and functional genomics, DNA sequencing, Human genome project; introduction to proteomics and transcriptomics. 6 class hours

Unit 4. Regulation of biotechnology: production and application of transgenic animals and plsnts, Genetically modified Organism, their benefits and risk assessment; IPR, patents and ethical issues related to biotechnology. 8 class hours

Bioinformatics **Marks:(24+6)=30**

Unit-1. Fundamentals of bioinformatics: introduction, history and scope of bioinformatics; sources of information, internet world wide web and web brousers. 5 class hours

Unit-2. Biological database: introduction, basic concepts of primary and secondary databases; Nuclic acid and protein sequence database (NCBI, gene bank and SWISS-PROT); Data mining and data mining tools (ENTREZ). 8 class hours

Unit 3. Database search and sequence alignment, Tools of sequence alignment – FASTA and BLAST; methods of sequence alignment. 4 class hours

Unit 4. Phylogenetic analysis: basic concept, steps in evaluation of phylogeny and constructing phylogenetic trees. 4 class hours

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ZOOM 606
Zoology Major- XXVI

(Practical

Marks: 40(32End+8IA),15 class hours

1.Different e-resources and database search.
2.Similarity search in sequence such as BLAST / FASTA.
3.Creation of databases.
4.Submission of charts and models etc.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs. **Marks: (32+8)=40**

1.Biotechnology	15
2. Bioinformatics	10
3. Practical record book	5
4. Viva voce	10
Total	**40**

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ZOOM 607
Zoology Major- XXVII

Economic Zoology

48End+12IA= 60

Objective of the course: The main objective of this course is to focus on the utilizations of animal resources for human welfare.

Unit-1: Major insect pests of paddy, tea and stored grains and their biology. 6 class hours

Unit-2: Life histories of silkworm (eri, muga and mulberry); culture technique of silkworms; diseases of silkworms and its prevention 6 class hours

Unit-3: Life history of honey bee (*Apis india*); rearing techniques of honeybee; Biology and culture of lac insect. 5 class hours

Unit-4: Pest management- chemical, cultural and biological; integrated pest management. 5 class hrs

Unit-5: Principles and practices in aquaculture; fish and prawn culture; preparation and management of different types of ponds for fish culture; induced breeding and hybridization technique in fishes; fish preservation methods; fish by-products. 8 class hrs

Unit-6: Piggery: management and practices of pig rearing; poultry: selection of breed (chicken and duck) and their scientific rearing methods; poultry diseases and its prevention/control. 6 class hrs.

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ZOOM 608
Zoology Major- XXVII
(Practical)

Marks: 40(32End+8IA), 15 class hours

1. Identification of silkworms (eri, muga & mulberry), immature and adult stages.
2. Submission of life cycles of eri/ muga/ mulberry silkworms.
3. Study of important pests of paddy, tea plants and stored grains and their submission.
4. Identification of economically important fish and prawn available locally.
5. Identification of common aquatic weeds, plankton and insects.
6. Demonstration of induced breeding in fish

SCHEME OF THE PRACTICAL EXAMINATION:
Time: 4 hrs. **Marks: (32+8)=40**

1.Collection ,identification,morphology etc.	15
2. Nutrient analysis etc.	10
3. Practical record book	5
4. Viva voce	10
Total	40 marks

***PROJECT WORK**: Topic of the project may be given in the **SEMESTER-V** and the report based on proper methodology and statistically correlated data should be submitted for evaluation at the time of **SEMESTER-VI** practical examination.

