

## **Annexure XII**

(Enclosure to Notification No. 1479/SS/T9/KGBV/URS/2022, Dt:16.06.2023 of DSE & EO-SPD, TSS, Hyd.)

### **Syllabus of Written Test for Recruitment of PGCRTs in KGBVs PGCRT - Botany**

#### **Part I - General Studies**

1. Current Affairs - Regional, National & International.
2. Indian Constitution; Indian Political System: Governance and Public Policy.
3. Social Exclusion; Rights issues such as Gender, Caste, Tribe, Disability etc., and inclusive policies.
4. Society Culture, Civilization Heritage. Arts and Literature of India and Telangana
5. General Science; India's Achievements in Science and Technology
6. Environmental Issues; Disaster Management- Prevention and Mitigation Strategies and Sustainable Development.
7. Economic and Social Development of India and Telangana.
8. Socio-economic, Political and Cultural History of Telangana with special emphasis on Telangana Statehood Movement and formation of Telangana state.

#### **Part II – Basic Proficiency in English**

1. School Level English Grammar:

Articles; Tenses; Noun & Pronouns; Adjectives; Adverbs; Verbs; Modals; Subject-verb Agreement; Non-finites; Reported Speech; Degrees of Comparison; Active and Passive Voice; Prepositions; Conjunctions; Conditionals.

2. Vocabulary:

Synonyms and Antonyms; Phrasal Verbs; Related Pair of Words; Idioms and Phrases; Proverbs.

3. Words and Sentences:

Use of Words; Choosing appropriate words and words often confused; Sentence Arrangement, Completion, Fillers and Improvement; Transformation of Sentences; Comprehension; Punctuation; Spelling Test; Spotting of Errors.

### Part III - Perspectives in Education

1. **History of Education:** Pre-Vedic and Post-Vedic period, Medieval period Recommendations of various Committees during British period with special reference to Woods Despatch (1854), Hunter Commission (1882), Hartog Committee (1929), Sargent Committee (1944), Recommendations of various Committees in the post independent period with special reference to Mudaliar Commission (1952-53), Kothari Commission (1964-66), Ishwarbhai Patel Committee (1977), National Policy on Education, 1968, National Policy on Education, 1986, Programme of Action, 1992 and National Educational Policy, 2020.

Aims, Objectives, Functions, Unipolar, Bipolar and Tripolar Processes of Education, Types of Education - Formal, Informal and Non-formal Education, their significance and interrelations, Philosophical, Sociological and Psychological Perspectives of Education.

2. **Teacher Education:** Concept, Teacher Preparation, NCFTE-2009, Pre-service and In service Teacher Education Programs, Teacher Motivation, Continuous Professional Development.

**Teacher Empowerment:** Meaning, Interventions for Empowerment, Professional Code of Conduct for Teachers, Role of Teacher Organisations in Professional Development of Teachers, National and State Level Institutions for Teacher Education.

3. **Educational Concerns in Contemporary India:**

**Environmental Education:** Meaning, Scope of Environmental Education, Concept of Sustainable Development, Role of Teacher, School and NGOs in Development and Protection of Environment; **Democracy and Education:** Equality, Equity, Equality of Educational Opportunities, Role of Education in promoting Democracy; **Economics of Education:** Meaning and Scope, Education as Human Capital, Education and Human Resource Development; **Population Education:** Significance of Population Education. Population situation, Approaches to Population Education and Themes of Population Education, Family Life Education, Sustainable development, Adolescence Education, Health Education, Gender Equality, Equity and Empowerment of Women, the Role of School and Teacher, Urbanization and Migration, Life Skills; **Inclusive Education:** Concept, Prevalence, Areas of Disabilities, Disadvantaged Groups, Gender etc., Myths & Facts, Importance of Early Identification and Assessment, Planning Inclusive

Education, Initiatives in Education, Method & Strategies of Classroom Management, Psycho-Social Management, Creation of Awareness – Students, Parents and Society & Sensitization Strategies, Evaluation, Documentation and Maintenance of Records; **Liberalization, Privatization and Globalization; Value Education; Initiatives in Education:** Sarva Siksha Abhiyan (SSA), National Programme for Education of Girls at Elementary Level (NPEGEL), Mid-day-Meal Programme, Rashtriya Madhyamika Siksha Abhiyan (RMSA), Samagra Shiksha and its interventions, KGBVS and Model Schools etc.

