RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS FOR COMPETITIVE EXAMINATION FOR THE POST OF ASSISTANT PROFESSOR IN BOTANY FOR COLLEGE EDUCATION DEPARTMENT

PAPER-I

1 Archaebacteria, eubacteria and cyanobacteria - ultra-structure and reproduction; L-Form Bacteria, Prions, Viroids, Virusoids; Characteristics and ultrastructure of virions; Mycoplasma, Spiroplasma and Phytoplasma - General characters and role in causing plant diseases; Microbiology of water, air and soil.

2 General account of diseases caused by plant pathogens; molecular basis of host parasite interaction, pathogen attack and defense mechanism; etiology of red rot of sugarcane, rust of wheat, covered smut of wheat, loose smut of wheat, green ear disease of bajra, leaf spot and smut of jowar, ergot and smut of bajra, root knot and rot diseases of vegetables; disease control and the role of information technology in disease management.

3 Algae of diversified habitats (Terrestrial, Fresh water, Marine); Thallus organization, cell structure and reproduction in different classes/groups; Criteria of classification of algae; Economic importance of algae.

4 General characteristics of different classes/groups of fungi, cell ultrastructure, cell wall composition, reproduction, heterothallism, para sexuality, recent trends in classification, economic importance of fungi; General account and economic importance of mycorrhiza and lichens.

5 General characters, structure, reproduction, evolution and inter-relationships of bryophytes, pteridophytes and gymnosperms. Evolution of stele, heterospory and seed habit; Principles of palaeobotany.

6 Taxonomic hierarchy, principles of nomenclature, taxonomic tools, important systems of classification (Bentham and Hooker; Engler and Prantl; Hutchinson and Takhtajan). Role of morphology, anatomy, embryology, palynology, cytology, phytochemistry, genome analysis and nucleic acid hybridization in taxonomy. Taxonomy of some selected families (Leguminosae, Cucurbitaceae, Asteraceae, Asclepiadaceae, Solanaceae, Euphorbiaceae and Poaceae). Phylogeny of angiosperms.

7 General concepts of plant morphology, origin and evolution of flower - Primitive living angiosperms, foliar stamens, open carpels. Plant anatomy – types of tissue; Organization of root and shoot apical meristems; Secondary growth (normal and anomalous) and Anomalous primary structures of root and stem.

8 Development of male and female gametophytes, pollination, pollen pistil interaction, fertilization, endosperm development and embryogenesis**;** seed development and fruit formation; polyembryony, apomixis, embryo culture**;** biochemistry and molecular biology of fruit maturation.

9 Basic concepts of ecology, ecological factors affecting the plants. Principle of limiting factors; population characteristics, population interaction, r and K selection, genecology and range extensions, community characteristics, community classification, continuum concept, ecological niche, plant succession in various habitats, concept of climax. Structure and function of ecosystem, energy flow and biogeochemical cycles (N,P,C,S), primary production, plant indicators, major biomes of the world. Phytogeographical regions of India, vegetation of Rajasthan. Ecosystem services.

10 Environmental pollution- air, water, noise and soil; Greenhouse effect, Ozone layer depletion, Acid rain; Concept of biodiversity with special reference to India, Hot spots, Rare, Endangered and Endemic plant species of Rajasthan, strategies for conservation of the flora. Bio-monitoring. Environmental Impact Assessment.

11 Plant civilization, centers of diversity/origin of crop plants, gene diversity Utilization, cultivation and improvement of food plants (rice, wheat, bajra, pulses, green-gram, moth and beans)**,** Oil seeds (mustard, soybean and ground nut), drugs (*Rauvolfia*, *Ephedra*, *Papaver*, *Atropa*, *Cinchona and Withania*), fibre (cotton, jute and coir) and plants of industrial value (Tobacco, sugarcane, tea and coffee). Ethnobotany, under-exploited plants of potential medicinal and food value with special reference to Rajasthan.

