Common to all Departments of studies in the Faculty of Science

Master's Programme
A master's Programme consists of a number of courses in M.Sc. A Master’s Programme consists of a set of compulsory courses and language papers.
The entire course carries credit system. The number and distribution of credits for the courses will be decided by the respective faculties.
A Course is divided into two semesters. Odd Semester and Even Semester.

Credits
The term credit is used to describe the quantum of syllabus for various programmes in terms and hours of study. It indicates differential weightage given according to the contents and duration of the courses in the Curriculum design.

The minimum credit requirement for the award of the Degree of Five Year Master's Programmes shall be 225.

Courses
Each course may consists of Lectures/ Tutorials/ Laboratory work/ Seminar /Project work /Practical training report / Viva – Voce etc.
Normally, in each of the courses, credits will be assigned on the basis of the Lectures/Tutorials/Laboratory work and other form of learning in a 18 week schedule.

Eligibility for Admission
Candidates for admission to the first year of the Five Year Integrated M.Sc Degree Courses shall be required to have passed the final examinations of the plus 2 Higher Secondary Course and Equivalent thereto with a minimum of 40% aggregate under Academic Stream with the following subjects as in Appendix – A, conducted by the Board of Secondary Education, Tamilnadu Government or an examination of any other authority accepted by the syndicate of the this University as equivalent thereto. They shall satisfy the conditions regarding qualifying marks, age and physical fitness as may be prescribed by the syndicate of the Annamalai University from time to time.

Grading System
The term Grading indicate a 10 point scale of evaluation of the performance of students in terms of marks, grade points, letter grade and class.

Course Duration
The duration for completion of a Five Year Integrated M.Sc Programme in any Course is Ten semesters.

Students Counsellors
To help the students in planning their course of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to members of the faculty who shall function as student counselor for those students throughout their period of study.
Attendance
Every teaching faculty handling a course shall be responsible for the maintenance of attendance Register for candidates who have registered for the course.

The instructor of the course must intimate the Head of the Department at least Seven Calendar days before the last instruction day in the semester about the particulars of all students who have secured an attendance of less than 80%.

A candidate who has attendance less than 80% shall not be permitted to sit for the End semester Examination in the course in which the shortage exists.

However, it shall be open to the authorities to grant exemption to a candidates who has failed to obtain the prescribed 80% attendance for valid reasons on payment of a Condonation fee and such Exemptions should not under any circumstances be granted for attendance below 70%.

Examination
The internal assessment for each course carries 25% marks for theory and 40% marks for practical and it is based on two internal assessment tests and a variety of assessment tools such as seminar and assignment. The respective faculty will decide the pattern of question paper. The tests are compulsory.

There will be two sessional assessments and one End- Semester Examinations during each semester.

Sessional Test -1 will be held during sixth week for the syllabi covered till then.

Sessional Test –I will be combination of a variety of tools such as class test, assignment and paper presentation that would be suitable to the course. This requires an element of openness. The students are to be informed in advance about the nature of assessment and the procedures. However, the tests are compulsory Test –I may be for one-hour duration. The pattern of question paper will be decided to the respective faculty Sessional Test -1 will carry 25 of marks of the entire course.

Sessional Test –II will be conducted with a variety of assessment tools. It will also have an elements of openness. The students are to be informed in advance about the nature of assessment and the procedures. However, the tests are compulsory. Test II may be for two hours duration.

The pattern of question paper will be decided by the respective Faculty. (Sessional Test –II)Carry 25 marks of the entire course average of sessional I & II will be taken.

There will be one End Semester Examination (75% marks for theory and 60% marks for Practical) of 3 hours duration for each course. The respective faculty will decide the pattern of question paper.

Evaluation
Evaluation will be done on a continuous basis. Evaluation may be objective Type Questions, Quiz, Short Answers, Essays or a combination of these. But at the End semester it has to be a Written Examination.

The performance of students in each course is evaluated in terms of percentage of marks (PM) with a provision for conversion to Grade Point (GP). The sum total performance in each semester will be rated by GPA while the continuous performance from the 2nd Semester onwards will be marked by OGPA.
Marks and Grading

A student cannot repeat the assessment of Sessional Test -1 and Sessional Test –II. However, if for any compulsive reason the student could not attend the test, the prerogative of arranging a special test lies with the teacher in consultation with the Head of the Department.

A minimum of 50% marks in each course is prescribed for a pass. A student has to secure 50% minimum in the End Semester Examination.

If a candidates who has not secured a minimum of 50% of marks in a course shall be deemed to have failed in that course.

The student can repeat the End Semester Examination when it is offered next in the subsequent Odd/Even Semesters still the regulations are in force. However, a candidate cannot move to the next odd/even semester if he/she more than six papers as arrears at any point of time.

A Candidate who has secured a minimum of 50 marks in all courses prescribed in the programme and earned a minimum of the credits will be considered to have passed the Master's Programme.

Grading

A ten –point rating is used for the evaluation of the performance of the student to provide letter grade for each course and overall grade for the Master's Programme.

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<td>49 or less</td>
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The successful candidate in the Core Subjects are classified as follows.

I - 60% marks and above in over all percentage of marks (OPM)

II - Class 50-59% marks in over all percentage of marks

Candidates who obtained 75% and above but below 90% of marks(OPM) shall be deemed to have passed the examination in First Class (Distinction) provided he/she passes all the course prescribed for the programme at the first appearance. Candidates who obtain 90% and above (OPM) shall be deemed to have passed the examination in First Class (Exemplary) provided he/she passes all the course prescribed for programme at the first appearance.

Candidate who obtain highest marks in all examinations at the first appearance alone considered for ranking.

For the Internal Assessment Evaluation the break up marks shall be as follows.

Test (10 + 10) : 20 Marks
Assignment : 05 Marks
Total 25 Marks
**Course-Wise Letter Grades**

The percentage of marks obtained by a candidate in a course will be indicated in a letter grade.

A student is considered to have completed a course successfully and earned the credits if he/she secures over all grades other than RA. A letter grade RA in any course implies a failure in that course. A course successfully completed cannot be repeated for the purpose of improving the Grade Point.

The RA Grade once awarded stays in the grade card of the student and is not deleted even when he/she completes the course successfully later. The grade acquired later by the student will be indicated in the grade sheet of the Odd/Even semester in which the candidate has appeared for clearance for clearance for the arrears.

