# Kerala PSC Scientific Assistant Syllabus

- **Renaissance**
- **Constitution**
- **Current Affairs**
- **PG level Physics, Chemistry and Biology (Zoology and Botany)**

## CHEMISTRY

- Module -I

Formulation of Quantum Mechanics - Approximation Methods - Hydrogen like Atoms -Multi Electron Systems - Angular Momentum - Applications

Chemical Bonding in Diatomic and Polyatomic Molecules-Electronic Spectroscopy of Atoms – Basic principles of Molecular Spectroscopy: Microwave, Infrared, Electronic, NMR, ESR, Raman and Mossbauer

Basic principles of Group Theory - Character Tables - Chemical and Spectral Applications

Introduction to Computational Chemistry - Computational methods : ab initio, Semi Empirical methods - Molecular Mechanics

- Module -II

Laws of Thermodynamics - Thermodynamics of Solutions - Thermodynamics of irreversible process- Phase Equilibria - Two and Three Component Systems

Statistical Mechanics - Fundamentals - Partition Function - Quantum Statistics - Heat capacities of Solids and Gases .

Electrodes and Electrochemical Cells - Nernst, Debye-Huckel, Omsager Equations - Electro kinetic Phenomena, Electrolytic Polarization.

Electro Analytical Methods : Potentiometry, Polarography , Coulometry, Conductometry, Voltametry and Amperometry.

Electronic Structure of Solids - Crystal Symmetry - Theories of Solids - Properties of Solids : Electrical, Magnetical and Optical - Crystal defects.

Structure and Theories of Liquids - Liquid Crystals and their applications.

Basic principles of Kinetics - Kinetics of Complex reactions - steady state approximation - Theories of Reaction Rates - Arrhenius equation - fast reactions.

Homogenous and Heterogeneous Catalysis - Enzyme Catalysis

Monolayer and multilayer adsorption - Adsorption Isotherms - Principles of SEM, TEM, ECSA and Augur Spectroscopy

Colloids - Zeta Potential - Electrokinetic Phenomena

- Module-III

Basic concepts of Organic reactions - Electron displacement effects - Aromaticity

Organic Reactions : Substitution, Addition, Elimination, Rearrangements - Mechanism

Concept of Molecular Chirality - Carbon and Nitrogen Compounds - Chiral reagents and Chiral Catalysts- Stereo chemistry of biphenyl and allenes . Topicity and prostereo isomerism - asymmetric synthesis.

Geometrical isomerism, Conformational analysis in acyclic and cyclic systems ,

Reactivity in substitution and elimination reactions.

Reaction intermediates - reactions related to substitution, addition, elimination and rearrangements -mechanism and application.

Esterification and ester hydrolysis reactions - structure and reactivity: Linear Free Energy relationship.

- Module-IV

Photoreactions of Carbonyl compounds - enes, dienes, arenes – applications Pericyclic reactions: Electrolytic, cycloaddition, Sigmatropic - Selection rules and stereochemistry - applications

Chromatographic techniques. Column, TLC, Paper, GC, HPLC and ion exchange Applications of UV, IR, HNMR, CNMR and Mass Spectroscopy - D NMR techniques -Structural Analysis using Spectral Data

ORD and CD - theory and applications

Organic, Inorganic and organo metallic reagents in organic synthesis.

Protecting groups in peptide synthesis

Natural Products : Terpenes, steroids, alakaloids, carbohydrates, proteins, nucleic acids, vitamins, prostoglandins, hormones and enzymes.

Fundamentals of polymerization - structure - property relationship of polymers - biopolymers.

- Module -V

Accuracy & Precision - statistical treatment of data - Theories of titrations

Thermal methods of analysis

Structure and bonding in molecules - chemical periodicity

Theories of acids and bases - Non-acqueous solvents - Isopoly and heteropoly acids

Theories in co-ordination chemistry - stereochemistry of co-ordination compounds - stability of metal complexes - reactions of metal complexes

Electronic, Infrared, NMR, ESR and Mossbauer spectra of complexes - Co-ordination complexes of Lanthanides and actinides.

- Module -VI

Synthesis, structure, properties and bonding of organometallic compounds - metal carbonyls and cyanides - Catalysts by organometallic compounds - hydrogenation, hydroformylation and polymerization.

Metal ions in biological systems - Role and effects - Coenzymes, Cytochromes, chlorophylls and hormones.

