S. V. K. P. & Dr. K. S. RAJU ARTS & SCIENCE COLLEGE (A)

FIRST SEMESTER M.Sc. ZOOLOGY & AQUACULTURE

SYLLABUS

(With effect from 2023-24 Admitted batch)

23ZAQT11 TOOLS AND TECHNIQUES FOR BIOLOGY

UNIT – I

Assays- Chemical and Biological assay, Centrifugation, Working Principle and applications of Centrifugation; differential and density gradient centrifugation, Ultrafiltration. Electrophoresis – Electrophoresis, Agarose Gel electrophoresis, 2- D Electrophoresis workingPrinciple, structural components and applications of electrophoresis. pH meter: Operation of pH electrodes, Principles and applications of Ion-selective and gas sensing electrodes.

UNIT-II

Chromatography-Working Principle and applications of chromatography, Chromatography Planar chromatography (paper & TLC), Gas Chromatography (GC-MS), High Performance Liquid Chromatography (HPLC), and LC-MS. Spectrophotometer - UV-visible, fluorescence, circular dichroism, absorption spectrophotometry principles and applications, NMR and ESR spectroscopy.

UNIT – III

Microscopy - Visualization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells. Principle and applications of different types of microscopes - Light, Phase Contrast, Fluorescence microscopy. Electron microscopy: SEM, TEM and Atomic force microscopy (AFM). Image processing methods in microscopy: Image acquisition- 2D image techniques- 3D image techniques- Analysis.

UNIT – IV

Microtomy- Working principle and different types of Microtomes. Knives and Blades. Tissue embedding (paraffin wax), Section cutting, Floatation (water bath), slide mounting, drying (oven or hot plate) and section adhesives. Applications of microtomy in biological studies: Traditional Histology Technique-Frozen section procedure- Electron Microscopy Technique-Spectroscopy Technique. Cryotechniques- History and applications of Cryotechniques for light and electron microscopy. Different fixation and staining techniques for EM, freeze-etch and freeze fracture methods for EM.

UNIT-V:

Media preparation & Sterilization, Inoculation and growth monitoring. Biochemical Mutants and their use, Microbial assays.

Suggested Readings

1. Principles and Techniques of Biochemistry and Molecular Biology, Wilson K and Walker J.M. Cambridge University Press

2. Biophysical& Biochemical Techniques, Wilson K and Walker J.M.,

3. Laboratory Exercises and techniques in Cellular Biology, Anthony Contan to Wiley Publ.2012

4. Histological & Histochemical methods: Theory and Practice, Kiernan J.A. Scion Publ.

5. Histochemistry: Pearse A.G.E, Garfield.

6. Animal cell culture - A practical approach, Ed. John R.W. Masters, IRI Press.

7. Introduction to Instrumental Analysis. Robert Braun. McGraw Hill International Edition.

8. A Biologist Guide to Principles and Techniques of Practical Biochemistry. KWilson& K.H. Goulding, ELBS Edition. Student Learning Outcomes: LO1. Student will learn about the basics of most often used tools, techniques, methodologies and methods of analysis used in biological research.

S. V. K. P. & Dr. K. S. RAJU ARTS & SCIENCE COLLEGE (A)

FIRST SEMESTER M.Sc. ZOOLOGY & AQUACULTURE

SYLLABUS

(With effect from 2023-24 Admitted batch)

23ZAQT12 BIOSYSTEMATICS, BIODIVERSITY AND EVOLUTION

UNIT – I

Definition & basic concepts of biosystematics & taxonomy, Importance and applications of biosystematics in biology, Material basis of biosystematics. Theories of biological classification (Essentialism, Nominalism, Empirism, Cladism). Chemotaxonomy; Cytotaxonomy; Molecular taxonomy; Eco - taxonomy and Behavioral taxonomy

UNIT-II

Taxonomic procedures – taxonomic collections, preservation, curetting of animals and Process of identification. Preservation of specimens.Taxonomic Keys - Procedure keys in taxonomy, Types, merits & demerits. Systematic publications – different kinds of publications, Process of typication and different Zoological types. International code of Zoological Nomenclature (ICZN) - Operative principles, Interpretation and application of important rules, Zoological nomenclature, formation of scientific names of various taxa. Interpretation of rules of nomenclature.

UNIT – III

Sustainable utilization of Biodiversity - Origin of biodiversity, Types of biodiversity & ecosystem, Threats of biodiversity. Equitable sharing & conservation of Biodiversity (in-situ & ex-situ & gene banks). Genetic Variations & Non genetic Variations - Molecular perspectives on conservation of Biodiversity, Hierarchy of categories.

