

# FURTHER DETAILS REGARDING MAIN TOPICS OF PROGRAMME NUMBER - 10/2016

## HIGH SCHOOL ASSISTANT (SOCIAL STUDIES)

### PART A

#### **Module I : Renaissance and freedom movement**

#### **Module II: General Knowledge and current affairs**

#### **Module III: Methodology of teaching the subject**

- History/conceptual development. Need and Significance, Meaning Nature and Scope of the Subject.
- Correlation with other subjects and life situations.
- Aims, Objectives, and Values of Teaching - Taxonomy of Educational Objectives - Old and revised
- Pedagogic analysis- Need, Significance and Principles.
- Planning of instruction at Secondary level- Need and importance. Psychological bases of Teaching the subject - Implications of Piaget, Bruner, Gagne, Vygotsky, Ausubel and Gardener - Individual difference, Motivation, Maxims of teaching.
- Methods and Strategies of teaching the subject- Models of Teaching, Techniques of individualising instruction.
- Curriculum - Definition, Principles, Modern trends and organizational approaches, Curriculum reforms - NCF/KCF.
- Instructional resources- Laboratory, Library, Club, Museum- Visual and Audio-Visual aids - Community based resources - e-resources - Text book, Work book and Hand book.
- Assessment; Evaluation- Concepts, Purpose, Types, Principles,  
Modern techniques - CCE and Grading- Tools and techniques -  
Qualities of a good test - Types of test items- Evaluation of projects,  
Seminars and Assignments - Achievement test, Diagnostic test –  
Construction, Characteristics, interpretation and remediation.
- Teacher - Qualities and Competencies - different roles - Personal  
Qualities - Essential teaching skills - Microteaching - Action research.

### PART B

#### **Module I**

1. Definitions of History

2. Bronze Age Civilizations – Egyptian, Mesopotomian, Harappan Civilizations
3. Graeco-Roman Civilizations
4. Renaissance, Reformation, Geographical discoveries.
5. Modern Revolutions – English, French, Russian Revolutions and Industrial Revolution.
6. World Wars – League of Nations and United Nations

### **Module II**

1. Vedic Age, Jainism and Buddhism.
2. Mauryas and Guptas.
3. State and Society in medieval India – Sultanate, Mughal and Vijayanagar.
4. Advent of Europeans – Birth and Growth of British power in India – Impact of Colonialism.
5. Emergence of Nationalism – Struggle for Freedom – Partition of India.
6. Sources of Kerala History – Jainism and Buddhism in Kerala.
7. Kerala in the Sangam Age – Perumals of Mahodayapuram – Bhakti Movement.
8. Rise of Modern Travancore – Resistance against Colonialism – Pazhassi Raja, Velu Thambi and Paliyathachan.
9. Renaissance in Kerala – Social and Religious reform movements.
10. National Movement in Kerala – Aikya Kerala Movement – Formation of Kerala State.

### **Module III: Economic Theory, Banking and Tools of Analysis**

Issues and Concepts in Economics – Theories of Consumer Behaviour: Cardinal and Ordinal Approaches – Elasticity of Demand – Production and Cost Functions – National Income Concepts – Sectoral Composition of GDP — Theories of International Trade: Absolute cost Advantage – Comparative Cost Advantage – Commercial banks and Central bank: Role and Functions. Application of measures of Central Values, Dispersion and simple Correlation in economics

### **Module IV: Indian economy, Development Economics, Public Finance and Kerala Economy**

Overview of Indian economy – Economic Planning – Five Year Plans in India- Major Development Issues: Poverty, inequality, unemployment – Concepts of Human Development: Measurement of Development – PQLI, HDI – Concept of sustainable development – Structure of Taxes and Expenditure of the Government – Concepts of Federal Finance – Development Experience of Kerala – Demographic transition, gender issues, migration and urbanization.

## **MODULE V**

1. Meaning, importance and approaches to the study of Political Science
2. Major concepts in Political Science- state, civil society, sovereignty
3. Political culture, political socialization
4. Federalism, rule of law, judicial review, Judicial activism,
5. Role of Political parties and pressure groups
6. Democracy- meaning and features - Direct and Indirect democracy - Parliamentary and Presidential systems
7. Indian political system: salient features of the Indian Constitution, Fundamental Rights and Directive Principles of State Policy. Working of Union and State Governments: A brief analysis
8. Human Rights- Meaning and importance, Universal Declaration of Human Rights

## **MODULE VI**

1. International Politics and Organizations. Diplomacy, Foreign Policy, Collective Security, Disarmament and Arms Control. UNO-Principal organs and functions. New trends: Globalization, WTO.
2. Public Administration. Principles of Organization, Bureaucracy: merits and demerits, New Public Administration, New Public Management, Development Administration, Significance of Local Self Government Institutions in India.
3. Political Thinkers. Plato, J S Mill, Aristotle, Rousseau, Marx, Gramsci and Gandhiji: Major contributions

## **Module VII – Physical Geography**

Solar System and Planets – latitudes and longitudes – time – seasons - maps, map scales – basics of remote – structure of the earth – continents and oceans – continental drift – plate tectonics – rocks – weathering and erosion – fluvial, glacial, Aeolian, landforms. Composition and structure of atmosphere – temperature and their distribution – pressure belts, winds – condensation and precipitation – Major oceans and their characteristics – tides and currents.

## **Module VIII – Human and Regional Geography**

Population – World population distribution, growth – migration – settlements – rural and urban – climatic regions of the world – Types of agriculture in the world - distribution of iron ore and coal in the world– distribution of industries in the world – iron and steel – cotton textiles. Physiography of India – drainage – climate – soils – forests – Distribution, growth and density of population in India - Distribution of rice, wheat, cotton and sugar cane in India. Irrigation and multipurpose projects of India. Distribution of iron ore, coal, bauxite, mica, petroleum and atomic minerals – non-conventional

energy resources – Distribution of iron and steel, textiles, and agro based industries in India – Transport in India – Geography of Kerala

## **(FOR KANNADA MEDIUM)**

### **PART A**

**Module I : Renaissance and freedom movement**

**Module II: Proficiency in Kannada**

### **PART B**

**Module-I -VIII same as above**

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## **HIGH SCHOOL ASSISTANT (MATHEMATICS)**

### **PART A**

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## **PART B**

### **Module I**

Elementary Set Theory, Relations, Partial order, Equivalence relation, Functions, bijections, Composition, inverse function, Quadratic equations –relation between roots and coefficients, Mathematical induction, Permutation and combination.

Trigonometric Functions – Identities solution of triangles, heights and distances.

Geometry – Length and area of Polygons and circle.

Solids – Surface area and volume, Euler’s formula.

### **Module II**

Theory of Numbers – divisibility, division algorithm, gcd, lcm. Relatively prime numbers (Co-primes), Fundamental Theorem of Arithmetic, congruences, solution of linear congruences, Fermat’s Theorem.

Matrices – Addition, Multiplication, Transpose, Determinants, singular matrices, inverse, symmetric, skew-symmetric, hermitian, skew-hermitian, Orthogonal matrices, normal form, echelon form, rank of a matrix. Solution of system of linear equations. Eigenvalues, eigenvectors, Cayley Hamilton Theorem.

### **Module III**

Calculus - Limits, Continuity, Differentiability, Derivatives, Intermediate Value Theorem, Rolle’s Theorem, Mean value Theorem, Taylor and Maclaurin’s series, L’Hospital’s rule. Partial differentiation, homogeneous functions, Euler’s Formula. Applications of differentiation - maxima and minima, critical points, concavity, points of inflection, asymptotes, Tangents and normals.