Nuclear reactions - structure and stability - radioactive equilibria - neutron activation analysis – counting techniques

Synthesis, reactions, structure and bonding in boranes - organoboranes and hydroboration - synthesis, structure and uses of phosphorous, nitrogen compounds, phosphorus - Sulphur compounds, silicones and silicates.

- Module -VII Recent Developments in Chemistry

Nanostructures - ID, 2D and 3D structures - Synthesis and applications of nanomaterials.

Principles of Green chemistry - Green synthesis - Application of Phase Transfer Catalysts -Green Reactions.

Molecular recognition: Synthetic Receptors, Cyclodextrin, Calixiranes, Cyclophanes, Crown Ethers. Drug design and Drug action.

## BOTANY

- MODULE -1 PHYCOLOGY

1. Classification of algae - Fritsch and Smith

2. Recent trends in classifications

3. General features of algae - thallus organization, vegetation, sexual and asexual reproduction and life cycle

4. Pattern of life cycle and salient features of the following classes: Cyanophyta, Chlorophyta, Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta

5. Economic importances of algae : Biofertilizers, Food industry, Industrial and medicinal importances, algal bloom

MYCOLOGY

1. Classification of fungi - Alexopoulos and Mims (1979), Ainsworth and Bisby (1983)

2. General features of fungi - thallus structure, cell wall structure, heterothallism, parasexuality and reproduction

3. Salient features of following classes- Myxomycota, Mastigomycota, Zygomycota, Ascomycota, Basidiomycota and Deuteromycota

4. Fungal associations - symbiosis, saprophytism, mycorrhiza, endophytes, lichens

5. Economic importances of fungi - degradation of pesticides and wastes, decomposition of organic matter, degradation of lignin, significances in medicine and industry, fungal toxins and human health

PLANT PATHOLOGY

1. Principles of plant pathology - biotic and abiotic agents and various symptoms of plant diseases

2. Process of infection and defense mechanisms - enzymes, toxins, structural and biochemical defense systems

3. Disease management - chemical, biological and quarantine measures

4. Common diseases of crops in Kerala - paddy, coconut, rubber, arecanut, pepper, ginger, cardamom, coffee and tea

BRYOLOGY

1. General account on morphology, anatomy and life cycle of the following groups: Hepaticopsida, Anthoceratopsida and Bryopsida

2. Origin, evolution and economic importances of bryophytes - indicators of pollution, horticulture, medicine etc..

PTERIDOLOGY

1. General account on morphology, anatomy and life cycle of the following groups -Psilopsida, Psilotopsida, Lycopsida, Sphaenopsida and Pteropsida

2. Heterospory, seed habit, stelar evolution

3. Economic importance of pteridophytes - as biofertilizers, in horticulture, medicine, ecological indicators, as weed, in food industry

GYMNOSPERMS

1. General account on morphology, anatomy and life cycle of the following groups - cycadopsida, coniferopsida and gnetopsida

2. Economic importances of gymnosperms

MICROBIOLOGY

1. Bacteria: ultra structure, major groups, nutritional types and reproduction

2. Viruses: ultrastructure, major groups, nutritional types, replication

3. Brief account on phones, viroids, virions, mycoplasmas, interferons, actinomycetes, bacteriophages

4. Economic importances of microbes- in ecology, food, industry, medicine, agriculture and other industries

PALAEOBOTANY

1. Geological time scale and evolution of plant groups

2. Types of fossilization

3. Fossil pteridophytes and gymnosperms

- MODULE-II ANGIOSPERM ANATOMY

1.Tissues - meristem, secretory and excretory tissues, primary and secondary tissues

2. Anatomy of stem, root and leaf - both primary and secondary structure in stem and root

3. Anomalous secondary growth in dicot and monocot stems

4. Brief account of nodal anatomy, wood anatomy and floral anatomy

MICROTECHNIQUE

1. Tools in microtechnique -microscopy, micrometry, camera lucida, cryostat, microtomes (rotary and sledge)

2. Fixing, killing, dehydration, clearing, embedding, staining and mounting - reagents used in each step

3. Brief account on vital staining, double staining, whole mount, maceration and histochemical

tests for carbohydrates, proteins and lipids

EMBRYOLOGY

1. Microsporogenesis and male gametophyte development

2. Megasporogenesis and embryosac development

3. Pollination, fertilization and embryogeny in both monocots and dicots

4. Endosperm types, polyembryony, parthenocarpy and apmixis

PALYNOLOGY

1. Ultrastructure of pollen wall, pollen morphology, - NPC system of classification of pollen apertures

2. Contributions of Dr. PKK. Nair to palynology

3. Palynology in relation to taxonomy

4. Aeropalynology and melittopalynology and pollen allergy

PLANT BREEDING

1. Methods in crop improvement and achievements - plant introduction, selection, mutation breeding, polyploidy breeding and hybridization