12 Bright field Microscopy, Electron microscopy (TEM & SEM), Confocal microscopy, phase contrast microscopy; Fixation (of lower and higher plant groups) and staining techniques (for bright field microscopy, cytology and bacterial staining); Chromatography, Electrophoresis, ELISA, Spectrophotometry, centrifugation.

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Note :- **Pattern of Question Paper**

1. **Objective type paper**
2. **Maximum Marks : 75**
3. **Number of Questions : 150**
4. **Duration of Paper : Three Hours**
5. **All questions carry equal marks.**
6. **Medium of Competitive Exam: Bilingual in English & Hindi**
7. **There will be Negative Marking.**

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PAPER-II

1 Plant-water relation, membrane transport and translocation of water and solutes.

2 Enzymes– General characteristics, Classification, mechanism of action, kinetics of enzymatic catalysis, regulation of enzyme activity, active sites, coenzymes, activators and inhibitors, isozymes.

3 Photosynthesis- Pigments, photophosphorylation, Mechanism of photosynthesis, photorespiration, photosynthesis in C_4 plants, CAM.

4 Nitrogen fixation and Nitrogen metabolism. Fatty acid metabolism. Signal transduction: overview, receptors and G-proteins, phospholipid signaling, second messengers, two-component sensor-regulator system in bacteria and plants.

5 Respiration- Glycolysis, TCA cycle, Oxidative phosphorylation, Glycogen breakdown, inter conversion of hexoses and pentoses.

6 Seed dormancy and germination. Concept of growth and development. Physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid and jasmonic acid. Plant rhythms and biological clock. Secondary metabolites. Plant responses to biotic and abiotic stresses. Physiology of flowering- Photoperiodism and Vernalization.

7 Ultrastructure of prokaryotic and eukaryotic cells; Cell membrane- structure and function; Cell organelles- structure and functions; Ultrastructure of nucleus; DNA: Structure, A, B and Z forms, replication, damage and repair; Cells cycle; Structure of chromatin and its organization; Special types of chromosomes; Banding patterns; Chromosomal aberrations and numerical chromosome abnormalities.

8 Genetics of prokaryotes and eukaryotic organelles; Mapping of bacteriophage genome; Genetic transformation, Conjugation and Transduction in bacteria; Cytoplasmic male sterility. Mendelism, Allelic and non-allelic gene interactions.

9 Techniques in cell biology-*in situ* hybridization, FISH, GISH. Genetic code, transcription and translation, RNA processing; Teminism; Regulation of gene expression in prokaryotes and eukaryotes; Genetic mapping; Independent assortment and crossing over, molecular mechanism of recombination, genetic markers. Mutations, molecular basis of spontaneous and induced mutations and their role in evolution. Principles of plant breeding, important conventional

methods of self and cross pollinated and vegetatively propagated crops; Mutation breeding.

10 Basic concepts, principles and scope of Biotechnology, plant cell and tissue culture. Concept of totipotency; Micropropagation by axillary bud proliferation and adventitious shoot bud differentiation; Embryogenesis and organogenesis; Somatic hybridization, protoplast- isolation, fusion and culture; Artificial seeds; Somaclones and somatic hybrids; *in-vitro* production of secondary metabolites and bioactive compounds.

11 Recombinant DNA Technology: Restriction enzymes, Gene cloning- principles and techniques; construction of gene library (genome and cDNA library); DNA sequencing, polymerase chain reaction, RT-PCR, DNA finger printing. Genetic engineering of plants: Aims and strategies for development of transgenics, Methods of gene transfer in plants, intellectual property rights and possible ecological risks and ethical concerns. Microbial genetic manipulation. Structural and functional genomics, microarray, genome sequencing projects (with special reference to rice, wheat, chick pea and tomato) and proteomics.

12 Principles and practices of statistical methods in biological research, samples and population, Data collection and processing in research; Basic statistics (averages, statistics of dispersion, coefficient of variation, standard error and deviation); Confidence limits, Probability, Distribution (Binomial, Poisson and Normal), Tests of statistical significance, Simple Correlation and Regression, Analysis of Variance.

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