

MADURAI KAMARAJ UNIVERSITY
(University with Potential for Excellence)
B.Sc Zoology (Non- semester)

REGULATIONS AND SYLLABUS

(This will come into force from the academic year 2013-2014 onwards)

1. Eligibility for Admission:

Candidates should have passed the Higher Secondary Examination conducted by the board of higher secondary education, Government of Tamil Nadu or any other examination accepted by the syndicate, as equivalent thereto, with zoology or biology as one of the subjects in Higher Secondary Education.

2. Duration of the course:

The students shall undergo the prescribed course of study for a period of three academic years.

3. Medium of instruction:

English/Tamil

4. Subject of study

Part 1: Tamil

Part 2: English

Part 3: Major (Zoology) Theory 8 papers, Practical 4 papers.

Ancillary I – Botany (I & II year only)

Ancillary II – Chemistry (II & III year only)

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Scheme of Examination

Duration: 3 Hrs

Max. Marks: 100 Marks

Passing Minimum: 35 Marks

Course Structure

S.No	Course	Medium	Course code
1	B. Sc Zoology	English	B. Sc Zoology (Non- semester)

B. Sc Zoology Major (Non- semester) (This will come into effect from the academic year 2013-2014 onwards)					
Year	Part I	Part II	Part III		
			Major (Zoology)		Ancillary
				Marks	
I	Tamil	English	Paper I – Invertebrata Paper II – Chordata Practical I – Invertebrata & Chordata	100 100 100	Botany
II	Tamil	English	Paper III – Cell Biology and Genetics Paper IV – Biochemistry and Physiology Practical II - Cell Biology, Genetics , Biochemistry and Physiology	100 100 100	Botany & Chemistry
III			Paper V - Immunology and Microbiology Paper VI – Ecology and Evolution Paper VII – Developmental Biology and Molecular Biology Paper VIII – Biotechnology Practical III - Immunology , Microbiology, Ecology and Evolution Practical IV - Developmental Biology , Molecular Biology and Biotechnology	100 100 100 100 100 100	Chemistry

Ancillary Zoology (non-semester)		
Year	Paper	Marks
I / II	Paper I - Animal diversity	100
II / III	Paper II - Physiology ,Developmental Biology ,Immunology, Evolution and Animal Biotechnology Practical - I Ancillary Zoology	100 100

Blue Print of the question paper (Major and Ancillary)

Theory (External only)

Time: 3 hours

Max.marks:100

Section-A (5 x 3 = 15 Marks)

Short question pattern (Definition, description type)

Out of eight questions five to be answered.

All units to be covered.

Section-B (5 x 8 = 40 Marks)

Answer all the questions choosing either (a) or (b) question.

Each unit comprises of one either (a) or (b) question.

9. (a) or (b)

10. (a) or (b)

11. (a) or (b)

12. (a) or (b)

13. (a) or (b)

Section-C (3 x 15 = 45 Marks)

Answer any three out of five questions.

One question should be asked from each unit.

Answer not to exceed four pages.

Questions 14 – 18

Practical: (External only)

Time: 3 hours

Max.marks:100

- | | |
|--|------------|
| 1. Major question – system/experiment | – 35 marks |
| 2. Minor question – analysis/mounting/experiment | – 15 marks |
| 3. Spotters (5 only) (5 x 6) | - 30 marks |
| 4. Record note book | - 20 marks |

SYLLABUS

Paper - I INVERTEBRATA

Unit-I

Taxonomy: Units of Classification, Criteria of classification - types of Coelom, types of Symmetry, Binomial nomenclature. Classification up to class level, General characters of the following phyla with examples- i) Protozoa, ii) Porifera, iii) Coelenterata, iv) Platyhelminthes, v) Nematoda, vi) Annelida, vii) Arthropoda, viii) Mollusca, ix) Echinodermata

Unit-II

Protozoa: Type study –Paramecium- general organization, cyclosis, contractile vacuole and conjugation only. Life history, pathology and control of i) *Plasmodium vivax* and ii) *Entamoeba histolytica*. Porifera: Type study—Olynthus, general organization, histology, Spicules, reproduction and development only. Canal system in Sponges.

Unit-III

Coelenterata: Type study- Obelia; structure of obelia colony, Medusa, Nematocyst, reproduction and development (metagenesis) – Polymorphism in Coelenterata. Helminthes: Type study- *Fasciola hepatica* – external characters, digestive system, excretion, reproduction and development (life cycle). Structure, pathology and control measures of *Ascaris* and *Wuchereria*.