2. Consequences of inbreeding, heterosis and incompatibility

3. Back cross breeding, resistance breeding (disease resistance and stress resistance), vertical and horizontal resistances

4. Seed production and certification, major centres of crop production in India

5. Plant breeder's rights, national biodiversitypolicy

6. Methods of vegetative propagation of plants

EVOLUTION

1. Origin of life - theories of evolution, classical and modern

2. Speciation

- MODULE-III

TAXONOMY

1. Principles of taxonomy - plant nomenclature, taxonomic hierarchy, phylogeny of angiosperms, taxonomic keys

2. Classification systems - artificial, natural and phylogenetic

3. Interdisciplinary approaches to angiosperm systematic (anatomy, embryology, morphology, cytology, palynology, chemotaxonomy, numerical taxonomy, molecular taxonomy)

4. Study of the following families and their characteristic features: Ranunculaceae, Magnoliaceae, Capparidaceae, Polygalaceae, Cryophyllaceae, Malvaceae, Leguminosae, Myrtaceae, Melastomaceae, Cucurbitaceae, Rubiaceae, Asteraceae, Asclepiadaceae, Boraginaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae, Scitamineae, Liliaceae, Commelinaceae, Arecaceae, Araceae, Cyperaceae, Poaceae.

MORPHOLOGY

1. Flower as a modifiedshoot

2. Floral whorls and their parts - fruits and seed morphology

3. Vegetative morphology = leaf, root and stem

ECONOMIC BOTANY

1. Common cereals, millets and pulses

2. Vegetables, spices, beverages crops

3. Timbers, fibres, sugar and oil yielding crops

4. Medicinal plants

ETHONOBOTANY

1.Methods of ethnobotanical studies

2. Contributions of SK. Jain to ethnobotany

3. Common plants of ethnobotanical importance in Kerala

4. Sacred groves and their importance

PHYTOGEOGRAPHY

1. Factors affecting plant distribution

2. Phytogeographic zones of India

3. Soil, climate and vegetation of India

FOREST BOTANY

1. Major and minor forest products with special reference to Kerala

2. Significances of forest on environment

3. Consequences of deforestation and industrialization

ENVIRONMENTAL BIOLOGY

1. Habitat ecology - terrestrial, fresh water, wet land and marine

2. Population ecology - community ecology and ecological succession

3. Ecosystems - structure, function and types and biomes ,

4. Species interactions - competitions, herbivory, carnivory, symbiosis etc..

5. Biogeochemical cycles and environmental pollution - air, water and noise

6. Global environmental problems - ozone depletion, global warming, acid rain, nuclear hazards, Elnino, climate change,

7. Environmental impact assessment and major programmes - UNEP, IUCN, MAB, Earth Summit, CBD

- MODULE - IV

CELL AND MOLECULAR BIOLOGY

1. A brief account on structure, function of cells and cell organelles, - prokaryotic and eukaryotic cells, cytoskeleton - organization and mobility

2. Origin, Ultrastructure and function of cell membrane, cell organelles

3. Chemistry of chromosome - DNA, RNA, kinetochore, NOR and constriction of chromosomes

4. Numerical and structural variations of chromosomes

5. Cell divisions - stages, synaptonemal complex, theories and mechanism of crossing over and molecular mechanism of crossing over