If a student secures RA Grade in the Project Work/Field Work/Practical Work/Dissertation work he/she shall improve it and resubmit it if it involves only rewriting incorporating the clarification of the evaluators or he/she can re-register and carry out the same in the subsequent semesters for evaluation.

**Transitory Regulations**

Wherever there has been change of syllabi, examinations based on the existing syllabus will be conducted for three consecutive times after implementation of the new syllabus in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent subjects, as per the new syllabus, on the recommendations of the Head of the Department concerned.

**Appendix - A**

| M.Sc (Zoology) | A Pass in H. Sc (10 + 2 Level) or Equivalent thereto with a minimum of 40% Aggregate under academic stream with the following subjects Viz. Physics & Chemistry, Biology or Zoology and Botany |
## Five Year Integrated M.Sc Zoology

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## Optional Courses offered by Department of Zoology in the X Semester

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## Optional Courses offered to Other Science Department in the VIII, IX and X Semesters

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## Ancillary Courses offered to Other Science Department in the I and II Semesters

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**Internal Assessment Test**
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FIRST SEMESTER SYLLABUS FOR INTEGRATED M.Sc ZOOLOGY (5 Years)

IZOT 14 – Invertebrata-I

Objective : To understand lower invertebrate diversity

UNIT I.
Principles of classification-salient features and classification upto orders in non-chordates. Structural organization in different classes of non-chordates.

UNIT II
Protozoa- Type study Entamoeba, Paramecium and Plasmodium study of locomotion, osmoregulation, nutrition and reproduction in protozoa.

UNIT III

UNIT IV
Ctenophora-. Type study and affinities.

UNIT V
Platyhelminthes and Nemathelminthes-Type study-Planaria, tape worm, liver fluke-reproduction and parasitic adaptations. Nematoda-Type study-Ascaris-nematode parasites-Salient features.

PRACTICALS
1. Examination of paramecium, amoeba , euglena.
2. Study of sycon ,hylonema and spongilla from slides and specimens
4. Slides and specimens of Fasciola and Taenia
5. Slides and specimens of ascaris
6. Demonstration of earthworm and leech- internal organs.
7. Transverse sections of tissues of leech and earthworm

TEXT BOOKS:
SECOND SEMESTER
IZOT 24 - Invertebrata-II

Objective: To understand higher invertebrate diversity

UNIT I
Anneldia -Salient features-Type study-Earthworm, Nereis , Leech-Coelom and excretory system-adaptive radiation in polychaetes.

UNIT II
Onychopora-Type study and affinities

UNIT III
Arthropoda-Salient features-classification upto orders – Type study – Penaeus and grasshopper ; Limulus and its affinities.

UNIT IV
Molluscs-Salient features-classification upto orders-Type study-Fresh water mussel and sepia; torsion in mollusca, foot in mollusca, shell in mollusca.

UNIT V
Echinodermata-Salient features-classification upto orders-Type study-Asterias-Echinoderm larvae-their significance

PRACTICALS:
1. Cockroach – demonstration of internal organs and mounts
2. Prawn- demonstration of internal organs and mounts
3. Spiders, ticks, mites – specimens
4. Pila – demonstration
5. Mounts of Radula, ctenidium
6. Echinoderm -specimen study
7. Minor phyla-specimen study

TEXT BOOKS:
THIRD SEMESTER
IZOT 33 – Chordata I

Objective:
To make the students to understand the origin, salient features, classifications, organizations, and structure of prochordates and chordates, origin and evolution of various classes of chordates and comparative anatomy of systems in chordates.

UNIT I Protochordata -General characters of Hemichordata, Urochordata and Cephalochordata and their larval forms. Retrogressive metamorphosis in Urochordata

UNIT II Chordate Origin -Dipleurula concept and the Echinoderm theory of origin of chordates
Agnatha - salient features-Type study-affinities

UNIT III: Vertebrata -Advanced features over Protochordata

UNIT IV : Agnatha -General characters and classification of cyclostomes up to class

UNIT V - Pisces-General characters of Chondrichthyes and Osteichthyes and classification up to order Migration in fishes, Osmoregulation, Parental care

PRACTICALS:
1. Protochordata
Balanoglossus, Herdmania, Branchiostoma, Colonial Urochordata
Sections of Balanoglossus through proboscis and branchiogenital regions
Sections of Amphioxus through pharyngeal, intestinal and caudal regions
Permanent slide of Herdmania spicules
2. Agnatha
Petromyzon
3. Fishes
Sphyrna, Pristis, Torpedo, Chimaera, Notopterus, Mystus, Heteropneustes, Labeo, Exocoetus,
Echeneis, Anguilla, Tetrodon/ Diodon, Anabas, Flat fish

TEXT BOOKS:
   S.Viswanathan Printers and publishers, Pvt.Ltd.,Madras
FOURTH SEMESTER
IZOT 43 – Chordata II

UNIT I: Amphibia Origin of Tetrapoda (Evolution of terrestrial ectotherms)
General characters and classification up to order- type study – frog- adaptive features of Anura, Urodela & Apoda. Parental care in Amphibians

UNIT II: Reptilia - General characters and classification up to order – Identification of poisonous and non-poisonous snakes of South India- Poison apparatus, Types of fangs, Biting mechanism in snakes – type study - Calotes

UNIT III: Aves - General characters and classification up to order- Principles and aerodynamics of flight, Flight adaptations- Flightless birds and their distribution - Archaeopteryx- a connecting link-Migration in birds

UNIT IV: Mammals General characters and classification up to order; Affinities of Prototheria
Adaptive radiation with reference to locomotory appendages- Flying mammals – Dentition in Mammals- Aquatic mammals

UNIT V: Zoogeography - Zoogeographical realms, Theories pertaining to distribution of animals, Plate tectonic and Continental drift theory, Distribution of vertebrates in different realms (Tabular form)

PRACTICALS:
Amphibia
Ichthyophis/Ureotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra

Reptiles
Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Draco, Ophiosaurus, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus
Key for Identification of poisonous and non-poisonous snakes

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

Mammalia
Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Hemiecheni
Objective:
To learn the functioning of cells and animals

UNIT I
Aim and scope of physiology-Biomolecules-carbohydrate-aminoacids, peptids, lipids, proteins, nuclic acids and nucleotides.