Unit-IV

Annelida: Type study—Earth worm, External morphology, setae, nephridia, nerves system and reproductive system – Metamerism in Annelids. Arthropoda: Type study-Marine Prawn – external morphology, appendages, digestive and excretory systems, reproductive system and development—Affinities of *Peripatus*.

Unit-V

Mollusca: Type study- *Pila* – external morphology, digestive system, respiratory system, osphridium only. –Cephalopods as an advanced Mollusc. Echinodermata: Type study – Star fish, external morphology, pedicellaria, Water vascular system only. Larval forms of Echinodermata.

Reference Books:

1. Invertebrate Zoology – **E.L. Jordon and P.S. Verma** (2005) S.Chand & co. New Delhi
2. Invertebrate Zoology – **P.S. Dhami and J.K. Dhami**. (2003) R.Cahnd & Co. New Delhi.
3. Invertebrate Zoology – **R.L.Kotpal**, (2005) Rastogi Publications, Meerat.
4. Text book of Invertebrata – **N.Arumugam et al.**, (2008) Saras Publications Nagerkovil.
5. A Manual of Zoology- **M.Ekambaranatha Iyer and T.N.Ananthkrishnan** (2003) Viswanathan Publications, Chennai.

Paper - II CHORDATA

Unit-I

General characteristics, Outline classification up to class level with example.

Prochordates - Type study-- Amphioxus – external morphology, digestive system, excretory system only. Ascidian tadpole larva and retrogressive metamorphosis. Affinities of Balanoglossus.

Unit-II

Pisces - Classification of fishes, Type study – Shark, external morphology, Digestive system, Circulatory system only -Migration of fishes, Economic importance of fishes, Amphibians – Frog – external morphology, respiratory system, reproductive system and development only. Parental care in Amphibian.

Unit- III

Reptilia -Type study – Calotes, external morphology, Urinogenetal system and nervous system. Poisonous and non-poisonous Snakes,-identification and biting mechanism, first aid. Decline of Mesozoic reptiles (Dinosaurs).

Unit-IV

Aves- Type study – Pigeon; external morphology, respiratory system, pectoral and pelvic girdles only. –Flight adaptation, beak and feet modification in birds, -Migration of birds, - Flightless birds, -Fossil bird Archaeopteryx and its evolutionary importance.

Unit-V

Mammalia - Classification of Mammals with examples, Type study- Rabbit, - external morphology, nervous system and reproductive system. Dentition in mammals, Stomach in ruminants, Aquatic mammals.

Reference Books:

1. Chordate Zoology – **E.L. Jordon and P.S. Verma** (2006) S.Chand & co. New Delhi.
2. Chordate Zoology - **P.S. Dhami and J.K. Dhami**. (2006) R.Chand & co. New Delhi.
3. Chordate – A Manual of Zoology, **M.Ekambaranatha Iyer** and **T.N.Ananthkrishnan** (2003) Viswanathan Publications, Chennai .
4. Vertebrate Zoology – **R.L.Kotpal**, (2005) Rastogi Publications, Meerat .
5. .Text book of Vertebrate – **N.Arumugam et al.**, (2008) Saras Pubulications. Nagerkovil.

Paper - III Practical I -I Invertebrata and Chordata

Dissection Charts:

1. Earthworm: Nervous system.
2. Cockroach: Digestive system and Nervous system,
3. Pila: Digestive system
4. Frog: Arterial system
5. Calotes: Venous system

Mounting Charts:

1. Earth worm – Body setae
2. Cockroach – Trachea
3. Honey Bee – Mouth parts and Sting
4. Pila – Radula
5. Shark –Placoid scales
6. Frog – Brain

Spotters:

1. Protozoa- paramecium-Entire, paramecium conjugation, euglena
2. Porifera – simple sponge, gemmule, spicules
3. Coelenterata – obelia colony, medusa of obelia, sea anemone,
4. Helminthes- liver fluke, redia larva, cercaria larva, ascaris male and female
5. Annelida – earthworm, nereis, hetero nereis, leech
6. Arthropoda – prawn, zoea larva, mysis larva, peripatus, honey bee and silk worm
7. Mollusca - pila, sepia, octopus, pearl oyster
8. Echinodermata – star fish, sea-urchin, sea-cucumber, bipinnaria larva
9. Prochordata – Amphioxus, Balanoglossus, Ascidian
10. Agnatha – Pertomyzon
11. Pisces –tilapia, eel, hippocampus, narcine,
12. Amphibian – Bufo, salamander, ichthiopsis, rhacophorus
13. Reptilia - Cobra, Krait, Viper, Dryophis, Ptyas, Chameleon, Draco
14. Birds – Pigeon, Archaeopteryx
15. Mammal – Bat, Rat, Platypus

Paper III- Cell Biology and Genetics

Unit-I

Microscopy: Compound microscope and Electron microscope Structure, magnification and applications. Protoplasm: Structure, chemical and biological properties.