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BOOKS RECOMMENDED:

1. A manual of Zoology Part I.: L. Ayyar.
2. A Manual of Zoology Part II : E. Ayyar.
3. A Text and reference book : Taxonomy: R.E. Blackwelder, John Wiley, N.Y. 1967.
4. Animal Taxonomy : N.T.J. Bailey, English Language Society, 1959.
5. Biochemistry.:K. Trechan, Wiley Eastern Ltd., New Delhi.
6. Biological Chemistry : H.R. Mahler & E.H. Cordes.
7. Biology of Human Reproduction : R. Pritom, University Science Books.
8. Cell & Molecular Biology: E.D. P. De Roberts & E.M.F. De Roberts.
9. Cell Biology : E.D.P. Roberts, W. Nowiski & F. Saez, W.B. Saunders Co. London.
10. Cell Physiology : A.C.C. Giese, Boxwood, 1975.
11. Chordate Zoology : S.N. Prasad, Kitab Mahal.
12. Comparative anatomy of Chordates : E.K. Weiohert, McGraw Hill, NY.
13. Comparative Anatomy of the Vertebrates : G.C. Kent and R.K. Carr, Tata McGraw Hill.
14. Concept of Ecology : B.J. Kormondy, Prantice Hall, ND 1976.
15. Concept of Insect Control : M.R. Ghose, Wiley Eastern Ltd. New Delhi 1989.
16. Developmental Biology : S.F. Gilbert, Sinaeur Associates Inc. Publishers, 2003.

17. Elementary statistics with application in Medicine and Biological Sciences.:E.E. Croxton, Doner publication.
18. Elements of Cytology : Cohn Haucourt.
19. Entomology & Pest Management : L.P. Pedigo, Prentice Hall, New Delhi, 1996.
20. Environmental Science : W.P. Cunninghum & B.W. Saigo, McGraw hill. 1989.
21. Evolution : M. Ridely, Blackwell Science, USA, 1996.
22. Evolution of Vertebrate : Colbert.
23. Functions of Human Body : A.C. Guiton, 6th Edn. W.B. Saunders Co. Tokyo.
24. Fundamental of Ecology: B.P. Odum, W.B. Saunders, Toftan Co. Tokyo
25. Fundamentals of Ecology : Eugene, P. Oduen, W.B. Saunders 1971.
26. Genetics : A.M. Winester, Oxford & IBH.
27. Genetics : M.W. Strickburger, Mc Millan, NY 1968.
28. Immunology: Introduction Book : N. Shetty, New Age International, 1996.
29. Introduction to Evolution : P.A. Mody, Harper & Raw, NY 1964.
30. Introduction to Parasitology : A.C. Chandler & C.P. Read, Wiley Easte Prittd.
31. Medical Parasitology : D.R. Arota & B. Arora.
32. Modern Text Book of invertebrate Zoology : R. L. Kotpal, A. Agarwal & Khetrapal.
33. Molecular Cell Biology : H. Lodish et al, W.H. Freeman & Co. Tokyo.
34. Organic Evolution : R.S. Lull, Light & Life Publishers, New Delhi, 1976..
35. Outline of Biochemistry : B.E.E. Conn & E.H. Cordes.
36. Physiology of Reproduction : E. Knobil (eds), Raven Press Ltd.
37. Principles of Gene Manipulation : T.O. Primrose, Blackwell, Oxford, 2003.
38. Principles of Genetics : E.J. Gardner, John Wiley, N.Y. 1972.
39. Principles of Systematic Zoology : E. Mayer, McGrew Hill, NY, 1969.
40. Reproduction in Mammals : C.R. Austin and R.V. Shoot; Cambridge Univ. Press.
41. Text Book of Histology : K. Garg, I. Bahl & M.A. Kaul, CBS publishers.
42. Text Book of Zoology (Vertebrates): T.J. Parker & W.A. Haswall; ELBS & McMillan, 1995.
43. Text Book of Zoology Vol. I Invertebrates: A.J. Marshall & W.D. Williams
44. The Living Body: A Text Book of Human Physiology : C.H. & N.B. Taylor.
45. Zoology : S.A. Miller & J.B. Harley, Tata McGraw Hill Publ. Co.
46. Zoology of Chordates: E.L. Jordan.

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