Integration – methods of integration, definite integrals – properties.

Fundamental theorem of calculus.

Applications of Integration – Area between curves, volume and area of revolution.

Double and Triple Integrals

Conic sections- Standard equations – Parabola, ellipse, hyperbola, Cartesian, Parametric and polar forms.

### **Module IV**

Bounded sets, infimum, supremum, order completeness, neighbourhood, interior, open sets, closed sets, limit points, Bolzano Weierstrass Theorem, closed sets, dense sets, countable sets, uncountable sets.

Sequences – convergence and divergence of sequences, monotonic sequences, subsequences.

Series – Convergence and divergence of series, absolute convergence, Cauchy’s general principle of

convergence of series. The series  $\sum 1/n^p$ .

Tests for convergence of series – comparison test, root test, ratio test. Continuity and uniform continuity, Riemann integrals, properties, integrability.

Complex numbers, modulus, conjugates, polar form,  $n^{\text{th}}$  roots of complex numbers. Functions of complex variables – Elementary functions of complex variables, Analytic functions. Taylor series, Laurent's Series.

### **Module V**

Vectors – Unit vector, collinear vectors, coplanar vectors, like and unlike vectors, orthogonal triads (**i, j, k**) Dot product, cross product- properties. Vector differentiation- unit tangent vector, unit normal vector, curvature, torsion, vector fields, scalar fields, gradient divergence, curl, directional derivatives. Vector Integration – Line Integrals, conservative fields, Green's Theorem, Surface Integrals, Stoke's Theorem, Divergence Theorem.

Differential Equations – Order and degree of differential equations. First order differential equations- solution of Linear equations, separable equations and exact equations.

Second order differential equations- Solution of homogeneous equations with constant coefficients – various types non-homogeneous equations, solutions by undetermined coefficients.

### **Module VI**

Data Representation: Raw Data, Classification and tabulation of data, Frequency tables, Contingency tables; Diagrams – Bar diagrams, sub-divided bar diagrams, Pie diagrams, Graphs – Frequency polygon, frequency curve, Ogives.

Descriptive Statistics: Percentiles, Deciles, Quartiles, Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic Mean; Range, Mean deviation, Variance, Standard deviation, Quartile deviation; Relative measures of dispersion – Coefficient of variation; Moments, Skewness and Kurtosis – Measures of Skewness and Kurtosis.

Probability: Random Experiment, Sample space, Events, Type of Events, Independence of events; Definitions of probability, Addition theorem, Conditional probability, Multiplication theorem, Baye's theorem.

### **Module VII**

Random variables and probability distributions: Random variables, Mathematical Expectation, Definitions and properties of probability mass function, probability density function and distribution function. Independence of random variables; Moment generating function; Standard distributions – Uniform, Binomial, Poisson and Normal distribution.

Bivariate distribution: Joint distribution of two random variables, marginal and conditional distributions.

Correlation and regression: Scatter Diagram, Karl Pearson's Correlation Coefficient, Spearman's rank correlation coefficient. Principle of least squares – curve fitting – Simple linear regression.

### **Module VIII**

Random Sampling Methods: Sampling and Census, Sampling and Non-sampling errors, Simple random sampling, Systematic sampling, Stratified sampling.

Sampling distributions: Parameter and statistic; Standard error, sampling distributions – normal, t, F, Chi square distributions; Central limit theorem. Estimates, Desirable properties of estimate – Unbiasedness, consistency, sufficiency and efficiency.

Testing of hypothesis (basic concepts only) - Simple and composite hypotheses, null and alternate hypotheses, Type I error, Type II error, Level of significance, Power of a test.

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**HIGH SCHOOL ASSISTANT (NATURAL SCIENCE)**  
**PART A**

**Module I : Renaissance and freedom movement**

**Module II: General Knowledge and current affairs**

**Module III: Methodology of teaching the subject**

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**PART B**  
**Module - I**  
**ANIMAL DIVERSITY**

**I Whittaker's five Kingdom Classification:**

**Kingdom Protista -**

Parasitic Protozoans

e.g. Entamoeba histolytica, }

Trypanosoma gambiense, }

Plasmodium vivax }

Salient features

Morphology, Life history, Pathogenicity

Prophylactic measures

**Kingdom Animalia**

Levels of organization -

Cellular, Tissue, Organ, Coelom, Symmetry

**Phylum Non-Chordata :**

**Phylum Coelenterata**

General characters

Classes: (1) Hydrozoa

e.g. Obelia

(2) Scyphozoa

e.g. Aurelia

(3) Anthozoa

e.g. Sea anemone

Polymorphism in Coelenterata

**Phylum Platyhelminthes:-**

General characters

Classes (1) Turbellaria

e.g. Planaria

(2) Trematoda

e.g. Fasciola

(3) Cestoda

e.g. Taenia solium

**Phylum Nematoda :**

General characters

e.g. Ascaris, Ancylostoma, Enterobius, Wuchereria

**Phylum Annelida**

General characters

Classes (1) Polychaeta

e.g. Arenicola

(2) Oligochaeta

e.g. Nereis

(3) Hirudinea

e.g. Hirudinaria

Vermiculture (brief account)

**Phylum Arthropoda**

General characters

Classes (1) Crustacea

e.g. Penaeus

(2) Insecta

e.g. Honey bee

(3) Merostomata

e.g. Limulus

(4) Myriapoda

e.g. Centepede



### **Phylum Onychophora**

Peripatus – Affinities, Distribution

Social Organization : Honey bee (mention caste system)

Economic Importance : Sericulture.

### **Phylum Mollusca**

General characters

Classes (1) Amphineura e.g. Chiton

(2) Bivalvia e.g. Perna

(3) Scaphopoda e.g. Dentalium

(4) Gastropoda e.g. Pila

(5) Cephalopoda e.g. Sepia

Economic Importance : Pearl culture

Classes: (1) Asteroidea e.g. Asterias

(2) Ophiuroidea e.g. Ophiothrix

(3) Echinoidea e.g. Echinus

(4) Holothuroidea e.g. Sea cucumber

(5) Crinoidea eg. Sea lily (Antedon)

## **II PHYLUM CHORDATA**

General characters

Sub phyla

(1) Urochordata : e.g. Ascidia

(2) Cephalochordata e.g. Amphioxus

(3) Vertebrata . General characters.

Divisions

(1) Agnatha – General character e.g. Petromyzon

(2) Gnathostomata - General characters.

Superclass :

(1) Pisces . General characters, Classification

Class (1)**Chondrichthyes** e.g. Scoliodon

Class (2)**Osteichthyes** e.g. Sardinella

(2) Tetrapoda

Salient features/ General characters.

Classes : (1) Amphibia : General characters

Orders(1) Urodela : e.g. Ambystoma

(2) Anura : e.g. Hyla, Bufo

(3) Apoda : e.g. Ichthyophis

(2) Reptilia

: General characters,

**Common examples:** Calotes

### **Identification of venomous and non-venomous snakes.**

(3) Aves : General Characters

**Common examples:**

Emu, Pavo

**Migration of Birds**

(4) Mammalia

: General characters

**Common examples:**

Rattus

Dentition in Mammals.

## **Module II**

### **I. PHYSIOLOGY, BIOCHEMISTRY & DEVELOPMENTAL BIOLOGY**

## **1) Physiology :**

### **- Nutrition :**

Types, Balanced diet, Nutritional disorders – Vitamin deficiency diseases, life style diseases, role of fibres, nervous & neuronal control of digestion.

### **- Circulation :**

Blood and its composition, blood group, blood clotting mechanisms, anticoagulants, heart beat, pacemaker and conducting system of heart, blood pressure, pulse, common cardiovascular diseases – ECG, angiogram, angioplasty.

