

# HIGHER SECONDARY SCHOOL TEACHER (JUNIOR) (BOTANY)

## HSST - BOTANY SYLLABUS

### HIGHER SECONDARY EDUCATION DEPARTMENT

#### 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, Anthocerotopsida 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, Lycopside, Sphaenopsida and Pteropsida
2. Heterospory, seed habit, stelar evolution
3. Economic importances 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 embryo sac 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 biodiversity policy
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 modified shoot
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

## ETHNOBOTANY

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, El-nino, 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 interaction
2. Linkage and crossing over, gene mapping
3. Polygenic inheritance
4. Extra chromosomal inheritance
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 - Hardy-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 phosphorylation
6. Ascent of sap - source and sink relationship
7. Growth and development - role of phytohormones, photoperiodism, vernalization, florigins
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, riboenzymes, 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 filtration, 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 - randomized 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, genomic and cDNA libraries
7. Gene transfer techniques - direct and indirect transposons 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, Phylogeny, GENSCAN
11. Applications of bioinformatics - transcriptomics, 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

#### **Module VIII**

#### **RESEARCH METHODOLOGY/TEACHING APTITUDE**

##### **I. TEACHING APTITUDE**

- Teaching: Nature, objectives, characteristics and basic requirements;
- Learner's characteristics;
- Factors affecting teaching;
- Methods of teaching;
- Teaching aids;
- Evaluation systems.

##### **II. RESEARCH APTITUDE**

- Research: Meaning, Characteristics and types;
- Steps of research;
- Methods of research;
- Research Ethics;
- Paper, article, workshop, seminar, conference and symposium;
- Thesis writing: its characteristics and format.

#### **Module IX (a )**

#### **Salient Features of Indian Constitution**

Salient features of the Constitution - Preamble- Its significance and its place in the interpretation of the Constitution.

Fundamental Rights - Directive Principles of State Policy - Relation between Fundamental Rights and Directive Principles - Fundamental Duties.

Executive - Legislature - Judiciary - Both at Union and State Level. - Other Constitutional Authorities.

Centre-State Relations - Legislative - Administrative and Financial.

Services under the Union and the States.

Emergency Provisions.

Amendment Provisions of the Constitution.

## **Module IX (b)**

### **Social Welfare Legislations and Programmes**

Social Service Legislations like Right to Information Act, Prevention of atrocities against Women & Children, Food Security Act, Environmental Acts etc. and Social Welfare Programmes like Employment Guarantee Programme, Organ and Blood Donation etc.

## **Module X (a)**

### **RENAISSANCE IN KERALA**

#### **TOWARDS A NEW SOCIETY**

Introduction to English education - various missionary organisations and their functioning- founding of educational institutions, factories, printing press etc.

#### **EFFORTS TO REFORM THE SOCIETY**

##### **(A) Socio-Religious reform Movements**

SNDP Yogam, Nair Service Society, Yogakshema Sabha, Sadhu Jana Paripalana Sangham, Vaala Samudaya Parishkarani Sabha, Samathwa Samajam, Islam Dharma Paripalana Sangham, Prathyaksha Raksha Daiva Sabha, Sahodara Prasthanam etc.

##### **(B) Struggles and Social Revolts**

Upper cloth revolts.Channar agitation, Vaikom Sathyagraha, Guruvayoor Sathyagraha, Paliyam Sathyagraha. Kuttamkulam Sathyagraha, Temple Entry Proclamation, Temple Entry Act .Malyalee Memorial, Ezhava Memorial etc.

Malabar riots, Civil Disobedience Movement, Abstention movement etc.

#### **ROLE OF PRESS IN RENAISSANCE**

Malayalee, Swadeshabhimani, Vivekodayam, Mithavadi, Swaraj, Malayala Manorama, Bhashaposhini, Mathnubhoomi, Kerala Kaumudi, Samadarsi, Kesari, AI-Ameen, Prabhatham, Yukthivadi, etc

#### **AWAKENING THROUGH LITERATURE**

Novel, Drama, Poetry, *Purogamana Sahithya Prasthanam*, *Nataka Prashtanam*, Library movement etc

#### **WOMEN AND SOCIAL CHANGE**

Parvathi Nenmenimangalam, Arya Pallam, A V Kuttimalu Amma, Lalitha Prabhu.Akkamma Cheriyan, Anna Chandi, Lalithambika Antharjanam and others

#### **LEADERS OF RENAISSANCE**

Thycaud Ayya Vaikundar, Sree Narayana Guru, Ayyan Kali.Chattampi Swamikal, Brahmananda



Sivayogi, Vagbhadananda, Poikayil Yohannan(Kumara Guru) Dr Palpu, Palakkunnath Abraham Malpan, Mampuram Thangal, Sahodaran Ayyappan, Pandit K P Karuppan, Pampadi John Joseph, Mannathu Padmanabhan, V T Bhattathirippad, Vakkom Abdul Khadar Maulavi, Makthi Thangal, Blessed Elias Kuriakose Chaavra, Barrister G P Pillai, TK Madhavan, Moorkoth Kumaran, C. Krishnan, K P Kesava Menon, Dr.Ayyathan Gopalan, C V Kunjuraman, Kuroor Neelakantan Namboothiripad, Velukkutty Arayan, K P Vellon, P K Chathan Master, K Kelappan, P. Krishna Pillai, A K Gopalan, T R Krishnaswami Iyer, C Kesavan. Swami Ananda Theerthan , M C Joseph, Kuttippuzha Krishnapillai and others

## **LITERARY FIGURES**

Kodungallur Kunhikkuttan Thampuran, KeralaVarma Valiyakoyi Thampuran, Kandathil Varghese Mappila. Kumaran Asan, Vallathol Narayana Menon, Ulloor S Parameswara Iyer, G Sankara Kurup, Changampuzha Krishna Pillai, Chandu Menon, Vaikom Muhammad Basheer. Kesav Dev, Thakazhi Sivasankara Pillai, Ponkunnam Varky, S K Pottakkad and others

## **Module X (b )**

### **GENERAL KNOWLEDGE AND CURRENT AFFAIRS**

*NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.*