UNIT II
Nutritional requirements and disorders, Nature of enzymes-digestion-Intra cellular and extracellular digestion-absorption of dietary component(carbohydrate, fats and protein) Metabolism-concept, selected examples, pathways and regulatory features.

UNIT-III
Blood-composition and function of blood and lymph; blood groups-blood coagulation, structure and function of haemoglobin-heart-structure-origin-conduction and regulation of heart beat; cardiac cycle and ECG-blood pressure-regulation.

UNIT IV

UNIT V
Physiology of neuronal function-Brief account of biological clock

PRACTICALS:
1. Ionic regulation of erythrocytes in two different media
2. Estimation of haemoglobin
3. Blood cell count
4. Blood coagulation
5. Qualitative test for sugars
6. Qualitative test for protein
7. Qualitative test for lipids
8. Activity of salivary amylase
9. Recording of heart beat by using kymograph
10. Histology of tissues (Testis, ovary, thyroid gland)

TEXT BOOKS:
IZOT 52 - MOLECULAR CYTOGENETICS

OBJECTIVE:
To Make the understand biology of chromosomes, human cytogenetics, regulation gene expression in Prokaryotes and Eukaryotes, molecular cytogenetics techniques and gene organization

UNIT I

UNIT II
Human Cytogenetics: Human genome-Techniques in human chromosome analysis-molecular cytogenetic approach-human karyotype-banding-nomenclature-numerical and structural abnormalities of human chromosomes-syndromes-mendelian and chromosome based heritable diseases in humans

UNIT III
Regulation of Gene Expression in Prokaryotes-induction and repression; details of genes; lac-operon, transcriptional and translational control; regulation in eukaryotes: Britten and Davidson's model; current views on eukaryotic gene regulation

UNIT IV
Molecular cytogenetic technique: FISH-DNA finger printing-automated karyotyping-chromosome painting

UNIT V

PRACTIALS:
1. Giant chromosomes in Chironomous larva
2. Heterochromatin and euchromatin
3. G-Banding of chromosome-geimsa stain
4. Automated karyotyping (Demonstration)
5. Structure and morphology of Bacteria and T4 phage(Demonstration)
6. Study of metaphase chromosome
7. Karyotyping of human chromosomes (Demonstration)

TEXT BOOKS:
IZOT 53 - CELLULAR AND MOLECULAR BASIS OF DEVELOPMENT

Objective:

To understand pattern growth and oncogenesis, physiology organic growth, cell interaction in development, differentiation and genomic equivalence and differential gene expression

UNIT I


UNIT II

Patterns of growth and oncogenesis: The mathematics of organismal growth-Growing pains; Physical limits to growth-Isometric growth-Brooks's law of linear growth-the equiangular spiral-allometric growth.

UNIT III


UNIT IV

Cell interaction in development; Role of cell surface-differential cell affinity; specific cell affinity-changes and migration in sea urchin embryo-models of cellular migration-chaemotaxis, haptotaxis, galvanotaxis, contact guidance, contact inhibition of movement-changing structure of cell surface, cell membrane changes with development; cell adhesion molecules- extra cellular matrix.

UNIT V


UNIT V

Aging-in population-cellular basis of aging; aging at the organismic level

PRACTICALS:
1. Cell structure – Prokaryotic and Eukaryotic types
2. Study of subcellular organelles
3. Chorio-allantoic graft in chick
4. Cell dissociation
5. Regeneration in amphibians
6. Effect of thyroxine on metamorphosis in frog

TEXT BOOKS:
IZOT – 54 EVOLUTION AND ANIMAL BEHAVIOUR

Objective: To make the students to learn the concepts of evolution –polymosphism, polyploidy and animal behaviour

EVOLUTION

UNIT I
Concept of evolution –origin of life- geological time scale-formation and dating of fossils

UNIT II
Theories of organic evolution: Darwinism and Neo - Darwinism; Lamarckism and Neo-Lamarckism; DeVries theory of mutation

UNIT III
Polymorphism-polyploidy-isolation and speciation-mimicry

UNIT IV

ANIMAL BEHAVIOUR

UNIT V
Concept of ethology-motivation-fixed action pattern-kinds of learning imprinting-reproductive behaviour-aggressive behaviour-social organisation-advantages of sociality-the evolution of sociality.

PRACTICALS
1. Gene frequencies calculation for human autosomal traits and multiple alleles
2. Study of fossils
3. Mimicry
4. Polymorphism
5. Animal adaptation
6. Genetic drift
7. Analogy and homology

TEXT BOOKS:
Objective:
The expose the students to the various physiological mechanisms functioning in animal kingdom.

UNIT I : Aim and scope of comparative physiology
Aim and scope of comparative physiology- Feeding and digestion; food – nutritional types-
Absorption: absorption of carbohydrates- fats- sterols – proteins – salts- mechanism of
absorption- faeces.

UNIT II : Blood and circulatory system
Blood and circulatory system- functions of blood; erythrocytes; leukocytes; blood platelets; plasma – coagulation-volume- transfusion-Heart function – Cardiac cycle- regulation of
heart beats- heart sounds – blood pressure.
Respiration-respiratory organs and respiratory pigments through different phylogenic
groups-metabolic pathways and variations in different phylogenic groups of animals.

UNIT III : Osmoregulation
Osmoregulation in different animal-patterns of nitrogen excretion among different animal
groups (Ammonotelic, ureotelic and uricotelic) circulation of body fluids and their regulation.

UNIT IV : Osmoregulation
Receptor physiology-a comparative study (Mechano reception, phono reception, photo
reception, chemoreception, equilibrium reception) Muscle-structure and function-brief account of
amoeboid, ciliary and flagellary movements.

UNIT V : Osmoregulation
Bioluminescence-Communication among animals-bioluminescence-pheromones-functional
regulation of chromatophores system. Colour change in animals.

PRACTICALS:
1. Pattern of osmotic response of Crab in two different media
2. Effect of chemical substance on respiratory metabolism of fish
3. Comparative study of vertebrate and insect eyes.
4. Ciliary mode of feeding in freshwater mussel
5. Effect of pH and amount of substrate activity of salivary amylase
6. Study of ciliary and amoeboid movements
7. Estimation of Nitrogenous waste products in cock-roach and birds
8. Estimation of Ammonia, urea and uric acid.