Ultra structure and functions of (a) Plasma membrane (b) Mitochondria (c) Endoplasmic reticulum and ribosome

Unit-II

Ultra structure and functions of nucleus, Chromosome and giant chromosome

Cell division: Mitosis and Meiosis- Genetic significance of meiosis.

Unit-III

Cancer: Definition, types, causes, diagnosis, treatment- Molecular basis of aging and genes responsible for aging. Stem cells: Occurrence, concept, types and application of karyotypic techniques

Unit-IV

Mendel's laws: Monohybrid cross and dihybrid cross in pea plant. Law of segregation and law of independent assortment. Multiple alleles-ABO blood groups and Rh factor in human beings. Linkage and crossing over: Linkage in Drosophila, Linkage groups. Crossing over in Drosophila- Mechanism of crossing over, Types of crossing over- Sex linkage: sex linked inheritance in man Haemophilia and colour blindness.

Unit-V

Inherited disorders: Allosomal (Kline felter's syndrome and Tuners syndrome) Autosomal (Down syndrome). Eugenics: Positive and negative-Euthenics and genetic counseling. Genetics and society: Human genome project.

Text Books:

1. Cell Biology- **De Robertis. E.D.Nowinski and Saez** (2001) WB Saunders Co. Philadelphia.
2. Genetics- **Verma, P.S. Agarval.**
3. Genetics- **P.K.Gupta.**

References:

1. Cell biology- **Ambrose E.J., and Dorothy M.E.,** (2002) ELBS Camlet press, Great Britain.
2. Cell and molecular biology – **De Robertis and De Robertis.** (2004) WB Saunders Co, Philadelphia.
3. Molecular biology-**David Freifelter** (2005) published by N.K.Mehra for Narosa publishing house, NewDelhi-110002.
4. Molecular biology of gene – **James D.Watson, Tunia A.Baker, Stephen P.Bell, Alexander Gann, Michel Lavine and Richard Losick,** Low priced edition (2005) published by Dorling Kindersly (India) Pvt. Ltd, FIE, Patparganj, New Delhi-110092.
5. Principles of Genetics- **Eldon John Gardner.**
6. Molecular biology of gene- **James D.Watson.**
7. Essentials of Human Genetics- **S.M.Bhatnagar.**
8. Principles of Genetics- **Robert H.Tamarin.**
9. Human Genetics- **S.D.Ganga.**

Paper IV-Biochemistry and Physiology

Unit-I

Biochemical techniques: pH meter, chromatography.

Carbohydrate: classification and structure of carbohydrate (Glucose, sucrose and starch).

Protein: classification and structure with examples.

Lipid: classification and structure with examples.

Unit-II

Enzymes: classification, mechanism of enzyme action, factors affecting enzyme action, Isoenzymes.

Vitamins: Structure and function of fat and water soluble vitamins.

Unit-III

Digestion: Physico-chemical process of digestion and absorption of carbohydrates, protein and lipids.

Respiration: Transport of oxygen and carbondioxide, respiratory quotient, mechanism of pulmonary respiration.

Excretion: Structure of nephron and formation of urine.

Unit-IV

Muscle physiology-ultra structure of muscle, mechanism of muscle contraction and relaxation.

Nerve physiology-ultra structure of neuron – physiology of nerve coordination.

Unit-V

Osmoregulation in crustaceans and teleost fish.

Thermoregulation: Poiklotherms and Homeotherms.

Chronobiology: characteristics of circadian rhythm.

Text books

1. Medical Biochemistry- **Ambika Shanmugam**.
2. General and comparative physiology- **Hoar and Willam**.

References:

1. Principles of Biochemistry- **Lehniger** (2000) Nelson & Co., CBS Publishers & Distributors, Delhi-110032. CBS ISBN, 81-239-0295-6.
2. Harpers Biochemistry – **Robert K.Muuay., Daryl.K.Granner., Peter.A.Mayes., & Victor.W.Rodwell** (2004) Prentice Hall International, ISBN-8385-3612-3.
3. Elements of Biochemistry (2006) – **H.S. Srivastava**, Rastogi Publications, Meerut.
4. Animal function- Principles and adaptation- **Gordon, S. Malean, et al.**, (2000) The Macmillan Company.
5. Text book of Physiology and Biochemistry – **Bell, Davidsar**.