6. Cell differentiation - characteristics and mechanisms

7. Prokaryotic and eukaryotic DNA replication

8. Molecular nature of genes

9. Molecular tools for studying genes and gene activities

10. Techniques of DNA analysis - preparation of DNA and RNA probes, hybridization, autoradiography, DNA finger printing

11. DNA sequencing, chemical synthesis of nucleotides

12. PCR and FISH and their applications

GENETICS

1. Mendelian genetics and gene interation

2. Linkage and crossing over, gene mapping

3. Polygenic inheritance

4. Extra chromosomal inheritanace

5. Microbial genetics - transduction, transformation and conjugation in bacteria, Lysogeny and lytic cycle in viruses

6. Nucleic acids - DNA and RNA types, structure, function and replication

7. Mutations, DNA damage and repair

8. Genetic code and gene expressions - protein synthesis, gene regulations - prokaryotes and eukaryotes

9. Translation, post translation and post transcription

10. Gene synthesis - Khorana -Kornberg

11. Population genetics - Hardey-Weinberg equilibrium - genetic drift, genetic load, consanguinity and its genetic effects

12. Human genetics - blood group systems - ABO, Rh and MN blood groups, human karyotype and syndromes caused by its aberrations, genetic counseling, pedigree analysis

13. Brief account of human genome project

- MODULE-V

PLANT PHYSIOLOGY

1. Water relation to plants - absorption and transpiration of water - opening and closing of stomata - factors affecting water transport

2. Mineral nutrition - hydroponics, aeroponics

3. Nitrogen metabolism in plants

4. Photosynthesis - C3, C4 and CAM cycle in detail, photorespiration

5. Respiration - oxidative photophosphorylation

6. Ascent of sap - source and sink relationship

7. Growth and development - role of phytohormones, photoperiodism, vernalization, florigines

8. Stress physiology - water, salt, hot and cold stress - heat shock proteins, adaptations

9. Seed germination - physiological and biochemical changes

BIOCHEMISTRY

1. Carbohydrates - structure, function and metabolism, inter conversion

2. Lipids - structure, function and metabolism, biosynthesis of fatty acids, alpha and beta oxidation

3. Amino acids and proteins - structure and properties and classification of amino acids and proteins, amino acid metabolism, Ramachandran plot, verification of proteins

4. Enzymes - major groups, relation of enzyme activity, enzyme kinetics, assay, regulation, allosteric enzymes, isoenzymes, ribioenzymes, coenzymes

5. Vitamins - classification, function and sources of vitamins and their role as co-enzymes

BIOPHYSICS

1. pH and buffers

2. Microscopy - bright field, phase contrast, fluorescent and electron microscope (SEM and TEM), photometry, colorimetry

3. Chromatogram - gel filteration, ion exchange, affinity, TLC, GC, HPLC, HPTLC, GCMS

4. Electrophoresis - AGE, PAGE, SDS-PAGE, isoelectrofocusing, ELISA

5. Centrifugation - density gradient and ultra centrifugation

6. Biophysical methods for analysis of biopolymers - x-ray diffraction, fluorescent, NMR spectroscopy, UV, visible and ESR spectroscopy, ORD/CD, atomic absorption and plasma emission spectroscopy

7. Radiation dosimetry, radioactive isotopes, autoradiography, Cerenkov radiation, liquid scintillation techniques

BIOSTATISTICS

1. Sampling methods and errors

2. Process and presentation of data - tables and graphs

3. Measures of central tendency - mean, median, mode

4. Measures of dispersion - range, quartile deviation, mean deviation, standard deviation and coefficient of variations

5. Probability - basic concept, theorems

6. Experimental design - randomnized block, latin square

7. Tests of significance - T-tests, Chi-square, F-tests, ANOVA

8. Correlation and regression analysis

- MODULE - VI

BIOTECHNOLOGY

1. Plant tissue culture techniques - direct and indirect regeneration

2. Somatic cell genetics and somatic clonal variations

3. Somatic embryogenesis - artificial seeds, protoplast culture, somatic hybridization, impacts in plant breeding

4. Haploid production- anther and ovule culture - applications

5. Production of secondary metabolites - cell immobilization - bioreactor technology, in vitro strategies of germplasm conservation

6. Isolation of genomic and organellar DNA. Methods of gene identification - vector mediated and vectorless PCR, genomioc and cDNA libraries