### **- Respiration :**

Gas exchange, respiratory pigments, Haemoglobin, Transport of respiratory gases – Regulation of respiration - Respiratory disturbances – Apnoea, dyspnoea, hypoxia, hyper and hypo capnia, asphyxia, CO poisoning, asthma

### **- Excretion :**

Nephron – Structure, Urine formation, role of kidney in osmoregulation, composition of urine, abnormal constituents of urine, renal disorders – nephritis, haematuria, renal calculi, acidosis and alkalosis, Dialysis.

### **- Muscle Physiology :**

Types of muscles, Ultrastructure of striated muscle fibre, Muscle proteins, Muscle twitch, All or none law, Rigor mortis, Physiological and biochemical changes in muscle contraction.

### **- Nerve Physiology :**

Structure of neuron, types; Synapse – types, nerve impulse propagation, Synaptic transmission, Reflex action, Neurotransmitters, EEG. Nerve disorders – epilepsy, Parkinson's diseases, Alzheimer's.

### **- Endocrinology :**

Endocrine glands in man, hormones and disorders, mechanism of hormonal activity.

## **2 Biochemistry:**

Biomolecules – Carbohydrates, Proteins, lipids and nucleic acids – structure and classification with examples.

### **- Metabolism :**

Carbohydrate– glycogenesis, glycogenolysis, glycolysis, Krebs's cycle Electron Transport Chain.

### **- Lipid:**

Beta Oxidation – Protein – deamination, transamination, Urea formation -

### **- Enzymes:**

Mechanism of enzyme action, factors affecting enzyme action, Isoenzyme, Coenzyme, enzyme inhibition and activation.

## **3. Developmental Biology**

### **Theories :**

Preformation, Epigenesis, Recapitulation and Germplasm.

- Spermatogenesis, Oogenesis, Typical egg and Sperm.

- Types of eggs.

### **Fertilization :**

Agglutination, Amphimixis, Physiological and biochemical changes during and after fertilization, Parthenogenesis, Artificial Parthenogenesis – Arrhenotoky, Thelytoky, Obligatory and facultative; Significance of fertilization and Partheogenesis.

### **Cleavage :**

Types, Morula, blastula (different types), fate maps. Gastrula – Morphogenetic movements – concept of germ layers.

### **Cell differentiation :**

Unipotency, Pluripotency and totipotency, Gene action – Homeotic genes, Hox genes.

### **Development:**

- Man – Implantation, Pregnancy, Placentation – Different types, function.

### **Teratology:**

Definition, Causes of infection, drug and chemicals, metabolic imbalance, ionizing radiation, malnutrition, auto immunization.

### **Experimental Embryology:**

Spemann's constriction experiment, Organizer and embryonic Induction, IVF and embryo transfer in man, cloning experiment in animals – Prenatal diagnosis – Amniocentesis, Chorionic villus sampling, ultrasound scanning, stem cells – embryonic and adult – Stem cell therapy.

## **Module – III**

# **CELL AND MOLECULAR BIOLOGY, GENETICS, BIOTECHNOLOGY AND BIOINFORMATICS**

### **CELL BIOLOGY :**

Development and Scope, Cell theory and its Modern version.

Types of Cells: Prokaryotic and Eukaryotic. Ultra structure and functions of Plasma membrane, Plasma membrane model – fluid mosaic, Functions, Membrane transport, Cell communication - Modifications of Plasma membrane.

### **Cell organelles :**

Nucleus - Structure, Interphase, nuclear envelope – functions.

Nucleolus - Structure, nucleolar organizer and functions.

Mitochondria - Structure and function, Oxidative phosphorylation.

Endoplasmic reticulum - Structure and function , types.

Lysosomes - Morphology, Polymorphism and functions.

Ribosomes - Different types – sub units, functions.

Centrioles and basal bodies – Structure and function.

Microbodies – Peroxisomes, glyoxisomes, functions.

Cell division

### **MOLECULAR BIOLOGY :**

Gene expression : Central dogma in Molecular Biology, One gene – one enzyme, one gene – one polypeptide hypotheses.

Genetic code - Wobble hypothesis.

Contributions of Khorana, Nirenberg and associates, RNA polymerase, chaperones, protein synthesis.

Gene regulation: Operon concept – Lac and Trp operon.

Bacterial Recombination : - Transformation, Conjugation and Transduction.

### **GENETICS AND BIOTECHNOLOGY :**

Human Genetics: Karyotyping, pedigree analysis, chromosomal anomalies in man

a) Autosomal (e.g. Down syndrome, Edwards syndrome)

b) Allosomal (e.g. Turners and Klinefelters syndrome)

Biochemical genetics:

Disorders Phenylketonuria, alkaptonuria, albinism, tyrosinosis.

### **Biotechnology: -**

Scope of Biotechnology, Recombinant DNA Technology, Techniques in gene cloning, restriction endonucleases, ligases, major steps in cutting and joining of DNA, Probes, linkers.

Blotting Techniques

Southern, Northern and Western, DNA finger printing.

Genomic library

cDNA library, PCR, DNA sequencing

Human Genome Project

Hybridoma and monoclonal antibodies, transgenic organisms.

Practical applications

Medicine, agriculture, industry, pollution control, forensic & judiciary.

Potential hazards of Biotechnology.

## **IMMUNOLOGY AND MICROBIOLOGY**

### **Immunology:**

Immunity : Definition, Types.

### **Immune System :**

Primary and Secondary.

### **Immunogens:**

Antigens – Definition, types.

Antigen – antibody reactions.

### **Immune responses :**

Allergy – Classification.

AIDS, Autoimmunity, Vaccines.

### **MICROBIOLOGY:**

Survey of microbes – Viruses – Prions, Viroids, Bacteria, Protozoa.

- Applied microbiology in various fields.

Microbial diseases in man.

## **Module IV**

### **ECOLOGY, ETHOLOGY, EVOLUTION AND ZOOGEOGRAPHY**

#### **ECOLOGY**

Population ecology :- Properties of Population, emigration, immigration and migration, population fluctuation.

Community ecology :- Definition, Species diversity.

#### **Wildlife conservation and Management**

Threatened Species, Red data book, IUCN, WWF, CITES, Green Peace, Biosphere reserve, National Park, Sanctuaries, forests in India, importance of mangroves, hotspots.

Ecosystem – Conservation and management.

#### **Ethology**

Motivation, Learning – types, socio biology, pheromones, human pheromone.

#### **Evolution**

– Geological time scale, fossils, fossil dating and significance of fossils.

- Genetic drift, genetic equilibrium, Hardy-Weinberg law, punctuated equilibrium.
- Speciation – Sympatric and allopatric; adaptive radiation.

#### **Zoogeography**

Animal distribution – Different types, factors affecting distribution.

Zoogeographical realms – Brief account of each realm

Biogeographical classification of India – Eastern and Western Ghats.

## **Module V**

### **MICROBIOLOGY**

Bacteria: Ultra structure, reproduction, genetic recombination, economic importances (Industrial uses, food preservation and spoilage, biopesticides, biofertilizers, sewage treatment, nitrogen fixation and symbiosis), staining techniques

Viruses: structure and reproduction – RNA and DNA viruses, bacteriophages, TMV and HIV

### **MYCOLOGY AND LICHENOLOGY**

Fungi: General characteristics, reproduction and life cycle, heterothallism and parasexuality

Distinguishing characters of different classes of fungi representing the following genera:

Mastigomycotina (Pythium), Zygomycotina (Rhizopus), Ascomycotina (yeast), Basidiomycotina (Agaricus) and Deuteromycotina (Cercospora)

Economic importances of fungi: industrial, medicinal, food and agriculture ( Biofertilizers and Biocontrols)

Lichens: Economic and ecological importances, habit of crustose, foliose and fruticose lichens – homomerous and heteromerous

General account and economic importance, structure, reproduction and lifecycle of Usnea.