TEXT BOOKS:
   and company
   India Ltd., New Delhi
   Cambridge
IZOT 62 - ECOLOGY

Objective:
To make the students understand the various concepts of environment, habitat, and the ecosystem.

UNIT I : The Environment

Physical environment; biotic environment; biotic and abiotic interactions. Habitat and niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement

UNIT II :Ecosystem

Structure and function; energy flow and mineral cycling (CNP); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine).

UNIT III : Population ecology

Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection); concept of metapopulation – demes and dispersal, interdemic extinctions, age structured populations. Species interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis.

UNIT IV :Population ecology

Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones.

UNIT V :Ecological succession

Types; mechanisms; changes involved in succession; concept of climax. Applied ecology: Environmental pollution; global environmental change; biodiversity-status, monitoring and documentation.

PRACTICALS:

1. Study of animal parasites, mutualism/symbiosis
2. Determination of T.D.S
3. Determination of dissolved oxygen
4. Determination of dissolved carbon-di-oxide
5. Determination of salinity
6. Examination of benthos

Text books
IZOT 63 -APPLIED ZOOLOGY

Objective:
To make the students acquire knowledge bioinformatics reproductive technologies, Aquaculture, medical zoology and vermitechology

UNIT I
Bioinformatics: Historical perspective on computer and their applications to biology-Introduction to programming-the internet and the biologists-data bases and information retrieval-genome information.

UNIT II
Reproductive Technologies: Gamates technology-collection and preservation of economically important invertebrates and vertebrates; sperm function tests, semen analyses-embryo sexing-methods and principles

UNIT III
Aquaculture: Types of culture-general culture techniques-pond culture-cage culture- pen culture-polyculture. Integrated fish farming; farm construction and management; Induced breeding-hypophysation technique. Culture of ornamental fishes.

UNIT IV
Medical Zoology: Brief accounts of life history-mode of infection and pathogenesis of organisms with reference to man, prophylaxis and treatment for entamoeba, trypanosoma, Leishmani-Girardia, Trichrmonas-plasmodium, Fasciolopsis,shistosoma, anacylostoma, wuchereria; Arthropods and vectors of human diseses-malaria,filariaris, epidemic diseases.

UNIT V
Composting-methods, factors affecting composting, vermiculture, vermicomposting practices-methods, advantages.

PRACTICALS:
1. Study of permanent slides and specimens of parasitic protozoans, helminths and arthropods.
2. Preparation of blood film, examination of blood parasites; trypanosoma and plasmodium.
3. Hypophysation techniques-location and removal of pituitay; pituitry extract, preparation and preservation
4. Culture method of ornamental fishes
5. Antibiotic assay-streptomycin
6. Wine production by – Saccromyces cervisae (yeast)
7. Histology of gametes (Testis and ovary)
8. Semen analysis

REFERENCE:
1. Chery,T.C. General Parasitology (Academic press)
2. Keitle,D.S. Medical Veterinary Entomology (CAB International)
IZOT 64 - TOOLS AND TECHNIQUES OF BIOLOGY

Objective:
To acquire knowledge in the application of various tools and techniques in the field of biology.

UNIT I
Principles and uses of Analytical Instruments: Balances, pH meter, colorimeter, spectrophotometer, Centrifuges, Spectrofluorometer, ESR an NMR spectrometers. Computer aided techniques for data presentation and data analysis.

UNIT II

UNIT III
Separation Techniques: Molecular separation by chromatography, electrophoresis and precipitation. Organelle separation by centrifugation. Cell separation by flow cytometry and density gradient centrifugation.

UNIT IV
Radio Isotope Techniques: Sample preparation for radio active counting Auto radiography, Liquid scintillation, Radio immuno assay (RIA)

UNIT V
Special Techniques: Organ ablations (ovariectomy, adrenalectomy etc) perfusion technique, parabiosis, cryopreservation for cells, tissues and organisms, cryotechniques for microscopy.

PRACTICALS:
1. Identification and working principle of different analytical instruments (pH meter, Colorimeter, spectrophotometer, centrifuges etc.)
2. Study of optical instruments (microscope)
3. Paper chromatography and thin layer chromatography
4. Application of computer in biology
5. Demonstration of perfusion technique
6. Organ ablation (ovariectomy, adrenalectomy etc)
7. Parabiosis
8. Microbial culture technique

TEXT BOOKS:
Objectives
To make the students understand the various concepts of development.

Unit–I: Gametogenesis

Unit–II: Fertilzation
Approach of the sperm to the egg, sperm penetration, essence of activation, acrosome, reaction of the egg, Biochemistry of egg activation- parthenogenesis.

Unit–III: Beginning of Embryogenesis and aspects of Gastrulation
Types of eggs, cleavage, laws of cleavage patterns of cleavage, physiological and biochemical changes, Role of egg cortex.

Fatemap, gastrulation, physiology of gastrulation, cell lineage; organizer–concepts– induction process.

Unit–IV: Embryonic Adaptation, Organ Formation and Differentiation

Unit–V: Morphogenetic Processes in the later part of Ontogenesis
Metamorphosis – hormonal regulation of metamorphosis in Amphibia and Insects.

Regeneration – regeneration of limb in salamander: Stimulation and suppression:

Histological process: polarity and gradients in regeneration.

Practical
1. Structure of spermatozoa of fish, frog, chick and mammal
2. Structure of egg in insects, fish, frog, chick and mammal
3. Study of types of cleavage
4. Vital staining of chick blastoderm
5. Analysis of excretory products during chick development
6. Histology of testis showing spermatogenesis
7. Histology of ovary showing oogenesis
8. Regeneration in amphibian
9. Effect of thyroxine on amphibian metamorphosis
10. Study of insect metamorphosis

Text Books

Reference Books
IZOT 72 CELL BIOLOGY

Objectives
To understand the basic concepts of cell organ structure, function, cell growth, metabolism and diseases.

Unit–I: Cell Structure and Plasma Membrane

Unit–II: Mitochondria
Structure of mitochondria – Shuttle system – Pasteur’s effects – role of mitochondria in metabolism – chemical coupling hypothesis – conformational coupling hypothesis - control of respiratory activity enzyme system.