Practical - II

Lab in Cell biology, Genetics, Biochemistry and Physiology

1. Mounting of squamous epithelial cell
2. Mitosis in onion root tip squash
3. Meiosis in grasshopper testis squash
4. Charts on mitochondria, endoplasmic reticulum, nucleus
5. Study the mendelian traits in man
6. Human blood grouping
7. Quantitative test for ammonia, urea and uric acid
8. Quantitative test for carbohydrate, protein and lipid
9. Amylase activity in human saliva in relation to pH and temperature
10. Estimation of oxygen consumption of fish with reference to body weight

PAPER V: IMMUNOLOGY AND MICROBIOLOGY

UNIT I

Organs of immune system : Thymus, Bone marrow, Bursa of fabricus, Spleen and lymph node. Cells of Immune system – Stem cells, B cells and T cells. Antigen – Haptens, epitopes, paratopes. Antibodies- Structure and properties and functions – IgG

UNIT II

Antigen – antibody reactions – *in vitro* method, Precipitation, Agglutination. Antigen – Antibody interactions- humoral immune response - Cell mediated immune response. Major Histocompatibility complex- autoimmune disorders. Immune techniques-VDRL, slide test, ELISA. Vaccines and Immunization

Unit III

History and Scope of Microbiology – Spontaneous generation theory – conflict – Contribution of Alexander Flemming, Leuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Joseph Lister, Winogradsky, and Waksman John Tyndall. Microbes in our lives. Methods of classifying and identifying.

Unit IV

Prokaryotic cell: Classification of Bacteria and Virus. Size, shape, arrangement, flagella, fimbriae, cell wall of Gram Positive and Gram Negative, cell membrane, nuclear material and spores. Eukaryote: Structural organization of yeasts and moulds (fungi).

Unit V

Infections – Types, Methods of transmission of infections, Sources of Infections. Bacterial infections- Tuberculosis. Viral infections- AIDS. Fungal infections – Candidiasis

References:

1. **Roitt, I.M** Essential Immunology. (2000) Blackwell scientific publishers
2. **William E.Paul** Fundamental immunology, (1989) 2nd Edition Raven press, New York.
3. **Prescott, L.M J.P. Harley and C.A. Klein**, Microbiology 2nd edition (1995). Wm, C. Brown publishers.
4. **Salle A.J.:**Fundamental Principles of Bacteriology 7th Edition, Tata Mc Hill Publishing Company Ltd.,
5. **William claus. G.W.**1989. Understanding Microbes – A Laboratory textbook for Microbiology, W.H. Freeman and Co., New York.
6. **Wilson. K and Goulding. K.H.** 1986. A Biologist's Guide to Principles and Techniques of Practical Biochemistry, ELBS, London. B.Sc., Microbiology (Colleges-revised) 2008-09 Annexure No. 33 A.

PAPER VI: ECOLOGY AND EVOLUTION

Unit I

Features of different habitats and adaptations of animals – Fresh water, Marine, Terrestrial. Desert and Cave. Temperature and Biogeochemical cycle – Carbon, Nitrogen and Phosphorus cycle. Intraspecific relationship, interspecific relationship: Types and examples, colonization, Aggregation, Social organization

Unit II

Population Ecology: Types – Density and Estimation – Natality – Mortality – Age distribution – Growth pattern – fluctuation and equilibrium – Biotic potential – Dispersal and distribution – Population Explosion – Regulation of population. Community Characteristics – Ecotone and Edge effect, Ecological Niche, Ecological succession. Ecosystem: Components – food chain and its types – food web; Ecological pyramids – Energy flow and productivity. Pond as an ecosystem.

Unit III

Causes, effects and control measures of air, water, and land pollution, Green house effect, Global warming and acid rain. Solid waste management, rain water harvesting, wild life conservation.

Unit IV

Evidences – Morphological evidences, Embryological evidences, Biochemical evidences and Paleontological evidences. Fossil and Fossilization, Dating of Fossils. Lamarck, Darwin and De Veries Theories of Evolution and their modern concepts.

Unit V

Mimicry and Animal colouration. Species concept; Isolating mechanisms.

Hardy Weinberg Principle: Gene, Gene pool and Gene frequency, Evolution of man.

References

1. **Clark Odum E.P** Fundamentals of Ecology, (1985). W.B. Saunders Publishers, Philadelphia.
2. **Verma & Agarwal** – “Principles of Ecology” second edition (1985). S.Chand & Company Ltd., Ramnagar, New Delhi.
3. **Janakiraman.N.**,”EnvironmentalBiology”(1988),TextBookPublishers,11,Subramaniapuram First St., Karaikudi 630 001.
4. **Veer Bala Rastogi & M.S. Jayaraj** “(1988) Animal Ecology and Distribution of animals” 6th revised Edition., Kedar Nath & Ram Nath, Meerut Delhi
5. **Janakiraman.N.**,”Evolution”,(1988) Text Book Publishers, 11, Subramaniapuram First St., Karaikudi 630 001.
6. **Savage**, Evolution (1998) Amerind Publishing Co.,Pvt Ltd, New Delhi
Moody, P.A., An introduction to evolution,(1997) Kalayani Publishers Ludhiya

LAB III: Lab in Ecology, Evolution, Immunology and Microbiology.