### **PLANT PATHOLOGY**

Principles of plant pathology – biotic and abiotic causes of plant diseases

Classification of plant diseases on the basis of causative organisms and symptoms:

Transmission and spread of diseases – quarantine regulations – disease control measures

Study of the following diseases – causal agent, symptoms, etiology and control measures : Tapioca mosaic disease, Citrus canker, Blast of paddy

### **BRYOLOGY**

Structure, reproduction and life cycle of the following types: Hepaticopsida (Riccia), Anthocerotopsida (Anthoceros), Bryopsida (Fuaria)

Economical importances of bryophytes

### **PTERIDOLOGY**

Structure, reproduction, life cycle and affinities of following types: Psilotum (Psilopsida), Selaginella (Lycopside), Equisetum (Sphenopsida) and Marsilea (Pteropsida)

Heterospory and seed habit

Affinities of pteridophytes with bryophytes and gymnosperms

Economic importances of pteridophytes - Biofertilizer

### **GYMNOSPERMS**

General characters, structure (external and internal), reproduction and life cycle of following gymnosperms – Cycas, Pinus, Gnetum

Origin and evolution of gymnosperms and their affinities with pteridophytes and angiosperms

Economic importances of gymnosperms

### **PALAEOBOTANY**

Objectives of palaeobotany, geological time scale, methods of fossilization, fossil pteridophyte (Rhynia)

## **Module VI**

### **MORPHOLOGY**

Description of various types of leaves, stem, inflorescence (racemose, cymose and mixed type), fruit (simple, multiple and aggregate) placentations (axile, marginal, free-central)

Seeds and seed dispersal

### **SYSTEMATICS**

Objectives and importances of systematic

Systems of classification: Artificial (Linnaeus), Natural (Bentham and Hooker), and Phylogenetic (Engler and Prantl)

Detailed study of Bentham and Hooker Classification

Principles and rules of plant nomenclature, ICBN

Taxonomic structure – hierarchical concept (Type, species, genus, family)

Recent trends in taxonomy: cytotaxonomy, chemotaxonomy, numerical taxonomy, molecular taxonomy

Taxonomic information resources: herbaria, botanical gardens, BSI, taxonomic literature: floras, manuals and monographs

Study the following families: Annonaceae, Malvaceae, Rutaceae, Leguminosae, Cucurbitaceae, Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Liliaceae, Orchidaceae, Poaceae

### **ECONOMIC BOTANY**

Botanical name, family, morphology of useful part of the following:

Cereals: Wheat, ragi

Pulses: Black gram, Bengal gram

Sugar: Sugar cane

Spices: Cardamom, black pepper, nutmeg

Tubers: Tapioca

Fibre: Coir, cotton, jute

Latex: Rubber

Beverages: Coffee

Medicinal: Adhatoda, Catheranthus, Rauwolfia, Phyllanthus, Neem

### **ANATOMY**

Typical structure of a plant cell

Non-living inclusions of plant cells – cystolith, raphides, aleuron grains, starch grains

Tissues: Meristematic, permanent and complex tissues

Roots and shoot apex organization

Primary and secondary structure of root, stem (monocot and dicot)

Anatomy of monocot and dicot leaf

Stomata – structure – dicot and monocot

Nodal anatomy

Structure of secondary wood – phellem, phellogen and phelloderm, lenticels and annual rings

Anomalous secondary growth – Boerhaavia, Bignonia and Dracaena

## **EMBRYOLOGY**

Microsporogenesis: Development of microsporangia, and male gametophyte

Megasporogenesis: Development of megasporangia and female gametophyte

Types of ovules: orthotropous, anatropous, campilotropous

Fertilization and endosperm formation

Endosperm formation: nuclear, cellular and helobial

Embryo – dicot and monocot embryo, polyembryony, apomixes, apospory and parthenocarpy

## **CROP IMPROVEMENT**

Objectives of plant breeding

Breeding techniques and achievements

Introduction and acclimatization

Selection - pure line selection, mass selection and clonal selection

Hybridization

Heterosis and inbreeding depression

Polyploidy breeding

Mutation breeding

Plant Propagation methods: Cutting, Budding, Grafting and Layering

## **Module VII**

### **PLANT PHYSIOLOGY**

Water in relation to plants: Water potential, diffusion, osmosis, DPD, turgor pressure, osmotic pressure, exosmosis, endosmosis, plasmolysis

Transpiration: Mechanism of guard cell movement, role of K ions, anti-transpirants

Mechanisms of water absorption, passive and active

Translocation of water: transpiration pull

Water stress and physiological consequences

Mineral nutrition – essential and non-essential elements and their role in growth and development

Mechanism of mineral absorption- active, passive and facilitated

Photosynthesis: chloroplast as photosynthetic apparatus, light phase, cyclic and non-cyclic photophosphorylation, dark reaction, C3, C4 and CAM path ways, photorespiration

Translocation of photosynthates: phloem transport, phloem loading and un-loading

Growth and Development : Concept of hormone and growth regulators on plant, hormones and their action: auxins, GA, cytokinines, ABA, ethylene

Photoperiodism, and vernalization

Photomorphogenesis, phototropism, gravitropism,

Nyctinastic, Seismonastic movement

### **METABOLISM AND BIOCHEMISTRY**

Biological nitrogen fixation, symbiotic nitrogen fixation, biochemistry of nitrogen fixation and genetics of nitrogen fixation

Biosynthesis of amino acids, reductive amination and transamination, GS/GOGAT pathways

Oxidation of fatty acids, alpha and beta oxidation of fatty acids, cellular respiration of proteins

### **CELL BIOLOGY**

Chromosomes, morphology, telomere, satellite, primary and secondary constrictions, nuclear organizer, chromosome banding, heterochromatic and euchromatic, nucleosomes, polytene and lampbrush chromosomes, chromosomal aberrations – deletion, duplication, inversion and translocation

Numerical aberrations: aneuploidy and euploidy

Cell cycle: mitosis and meiosis, significances of meiosis

### **GENTICS AND MOLECULAR BIOLOGY**

Mendel's experiments, symbols, terminology, Mendalian laws, Monohybrid cross, Dihybrid cross, backcross, Test cross, Modified Mendelian ratios inter actions of genes, epistasis, Complementary genes, Inhibitory genes, quantitative inheritance

Multiple alleles- Self sterility in nicotiana

Linkage and crossing over- 2 point and 3 point crosses, Linkage maps, Interference and co-incidence

Sex determination and Sex linked inheritance

XX-XY type, XX- XO type, Sex determination plants, criss cross inheritance, Sex limited and sex influenced traits

Extra nuclear inheritance plastid inheritance in mirabilis, coiling of shells in snails

Mutation- Types, Mutagens, Physical and Chemical, Molecular basis of Mutations, transitions, transversion, frameshift

Nucleic acids- DNA, RNA – Evidence of DNA as genetic material DNA structure Watson and Cricks model, types of DNA, A,B,Z, RNA structure types (mRNA, tRNA, rRNA)

DNA replication, enzymology of DNA replication, semi conservative mode, Meselson and Stahl's experiments, molecular mechanism of replication

Gene Expression- Genetic Code, transcription in Prokaryote and Eukaryote

Post transcriptional modifications, translation, termination

### **EVOLUTION**

Molecules and origin of life, evolution of Prokaryotic and Eukaryotic cells, Mitochondrial and endosymbiotic theory, Chloroplast and endosymbiotic theory.