Unit–III: Other Cytoplasmic Organelles
General morphology and function of Golgi complex and lysosome - Secretory cycles, primary and secondary lysosome, structure and functions of endoplasmic reticulum, structural organization and function of Prokaryotic and Eukaryotic ribosome.

Unit–IV: Nucleus
Structural organization and functions of nucleus, membrane pore complex and nucleolus - Organization of DNA into chromosome, nucleosome, Solenoid, Loops, rosette coil, chromatid, chromosome, Heterochromatin, Euchromatin, Lampbrush chromosome, Polytene chromosome.

Unit–V: Cell Cycle and Cancer

Practicals
1. Light microscope – components, use and principles
2. Mounting of polytene chromosomes
3. Identification of different stages in meiosis in grasshopper
4. Micrometry (A) Camera Lucida (b) Stage Micrometer (C) Ocular Micrometer
5. Determination of Nucleo - Cytoplasmic index
6. Determination of cell diameter
7. Identification of Cancer tissues
8. Preparation of mitosis in Onion root tip
9. Electrophoretic separation of proteins
10. Identification of different tissues – muscle tissues, skeletal tissues- epithelial tissues – nervous tissue and reproductive tissue

Text Books

Reference Books
IZOT 73 GENETICS

Objectives
To make the students understand the fundamental concepts of genetics, human health related genetic problems, inborn errors and genetic counselling.

Unit–I: Mendel’s Laws & Gene Expression
Principles of segregation and independent assortment-deviation from Mendel’s findings – the chromosome theory of inheritance –DNA is the genetic material-Tobacco Mosaic Virus-penetrance and expressivity-effect of temperature and light on gene expression-environmental effects and twin studies.

Unit–II: Polygenic Inheritance
Polygene concept-mode of inheritance of kernal color in wheat-skin color in man-transgressive variation-heritability-Multiple alleles-ABO blood groups in man-MN blood group-Rh blood group-erythroblastosis foetalis-sickle cell anemia-Thalasemia.

Unit–III: Linkage, Crossing over and Gene Mapping
Bateson and Punett coupling and repulsion concept-Margan and Bridges theory of linkage and crossing over - chiasma frequency-genetic map-gene mapping in Drosophila using three point test cross – interference, Hardy- Weinberg law of genetic equilibrium.

Unit–IV: Gene fine structure & Molecular Mechanism of Gene Mutations

Unit–V: Genetics of Human Metabolic Disorders
Garrod’s discovery-defects in amino acid, lipid and sugar metabolism – one gene and one enzyme theory – one gene one polypeptide theory – co-linearity of gene and its polypeptide products – chromosomal disorders. Genetic counselling

Practicals
1. Experiments on Mendelian inheritance
2. Experiments on polygenic inheritance
3. Human traits survey
4. Gene frequency calculations.
5. Statistical analysis of genetic data using Chi-square test.
6. Human pedigree construction for a family data.
7. Tracing of genes in family pedigree studies
8. Collection and identification of human finger prints
9. Study of hereditary disorders with the aid of chromosome karyotyping
10. Identification of sex and mutant characters in Drosophila

Text Books

Reference Books
EIGHT SEMESTER
IZOT 81 ANIMAL PHYSIOLOGY

Objectives
To expose the students to the various physiological mechanisms functioning in animal kingdom.

Unit–I: Food and Digestion
Composition of food-classification of nutritive substances-digestion-digestive enzymes-absorption-hormonal control of digestion.

Unit–II: Excretion and Osmoregulation
Organs of Excretion in different animal groups – vertebrate kidney – Urine formation – Nitrogenous wastes – Acid base regulation in vertebrate kidney, ion exchange mechanism in fish gills – Hormonal control of kidney function in mammal.
General concepts of osmoregulation – osmoregulation in invertebrates and vertebrates.

Unit–III: Circulation
Circulation of the blood – Open and Closed systems – vascular pumps – Arthropod heart – Chambered hearts and booster pumps.
Structure of mammalian heart, origin, conduction and regulations of heart beat – patterns of circulations in the vertebrates – ECG – Composition of blood – clotting mechanism – blood groups – buffer system of blood- circulation of body fluids and their regulations.

Unit–IV: Respiration

Unit–V: Neuromuscular and Receptors
Structure of neuron-electrical phenomena of nerves-theories of excitation-synaptic transmission-neuroendocrine system - hormones and their functions.
Structure of muscle-chemical - composition – mechanism of muscle contraction-energy for muscle contraction
Mechanoreceptors – chemoreceptors - photoreceptors – phonoreceptors
Practicals
1. Activity of salivary amylase.
2. Effect of substrate concentration and activity of salivary amylase
3. Effect of enzyme concentration and activity of salivary amylase
4. Effect of pH concentration and activity of salivary amylase
5. Quantitative estimation of proteins.
7. Counting of blood cells.
8. Identification of blood groups.
10. Effect of thyrooxin on the respiratory metabolism of fish.

Text Books

Reference Books
IZOT 82 MOLECULAR BIOLOGY

Objectives
To understand the molecular basis of the cell structure, function and to familiarise the recent developments and techniques in the field of molecular biology.

Unit–I : Structure and properties of DNA

Unit–II: Replication of DNA

Unit–III : Structure and properties of RNA
RNA polymerases in proaryotes and eukaryotes. Types, structure and functions of RNAs, Transcription in prokaryotes and eukaryotes, ‘rho’ dependent and independent termination, TATA box and Pribnow box.

Unit–IV: RNA Processing, Editing and Genetic Code
Processing of mRNA, rRNA, tRNA and splicing mechanisms- RNA editing, Genetic code and its properties – Protein synthesis – Protein secretion and Signal hypothesis.

Unit–V: Recombinant DNA Technology
Reverse transcription and cDNA synthesis – steps involved in the recombinant DNA technology – gene targeting – apoptosis and cancer role of oncogene in cancer.

Practicals
1. Identification of drum stick chromosome in human blood
2. Identification of Barr body in buccal epithelial cells
3. G-banding of chromosome – Geimsa stain
4. Mitotic index
5. Localization of DNA
6. Localization of RNA
7. Localization of carbohydrates
8. Localization of protein
9. Estimation of DNA
10. Estimation of RNA.