UNIT – IV

Species Concept - Different species concepts - Typological, Nominalistic, Biological& evolutionary species concept. Sub-species and other infra specific categories, Polytypic species. Speciation – Allopatric, Sympatric &Parapatric speciation, and factors affecting speciation.Concept of Oparin and Haldane. Experiment of Miller. Evolutionary time scale – Eras, Periods and epochs.

UNIT – V

Concepts of evolution – An overview of evolutionary biology, & theories of organic evolution. Concepts of Neutral Evolution, Population genetics- Populations, gene pool, Gene frequency; Hardy Weinberg law. Concepts and rate of change in gene frequency through Natural selection, mutation, migration and random genetic drift. Phylogenetic gradualism, punctuated equilibrium and origin of higher categories.

Suggested Readings

1. M. Kato. The Biology of Biodiversity, Springer.

2. J.C. Avise. Molecular Markers, Natural History and Evolution, Chapman & Hall, New York.

3. G.G. Simpson, Principle of Animal taxonomy, Oxford IBM Publishing Company.

4. E.O. Wilson. The diversity of Life (The College Edition), W.W. Northern & Co.

5. B.K. Tikkadhar, Threatened Animals of India, ZSI Publication Calcutta.

6. Mayr, E. 1969. Principles of Systematic Zoology. McGraw-Hill, N.Y.

7. Mayr, E. 1970. Populations, species and evolution, Cambridge Mass, Harvard Univ. Press.

8. Ferguson, A., 1976. Biochemical systematics and evolution, john biley and Sons, N.Y., Toronlo.

9. Gote, H.E. 1982. Animal Taxonomy.

10. Mayr, E. & E. Aschhok. 1991. Principles of systematic, McGraw Hill Book Co. London.

11. Minell, A. 1983. Priological systematics, The state of Art champan of Hill, London.

12. Quicke, D.L.J. 1996. Principles and Techniques of contemporary Taxonomy.Blacky Academic and

Professional, London, New York.

13. Sebuh, R.T. 2000. Biological systematics: Principles & Application, Cornell University Press.

Learning Outcomes: After completion of this course, students are able to

LO1. Classify animals on the basis of their relation to other animals by body structure, external characters,

development and DNA

LO2. Apply the International rules of nomenclature to give a scientific name to animals which are found

during research.

LO3. Understand the gradual development and evolutionary history of different kinds of living organisms

from earlier forms over several generations

LO4. Understand and demonstrate various animals, biodiversity and relate

S. V. K. P. & Dr. K. S. RAJU ARTS & SCIENCE COLLEGE (A)

FIRST SEMESTER M.Sc. ZOOLOGY & AQUACULTURE

SYLLABUS

(With effect from 2023-24 Admitted batch)

23ZAQT13 BIOMOLECULES

UNIT- I

Biomolecules- chemical composition and bonding , chemical reactivity , ionization of water. Weak acids and weak bases (pH) , buffers: buffering in biological systems, Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.). Principles of bioenergetics – Principles and Laws of thermodynamics, reaction kinetics, colligative properties and their applications in biological system : entropy and enthalpy.

UNIT - II

Chemical foundations of biology, Amino acids – classification, Peptide bond, Proteins – classification, structural organization of proteins, primary structure, secondary structure, tertiary structure, quaternary structure, Conformation of proteins (Ramachandran plot) - domains, motifs and folds. Denaturation & renaturation of proteins.

UNIT - III

Carbohydrates: Definition and classification of carbohydrates, nomenclature, Reaction of Mono-saccharides, Acid derivatives of Mono-saccharides, amino-sugars, Oligo-saccharides, structure and properties, Chemistry and biological roles of homo and hetero-polysaccharides, peptidoglycan, glycosaminoglycans, glycoproteins and other glycoconjugates.

UNIT - IV

Classification of Lipids & Fatty acids and their physicochemical properties, characterization of fats and oil; Structure, properties and biological roles of triacylglycerol, phospholipids, sphingolipids, Gangliosides, Prostaglandins, Thromboxanes, Leukotrienes and steroids.

UNIT - V

Nucleic acids – nitrogen bases, nucleosides, nucleotides, physicochemical properties of nucleic acids, cleavage of nucleic acids by enzymatic and non-enzymatic methods, chemical synthesis of DNA; Nucleic acid sequencing, chromatin structure, Three dimensional structure of DNA; Types of RNA, Structure of RNAs – Secondary and Tertiary structure; DNA denaturation and renaturation.