7. Gene transfer techniques - direct and indirect traspossors as vectors - gene silencing

8. DNA markers - RFLP, RAPD, AFLP and Antisense RNA

9. Blotting techniques - Northern, Southern and West

10. Transgenic biology - gene cloning and transformation technique in plants-gene targeting and sequence tag

11. Genetically modified organisms and foods, social and ethical considerations, IPR issues, patents and biopiracy

5. BIOINFORMATICS

6. Introduction to data structures, data base concepts, tools for searching, homology searching

7. Application of databases in biology

8. Sequence databases, sequence comparison, structural databases, proteomics and genomics (elementary)

9. Major bioinformatic resources - NCBI, EBI, EMBL, GENBANK, DDBJ, SWISSPROT, PDB

10. Tools in bioinformatics - BLAST, CLUSTAL -X, CLUSTAL-W, Phylip, GENSCAN

11. Applications of bioinformatics - transcriptomix, metabolomics, pharmacogenomics (brief account only)

COMPUTER APPLICATIONS

1. Computer application in biology

2. Computer packages for biostatistics and numerical taxonomy

3. Hardware and software parts of a computer

4. Internet online biology resources, public library of sciences, online publications, electronic journals and books

- MODULE – VII

Recent developments in Botany

## PHYSICS

- Module I

Mathematical Methods of Physics Curinlinear coordinates, circular cylindrical and spherical polar coordinates Victor algebra and Victor calculus, Matrices – Cayley Hamilton Theorem, Eegin values and Eegin vectors.

Special Functions (Gama, Beta, Hermite, Bessel, Laguerre, Legendre)

Complex Analysis – Analytic function, Taylor and Laurent expansions, poles, residue and evaluation of integrals.

Fourier Series, Fourier and Laplace transforms.

Tensors, Introductory group theory, representation of groups. Irreducible representation SU (2),SU(3).

- Module II

Classical Mechanics

Newtons laws, Lagrangian and Hamiltonian formalism. Canonical Transformation and Poison Bracket, Hamilton Jacobi Theory

Rigid body Dynamics -

Small oscillations

Special theory of relativity

Non linear Dynamics – logistic map – bifurcation – attractors – fractal, fractal dimension.

- Module III

Quantum Mechanics

Wave particle duality, Fundamental postulates of Q.M., Schrodinger picture & Heisenberg picture

Eigen value problem (particle in a box, harmonic ocillator). Tunneling through a barrier.

Heisenberg uncertainly principle. Algebra of linear vector space, Dirac notation, Angular Momentum algebra (spin, addition of angular momentum).

Time independent perturbation theory and applications :

Variational method.

Time dependent perturbation theory and Fermi Golden Rule.

Elementary theory of Scattering phase shifts, partial waves, Born approximation.

Relaturistic Quantum Mechanics : Klein Gordon – Dirac equations.

- Module IV

A) Electro Dynamics & Statistical Physics

Review of Electrostatics and Magnetostatics

(Gausi's law, Biot Savart Law, Amperes theorum)

Maxivells equation in free space and linear isotropic media – boundary conditions on the fields at interfaces. Sealar and vector potentials.

(Retarded potential Lienard Wiehirt potential, field of a moving point charge)

Electromagnetic waves in free space. Dielectrics and conductors. Reflection, refraction, polarisation

Transmission lines and Wave guides.

Statistical Physics

B) Laws of thermodynamics. Thermodynamic potentials

Phase space, micro and macrostates, Micro canonical, canonical and grand canonical ensembles and partition funtions. Classical and quantum statistics, Ideal Bose and Fermi gases.

First and second order phase transitions. Diamagnetism, paramagnetism an ferromagnetism.

- Module V

Spectroscopy and Condensed Matter Physics

A) Spectroscopy

Introduction to Atomic Spectroscopy :- LS coupling, - J J coupling, - Zeeman effect, - Stark effect, Lande - g factor

Electronic, rotational, vibrational and Raman Spectra of diatomic molecules, selection rules.

Spin Resonance Spectroscopy : NMR, ESR, Mossbauer Spectroscopy.

Laser : Spontaneous and stimulated emission, Einstein coefficients. Optical pumping, population inversions, rate equation. Modes of resonators and coherence length.

B) Condensed Matter Physics

Bravais lattice, Reciprocal lattice. Diffraction and the structure factor. Brillouin zone. Vibractions of crystals with monoatomic and diatomic basis – Phonon heat capacity – Density of states in one an three dimensions – Einstein and Debye models

Free electron theory and electronic specific heat.

Hall Effect

Super conductivity Type I and Type II superconductors.

Josephson functions, BCS theory

- Module VI

Nuclear and Particle Physics & Electronics

A) Nuclear Properties : size shape and charge distribution, spin and parity – Binding energy, semi empirical mans formula, liquid drop model, Nature of nuclear force. Elmentary ideas of alpha, beta and gamma decay and their selection rules. Fission and fusion. Nuclear for reactions. Reaction crossection, Q valve.