Text Books

Reference Books
IZOT 83 ENVIRONMENTAL BIOLOGY

Objectives
To make students to realize the structure and function of ecosystem, wealth of our natural resources and conservation measures to be taken and create awareness of the laws governing environment.

Unit–I: Ecosystem
Composition of atmosphere – structure and stratification of atmosphere - Hydrological cycle-kinds of ecosystem-structure and functions of ecosystem-energy flow in ecosystem-trophic levels

Unit–II: Natural Resources and Conservation
Types of resources-conventional and non- conventional sources of energy-conservation of soil, land and forest - Deforestation and Afforestation – Conservation strategies (WCS &NCS) - Wild life management in India.

Unit–III: Air and Water Pollution
Air pollution-types of air pollutants-classification and effect of pollutants on vegetation, farm animals and human health-prevention and control of air pollution.

Unit–IV: Radiation, Noise and Industrial Pollution
Radiation pollution-sources and effects of ionizing radiation.

Unit–V: Environmental Impact Assessment and Law
The objective of Environmental Impact Assessment (EIA) – Environmental Appraised Committee (EAC) – The Environmental Management Plan (EMP) – Control of Environmental pollution through law – Environmental Protection Act (1986).

Practicals
2. Oxygen sag curve from river.
3. Estimation of dissolved Carbon-di-oxide
4. Estimation of Hydrogen sulphide
5. Estimation of Residual chlorine
6. Estimation of total dissolved Solids
7. Determination of sulphate in water
8. Determination of iron in water
9. Determination of silicate in water
10. Determination of Nitrite/Nitrate in water.

Text Books

Reference Books
OBJECTIVES
To make the students to learn the application of scientific and engineering principles to the processing of materials by biological agents to provide goods and service.

UNIT-I: Basic Biotechnology
Definition – Scope – Achievements of Biotechnology – Restriction Enzymes, DNA ligases, polymerase etc. Cloning vehicles – Plasmid Bacteriophage, Cosmids, Yeast plasmids- Genomic DNA libraries, cDNA libraries.

UNIT-II: Techniques in Biotechnology
Southern blotting, Northern blotting, Western blotting, In-situ hybridization DNA sequencing PCR, DNA finger printing, DNA probes, site – directed mutagenesis, particle gun, microinjection, electroporation.

UNIT-III: Medical Biotechnology
Insulin, Somatotrophin, somatostatin, hormone production, vaccines, interferons, gene therapy, monoclonal antibodies, Antenatal diagnosis, Invitro fertilization technology, Human genome project.

UNIT-IV: Agricultural Biotechnology

UNIT-V: Microbial and Environmental Biotechnology

Practicals
1. Methods of sterilization
2. Preparation of culture media and Agar slants
4. C.S. of stem and Root nodule of leguminous plants
5. Conn’s direct microscopic count of soil microbial population
6. Standard plate count
7. Antibiotic assay – Streptomycin
8. Purification of Bacteria
9. Agarose Gel Electrophoresis
10. Study of Biogas Plant.

Text Books

Reference Books
IZOT 92 IMMUNOLOGY

Objectives
To make the students aware of the basic principles of immunology and expose to the organs and mechanism of immunity.

Unit–I: Immune System

Unit–II: Cells and Organs of the Immune System

Unit–III: Antigens

Unit–IV: Antibodies
Basic structure of immunoglobulins – classification - functions of immunoglobulins - antibody diversity.

Unit–V: Antigen Antibody Interactions
Strength of antigen antibody interactions-Antibody affinity-Antibody avidity-Cross reactivity, Precipitin reaction-Agglutination reaction-Haemagglutionations-RadioImmuno Assay (RIA), Enzyme linked Immunosorbant Assay (ELISA)-western blotting.

Practicals
1. Preparation of solutions of different normality, molarity, and dilutions.
2. Demonstration of lymphoid organs
3. Cell imprinting of lymphoid organs
4. Histology of lymphoid organs
5. Study of bone marrow cells
7. Differential count of W.B.C. from blood smear preparation
8. Human blood grouping
9. Antigen antibody interaction-immunology
10. Rapid plasma regain (RpR) test for syphilis

Text Books

Reference Books
IZOT 93 TOXICOLOGY

Objectives
To make the students to understand the various types of toxicants and its impact on living organisms.

Unit–I: Absorption Distribution and Excretion of toxicants

Unit–II: Bio-Transformation of Toxicants

Unit–III: Bio-chemical basis of Toxicology

Unit–IV: Methods of Toxicology

Unit–V: Chemical and Immuno toxicology

Practicals
1. Observation and recording of Behavioural changes of normal and treated fish.
2. Estimation of oxygen consumption of normal and toxicant treated fishes.
3. Analysis of pesticide residues in vegetables by finger printing technique.
4. Estimation of acid and alkaline phosphatase activity of normal and toxicant treated animal tissue.
5. Estimation of SDH activity in liver tissue of normal and malathion treated fish.
6. Estimation of total protein content in the muscle tissue of normal and endosulfan treated fish.
7. Estimation of Glucose and Glycogen level in the liver tissue of normal and Lead treated fish.
9. Estimation of GSH level in liver tissue of normal and endrin treated mouse.
10. Determination of cell volume in liver tissue of normal and copper treated fish.
11. Histopathological observation of the following
12. Determination of LC$_{50}$ value of Zinc on fish.

Text Books
1. Sharma, P.D. 1996 Environmental Biology and Toxicology. Rastrogi Publication, meerut, India.

Reference Books
TENTH SEMESTER
IZOT 101: ENTOMOLOGY

Objectives
To understand the insect by study of their morphology, anatomy and physiology of various systems, acquire knowledge of Sericulture, Apiculture, Vector insects and integrated pest management.

Unit–I: Insect Morphology

Unit–II: Insect Physiology
Structure and physiology of integumentary, digestive, excretory, circulatory, respiratory, endocrine, reproductve and nervous system.

Unit–III: Agricultural Entomology
Insect – pests out break – assessment of insect population – Identification, seasonal history, biology, nature of damage and control measures of major pests of paddy, sugarcane, vegetables (Brinjal).