Suggested Reading Material:1. Nelson.D.L, Cox. M. M. Lehninger's Principle of Biochemistry. Freeman.

2. Murray. R.K, Granner.D.K, Mayes. P. A, Rodwell. V. W. Harper's Biochemistry, McGraw Hill.

3. Fundamentals of Biochemistry by Donald Voet.

4. Textbook of Biochemistry West, E.S., Todd, Mason &Vanbruggen, Macmillian&Co.

5. Biochemistry, Lubert Stryer.

S. V. K. P. & Dr. K. S. RAJU ARTS & SCIENCE COLLEGE (A)

FIRST SEMESTER M.Sc. ZOOLOGY & AQUACULTURE

SYLLABUS

(With effect from 2023-24 Admitted batch)

23ZAQT14 MOLECULAR CELL BIOLOGY

UNIT - I

Biomembranes

Molecular composition and arrangement, functional consequences Transport across cell membrane: diffusion, active transport, pumps, uniports, symports and antiports Membrane potential Co-transport by symporters or antiporters Transport across epithelia: Transport of macromolecules

UNIT - II

Cytoskeleton

Microfilaments and microtubules – structure and dynamics, Microtubules and mitosis Cilia and flagella. Cell movements – intracellular transport, role of kinesin and dynein, signal transduction mechanisms.

UNIT - III

Cell-Cell Signaling

Cell surface receptors, Second messenger system, MAP kinase pathways

Apoptosis: Definition, mechanism and significance

UNIT – IV

Cell-Cell adhesion and communication

Ca++ dependent homophillic cell-cell adhesion, Ca++ independent homophillic adhesion, Gap junctions and connections, Integrins, Collagen.

Cell cycle :Cyclines and cyclin dependent kinases, Regulation of CDK-cycline activity

UNIT-V

Genome organization. Hierarchy in organization, Chromosomal organization of genes and non-coding DNA. Mobile DNA, Morphological and functional elements of eukaryotic chromosomes, Intracellular protein traffic. Protein synthesis on free and bound polysomes, Uptake into ER, Membrane proteins, Golgi sorting, post-translational modifications, Biogenesis of mitochondria and nuclei, Trafficking mechanisms

Suggested Reading Material:

1. Molecular Cell Biology, J. Darnell. H. Lodish and D. Baltimore,Scientific American Book INC,USA.
2. Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff,K. Roberts and J.D. Watson Garland Publishing INC, NewYork.

S. V. K. P. & Dr. K. S. RAJU ARTS & SCIENCE COLLEGE (A)

SECOND SEMESTER M.Sc. ZOOLOGY & AQUACULTURE

SYLLABUS

(With effect from 2023-24 Admitted batch)

23ZAQT21 BIOSTATISTICS & BIOINFORMATICS

UNIT - I

Biostatistics- Introduction and Scope of biostatistics, Sampling. Primary and Secondary data, Frequency distribution, Graphic representation of data- bar diagram, histograms, pie diagram, frequency polygon and Ogive.

UNIT-II

Measures of central tendency- mean, median, mode. Measures of Dispersion- variance, standard deviation, coefficient of variation

UNIT - III

Probability and probability distributions-definition of probability - Bernoulli, binomial, Poisson and normal distributions; Correlation and regression Tests of Significance - hypothesis, critical region and error probabilities, t- test, chi-square test for independence, one way and two- way analysis of variance.

UNIT - IV

Basic components of computers– hardware (CPU, input, output, storage devices), Software (operating systems), Application software; Introduction to MS-EXCEL. Use of bar diagram, histogram, scatter plots, Graphical tools in EXCEL for presentation of data; Introduction to MS-WORD, word processor- editing, copying, moving, formatting, table insertion, drawing flow charts etc; Introduction to Power Point, image and data handling.