Theories on origin and evolution of species, Lamarkism, Darwinism, Weismann, Devries, Neo Darwinism

## **Module VIII : ENVIRONMENTAL BIOLOGY**

### **Ecosystem**

Introduction- Basic principles and concepts of ecology and environment – Interdisciplinary approach- Scope and relevance of society and human environment. Need for public awareness- Ecosystem- Definition, ecosystems- concept of an ecosystem – structure and function of an ecosystem. A) Abiotic factors: Climate shapes the character of ecosystem- Edaphic factors- B) Biotic factors-, food chain Food web and ecological pyramids. Biogeochemical cycle: Gaseous-Carbon, Oxygen & Nitrogen. Hydrological- Water-Ecological succession- definition, types, causes of succession, process of succession. Hydrosere and Lithosere. Ecological groups of plants: Hydrophytes, Xerophytes, Halophytes, Epiphytes and Parasites (brief account only)

### **Natural resources**

Renewable and non-renewable resources. Natural resources and associated problem. Forest resources- deforestation, afforestation, - conservation- protection forestry-chipko movement- production- commercial forestry-social forestry, Agroforestry- timber extraction, mining, dams and their effects on forest, and tribal people-mineral resources- Environmental effects of extracting and using mineral resources- Water resources-use and overuse of surface water and ground water-floods, droughts- Food resources –World food problems- Energy resources.

### **Social issues and the environment**

Environmental pollution a) Definition, causes-effects and control measures. Types of pollution- Soil, Air, Water, Solid wastes-management- radioactive, noise & thermal pollution. Role of an individual in prevention of pollution. Pollution case studies. Role of pollution control board- Urban problems related to energy. Water conservation- Rain water harvesting and water shed management. Resettlement and rehabilitation of people- its problems and concerns. Environmental ethics: issues and possible solutions- Climate change and Global warming, acid rain, ozone layer depletion, nuclear accidents- Wasteland reclamation, Issues involved in enforcement of environmental legislation- Public awareness- Human population and environment- Population growth, variation among nations. Population explosion- Family welfare program. Environment and human health: Human rights- The Ecological crisis- industrialization- the human transformation of the earth- human activity is placing the biosphere under increasing stress growth of the world economy- urbanization- the vulnerable planet. World Earth summits and protocols- Rio, Kyoto. Johannesburg. The failure of ecological reforms-

### **Biodiversity and Conservation**

Biodiversity-Concepts of biodiversity- Types of biodiversity- biodiversity in India. India as mega diversity nation- hotspots of biodiversity, threats to biodiversity- Conservation of biodiversity- The conservation strategies are multidimensional- National parks, wildlife sanctuaries.

## **TISSUE CULTURE AND BIOTECHNOLOGY**

### **Plant Tissue culture**

Plant Tissue Culture- History, Principle – Totipotency, differentiation, dedifferentiation, redifferentiation. Tissue culture laboratory, Media- MS medium composition, Preparation, Sterilization techniques, Ex-plant selection, sterilization and Inoculation. Types of culture- Meristem culture, Organ culture; Sterilization and Inoculation.

## **Recombinant DNA and Molecular cloning-**

Cloning vectors – Plasmids-Bacteriophages PBR322, PUC, phage. Artificial chromosome vectors- BAC, YAC, Shuttle vectors. Construction of recombinant DNA methods.

Gene transfer technique- Vector method. Agrobacterium mediated gene transfer- Ti and Ri Plasmids; Direct DNA uptake- Electroporation – shot gun method-microinjection, lipofection.. Herbicide Resistance- drought resistance- enrichment of storage protein , Improvement of the nutritional quality of seeds.

Biotechnology and Bio ethics- Gene therapy

GMOs food safety, environmental and Biosafety issues, Concerns, Role of multi national companies in biotechnology- Agribusiness- Golden Rice, Terminator Genes. Economical and Legal issue. Bio Ethics- Patenting

## **Bioinformatics**

Bioinformatics- Introduction, scope and fields of application.

Major databases in Bioinformatics:

Nucleotide sequence databases-EMBL, DDBJ, Genbank; Protein sequence databases swiss Prot, PIR,

Database Search Engines- Entrez at NCBI of USA, SRS at EBI of England. Sequence Similarity Search:

Pair wise sequence alignment- BLAST, FASTA; Multiple sequence alignment-CLUSTALW, CLUSTAL X

Homology modeling of protein, structure prediction- Protein Data Bank. Similarity search.

Microarrays, Proteomics, Genomics and Application of bioinformatics.

Microtechnique- Principles of Microscopy, micrometry, Killing and fixing, Dehydration, Embedding, Staining, Clearing, Mounting media, wholemount, maceration.

**Biostatistics**- Measures of Central tendency- Arithmetic Mean, Median, Mode; Measures of Dispersion- Range, Standard Deviation, Standard Error; Correlation and Regression, Analysis of variance ANOVA; Application of Biostatistics.

Design of Experiment- Data collection, representation and interpretation, observation direct and indirect observations, controlled and uncontrolled observations, Human and machine observations.

## **(FOR KANNADA MEDIUM)**

### **PART A**

- **Module I : Renaissance and freedom movement**
- **Module II: Proficiency in Kannada**

### **PART B**

**Module-I -VIII same as above**

*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.*

## HIGH SCHOOL ASSISTANT (PHYSICAL SCIENCE)

### PART A

#### **Module I : Renaissance and freedom movement**

#### **Module II: General Knowledge and current affairs**

#### **Module III: Methodology of teaching the subject**

- History/conceptual development. Need and Significance, Meaning Nature and Scope of the Subject.
- Correlation with other subjects and life situations.
- Aims, Objectives, and Values of Teaching - Taxonomy of Educational Objectives - Old and revised
- Pedagogic analysis- Need, Significance and Principles.
- Planning of instruction at Secondary level- Need and importance. Psychological bases of Teaching the subject - Implications of Piaget, Bruner, Gagne, Vygotsky, Ausubel and Gardener - Individual difference, Motivation, Maxims of teaching.
- Methods and Strategies of teaching the subject- Models of Teaching, Techniques of individualising instruction.
- Curriculum - Definition, Principles, Modern trends and organizational approaches, Curriculum reforms - NCF/KCF.
- Instructional resources- Laboratory, Library, Club, Museum- Visual and Audio-Visual aids - Community based resources - e-resources - Text book, Work book and Hand book.
- Assessment; Evaluation- Concepts, Purpose, Types, Principles,  
Modern techniques - CCE and Grading- Tools and techniques -  
Qualities of a good test - Types of test items- Evaluation of projects,  
Seminars and Assignments - Achievement test, Diagnostic test –

Construction, Characteristics, interpretation and remediation.

- Teacher - Qualities and Competencies - different roles - Personal Qualities - Essential teaching skills - Microteaching - Action research.

## **PART B**

### **Module I**

Particle dynamics-Newton's laws of motion, rotational dynamics, conservation laws- Linear momentum, angular momentum, energy. Simple harmonic motion, damped and forced oscillations, wave motion-progressive waves, super position of waves, Doppler effect.

Frames of reference, special theory of relativity

Elasticity-Young's modulus, rigidity modulus, bulk modulus, surface tension, viscosity.

### **Module II**

Electrostatics, transient current, current electricity, electromagnetic induction, alternating current, magnetic properties of materials.

Semiconductor physics- diodes, transistors, amplifiers, oscillators, logic gates.

### **Module III**

Reflection, refraction, dispersion, interference, diffraction, scattering, polarization, fibre optics, lasers, basic idea of spectroscopy.