4. Constitutional Provisions relevant to Education: Acts/Rights, Right of Children to Free and Compulsory Education Act, 2009, Right to Information Act 2005, Child Rights, Human Rights, PWD Act, 2016 and other Provisions pertaining to Education.
5. National Curriculum Framework, 2005 and NCFSE, 2023.

#### **Part IV - Content**

- I.** Nature, Scope and Meaning of Botany, Branches of Botany, Levels and Hierarchy of Classification, Five kingdom (Whittaker's) classification, Identification, Nomenclature, Species Concept, Kingdom Plantae, Diversity in living world.
- II. Monera & Protista:** Bacteria, Cyanobacteria, Slime moulds, Protozoans, Dinoflagellates - Ultrastructure cell wall, nutritional types, reproduction.  
**Viruses-** Characters and ultra structure of virions and transmission of plant viruses: Microbes in medicine, agriculture and environment.
- III. Phycology** - Thallus organization cell ultra structure Reproduction (Vegetative, Asexual Sexual) criteria for classification of Algae - pigments, reserve food, flagella classification of Algae, Salient features of Chlorophyta, Phaeophyta and Rhodophyta. Algal blooms and toxic algae, algal Biofertilizers algae as food and feed, role of algae in industry.
- IV. Mycology** - General characters of Fungi: substrate relationship in fungi, cell ultra structure, unicellular and multicellular organization, composition of cell wall, nutrition (saprophytic, parasitic & symbiotic) reproduction (Vegetative, Asexual, Sexual) Heterothallism, heterokaryosis, parasexuality Molecular aspects in classification. General account of Mastigomycotina, Zygomycotina, Ascomycotina. Basidiomycotina, Deuteromycotina fungi in industry, medicine and as food fungal diseases in plants and humans Mycorrhizae fungi as bio-control agents.

## V. **Bryophyta, Pteridophyta and Gymnosperms.**

**Bryophyta** - Morphology, structure, reproduction and life history distribution and classification of Marchantiales, Jungermaniales, Anthocerotales, Sphagnales. Funariales and Polytricales, economic and ecological importance

**Pteridophyta** - Morphology, anatomy and reproduction classification of Psilopsida Lycopsidea, Sphenopsida and Pteropsida: Evolution of stele Heterospory and origin of seed habit, General account of fossil Pteridophytes

**Gymnosperms** - Introduction and classification. Structure and reproduction of Cycadales, Ginkgoales, Coniferales, Ephedrales, Welwitschiales and Gnetales, Different Life cycles of plants and alternation of generations.

## VI. **Morphology of Flowering Plants:** Root, stem, leaf – structure and modifications, inflorescence - types, detailed structure of a typical flower and floral parts, types of fruit and the seed.

**Reproduction in flowering plants:** Types (Vegetative, Asexual and Sexual), Life cycle of a typical angiospermic plant, Sexual reproduction in flowering plants, pollination and fertilization

## VII. **Plant systematics - Taxonomy of Angiosperms**

The species concept, Taxonomic hierarchy, different categories of taxon, Salient features of the international Code of Botanical nomenclature (ICBN), Taxonomical aids/tools: Herbarium, Floras, Botanical gardens, Museum, Key, histological, cytological, phytochemical, serological, biochemical and molecular techniques.

**Different Systems of Classifications:** Major systems of classifications and their merits and demerits. Detailed study of the following families: **Fabaceae, Solanaceae** and **Liliaceae**.

## VIII. **Plant Anatomy and Embryology :**

**Shoot and root development:** Organization of the Shoot Apical Meristem (SAM), organization of Root Apical Meristem (RAM), tissue differentiation especially xylem and phloem, secretory ducts and laticifers, Phyllotaxy and leaf differentiation,

different types of plant tissues- Simple, Complex, Special tissues, Organisation vascular bundles and types, Anatomy of Root, Stem and Leaf.