Elementary particles and their Quantum numbers.

Quark Model

A) Electronics :

Semi conductor devices (diodes, functions, transistors, FET) Amplifuro, Oscillators.

Opto electronic devices (solar cells, photo detection, LED), Operational amplifiers and their applications. Digital techniques and applications (registers, counters, comparators) A/D and D/A converters.

- Module VII

Recent Developments in Physics

Nanotechnology

Properties of metal, semi conductor, rare gas and molecular nanoclusters – superconducting fullerene – quantum confined meterials – quantum wells, wires, dots and rings – meta materials – graphene

Non Linear Dynamics

Soliton – Effect of nonlinearity and dispersion.

Non Conventional Energy Resources

Wind Energy, Solar Energy, Tidal energy, Bio.

Evolution of Universe

Big Bang Theory : Spontaneous symmetry breaking, Higgs Boson.

Basis of Quantum Computing

## ZOOLOGY

- MODULE I: SYSTEMATICS AND EVOLUTIONARY BIOLOGY

1. SYSTEMATICS

• Basic concepts , Importance and applications

• Trends -Chemotaxonomy, Cytotaxonomy, Molecular taxonomy, Cladistics, Numerical taxonomy

• Dimensions of speciation, Species concept, Theories of biological classification, Hierarchy of categories.

• Procedural keys- Taxonomic procedures- Collection, Preservation, Curating, Identification.

• Taxonomic keys- Merits and demerits; ICZN, Formation of scientific names of various taxa.

2. EVOLUTIONARY BIOLOGY

An outline of evolutionary theories: Darwinism, Lamarckism, Modern synthesis (not in detail).

Origin of higher categories- Punctuated equilibrium- Macroevolution-MicroevolutionCoevolution-Founder principle- C-value paradox-Concept of molecular clockCytochrome C- Haemoglobin-Histone.

- MODULE II: PHYSIOLOGY AND BIOCHEMISTRY.

I. PHYSIOLOGY

1. Nutrition and Digestion

• Types of nutrition

• Mechanism of Digestion , Absorption

• Gastro intestinal hormones

• Deficiency diseases of nutrients.

2. Circulatory Physiology

• Physiology of cardiac muscles

• cardiac cycle

• Electrical properties

• conducting system of heart

• Blood pressure

• Blood volume

• pressure control - integrated system.

3. Nerve Physiology

• Nerve action potential

• conduction of nerve impulse

• Synapse

• Synaptic transmission

• Neurotransmitters.

4. Excretory physiology

5. Respiratory physiology

6. Muscle physiology

7. Endocrinology

• Major Endocrine glands and their hormones and functions

• Mechanism of hormone action.

II. BIOCHEMISTRY

Biomolecules

• Carbohydrates: Classification, Structure, Properties, Functions.

• Proteins: Classification, Structure, Properties, Functions.

• Lipids: Classification, Structure, Properties, functions.

Enzymes: Mechanism of enzyme action. Factors affecting enzyme action, Enzyme kinetics, MentonMichaelis kinetics, Substrate concentration, Enzyme inhibition and regulation, Isozyme, Coenzyme, Ribozymes.

Metabolism of carbohydrate: Glycolysis, TCA cycle, Pentose phosphate pathway, Glycogenesis, Glucogenesis, Gluconeogenesis, Regulation of carbohydrate metabolism.

Metabolism of protein: Deamination, Transamination,

Metabolism of Lipids: B oxidation, Synthesis of Fatty acid, Biosynthesis of cholesterol.

Energy metabolism: Oxidative metabolism, Oxidative phosphorylation, Chemiosmotic theory

- MODULE III: MICROBIOLOGY AND IMMUNOLOGY

I. MICROBIOLOGY

• Classification of Microorganisms- Berg's manual.

• Salient features of Bacteria, Viruses, Fungi, Protozoa, Algae.

• Bacterial Cell- Structure and function

• Bacterial Cell wall- Peptidoglycan, Gram's positive and Gram's negative, Mechanism of Gram's staining.

• Bacterial culture media

• Growth curves

2. Industrial Microbiology: Fermentation.

II: IMMUNOLOGY

• Types of immunity - Innate, Acquired, Passive, Active, Cell mediated.

• Cells of primary and secondary lymphoid organs.