Heat and thermodynamics-conduction, convection, radiation, laws of thermodynamics, Carnot engine, entropy.

Statistical distribution-ensemble, phase space, Maxwell-Boltzmann statistics.

### **Module IV**

Bohr atom model, vector atom model, hydrogen spectra, nuclear structure and properties, radio activity, nuclear fission and fusion, elementary particles.

Crystal structure, crystal symmetry, miller indices, brevais lattice, Bragg's law, packing fraction, super conductivity.

Wave nature of matter, uncertainty principle, postulates of wave mechanics, Schrodinger equation.

### **Module V**

Eigen functions and Eigen values -Postulates of quantum mechanics Time Schrödinger wave equation - Application to particle in a one dimensional box – Normalization of wave functions - Application of Schrödinger wave equation to hydrogen atom – Conversion of cartesian coordinates to polar coordinates - Radial and angular functions (mention only) – Orbitals and concept of Quantum numbers

Energy levels in molecules - Born-Oppenheimer approximation. *Rotational, vibrational, Raman,*

*Electronic and NMR spectroscopy*: Basic Principles and applications. Elements of symmetry of molecules

Amorphous and crystalline solids , Defects in crystals - Stoichiometric and non stoichiometric defects . Ideal and non ideal solutions -Henry's law , Raoult's law - Dilute solutions - Colligative properties - Abnormal molecular mass – Van't Hoff factor.

Solubility product and common ion effect, precipitation of cations , Principles of volumetric analysis, Theories of indicators.

Principles and applications of Column chromatography, Paper chromatography, Thin layer chromatography, Ion exchange chromatography, - R<sub>f</sub> values.

Structure and applications of silicones, silicates and zeolites. Cement , Glass , Inorganic fertilizers , Rocket propellants (Brief study)

Types of pollution: Air and water. Pollutants , Control of air and water pollution

## **Module VI**

Atom Models– Planck's quantum Theory - Photoelectric effect -de Broglie's relation – Dual nature of matter and radiation, Heisenberg's uncertainty principle. Atomic orbitals and Quantum numbers - Pauling's Exclusion principle - Hund's rule of maximum multiplicity -Aufbau's principle – Electronic configuration of atoms.

Ionic bond – Properties - Born-Landé equation (derivation not expected) – Born-Haber cycle – Fajan's rules and its applications. Covalent bond - Valence bond theory–VSEPR Theory - Concept of Hybridisation —Types: sp, sp<sup>2</sup>, sp<sup>3</sup>, dsp<sup>2</sup>, sp<sup>3</sup>d, d<sup>2</sup>sp<sup>3</sup>,sp<sup>3</sup>d<sup>2</sup> - Explanation with simple examples .Molecular Orbital Theory – LCAO - Bonding and anti bonding molecular orbitals - Bond order. Theories of Metallic bonding: Free electron theory, valence bond theory and band theory (Basics concepts only).Hydrogen bond – Intra and inter molecular hydrogen bond.

Periodic laws, – Periodic properties – Electronegativity scales (Pauling and Mullikan scales) – Effective nuclear charge – Slater rule – Diagonal relationship

Representative and Transition Elements – General Characteristics, preparation and properties of simple compounds. Lanthanides and actinides

Metals: Occurrence, Concentration of ores, Refining of metals, Extractive metallurgy of Al, Fe, Ni, Cu and Ti – Classification of steel, hardening of steel.

Isomerism in coordination compounds - Werner's theory -EAN rule - Valence bond theory - Crystal field theory - Splitting of d-orbitals in octahedral, tetrahedral and square planar complexes – Applications

Organometallic Compounds: Definition, Classification and Applications

Radioactivity –Natural and artificial, Nuclear stability – N/P ratio –Nuclear forces –Half life period – Gieger Nuttal rule –Disintegration series – Transmutation , Nuclear fission and Nuclear fusion – Application of radioactive isotopes

## **Module VII**

Postulates of kinetic theory of gases - Collision number.

First law of thermodynamics – Joule-Thomson effect - Liquefaction of gases – Inversion temperature. Second law of thermodynamics - Concept of entropy - Entropy as criteria of spontaneity. Free energy functions - Hess's law, Bond energies. Third law of thermodynamics.

Law of mass action - Law of chemical equilibrium - Equilibrium constant in terms of concentration, partial pressure and mole fractions Van't Hoff's equation - Homogeneous and heterogeneous equilibria - Le Chatelier's Principle and its applications.

Rate of a reaction - Factors influencing the rate of a reaction - Rate law - Order and molecularity - Rate constants for first, second, third and zero order reactions - half life period for first order reaction - Arrhenius equation - Collision theory - Transition state theory - Homogeneous and heterogeneous catalysis - Enzyme catalysis

Photosynthesis - Simple Photochemical reactions – Fluorescence – Phosphorescence

Chemisorption and physisorption - Factors affecting adsorption - Adsorption isotherms Classification, Preparation, purification and properties of colloids, Protective colloids - Gold number - Applications of colloids.

Phase Equilibria: Components and degrees of freedom - One component and two component systems (Simple cases only)

Faraday's laws, Kohlrausch's law - Arrhenius theory, Ostwald's dilution law – Debye-Huckel - Onsager's equations for strong electrolytes, Galvanic cells, electrochemical series - Nernst equation

## **Module VIII**

Uniqueness of Carbon, Classification of organic compounds - Hybridization of carbon in organic compounds. Structural and Stereoisomerism, Baeyer strain theory, Conformation and configuration - Specific rotation – Chirality, Enantiomers, Diastereomers – Racemic mixture - Resolution methods

Inductive effect, Mesomeric effect, Hyperconjugation and Electromeric effect - Steric effect. *organic reactions*: Substitution, Addition, Elimination and Rearrangement. Mechanisms of SN1, SN2, E1 & E2

Nomenclature of organic compounds – Preparation and properties of alkanes, alkenes, alkynes, alkyl halides, alcohols, aldehydes and ketones, carboxylic acids & their derivatives.

Aromaticity, Huckel's rule - Structure and stability of benzene, Electrophilic substitution reactions in benzene with mechanisms

Grignard reagent-Preparation and synthetic applications

Classification of polymers, preparation and applications of important polymers, biodegradable polymers

Biomolecules: Carbohydrates, proteins, nucleic acids, vitamins (Classifications with examples, applications/functions)

## **(FOR KANNADA MEDIUM)**

### **PART A**

- **Module I : Renaissance and freedom movement**
- **Module II: Proficiency in Kannada**

## **PART B**

**Module-I -VIII same as above**

*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.*

## **ASSISTANT PROFESSOR IN CIVIL ENGINEERING** **(CATEGORY No. 543/2014)**

### **Module I : General Knowledge and Current Affairs**

#### **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.

#### **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.

### **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, Al-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 Chavara, 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, Kerala Varma 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

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

General Knowledge and Current Affairs

## **Module II :**

### **a) MATHEMATICS (ENGINEERING)**

**Matrices:** Rank, systems of linear equations, consistency, eigen values, eigen vectors, Cayley Hamilton Theorem, diagonalisation, linear dependence and independence of vectors.

**Partial Differentiation:** Partial derivatives, Euler's theorem on homogeneous functions, total derivatives, Jacobians, Taylor's series (one and two variables) – Maxima and minima of functions of two variables – Lagrange's method.

**Vector Differentiation:** Scalar and vector functions, differentiation of vector functions – velocity and acceleration – scalar and vector fields – operator  $\nabla$  – Gradient – Directional derivative – Divergence – Curl – irrotational and solenoidal fields – scalar potential.