**Pollination and fertilization:** Pollination types - Self and cross pollination, Floral characteristics pollination mechanisms and vectors; self-incompatibility and their contrivances.

**Male gametophyte** Structure of anthers, microsporogenesis, role of tapetum, pollen development, male sterility sperm dimorphism and hybrid seed production pollen, germination pollen tube growth

**Female gametophyte.** Ovule development, megasporogenesis, organization of the embryo sac, structure of the embryo sac and its cells. Double fertilization and triple fusion. Seed development and fruit growth Endosperm development during early, maturation and desiccation stages; embryogenesis, cell lineages during late embryo development storage proteins of endosperm and embryo, polyembryony, apomixes; embryo culture that maturation Dormancy Seed dormancy, overcoming seed dormancy, bud dormancy.

## **IX. Plant Resource Utilisation and Conservation**

Origin and evolution- cultivation and uses of (i) Food forage and fodder crops (ii) forage crops (iii) medicinal and aromatic plants and (v) vegetable yielding crops. Ethnobotany- Scope and objectives of Ethnobotany, important fire-wood and timber yielding plants and non-wood forest products (NWFPs) such as bamboos, raw materials for paper-making, gums, tannins, dyes, resins (secondary metabolites) and different types of fruits. Role of plants in Medicine morphology, active principles and medicinal value of the following plants- *Andrographis*, *Asparagus*, *Phyllanthus*, *Gymnema*.

Strategies for conservation in situ conservation International efforts and Indian protected areas in India sanctuaries, national parks, biosphere reserves. wetlands mangroves and coral reefs for conservation of wild biodiversity. Strategies for conservation ex-situ conservation Principles and practices, botanical gardens, field gene banks, seed banks, in vitro repositories, cryobanks.

General account of the activities of different National and international institutes related to Biology: Botanical Survey of India (BSI). National Bureau of Plant Genetic Resources (NBPGR), Indian Council of Agricultural Research (ICAR), Council of

Scientific and industrial Research (CSIR) and the Department of Biotechnology (DBT), ICRISAT, CIMAP, IARI, ICMR, IRRI - conservation, non-formal conservation efforts

## **X. Plant Ecology**

Climate, soil and vegetation patterns of the world, Life zones, major biomes and major vegetation and soil types of the world. Vegetation organization, Concepts of community, Population characters, interactions of species- positive and negative interactions of species, Ecological succession types, changes involved in succession, concept of climax, Biotic and abiotic interactions, habitat and niche, Allopatric and Sympatric speciation, Ecosystem organization, Structure and functions primary production, methods of measurement of primary production, energy dynamics (trophic organization energy flow Pathways, ecological efficiencies) food chains, food web and ecological pyramids, biogeochemical cycles of C,N,CO<sub>2</sub> & O<sub>2</sub> in terrestrial and aquatic ecosystems, Biodiversity Concept- speciation and extinction IUCN categories of distribution and global patterns, hot spots, endemism.

**Air, water and soil pollution:** sources, effects on plants, animals and ecosystems.

Climate change: Green house gases (CO, CO<sub>2</sub> CH<sub>4</sub>, CFCs sources and their role). Ozone layer- Its role and causes and consequences of O<sub>3</sub>- depletion, consequences of climate change (Global warming, sea level rise, UV radiation), Bio-geographical zones of India, Flora of Telangana- vegetation types.

## **XI. Cell Biology**

Ultrastructure of a typical plant cell: structure and functions of cell organelles- Cell wall, Plasma membrane, Plasmodesmata, Protoplasm, Nucleus, Cytoplasm, Chloroplasts, Mitochondria, Endoplasmic Reticulum, Ribosomes, Golgi apparatus, Lysosomes, Vacuoles, microbodies.

**Cell cycle and types:** Mitosis and Meiosis- their significance

### **Cytogenetics**

Chromatin organization Chromosome structure and Packaging of DNA molecular organization of centromeres and telomeres: nucleolus and ribosomal RNA (r-RNA) genes Euchromatin and Heterochromatin Karyotype, types of chromosomes Polytene,

Lampbrush B-chromosomes and sex chromosomes, molecular basis of chromosome pairing.