• Cells and organs of immune system.

III. Immunogens [ Antigen]

• General properties- Structure and function, Variability and Diversity.

• Factors affecting antigenicity

• Epitopes and haptens

• Adjuvants.

IV. Immunoglobulins [Antibodies]

• General properties- Structure and function

• Different classes- Ig A, IgD, IgE, IgM

• Variability and Diversity

• Monoclonal and polyclonal antibodies

V. Antigen Antibody interaction

Complement system- Classical pathway, Alternate, cell mediated and humoral reactions.

VI. Transplantation

MHC genes, Auto-immune diseases.

- MODULE IV CELL, MOLECULAR BIOLOGY AND BIOTECHNOLOGY

CELL

Cell membrane- Structure and function.

Cell organelles with special reference to Mitochondria and Ribosomes

MOLECULAR BIOLOGY

• Organization of eukaryotic genome, gene content and genomic size complexity of eukaryotic genome, conserved exons and recombination

• DNA replication, Repair and Recombination

• Prokaryotic and eukaryotic DNA replication. Enzyme involved in replication. DNA damage and repair.

• Transcription and RNA processing

• Prokaryotic and Eukaryotic transcription, Binding of transcription complexes, Post - transcriptional processing

• Translation- prokaryotic and eukaryotic gene expression, Translational machinery, mechanism of initiation, elongation and termination, Post-translational modification of protein.

• Gene regulation mechanism in Prokaryotes, Eukaryotes

• Transcriptional signals-TATA, CAAT box, Enhancers.

A. BIOTECHNOLOGY

Gene cloning.

• Major steps in cloning, Isolation and purification of genes.

• Vectors- properties of an ideal vector, different types [ plasmids, Ti plasmid, bacteriophages, cosmids, phagemids, artificial chromosomes].

• Enzymes in gene cloning.

• Probes and molecular markers [RFLP, RAPD, AFLP].

• Homoploymer tailing, linkers and adapters. Genetic engineering techniques.

B1 Polymerase Chain reaction, DNA finger printing, Blotting techniques [ Northern, Southern , Western blottings, Dot blot, Slot blot].

B2 DNA sequencing - Maxam-Gilbert method, Sanger-Coulson method. Chromosome jumping, Genomic library and cDNA library, Site specific mutagenesis and gene targeting,

Human genome project, Human gene therapy, and other genome projects. B3 Transgenic animals.

- MODULE V: GENETICS AND DEVELOPMENTAL BIOLOGY

I. GENETICS.

• Mendelian principles of genetics- Laws , Linkage, Crossing over, Mutation, DNA, Types of DNA, RNA, Types of RNA.

• Lyon hypothesis.

• Syndromes- Klinefelter, Down, Turner.

• Genetic code.

II. DEVELOPMENTAL BIOLOGY

• Gametogenesis, Fertilization and early development - Cleavage, Blastulation, gastrulation, Organogeny.

• Experimental Embryology.

• Embryonic induction.

- MODULE VI: ECOLOGY, ETHOLOGY , BIODIVERSITY CONSERVATION AND BIOSTATISTICS

1. ECOLOGY:

Definitions- Habit and habitat, Ecological niche, Ecosystem, Population ecology, Community ecology, Ecological succession, Pollution, Global warming.

2.ETHOLOGY

Learning behaviour, Communication behaviour, Motivation.

3.BIODIVERSITY CONSERVATION

Biodiversity concept, status in India, Value, Loss and causes of loss.

Indices, Hot spots of Biodiversity. In situ and Ex-situ conservation.

4.BIOSTATISTICS

Mean, Median, Mode, Standard deviation; Graphical representation of data.

BIOPHYSICS, BIOINFORMATICS AND COMPUTER APPLICATION

1. INSTRUMENTATION

• Scanning electron microscope, Transmission electron microscope

• Electrophoresis- Gel, PAGE, Agarose, 2D- Immunoelectrophoresis, Fluorescent

• HPLC, Flow cytometry

• NMR spectroscopy- Mass, Plasma , Atomic

• X-ray diffraction

• ELISA

2. BIOINFORMATICS

Proteomics, Genomics, Data bases - Primary and Secondary, Search engines.

Transgenic animals, Stem cell research, IPR, Carbon trading, Ecological foot printing, Treaties and protocols related to climate change.

- MODULE – VII

Recent developments in Zoology