ECOLOGY

1. Analysis of fresh water and marine planktons and mounting of planktons.
2. Detection of transparency of water by Secchi disc
3. Estimation of dissolved Oxygen
4. Observation of animal associations, symbiosis, parasitism, predation and commensalism
5. Study of Pond ecosystem.

EVOLUTION

1. Animals of evolutionary importance: Peripatus, Limulus, Archaeopteryx.
2. Mimicry: Leaf insects, Stick insects, Monarch and Viceroy butterfly.
3. Adaptive Colouration: Chameleon, Lycodon
4. Experiment to prove the Hardy & Weinberg rule [Demonstration].

IMMUNOLOGY

1. Anatomy of lymphoid organs
2. Histology of lymphoid organs
3. Isolation of lymphocytes

MICROBIOLOGY

1. Laboratory safety and sterilization techniques.
2. Preparation of culture media – nutrient broth and nutrient agar.

3. Culturing of microorganisms – in broth and in plates (pour plates, streak plates, isolation and preservation of bacterial cultures).
4. Determination of microbiological quality of raw milk and pasteurized milk samples – using MBR test (Methylene blue reduction).
5. Hanging drop technique.

Paper VII- Molecular Biology & Developmental Biology

UNIT-I Structure and organization of chromosome & DNA replication

Chromosomes - gross morphology – Nucleosome - higher order of Eukaryotic Chromatin organization. DNA Replication in *E. coli* and Eukaryotes; General features of replication - Enzymology of replication; Steps involved in replication -Types of replication.

UNIT- II DNA repair, recombination and transcription

Types of Repair Mechanisms- Role of Rec A & Rec BCD proteins, Transcription in Prokaryotes and Eukaryotes. Operon concept -Lac operon - positive and negative control – Trp operon – negative control- regulatory units of the Eukaryotic gene. Post transcriptional modifications, polyadenylation, capping & splicing.

UNIT-III Translation, its regulation & signal transduction

Translation in Prokaryotes & Eukaryotes.
General features, steps involved in translation and post translational Modifications; Signaling Pathways- Receptors, enzyme cascade – second messengers-Signal delivery; Cellular oncogenes. & human Cancer.

UNIT- IV Gametogenesis, Fertilization, Cleavage & Gastrulation

Spermatogenesis and oogenesis process; types of sperms and eggs.
Fertilization- approach of sperm to the egg- Activation of egg - Cortical reaction.
Patterns of cleavage - Amphibia, chick & mammal- Fate maps.
Gastrulation in amphibia, chick & mammal.

UNIT-V Organogenesis, Placentation & Metamorphosis

Development of eye, heart and urinogenital system; placentation in mammals and types of placenta, *invitro* fertilization – test tube babies.
Metamorphosis in amphibia, insects and their hormonal regulation-thyroid hormones, ecdysone & juvenile hormone – experimental evidences ;
Asexual reproduction –fission, budding, gemmule formation, parthenogenesis.

REFERENCE BOOKS:

Molecular Biology

1. Twyman R.M. – **Advanced molecular biology**, 4th ed. Viva books Pvt.Ltd, New Delhi, 1998.
2. Alberts B ., BrayD., Lewis J., Raff M., Roberts K. and Watson J. D 5rd ed. **Molecular Biology of the Cell.**, 5th ed. Garland Publishing. USA Science. 2008.
3. Darnel J., Lodish H. and Baltimore D. – **Molecualr Cell Biology**, 2nd ed. Scientific American Books. W.H. Freeman & company , New York, 2008.
4. Friefelder D. **Molecular Biology**, 2nd ed. Jones Bartlett Pub. USA.1990.
5. Watson J.D., Baker, T.A., Bell S. P., Gann,A., Levine M.,and Losick R **Molecular Biology of the Gene**, Pearson Education,, Inc. 2009
6. Turner P.C., McLennan, .G, Bater A.D. & White M.R. H. **Instant notes in Molecular Biology**, 1 st ed. Viva books Pvt.Ltd, New Delhi, 1998.
7. Weaver R. and Hedrick P.W. – **Genetics**, 2nd ed. WBC Wm.C Brown publishers. Dubuque, USA, 1992.
8. Wolfe S.L. – **An Introduction to Cell and Molecular Biology**, Wads worth publishing company, New York, 1995.