**Mutations** Spontaneous and induced mutations, physical and chemical mutagens, molecular basis of gene mutations, transposable elements in prokaryotes and eukaryotes, induced transposons, site-directed mutagenesis DNA damage and repair mechanisms, Structural and numerical alterations in chromosomes- Duplication, deficiency, inversion and translocation, autopolyploids, allopolyploids, evolution of major crop plants

Genetics of Prokaryotes and Eukaryotic organelles, genetic recombination in phage genetic transformation, conjugation and transduction in bacteria, Gene structure and expression Genetic fine structure cis-trans test Benzers experiment: introns and their significance RNA splicing regulation of gene expression in prokaryotes and eukaryotes

**XII. Plant Physiology-** Fundamentals of enzymology General aspects allosteric mechanism regulatory and active sites, isoenzymes, kinetics of enzymatic catalysis, Michaelis Menton equation and significance

**Membrane transport** and translocation of water and solutes Plant water relations mechanism of water transport through xylem, passive and active solute transport membrane transport proteins.

**Photochemistry and photosynthesis** : Photosynthetic pigments and light harvesting complexes, photolysis of water, mechanisms of electron and proton transport, carbon assimilation- Calvin cycle (C<sub>3</sub>-cycle), C<sub>4</sub>-cycle, CAM pathway, Photorespiration and its significance, biosynthesis of starch and sucrose.

**Respiration and lipid metabolism:** Aerobic and anaerobic, Glycolysis, TCA cycle, Electron Transport System and ATP synthesis, Fermentation, Pentose Phosphate Pathway, Glyoxylate Cycle, alternative oxidase system structure and function of lipids, fatty acid biosynthesis, synthesis of membrane lipids, Structural lipids and storage lipids and the catabolism

**Nitrogen fixation and metabolism:** Biological Nitrogen fixation, nodule formation and nod factors, mechanism of nitrate uptake and reduction, Ammonium assimilation, Photobiology Photochromes and cryptochromes, photophysiology of light induce responses.

**Plant growth regulators:** Physiological effects of Auxins, Gibberellins, Cytokinins, Ethylene, Abscisic Acid (ABA), The flowering process, Photoperiodism, endogenous clock and its regulation floral induction and development, Vernalization

**XIII. Biotechnology and Genetic Engineering:** Plant Biotechnology Principles, scope and applications, Plant cell and tissue culture General introduction scope, cellular differentiation, and Organogenesis and adventives embryogenesis Morphogenesis, somatic embryogenesis, Somatic hybridization Protoplast isolation, fusion and culture. Applications of plant tissue culture Clonal propagation, artificial seed, production of hybrids and soma clones, production of secondary metabolites, Tissue culture, Single Cell Proteins (SCP)

**Genetic Engineering:** Cryopreservation and germplasm storage, Recombinant DNA technology (r-DNA technology) Gene cloning principles and techniques, genomic/ c-DNA, vectors, DNA synthesis and sequencing, polymerase chain reaction. DNA-fingerprinting and DNA markers, transgenic plants. Methods of gene transfer *Agrobacterium* mediated, chloroplast transformation intellectual property rights, Role microbes in Human welfare- production of antibiotics & fermentation products at industrial level, Bio-fuels, Bio-gas, Bio-fertilizers, Bio- pesticides, sewage treatment, Biological control, ecological risks, challenges and ethical concerns.

## **Part V - Pedagogy**

### **Unit-I - Nature of Science:**

The Nature and scope of Science, The History and Development of Science, including the eminent contributions of important Biologists – Aristotle, William Harvey, Lamarck, Charles Darwin, J.C. Bose, M.S. Swaminathan, Birbal Sahni, Elizabeth Blackburn, Recent advancement in Biological Science, Biological Science in Everyday Life.