**Laplace Transforms:** Transforms of elementary functions, shifting property – inverse transforms – transforms of derivatives and integrals – transform of functions multiplied by t and divided by t – convolution theorem, solution of ordinary differential equations with constant coefficients using



Laplace transforms.

**Ordinary Differential Equations:** First Order ordinary differential equations, systems of linear first order ordinary differential equations, linear ordinary differential equations of higher order with constant coefficients, linear second order ordinary differential equations with variable coefficients (Cauchy and Legendre equations), Method of Laplace transforms for solving ordinary differential equations.

**Complex Analysis:** Analytic functions, conformal mappings, bilinear transformations, complex integration, Cauchy's integral theorem and formula, Taylor and Laurent's series, residue theorem.

**Fourier Series:** Fourier series of periodic functions of period  $2\pi$  and  $2\ell$ , odd and even functions, Half range expansions.

### **b) BASIC CIVIL ENGINEERING**

Mechanics – statics – Coplanar forces – conditions of equilibrium. Support reactions – Simply supported and overhanging beams. Friction – Laws of friction – applications. Centre of gravity and moment of inertia of plane areas. Dynamics – rectilinear motion – Newton's laws of motion – curvilinear motion.

Building materials – common building materials – stone, brick, cement, steel, aggregate, concrete, timber – properties, IS specification. Building construction – types and functions of the following structural components of buildings – foundations and superstructure.

Surveying – principle of surveying – linear measurements using chain – levelling work – reduction of levels.

### **c) BASIC MECHANICAL ENGINEERING**

Zeroth, first and second laws of thermodynamics, CI and SI Engines, properties of steam. Centrifugal and reciprocating pumps, hydraulic turbines, refrigeration and air conditioning, hydro-electric, thermal and nuclear power plants, mechanical power transmission systems such as belt, rope, chain and gear, manufacturing process – casting, forging, rolling, brazing, soldering, and welding, machining process – turning, shaping, drilling, grinding and milling. Conic sections and miscellaneous curves, orthographic, isometric and perspective projections.

#### **Module III :**

### **a) BASIC ELECTRICAL ENGINEERING**

Ohm's law, Kirchoff's laws – solution of series and parallel circuits with dc excitation.

Magnetic circuits: MMF, field strength, flux density, reluctance, electromagnetic induction, Faraday's laws, Lenz's law, statically and dynamically induced emfs, self and mutual induction, co-efficient of coupling.

Principle of generation of alternating current – waveforms – frequency, period, average and rms values, form factor.

Generation of 3 phase ac voltage, star and delta connections, voltage & current relationships in star and delta (balanced system only).

Principle of operation of dc motor & generator, single phase transformer and three phase induction motor.

Types of lamps, necessity of earthing.

### **b) BASIC ELECTRONICS ENGINEERING**

Devices – working principle of PN junction, Zener diode and BJT.

Systems – Rectifiers : Half wave, Full wave and Bridge. Filters: Capacitors and Inductors.

Amplifiers & Oscillators – Common Emitter RC coupled amplifier and its frequency response.

Principles of Wein-bridge oscillator. Op-amps: Basics, inverting and non-inverting amplifier.

Communication – Need for modulation, principles of AM and FM.

Measurements – Working principles of CRO and Multimeter.

### **c) BASIC COMPUTER SCIENCE**

Functional units of a computer.

Programming in C – control structures, functions.

#### **Module IV : Mechanics of Structures**

Simple stress and strain relationship: Stress and strain in two dimensions, principal stresses, Stress transformation, Mohr's circle – Bending moment and shear force in statically determinate beams – Simple bending theory, flexural and shear stress – Thin walled pressure vessels, uniform torsion, buckling of column, combined and direct bending stresses.

Analysis of statically determinate trusses, arches, beams, cables and frames – Deflection of beams, methods – Displacements in statically determinate structures and analysis of statically indeterminate structures by force / energy methods, analysis by displacement methods (slope deflection and moment distribution methods) – influence lines for determinate and indeterminate structures – Basic concepts of matrix methods of structural analysis.

#### **Module V : Structural design, Construction and Management**

Concrete Structures – Concrete technology – properties of concrete, mix design. Concrete design – working stress and limit state design concepts – analysis of ultimate load capacity and design of members subjected to flexure, shear, compression and torsion by limit state methods. Basic elements of pre-stressed concrete, analysis of beam sections (rectangular and I sections). Design of retaining walls and water tanks. Steel structures – Analysis and design of tension and compression members, beams, beam-columns, column bases. Connections – simple and eccentric beam column connections – plate girders and trusses – Plastic analysis of beams and frames. Construction Management – Construction, planning and scheduling – Bar chart, CPM, PERT – construction equipments – construction procedures – contract, tender documents.

Building Planning – building bye laws – functional planning of buildings.

Building materials and construction – construction materials, properties, IS specifications, prefabricated structural elements.

Quantity surveying & valuation – Building construction – detailed specification, preparation of data and analysis of rates for various items of work. Type of estimates – Detailed estimate for buildings.

Valuation methods.

#### **Module VI : Fluid Mechanics and Water Resources Engineering**

Fluid mechanics and Hydraulics – Properties of fluids, Principle of conservation of mass, momentum, energy and corresponding equations, potential flow, applications of momentum and Bernoulli's equation, laminar and turbulent flow, flow in pipes – flow in open channels – uniform flow, critical flow and gradually varied flow, specific energy concept, hydraulic jump. Forces on immersed bodies, flow measurement in channels, tanks and pipes. Dimensional analysis and hydraulic modelling, kinematics of flow, velocity triangles and specific speed of pumps and turbines.

Hydrology and water Resources – Hydrologic cycle – rainfall, evaporation, infiltration, unit hydrograph. Reservoir capacity, well hydraulics.

Irrigation – duty, delta, crop water requirements – Design of lined and unlined canals – canals on alluvium, head works, gravity dams and spillways. Design of weirs on permeable foundations – Canal Head works, cross drainage works.

#### **Module VII : Transportation and Geotechnical Engineering**

Soil mechanics – soil classification, three phase system, fundamental definitions, relationship and interrelationships, permeability and seepage, effective stress principle, consolidation, compaction, shear strength.

Foundation Engineering – subsurface investigations – drilling bore holes, sampling, penetration tests,

plate load test. Earth pressure theories, effect of water table, layered soils. Stability of slopes, infinite slope, finite slope. Foundation types – foundation design requirements. Shallow foundations – bearing capacity, effect of shape, water table and other factors, stress distribution, settlement analysis in sand and clay. Pile foundations, types, dynamic and static formula load capacity of piles in sand and clay, negative skin friction.

Highway Engineering – Geometric design of highways, testing and specifications of paving materials, design of flexible and rigid pavements. Traffic Engineering – Traffic characteristics – theory of traffic flow, intersection design, traffic signs and signal design, highway capacity.

Railway Engineering – points and crossing – signalling stations and yards.

Harbour Engineering – classification – requirement and site selection – break waters – classification – docks, functions and types of docks.

Tunnelling – Transfer of centre line – methods of construction on rocks and soils, tunnel lining, ventilation, lighting and drainage.

Airport – planning and design – characteristics, component parts – site selection – runway design.

### **Module VIII : Environmental Engineering and Surveying**

Water requirements: Quality standards, basic unit processes and operation for water treatment.

Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution of water sewage and sewerage treatment, quantity and characteristics of waste water. Primary, secondary and tertiary treatment of wastewater, sludge disposal, effluent discharge standards. Domestic waste water treatment, quantity and characteristics of domestic wastewater, primary and secondary treatment. Unit operations and unit processes of domestic wastewater, sludge disposal.