Developmental Biology:

1. Balinsky B.I., An introduction to embryology (2004) 5th ed., Holt – Saunders International, Philadelphia, London.
2. Carlson, B.M., Patten’s foundation of embryology (2007) 6th ed. Mc Graw Hill Inc., London.
3. Gilbert, S.F., Developmental Biology (2006) 8th ed. Sinauer associates Inc., Sunderland, Massachusetts.
4. Browder, L.W., Erickson C.A. and Jeffery W.R., Developmental Biology (1991) 3rd ed. Saunder College pub., London.
5. Berril, N.J. Developmental Biology (1980) Tata Mc Graw Hill Pub. Company Ltd., New Delhi.
6. Patten M. Bradley, The Early Embryology of the Chick, (1925) 3rd Edi., The Blakiston Company, Toronto.

PAPER VIII- BIOTECHNOLOGY

UNIT I History & scope of Biotechnology & Overview of Gene transfer methods

Introduction on history and scope of Biotechnology; Animal cell culture- Media – serum & free media, biology of cultured cells- cell growth kinetics, primary culture-subculture – Development of cell lines- types of culture methods ; stem cell culture, tissue engineering, scale-up- monolayer and suspension and applications of animal and plant tissue cultures.

Transfection-Transient & Stable, Physical & Chemicals methods- Virus mediated transformation –SV40, Adenovirus, AAV, Retrovirus, Baculovirus; Selectable markers and gene amplification, high-level expression in plant and animal cells.

UNIT II Embryo transfer & transgenic animal technology

Artificial insemination in cattle, Super ovulation, Embryo transfer, sexing, splitting, cryopreservation, Microinfection, Stem cell Technology; targeted gene transfer-Knock in and knock out technology.

UNIT III Animal cloning & gene therapy

Nuclear transfer - obstacles & applications, reproductive and therapeutic cloning – Genetic defects – germ line and somatic gene therapy – strategies involved in gene therapy – Examples and potential of gene therapy. - *ex vivo* and *in vivo* gene therapy.

UNIT IV Genetic engineering of plants and transgenic plants

Structure, Biology and vector construction of Ti Plasmid and Ri plasmid, CaMV – transfer of transgenes into plants – use of marker and reporter genes; Development of pathogen and herbicide resistant plant – stress and senescence tolerant plants – modified nutrient content, flower pigmentation, taste and appearance - and their uses.

UNIT V Genetically Modified organisms, Bioethics, Biosafety regulations and IPR

Transgenic mice, goat, cattle-gene pharming & Applications of transgenic animals Vaccine production - Humanized antibodies in transgenic mice & recombinant immunotoxins ; golden rice, Bt cotton, papaya, Flavr-Savr tomato, potato, banana, soyabean, biopharming and plant neutraceuticals - microbial insecticide (Bt strains); Intellectual property rights, Patents - case studies, plant breeders rights – ethical and social issues of IPR – ethical limits of animal use – ethics of genetic engineering – bioethical implications of cloning – Biosafety regulations and organizations – containment categories and safe disposal methods.

REFERENCE BOOKS:

1. **Old, R.W & Primrose, S.B.**, Principles of Gene manipulation – An introduction to Genetic Engineering , 5th edition– Blackwell Scientific Publishers, 1994.
2. **Puhler A.**, Genetic Engineering of Animals, VCH publications, New York, U.S.A., 1993.
3. **Slater A., Scott N. and Fowler M.**, Plant Biotechnology – The genetic manipulation of plants, Oxford University Press, Oxford, 2003.
4. **De K.K.**, An Introduction to plant tissue culture, 1st edition, New Central Book Agency, Calcutta, 1992.
5. **Dubey R.C**, A Textbook of Biotechnology, S.Chand & Comp.Ltd, New Delhi, 2004.