### **Unit-II - Aims of Learning Biological Science:**

Values, Aims and Objectives of Teaching Biological Science, Knowledge and understanding through Science, Nurturing Process, Skills of Science, Development of Scientific Attitude and Scientific Temper, Respect for Evidence, Open Mindedness, Truthfulness in reporting observations, Critical thinking, Logical thinking, Skepticism, Objectivity, Perseverance, Role of Science Teacher, Relating Biological Science Education to Physical Science and Social Environment, Technology, Society and Environment.



### **Unit-III - Learning objectives of Biological science:**

Meaning of Learning objectives, Developing of Learning objectives and features well developed learning objectives, Bloom's Taxonomy of Educational objectives, specific / behavioral / instructional objectives, Anderson and Krathwohl's Taxonomy, Academic Standards in Biological Science.

### **Unit-IV - Biological Sciences Curriculum:**

Historical of Development of Curriculum Framework, Curriculum Framework - Curriculum and Syllabus, Principles of Curriculum construction in Biological Science, Organization of subject matter – different approaches - correlated, integrated, topical, concentric, unit and chronological. Recommendations of NCF-2005 and TSCF -2011 on Science Curriculum National Focus Group Position Paper on Science and State Position Paper (2011) on Science, Constructivist approach in Biological Science, Trends of Science Curriculum / Syllabus, moving from Textbook to Teaching-Learning Materials, going beyond the Textbook, Print Resources: Textbooks, Popular Science Books, Journals and Magazines, Edger Dale's Cone of Experiences-Using the Cone of Experience, Teacher as Curriculum Developer.

### **Unit-V - Approaches and Methods of teaching Biological Science:**

Lecture method, Lecture cum Demonstration method, Historical method, Heuristic method, Project method, Laboratory method, Problem Solving method, Scientific method, Microteaching, Team teaching, Inductive and Deductive Approaches, Constructivist Approach- 5 E Learning Model, Collaborative Learning Approach (CLA), Problem Solving Approach (PSA), Concept Mapping, Experiential Learning, Multimedia approach in teaching learning process and Programmed learning, Computer Assistant Instruction (CAI) and Computer Aided Learning (CAL).

### **Unit-VI - Planning for Effective Instruction in Biological Science:**

Year plan, Unit plan, Lesson plan, Learning experiences, Characteristics, Classification, Source and relevance, Teaching Learning Material (TLM) – Characteristics and importance, Principles to be followed in preparation and usage, Classification, Types, Hardware and Software in TLM, Planning ICT applications.

## **Unit-VII – Community and Learning Resources**

Using Community Resources - Bringing community to the class, taking class to the community: Field visit, Pooling of Learning Resources, Teaching Learning Material and Improvisation of Apparatus, Science Kits, Laboratory as a Learning Resource, different forms of ICT and its applications in Biological Science Education – Audio aids, Video aids, Educational TV, Use of computer for simulation, internet and Open Learning Resources.

## **Unit-VIII – Assessment and Evaluation in Biological Sciences:**

Test, Examination, Measurement, Assessment and Evaluation, Continuous and Comprehensive Evaluation (CCE), Performance Based Assessment, Assessment Framework - Purpose of assessment, Learning Indicators, Tools and Techniques of Assessment - Written test, Project work, Field trips and field diary, Laboratory work, Interview/Oral test, Journal writing, Concept mapping, Use of Rubrics, Recording and Reporting of the project work, Technical and Academic Guidance, Measurement of students' achievements, Grading system, Measurement of process skills, Portfolio: Its role in evaluating students' performance, Assessment as a reflecting process, Assessment of Learning of Students with special needs.

## **Unit-IX - Pedagogical Shift in Biological Science:**

Pedagogical Shift: Science as Fixed Body of Knowledge to the Process of Constructing, Knowledge, Learners, learning and teachers, Scientific method to Science as inquiry, Inclusion- Science curriculum, Diversity in class approaches, Information and Communication Technology (ICT), Continues Professional Development (CPD): Role of reflective practices in professional development of biological teachers, Content-cum-methodology: Meaning, Concept & Nature.

## **Unit-X – Child Development**

Psychology of teaching and learning of Biological Science, Learning disabilities – Difficulties in education of Exceptional and disable children.