UNIT - V

Bio-informatics –Introduction, History, Internet, Knowledge. Review of relevant definitions in molecular biology. Biological Databases –introduction. Examples of databases together with steps involved in use and interpretation of results). Sequence alignment. Phylogenetic analysis with the program PHYLIP, Introduction to computational genomics and proteomics

Suggested Reading Material:

1. Batschelet, E., Introduction to Mathematics for Life Scientists. Springer- Verlag, Berling.

2. Principles of Biostatistics, Pagano M., Gauvreau, K, (2000), Duxbury Press, USA

3. Murray, J.D. Mathematical Biology. Springer – Verlag, Berlin.

4. T.K. Attwood & D.J. Parry-Smith 1999. Introduction to Bioinformatics. Pearson Education Asia.

5. Stephen Misener & S.A. Krawez 2000. Bioinformatics: Methods and Protocol.

6. Bioinformatics: Sequence and Genome Analysis, Mount, D. W. (2nd Ed., 2001), Cold Spring Harbor Laboratory Press, New York, USA

7. Bioinformatics for Dummies, Claverie J. M., Notredame C., (2nd Ed., 2007), Wiley Publishing, Inc., New York, USA

8. Sokal, R.R. & F.J. Rohlf. Biometry. Freeman, San Francisco.

9. Snedecor, G.W. and W.G. Cochran, Statistical methods for environmental biologists. John Wiley Sons, New York

S. V. K. P. & Dr. K. S. RAJU ARTS & SCIENCE COLLEGE (A)

SECOND SEMESTER M.Sc. ZOOLOGY & AQUACULTURE

SYLLABUS

(With effect from 2023-24 Admitted batch)

23ZAQT22 ANIMAL PHYSIOLOGY

UNIT - I

Muscle: Molecular Structure and properties of Muscle and muscle contraction , Sliding filament theory. Blood and Circulation – Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, Blood groups, Haemoglobin, immunity, haemostasis , factors affecting blood coagulation.

UNIT-II

Nerve impulses , Synaptic transmission & Neurotransmitters, Nervous system : Neurons, action potential, gross neuro anatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture

Sensory physiology: Photoreceptors, Auditory, Chemoreceptor, Mechanoreceptors

UNIT - III

Thermoregulation: Comfort zone, body temperature- Physical, chemical, neural regulation, acclimatization.

Osmoregulation in aquatic and terrestrial Environments mechanism of ionic regulation

Stress Physiology: Responses to biotic and abiotic factors: Light, temperature, salts

UNIT – IV

Digestion: absorption, energy balance of BMR

Respiratory system - comparison of respiration in different species, anatomical considerations, transport of gasses, exchange of gases, waste elimination, neural and chemical regulation of respiration.

Excretory System : Comparative physiology of excretion, Kidney, Urine formation, Urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.

Cardiovascular System: Comparative anatomy of heart structure, myogenic heart, specialized tissue ECG - its principle and significance, heart as a pump, blood pressure.

UNIT - V

Physiological Adaptation: Marine environment, shores, Estuaries Fresh water and Terrestrial environment. Role of Yoga and meditation on Health.

Suggested Reading Material:

1) Eckert, R .Animal Physiology: Mechanisms and adaptation, W .H.Freeman and Company, New York

2) Hochackka,P.W. and Somero, G.N.Biochemicaladaptation,Princeton,N.J.

3) Hoar,W.S.General and comparative Animal physiology prentice Hall of India.

4) Schimdt Neisen,Animalphysiology ,Adaptation and Environment,Cambridge.

5) Stamd,F.L.Physiology: A regulatory systems approach,Macmillan publishing Co., NewYork.

6) Punmer, L.PracticalBiochemistry,Tata McGraw-Hill.

7) Prosser,C.L. and Brown .Comparative Animal physiology.

8) Wilson,K.and Walker, j.Practical Biochemistry.

9) Willmer, PIG Sone and 1.Johnson, Environmental physiology,BlackWellScience,Oxford, U.K .944p

10) Newell,R.C.(ed)1976.Adaptation to environment, Essays on the physiology of marine animals.

Butterworths,London,UK539pp

11) Townsend ,C.R and P.Callow, physiological Ecology An evolutionary approach resource use,

Blackwell Sci.publication, Oxford, UK

S. V. K. P. & Dr. K. S. RAJU ARTS & SCIENCE COLLEGE (A)

SECOND SEMESTER M.Sc. ZOOLOGY & AQUACULTURE

SYLLABUS

(With effect from 2023-24 Admitted batch)

23ZAQT23 IMMUNOLOGY

UNIT - I

Immunity-innate and acquired, innate immune mechanisms, acute phase reactants, properties of acquired immunity, Immunogens and antigens- Properties, factors governing immunogenicity, haptens, epitopes size and identification. Adjuvants- properties and mechanism of action.