Surveying: Importance of surveying, principles and classification, measurement of distances and directions, levelling, contouring, computation of areas and volumes, traversing, theodolite and plane table. Errors and adjustments, curves – vertical and horizontal.

Tacheometric survey – Stadia and tangential systems.

Photogrammetry – Heights and distances – vertical photograph – Relief displacement. Total station – types. Working principles – measurement techniques.

Hydrographic survey.

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## **ASSISTANT PROFESSOR IN INFORMATION TECHNOLOGY (CATEGORY No. 545/2014)**

### **Module I : General Knowledge and Current Affairs**

#### **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.

### **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.

### **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. Kuttankulam Sathyagraha, Temple Entry Proclamation, Temple Entry Act. Malayalee 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 Chavara, 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

## **GENERAL KNOWLEDGE AND CURRENT AFFAIRS**

General Knowledge and Current Affairs

### **Module II :**

#### **a) MATHEMATICS (ENGINEERING)**

**Matrices:** Rank, systems of linear equations, consistency, eigen values, eigen vectors, Cayley Hamilton Theorem, diagonalisation, linear dependence and independence of vectors.

**Partial Differentiation:** Partial derivatives, Euler's theorem on homogeneous functions, total derivatives, Jacobians, Taylor's series (one and two variables) – Maxima and minima of functions of two variables – Lagrange's method.

**Vector Differentiation:** Scalar and vector functions, differentiation of vector functions – velocity and acceleration – scalar and vector fields – operator  $\nabla$  – Gradient – Directional derivative – Divergence – Curl – irrotational and solenoidal fields – scalar potential.

**Laplace Transforms:** Transforms of elementary functions, shifting property – inverse transforms – transforms of derivatives and integrals – transform of functions multiplied by  $t$  and divided by  $t$  – convolution theorem, solution of ordinary differential equations with constant coefficients using Laplace transforms.

**Ordinary Differential Equations:** First Order ordinary differential equations, systems of linear first order ordinary differential equations, linear ordinary differential equations of higher order with constant coefficients, linear second order ordinary differential equations with variable coefficients (Cauchy and Legendre equations), Method of Laplace transforms for solving ordinary differential equations.

**Complex Analysis:** Analytic functions, conformal mappings, bilinear transformations, complex integration, Cauchy's integral theorem and formula, Taylor and Laurent's series, residue theorem.

**Fourier Series:** Fourier series of periodic functions of period  $2\pi$  and  $2l$ , odd and even functions, Half range expansions.

#### **b) BASIC CIVIL ENGINEERING**

Mechanics – statics – Coplanar forces – conditions of equilibrium. Support reactions – Simply supported and overhanging beams. Friction – Laws of friction – applications. Centre of gravity and moment of inertia of plane areas. Dynamics – rectilinear motion – Newton's laws of motion – curvilinear motion.

Building materials – common building materials – stone, brick, cement, steel, aggregate, concrete, timber – properties, IS specification. Building construction – types and functions of the following structural components of buildings – foundations and superstructure.

Surveying – principle of surveying – linear measurements using chain – levelling work – reduction of levels.

#### **c) BASIC MECHANICAL ENGINEERING**

Zeroth, first and second laws of thermodynamics, CI and SI Engines, properties of steam. Centrifugal and reciprocating pumps, hydraulic turbines, refrigeration and air conditioning, hydro-electric, thermal and nuclear power plants, mechanical power transmission systems such as belt, rope, chain and gear, manufacturing process – casting, forging, rolling, brazing, soldering, and welding, machining process – turning, shaping, drilling, grinding and milling. Conic sections and miscellaneous curves, orthographic, isometric and perspective projections.

### **Module III :**

#### **a) BASIC ELECTRICAL ENGINEERING**

Ohm's law, Kirchoff's laws – solution of series and parallel circuits with dc excitation.

Magnetic circuits: MMF, field strength, flux density, reluctance, electromagnetic induction, Faraday's laws, Lenz's law, statically and dynamically induced emfs, self and mutual induction, co-efficient of coupling.

Principle of generation of alternating current – waveforms – frequency, period, average and rms values, form factor.

Generation of 3 phase ac voltage, star and delta connections, voltage & current relationships in star and delta (balanced system only).

Principle of operation of dc motor & generator, single phase transformer and three phase induction motor.

Types of lamps, necessity of earthing.

### **b) BASIC ELECTRONICS ENGINEERING**

Devices – working principle of PN junction, Zener diode and BJT.

Systems – Rectifiers : Half wave, Full wave and Bridge. Filters: Capacitors and Inductors.

Amplifiers & Oscillators – Common Emitter RC coupled amplifier and its frequency response.

Principles of Wein-bridge oscillator. Op-amps: Basics, inverting and non-inverting amplifier.

Communication – Need for modulation, principles of AM and FM.

Measurements – Working principles of CRO and Multimeter.

### **c) BASIC COMPUTER SCIENCE**

Functional units of a computer.

Programming in C – control structures, functions.

#### **Module IV : Computer Organization & Architecture**

**Digital Logic:** Logic functions, minimization, design and synthesis of combinational and sequential circuits, number representation and computer arithmetic (fixed and floating point).

**Computer Organization:** Machine instructions and addressing modes, ALU, CPU control design, memory interface, I/O interface, DMA, interrupts, pipelining, memory hierarchy, parallel computer models.

**Microprocessors:** Internal architecture of 8085 and 8086, interfacing with peripheral devices, microcontrollers.

#### **Module V : Programming Languages & Information Systems**

**Object Oriented Programming:** Object oriented design concepts, programming in C++, Java.

**Databases:** ER model, relational algebra, tuple calculus, database design, integrity constraints, normalization, SQL, B-trees, B+ - trees, transactions and concurrency control.

**Software Engineering:** Software process models, planning and managing a software project, design, implementation, software testing, quality models and maintenance.

**Programming Language Concepts:** Parameter passing, binding, scope, recursion, functional and logic languages.

#### **Module VI : Data Structures & Algorithms**

**Data Structures:** Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

**Algorithms:** Analysis, space and time complexity. Design – greedy approach, dynamic programming, divide-and-conquer, sorting and searching, complexity classes – P, NP, NP-hard, NP-complete.

**Graph Theory:** Connectivity, covering, colouring, planarity, isomorphism.

**Computer Graphics:** Line drawing, circle drawing, filling, hatching, 2D/3D transformations, projections, hidden surface removal.

#### **Module VII : Computing and System Software**

**Set Theory:** Sets, relations, functions, groups, partial orders, lattice, algebraic structures.

**Theory of Computation:** Regular languages and finite automata, context-free languages & pushdown automata, recursively enumerable sets & Turing machines, undecidability.

**System Software:** Compiler design, lexical analysis, parsing, syntax directed translation, code generation and optimization, Assemblers, linkers and loaders, macroprocessors, operating systems – processes, threads, inter-process communication, synchronization, deadlocks, CPU scheduling, memory management and virtual memory, file systems, I/O systems, protection & security.

**Module VIII : Networking & Web Technology**

**Computer Networks:** Layered architecture, LAN technologies, wireless LAN, flow and error control, routing algorithms, congestion control, TCP/UDP and sockets, IPv4, IPv6, ICMP, DNS, SMTP, POP, FTP, HTTP, MIME, Hubs, switches, routers and gateways, public key and private key cryptography, digital signature, firewalls, wireless networks, 2G and 3G networks, Bluetooth.

**Web Technologies:** HTML, XML, client-server computing, web server, proxy server, web application development, MVC architecture, e-commerce, web services.

**Distributed Systems:** Characteristics, inter-process communication, distributed file systems.

**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.**