6. **Freshney R.I.**, Culture of Animal cells – A Manual of Basic Techniques, 5th edition John Wiley and Sons (Asia) Pvt. Ltd, 2006.
7. **Glick B.R. and Pasternak J.J.**, Molecular Biotechnology 3rd edition ASM press, Washington D.C., 2003.
8. **Ignacimuthu, S.** Plant biotechnology Oxford & IBA publishing Co. Pvt. Ltd, 1997.
9. **Jogdand S.N.**, Gene Biotechnology, Himalaya Publishing House, Mumbai, 2000.
10. **Masanaru M.**, Plant Tissue culture: An alternative for production of useful metabolites, Daya Publishing house, New Delhi, 1997.
11. **Narayanaswamy S.**, Plant Cell & Tissue Culture, Tata McGraw – Hill Publishing Company, New Delhi, 1999.
12. **Ramadass P and Meerarani S.**, Textbook of Animal Biotechnology, 2nd edition Madras Veterinary College, Chennai, 2002.
13. **Razdan M.K.**, An Introduction to Plant Tissue Culture, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 1994.
14. **Trivedi. P.C.**, Plant Biotechnology – Recent Advances, Panima Publishing Corporation, New Delhi, 2000.
15. **Walker J.M. and Rapley R.**, Molecular Biology and Biotechnology, 4th edition Panima Publishing Corporation, New Delhi, 2003.
16. **Watson, J.P., Gilman, M., Witowski. J and Zoller. M.** Recombinant DNA 2nd edition Freeman & Company, 1996.

Practical IV Molecular Biology, Developmental Biology & Biotechnology

1. Cell fractionation
2. Separation of cell components using differential / density gradient centrifugation technique.
3. Isolation of genomic DNA from mammalian tissues.
4. Electrophoretic separation of DNA.
5. Extraction of Plasmid DNA.
6. Chick embryo – 24hrs or 48hrs – Observation of live chick embryo – Blastoderm mounting.
7. T.S. of mammalian ovary, T.S. of chick ovary, T.S. of mammalian testis.
8. Observation of Yolk sac placenta, discoidal / endothelio–chorial placenta
9. Observation of frog development and tadpole regeneration.
10. Visit to an animal cell culture or plant tissue culture unit and submission of a report.

REFERENCES:

1. **Friefelder D.** Molecular Biology, 2nd edn. Jones Bartlett Pub. USA.1990.
2. **Watson J.D., Baker, T.A., Bell S. P., Gann, A., Levine M., and Losick R** Molecular Biology of the Gene, Pearson Education., Inc. 2009.
3. **Turner P.C., McLennan, .G, Bater A.D. & White M.R. H.** Instant notes in Molecular Biology, 1 st edn. Viva books Pvt. Ltd, New Delhi, 1998.

4. **Balinsky B.I.**, An introduction to embryology 5th ed., Holt – Saunders International, Philadelphia, London. 2004.
5. **Carlson, B.M.**, Patten's foundation of embryology. 6th ed. Mc Graw Hill Inc., London. 2007.
6. **Gilbert, S.F.**, Developmental Biology. 8th ed. Sinauer associates Inc., Sunderland, Massachusetts. 2006.
7. **Old, R.W & Primrose, S.B.**, Principles of Gene manipulation – An introduction to Genetic Engineering , 5th edition– Blackwell Scientific Publishers, 1994.
8. **Walker J.M. and E.B.Gingold**, Molecular biology and biotechnology. 3rd edition Panima Publishing Corporation. 2001.
9. **Balasubramaniaam D., Bryce C.F.A., Dharmalingam. K.**, Concepts in biotechnology Universities Press India Limited. 1996.
10. **Dubey R.C**, A Textbook of Biotechnology, S. Chand & Comp. Ltd, New Delhi, 2004.
11. **Freshney R.I.**, Culture of Animal cells – A Manual of Basic Techniques, 5th edition John Wiley and Sons (Asia) Pvt. Ltd, 2006.
12. **Glick B.R. and Pasternak J.J.**, Molecular Biotechnology 3rd edition ASM press, Washington D.C., 2003.
13. **Ignacimuthu, S.** Plant biotechnology Oxford & IBA publishing Co. Pvt. Ltd, 1997.
14. **Jogdand S.N.**, Gene Biotechnology, Himalaya Publishing House, Mumbai, 2000.

B.Sc. Degree Zoology – Ancillary PART – III

I Year

Theory Paper I

ANIMAL DIVERSITY

Unit- I: PROTOZOA AND PORIFERA

1. Outline classification of Animal kingdom up to class level with example - Flow chart only.
2. General characters of the following phyla, i) Protozoa, ii) Porifera, iii) Coelenterata, iv) Platyhelminthes, v) Nematoda, vi) Annelida, vii) Arthropoda, viii) Mollusca, ix) Echinodermata.
3. Protozoa – type study – Amoeba.
4. Structure, pathology, prevention and control measures of i) *Plasmodium vivax* and ii) *Entamoeba histolytica*.
5. Canal system in sponges.

Unit- II: COELENTERATA, HELMINTHES AND ANNELIDA

1. Obelia , Types of Corals,
2. Fasciola hepatica (Liver Fluke) – External morphology, reproductive system and development only.
3. Structure, pathology, prevention and control measures of Ascaris and Wucheraria.
4. Earth worm – External morphology and excretory system only.