Immunoglobulins- structure, isotypes, allotypes and idiotypes. Functions of antibody in relation to structure

UNIT - II

Antigen-antibody interactions- affinity of antibody, avidity, bonus effect, classical precipitin reaction, antigen-binding site of antibody, forces involved in antigen - antibody complex formation. Lymphoid tissue- primary and secondary lymphoid organs, structure and cellular organization. Lymphocyte traffic. Cells involved in the immune response- T cells, B cells, CD antigens, neutrophils, eosinophils and natural killer cells.

UNIT-III

Antigen presentation - pathways of antigen processing and presentation of intracellular and extracellular antigens.

Antibody response - Primary and secondary antibody response, antibody response to haptens, enumeration of antibody-forming cells, T- dependent and T- independent antigens. Macrophage-role in immune response and activation.

UNIT-IV

Cell mediated immunity- helper, cytotoxic, suppressor T cells. In vivo and in vitro assays for assessment of cell mediated immunity

Complement- classical and alternative pathways of activation. Regulation of complement activation and functions.

Antigen receptors -On T and B cells. Generation of receptor diversity.

UNIT - V

Development of immune system- T cell ontogeny in thymus, thymic hormones, cell development. Immunological tolerance - pathways of tolerance and mechanisms of tolerance in T and B cells. Immunological tests- Immunodiffusion, immunoelectrophoresis, immunofluorescence, radioimmunoassay and enzyme-linked immunosorbent assay.

Suggested Reading Material:

1. Immunology and Immunopathology by Stewart.

2. Cellular and Molecular Immunology by Abul K. Abbas et. al.

3. Textbook of Immunology by Barret.

4. Essential Immunology by Roitt, Brostoff, Male, Harcourt Brace & Company (5th Ed), Mosby (6th Ed).

5. Immunology by Kuby, Richard A. Goldsby, Thomas, J. Kindl, Barbara A.Osbome, Freeman & Company, Mosby publishers.

6. Immunobiology – The immune system in Health disease by Janeway and Travers.

7. Immunology – An introduction by Tizard.

8. Text book of Immunology by Unani and Benacerraf.

9. Fundamentals of Immunology by Paul.

10. Immunology – A short course by Benjaini, Sunshine and Lesrowitz.

S. V. K. P. & Dr. K. S. RAJU ARTS & SCIENCE COLLEGE (A)

SECOND SEMESTER M.Sc. ZOOLOGY & AQUACULTURE

SYLLABUS

(With effect from 2023-24 Admitted batch)

23ZAQT24 MOLECULAR BIOLOGY

UNIT - I

History and scope of Molecular Biology DNA Structure and Replication Prokaryotic and Eukaryotic DNA Replication Mechanics of DNA Replication Enzymes and accessory proteins involved in DNA Replication

UNIT - II

Transcription Prokaryotic Transcription Eukaryotic Transcription RNA Polymerases Post-transcriptional modifications in RNA Cap formation Transcription Nuclear Export of m-RNA

UNIT - III

Translation Genetic Code Prokaryotic and eukaryotic Translation Mechanisms of initiation, elongation and termination Regulation of translation Antisense and Ribozyme technology Molecular mechanisms of antisense molecules Inhibition of splicing, polyadenylation and translation

UNIT – IV

DNA damage - DNA damaging agents, Physical, chemical and biological mutagens; types of damage caused by endogenous and exogenous agents, Molecular mechanisms of mutagenesis – Transition, Transversion, Frame Shift, mis-sense and non-sense mutations

Recombination and Repair Holiday junction, gene targeting and gene disruption RecA and other Recombinases DNA repair mechanisms

UNIT-V

Molecular mapping of genome Genetic and physical maps Physical mapping and map-based cloning

Southern fluorescence insitu hybridization (FISH) for genome analysis

Suggested Reading Material:

1. J.D. Watson, N.H. Hopkins, J.W. Roberts, J.A. Steitz and A.M. Weiner. Molecular biology of Gene. The Benjamin/Cummings Pub. Co. Inc., California.

2. Alberts, B., D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson. Molecular Biology of the Cell. Garland Publishing Inc., New York.

3. Benjamin Lewin, Gene IV, Oxford University Press, U.K.

4. Meyers, R.A. (Eds.) Molecular Biology and Biotechnology : A comprehensive desk reference. VCH Publishers Inc., New York.

5. Sambrook, J., E.F. Fritch and T. Maniatis. Molecular cloning : A Laboratory Manual. Cold Spring Harbor Laboratory Press, New York.

6. Daber, P.D. Introduction to practical Molecular Biology.John Wiley & Sons Ltd., New York.

7. Brown, T.a. (Eds.). Molecular Biology Lab Fax. Bios Scientific Publishers Ltd., Oxford