Unit–IV: Principles and methods of Pest Management

Unit–V: Beneficial insects and Vector insects
Sericulture: biology of silk worm, silk gland, cultivation of mulberry plants, rearing silkworm and uses of silk – Apiculture: types of bees, bee colony, life history, Beekeeping accessories and byproducts of bees and its uses. Useful insects – Biology and control measures of important insect vectors – mosquitoes and houseflies.

Practicals
1. Methods of harmful insect collection, preservation and submission of insect box.
2. Identification of at least 10 insects belonging to different orders.
3. Mounting of salivary gland of cockroach, mouth parts of cockroach, housefly, and mosquito.
4. Mounting of different types of antennae and legs of insects, wings and their venation.
5. Demonstration of digestive, reproductive (male and female) and nervous system of insects (Cockroach and Odontopus).
7. Life history of silkworm (egg, larva, cocoon and adult).
8. Bee keeping equipments and its accessories.
9. Bioassay of insecticides on insects (LC50)
10. Collection and Identification of medically important arthropods (Mosquitoes, house flies, lice and mites).
Text Books

Reference Books
IZOT 102: FISHERIES AND AQUACULTURE

Objectives
To make the students to understand the Indian fisheries scenario in relation to world aquaculture and learn culture practices.

Unit–I: Capture Fisheries
Present status and scope of capture fisheries - commercially important fishes - Food and feeding habits of important edible fishes - Age and growth - Method of age determination - length - weight relationship.

Unit–II: Culture Fisheries
Present status and scope of culture fisheries - Biology of important cultivable fishes - Marketing of cultured fishes - Major diseases - symptoms and treatments.

Unit–III: Aquaculture Principles and Practices
Aquaculture - types of culture - fish farm - types of ponds - maintenance and management - eradication of algal bloom - predators - induced breeding - hypophysation - factors of induced spawning - transport of fish seed.

Unit–IV: Culture Methods

Unit–V: Fish Harvest Technology
Harvesting methods - handling and preservation - Fishing Gears - Fish preservation - fishery byproducts - marketing and economics.

Practical
1. Estimation of pH, total hardness, dissolved O2, salinity
2. Determination of nitrate, sulphate, phosphate and silicate
3. Identification and biology of important cultivable fishes.
4. Morphology and Morphometry study of fish
5. Types of scales in fishes
6. Analysis of gut content of fish
7. Collection and identification of fish parasites
8. Collection and identification of fish predators
9. Identification of commercially important species
10. Demonstration of Hypophysation technique in fish

Text Books

Reference Books
IZOT 103 : ENDOCRINOLOGY

Objectives
To make the students to learn the objectives and scope of comparative endocrinology, anatomy, morphology and histology of endocrine tissues of vertebrates, crustacean and insect endocrine organs and their functions.

Unit–I: Pituitary Gland
General characteristics of hormones-Pituitary gland-structural organization-Pituitary hormones functions - hypothalamic control.

Unit–II: Thyroid Gland
Thyroid gland-structural organisation- metabolic effects of thyroid hormone- effects of thyroid on reproduction – Parathyroid – structure – function of parathyroid hormone.

Unit–III: Pancreas and Adrenal Glands
Structure of pancreas- function of Insulin and glucagon- Adrenals – structural organization, functions of cortical and medullary hormones.

Unit–IV: Vertebrate Reproductive Endocrinology

Unit–V: Insect and Crustacean Endocrinology
The concepts of neurosecretion – Endocrine system in crustacea – endocrine control of moulting and metamorphsis – Neuroendocrine system in insects- endocrine control of moulting and metamorphosis.

Practicals
1. Demonstration of endocrine organs in vertebrates
2. Demonstration of reproductive systems in vertebrates
3. Histological study of pituitary, adrenal, testis, ovary, corpus luteum, pancreas and thyroid gland
4. Demonstration of reproductive system in insects
5. Demonstration of neuroendocrine complex in insects.
6. Histology of ovary, accessory glands, corpus allatum and brain in insects
7. Demonstration of Parabiosis in cockroach
8. Demonstration of Ovariectomy in cockroach.
9. Vaginal smear showing various stages of estrus cycles
10. Demonstration – influence of insulin on blood glucose level.

Text Books

Reference Books
ANCILLARY -I
INTEGRATED M.Sc ZOOLOGY (5 Years) SYLLABUS FOR ANCILLARY PAPER
AZOT 01 – ANCILLARY ZOOLOGY- I (ANIMAL DIVERSITY-I)

UNIT-I.

Principles of classification-salient features and classification upto orders in non-
chordates. Protozoa- Type study Entamoeba. Porifera and coelenterata-Type Sycon
sponge, Obelia

UNIT-II
Platyhelminthes and Nemathelminthes-Type study-Planaria- parasitic adaptations.
Ascaris-annelida –Salient features-Type study-Earthworm., Arthropoda-Salient features

UNIT-III
Cockroach- Molluscs-Salient features Type study-Fresh water mussel- torsion in
mollusca- Echinodermata-Salient features Asterias-Echinoderm larvae-their
significance.

UNIT-IV
Orgin and salient features of chordates. Agnatha - salient features-Type study-affinities
Fishes- parental care ,respiratory organs, migration. Amphibians- parental care

UNIT-V
Reptiles-Classification upto orders, extinct reptiles, poisonous snakes of India.
Birds-salient features flightless birds - adaptive radiation. Mammals. salient features
brief account of monotremes, marsupials - Dentition in mammals.

PRACTICALS
1. Examination of paramecium, amoeba, euglena.
2. Study of sycon, hyalonema and spongilla from slides and specimens
3. Slides and specimens of hydra, obelia, aurelia, sea-anemone, 4. Slides and specimens
   of Fasciola and Taenia
5. Slides and specimens of ascaris
6. Cockroach – demonstration and mounts
7. Prawn- demonstration and mounts
Mounts of Radula, ctenidium
8. Echinoderm -specimen study.
10. Reptiles- museum specimens.
11. Aves-mounts and museum specimens.
12. Mammals- museum specimens

TEXT BOOKS:
   Delhi
   Delhi
   S.Viswanathan Printers and publishers, Pvt.Ltd.,Madras
   Depot, Allahabad
Ancillary-II
AZOT 02- Ancillary Zoology Paper-II

Unit I: Cell Biology

Unit II: Human Anatomy


Unit III: Genetics
Introduction - Multiple alleles - Quantitative inheritance - Sex determination - Sex linked inheritance - Pleiotropy-Hardy Weinberg law- Population genetics.

