

**RAJASTHAN PUBLIC SERVICE COMMISSION**  
**Syllabus for screening test for the Post of**  
**Assistant Agriculture Research Officer (Botany)**  
**Agriculture Department**

**Cytology:** Structure of cell and cell organelles and their functions, cell division (Mitosis and meiosis), chromosome structure and chromatin organization, chromosomal aberrations, structure and properties of nucleic acid, genetic code, DNA transcription and its regulation.

**Genetics :** Mendelian genetics, gene interactions, chi-square test, qualitative and quantitative traits, gene structure and expression, linkage and crossing over, chromosomal theory of inheritance, multiple alleles, Sex linked, sex-influenced and sex-limited traits, extra chromosomal inheritance, euploids and aneuploids, genetic material in organisms, mechanism of recombination in prokaryote, cytoplasmic inheritance, Hardy-Weinberg law and factors affecting gene and genotypic frequencies, , principles of Analysis of Variance (ANOVA), random and fixed models, comparison of means and variances for significance, Commonly used designs: RBD and CRD for plant breeding experiments, nature of gene action - additive, dominance, epistatic and linkage effects,  $D^2$  statistics, components of genetic variance, phenotypic and genotypic correlations, path analysis, selection indices, heritability and genetic advance, concept of combining ability and gene action, mating designs (diallel, partial diallel, line x tester analysis, NCDs and TTC), , GxE interaction, AMMI analysis, germplasm documentation and their implications in genetics and plant breeding.

**Plant Breeding:** History of plant Breeding (pre and post-Mendelian era), objective of plant breeding, characteristics improved by plant breeding, Pattern of evolution in crop plants, centre of origin-biodiversity and its significance, genetic basis of breeding self and cross pollinated crops including mating systems and response to selection, nature of variability, components of variation; Plant introduction, domestication and centres of origin, plant genetic resources. Pure line theory, Breeding methods in self pollinated crops: pure line selection and mass selection methods, line breeding, pedigree, bulk, backcross, single seed descent and multiline method, population breeding in self pollinated crops, breeding method in cross pollinated crops, population breeding mass selection and ear-to-row methods,  $S_1$  and  $S_2$  progeny testing, progeny selection schemes, recurrent selection scheme for intra and inter population and improvement and development of synthetics and composites, genetical and physiological basis of heterosis and inbreeding, population of inbreds, breeding approaches for improvement of inbreds, predicting hybrid performance, seed production of hybrid and their parent varieties/inbreds, hybrids, composite and synthetic varieties, breeding methods in asexually/ clonally propagated crops, clonal selection apomixes, clonal selection, self-incompatibility and male sterility in crop plants and their commercial exploitation, crop ideotype breeding.

**Plant genetic resources and seed technology:** Domestication, germplasm and genetic diversity, gene pool concept, centres of origin, conservation of germplasm, fundamentals of germplasm exploration, conservation and exchange, plant genetic resources for food & agriculture, PGR and benefit sharing, IPR, PBR, UPOV, CBD and PPV&FR, seed structure, development of seed industry in India, classes of improved seeds, requirements for certified and foundation seed, objectives & principles of seed production, categories of seed, maintenance breeding & seed

production in cereals, pulses, oil seeds, fibre & forage crops, seed certification and seed standards, seed processing, storage, marketing and distribution, variety development, release and notification, seeds act and law enforcement, new seed act seed policy, DUS testing, national and international institutes related to germplasm conservation and exploration.

**Biotechnology:** Tissue culture and micropropagation techniques, molecular markers, marker-assisted selection for quantitative and qualitative traits, QTLs analysis in crop plants, Marker assisted backcross breeding for rapid regression, gene pyramiding, recombinant DNA technology, identification and isolation of desired gene/DNA, transgenes, method of transformation, production of transgenic plants, methods of gene transfer, bioinformatics.

**Botany and breeding of crops:** Structure and functions of different morphological parts of a plant and their modifications including their histology. Different methods of classification of plants. Botany and taxonomy, chromosome number, center of origin, species relationship, floral biology, breeding objectives, disease and pest resistance and quality improvement, conventional and non-conventional breeding methods, important varieties and future thrust area in crops like economic importance of wheat, rice, maize, pearl millet, gram, greengram, cowpea, groundnut, mustard, potato, cotton, coriander, and fenugreek.

**Mutation breeding:** History, nature and classification, mutagenic agents, effect of mutation on DNA, DNA repair mechanisms, observing mutagen effect in  $M_1$  and  $M_2$  generations, use of mutagens in creating oligogenic and polygenic variations, use of mutagen in genomics, allele mining.

\*\*\*\*\*

**Pattern of question papers:**

1. Objective Type Paper.
2. Maximum Marks : 100
3. Number of Question : 100
4. Duration of Paper : Two Hours
5. All Question carry equal Marks.
6. There will be Negative Marking.

\*\*\*\*\*