Unit-III: ARTHROPODA, MOLLUSCA AND ECHINODERMATA

1. *Pila globosa* – External morphology, Digestive system, Respiratory system, and Osphradium
2. Cephalopods as an advanced Mollusc,
3. Star fish - External morphology, Pedicellaria, and Water vascular system.
4. Metamerism in Annelids.
5. Larval forms in Echinodermata.

Unit-IV:

1. Chordata characteristics, Outline classification up to class level with examples.

Type study: Frog.

General topics:

1. Affinities of *Balanoglossus*.
2. Migration of Fishes.
3. Parental care in Amphibia.
4. Identification of Poisonous and non-poisonous snakes.

Unit-V:

Type study: Pigeon – External morphology, Circulatory system, Pectoral and Pelvic girdles only.

General topics:

1. Flight adaptations in birds.
2. Archaeopteryx and its Evolutionary importance.
3. Dentition in mammals.
4. Adaptation of aquatic mammals.

Text book:

N. Arumugam et al., Text book of Invertebrata - (2010) Saras Publications,

T.C. Majupuria, Invertebrate Zoology – Pradeep Publications, Jalandar.

M. Ekambaranatha Iyer and T.N. Ananthakrishnan, Manual of Zoology – Vishwanathan publishers – Chennai.

E.L. Jordon and P.S. Verma. Invertebrate Zoology – S. Chand and Company, New Delhi

R.L. Kotpol, Invertebrate Zoology – Rostogi publications, Meerut.

P.S. Dhomi and J.K. Dhami, Invertebrate Zoology – R.Chand Company, New Delhi.

N. Arumugam et al., Text book of Chordata - (2010) Saras Publications,

E.L. Jordon and P.S. Verma. Chordata Zoology – S. Chand and Company, New Delhi

R.S. Verma & T.S. Parson., The vertebrate body W.B. Saunders, New Delhi.

**HUMAN PHYSIOLOGY, DEVELOPMENTAL BIOLOGY, IMMUNOLOGY
EVOLUTION AND ANIMAL BIOTECHNOLOGY**

HUMAN PHYSIOLOGY

1. Digestion of carbohydrates, Protein and Lipids.
2. Mechanism of respiration and Transport of gases.
3. Structure and function of Heart, Pace maker, Blood pressure and ECG.
4. Structure of Nephron and formation of Urine.

DEVELOPMENTAL BIOLOGY

1. Structure of Sperm and Ovum in Frog.
2. Fertilization, Blastulation and Gastrulation in Frog.
3. Placenta in Mammals – Types and functions.
4. *In Vitro* fertilization and Test tube baby.

IMMUNOLOGY

1. Types of Immunity- Innate and acquired immunity.
2. Lymphoid organs (Primary and secondary).
3. Structure and functions of Immunoglobulins.
4. Antigens - antibody reactions.

EVOLUTION

1. Lamarckism
2. Darwinism and Modern Mutation theory.
3. Speciation - Allopatric and Sympatric.
4. Human evolution – Cultural and future evolution.

ANIMAL BIOTECHNOLOGY

1. Recombinant DNA Technology - major steps involved in Insulin gene cloning.
2. Stem cell culture – applications.
3. Transgenic animals (any one example) applications.
4. DNA finger printing.

General and comparative physiology, 2002, - **Hoar S. William**

Chordate Embryology, **Verma. S. and Agarwal V.K.**, (2000), S. Chand & Co., New Delhi.

Text Book of Embryology, **Arumugam, N.A.** (2008) Saras publication, Kottar.

An introduction to Evolution - **Moody, P.A.**

Essential Immunology - **Roitt, L.M.**

A text book of Biotechnology - **Sathyanarayana**

A text book of Biotechnology - **Armugam.**

Invertebrata , Chordata, Physiology, Developmental Biology, Immunology and Evolution.

Honey Bee: Mounting Mouth parts and Sting. Using models and charts only.

Frog : Arterial and Venous system.

Simple staining of non-pathogenic bacteria.

Qualitative tests for ammonia, Urea and uric acid.

Qualitative tests for carbohydrates, protein and lipid.

Blood group test.

Spotters: Amoeba, Paramecium, Plasmodium, Hydra, Obelia , medusa, Tape worm, Liver fluke, Ascaris, Wucheraria, Earth worm, Leech, Pearl oyster, Star fish, Amphioxus, Balanoglossus, Any two edible fishes, Cobra, Natrix, Viper,

Different morphological appearance of Bacteria.

Following stages of frog embryo: egg, sperm, blastula and gastrula.

Sheep placenta

Homologous and Analogous organs and fossils – Archaeopteryx, Peripatus and Limulus.