Unit IV: Developmental Biology

Introduction - Types of eggs - Cleavage and types - Frog’s egg - Gastrulation in frog embryo - Organogenesis in frog-Developmental stages in eye and heart.

Unit V: Origin of life
Theories - Geological time scale - Fossils - Extinct animals – Mass extinction-Evidences for evolution-Comparative anatomy-Embryology- Physiology-Vestigeal organs-Geographical distribution.

Practicals:
1. Study of microscope-Light Microscope
2. Preparation of mitosis in onion root tip
3. Identification of blood group
4. Experiments on mendelian inheritance
5. Experiments in polygenic inheritance
6. Vital staining chick blastodein
7. Study of animal adaptation

References:
Objectives
To make the students aware of public health importance, different diseases, causing organisms to human beings and control measures.

Unit - I

Unit - II
Protozoan and human diseases (Kala-azar, typhoid, amoebic dysentery, cholera, sleeping sickness). Morphology, life cycle and control measures of sand flies, Houseflies and Tsetse fly.

Unit - III
Protozoan and Human diseases. Life cycle and Public Health Importance of Trypanosomiasis, Leishmaniasis and Trichomoniasis

Unit - IV
Protozoan and Human diseases. Life cycle and Public Health Importance of Taenia solium, Schistosoma and Ascaris.

Unit - V

TEXT BOOK

REFERENCE BOOK
Objectives
To make the students acquire knowledge of the biological diversity and their interspecific relations.

Unit-I
Characteristic features of major Invertebrate and Vertebrate phyla. (Protozoa, Porifera, Coelenterata, Platyhelminthes, Annelida, Arthropoda, Mollusca and Echinodermata. Protochordata, Fishes, Amphibia, Reptiles, Birds and Mammals)

Unit-II
Arthropods and vectors of human diseases (mosquitoes, lice, House fly and ticks). Mode of transmission of pathogens by vectors: control measures of vectors. Useful insect: silkworm

Unit-III

Unit-IV
Gametogenesis in animals - Molecular events during fertilization. Cleavage patterns and fate maps- and gastrulation

Unit-V
Origin of life-different concepts, Theories of organic evolution. (Darwinism, Neo-Darwinism, Lamarckism and Neo-Lamarckism): speciation.

TEXT BOOKS

REFERENCE BOOKS
Objectives
To make the students to understand the methods of vermicomposting and techniques of Sericulture, Apiculture and Aquaculture.

Unit - I
Method of composting - factors responsible for composting – vermicomposting – biofertilizers

Unit- II
Types of honey bees-bee colony-social life in honey bees-types of beehives and other accessories-uses of honey.

Unit - III

Unit - IV
Types of culture-general culture techniques-induced breeding-culture of edible fishes.

Unit - V
Ornamental Fish Culture – Angel fish-Fighter fish-Gold Fish-Gurami and Guppies.

TEXT BOOK


REFERENCE BOOKS

Objectives
To make the students to become aware of the environmental problems of pollution, wild life sanctuaries and conservation and environmental educations.

Unit-I

Unit – II

Unit-III

Unit-IV

Unit – V

TEXT BOOKS

REFERENCE BOOKS
IZOT O 85 - ANIMAL CULTURE TECHNIQUES
(Optional for students of other science departments to be offered in the VIII Semester)

Objectives
To make the students to understand the methods of vermicomposting and techniques of Sericulture, Apiculture and Aquaculture.

Unit - I
Method of composting - factors responsible for composting –vermicomposting – biofertilizers

Unit- II
Types of honey bees-bee colony-social life in honey bees-types of beehives and other accessories-uses of honey.

Unit - III

Unit - IV
Types of culture-general culture techniques-induced breeding-culture of edible fishes.

Unit - V
Ornamental Fish Culture – Angel fish-Fighter fish-Gold Fish-Gurami and Guppies.

TEXT BOOK


REFERENCE BOOKS

Optional - II
IZOT O 95 - ENVIRONMENTAL SCIENCE
(Optional for students of other science departments to be offered in the IX Semester)

Objectives
To make the students to become aware of the environmental problems of pollution, wild life sanctuaries and conservation and environmental educations.

Unit-I

Unit – II

Unit-III

Unit-IV

Unit – V

TEXT BOOKS

REFERENCE BOOKS
Objectives

To make the students aware of public health importance, different diseases, causing organisms to human beings and control measures.

Unit - I


Unit - II

Protozoan and human diseases (Kala-azar, typhoid, amoebic dysentery, cholera, sleeping sickness). Morphology, life cycle and control measures of sand flies, House flies and Tsetse fly.

Unit - III

Protozoan and Human diseases. Life cycle and Public Health Importance of Trypanosomiasis, Leishmaniasis and Trichomoniasis

Unit - IV

Protozoan and Human diseases. Life cycle and Public Health Importance of Taenia solium, Schistosoma and Ascaris.

Unit - V


TEXT BOOK


REFERENCE BOOK

Optional - IV
IZOT O 106 - ANIMAL SCIENCE

(Optional for students of other science departments to be offered in the X semester)

Objectives
To make the students acquire knowledge of the biological diversity and their interspecific relations.

Unit-I
Characteristic features of major Invertebrate and Vertebrate phyla. (Protozoa, Porifera, Coelenterata, Platyhelminthes, Annelida, Arthropoda, Mollusca and Echinodermata. Protochordata, Fishes, Amphibia, Reptiles, Birds and Mammals)

Unit-II
Arthropods and vectors of human diseases (mosquitoes, lice, House fly and ticks). Mode of transmission of pathogens by vectors: control measures of vectors. Useful insect: silkworm

Unit-III
Important human and veterinary parasites (protozoans and helminthes): morphology and life cycle of Ascaris, Wuchereria. Fasciola. Schistosoma Leishmania and plasmodium

Unit-IV
Gametogenesis in animals - Molecular events during fertilization. Cleavage patterns and fate maps- and gastrulation

Unit-V
Origin of life-different concepts, Theories of organic evolution. (Darwinism, Neo-Darwinism, Lamarckism and Neo-Lamarckism): speciation.

TEXT BOOKS

REFERENCE BOOKS