

# **RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER**

## **SYLLABUS FOR SCREENING TEST FOR THE POST OF ASSISTANT AGRICULTURE RESEARCH OFFICER (BOTANY) AGRICULTURE DEPARTMENT**

### **PART-A**

#### **General Knowledge of Rajasthan**

##### **Unit-I**

Historical Rajasthan: Pre and Proto-historical sites of Rajasthan. Important historical centers of early Christian Era. Prominent rulers of major Rajput dynasties of Rajasthan and their achievements & contributions – Guhilas- Sisodiyas, Chauhans, Rathores and Kachchawas.

Emergence of Modern Rajasthan: Agents of Social Awakening in Rajasthan during 19<sup>th</sup> and 20<sup>th</sup> Centuries. Political Awakening: role of newspapers and political institutions. Praja Mandal movement in various princely states in 20<sup>th</sup> century. Integration of Rajasthan.

Art of Rajasthan: Architectural tradition of Rajasthan- temples, forts and palaces from ancient to modern period; Various schools of paintings developed during medieval period; Classical Music and Classical Dance, Folk Music & Instruments; Folk Dances & Drama.

Language & Literature: Dialects of Rajasthani language, Literature of Rajasthani language and Folk literature.

Religious life: Religious communities, Saints and Sects in Rajasthan. Folk Deities of Rajasthan.

Social Life in Rajasthan: Fairs and festivals; Social customs and traditions; attires and ornaments.

Geography of Rajasthan:- Broad physical features- Mountains, Plateaus, Plains & Desert; Major Climatic types; Major rivers and lakes; Major forest types and distribution; Population growth, Density and Distribution; Desertification, Droughts & Floods; Environmental pollution and Ecological concerns. **- 30 Questions**

**PART-B**  
**(BOTANY)**

- 1. Cytology:** Ultrastructure structure of cell and cell organelles and their functions, cell division (mitosis and meiosis), chromosome structure and chromatin organization, interphase nucleus, chromosomal aberrations, structure and properties of nucleic acid, genetic code, DNA transcription and its regulation.
- 2. Genetics:** Beginning of genetics, early concepts of inheritance, 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, extrachromosomal inheritance, euploids and aneuploids, genetic material in organisms, mechanism of recombination in prokaryote, cytoplasmic inheritance, DNA organization in eukaryotic chromosomes – DNA content variation, types of DNA sequences – unique and repetitive sequences; gene amplification and its significance; proteomics and protein-protein interaction, split genes, transposable genetic elements, overlapping genes, pseudogenes, oncogenes, gene families and clusters, regulation of gene activity in prokaryotes; molecular mechanisms of mutation, repair and suppression; molecular chaperones and gene expression. gene regulation in eukaryotes, RNA editing, genomics, functional and pharmacogenomics; metagenomics, signal transduction; genes in development; cancer and cell aging, methods of studying polymorphism at biochemical and DNA level; 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.
- 3. Botany and Plant Breeding:** 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, species relationship, floral biology, 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, plant genetic resources, pure line theory, breeding methods in self pollinated, cross pollinated and asexually/clonally propagated crops, improvement and development of synthetics and composites, population of

inbreds, breeding approaches for improvement of inbreds, hybrids, predicting hybrid performance, seed production of hybrid and their parent varieties/inbreds, self-incompatibility and male sterility in crop plants and their commercial exploitation, crop ideotype breeding, transgressive breeding, important varieties and future thrust area in economically important crops like wheat, rice, maize, sorghum, pearl millet, cluster bean, gram, green gram, cowpea, moth, groundnut, mustard, potato, cotton and seed spices.

**4. Plant Genetic Resources and Seed Technology:** Genetic resources in historical perspectives, germplasm and genetic diversity, gene pool concept, germplasm introduction, types of genetic resources and their survey, fundamentals of germplasm exploration, conservation, principles of *in vitro* and cryopreservation, national and international institutes related to germplasm conservation and exploration 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, maintenance breeding & seed production in cereals, millets, pulses, oil seeds, fibre, forage and seed spices crops, seed certification and seed standards, seed processing, storage, marketing and distribution, variety development, release and notification, seeds act, seed rules and law enforcement, new seed act, seed policy, DUS testing. History of seed industry and role of various seed organizations.

**5. Biotechnology:** Biotechnology and its relevance in agriculture; definitions, terminologies and scope in plant breeding, tissue culture and micropropagation techniques, techniques of DNA isolation, quantification and analysis; genotyping; sequencing techniques; vectors, vector preparation and cloning, gene isolation, synthesis and cloning, genomic and cDNA libraries, PCR-based cloning, positional cloning; nucleic acid hybridization and immunochemical detection; DNA sequencing; DNA restriction and modification, anti-sense RNA and ribozymes; micro-RNAs (miRNAs). biochemical and molecular markers: morphological, biochemical and DNA-based markers (RFLP, RAPD, AFLP, SSR, SNPs, ESTs etc.), mapping populations ( $F_2$ s, back crosses, RILs, NILs and DH), molecular mapping and tagging of agronomically important traits, statistical tools in marker analysis, marker-assisted selection for qualitative and quantitative traits; QTLs analysis in crop plants, marker-assisted backcross breeding for rapid introgression, generation of EDVs, gene pyramiding, biotechnology applications in male sterility/hybrid breeding, molecular farming, gene silencing, recombinant DNA technology, transgenes, method of transformation, selectable markers and clean transformation techniques, vector-mediated gene transfer, physical methods of gene transfer, production of transgenic plants in various crops, commercial releases. MOs and related issues, GMO; biosafety issues of GMOs; regulatory procedures in major countries including India, ethical, legal and social issues, bioinformatics & bioinformatics tools, nanotechnology and its applications in crop improvement programmes.

**6.Heterosis and Breeding for Biotic and Abiotic Stress:** Historical aspect of heterosis - nomenclature and definitions of heterosis, pre-Mendelian and post-Mendelian ideas, genetic theories of heterosis, physiological, biochemical and molecular factors underlining heterosis, prediction of heterosis from various crosses, development of heterotic pools in germplasm/genetic stocks and inbreds, their improvement for increasing heterosis, fixation of heterosis in self, cross and often cross pollinated crops, asexually/clonally propagated crops, organellar heterosis and complementation, heterosis breeding in cereals, millets, pulses and oilseed crops, importance of plant breeding with special reference to biotic and abiotic stress resistance; classification of biotic stresses, concepts in insect and pathogen resistance; host defence responses to pathogen invasions, types and genetic mechanisms of resistance to biotic stresses, phenotypic screening methods for major pests and diseases, classification of abiotic stresses, genetics of abiotic stress resistance, exploitation of wild relatives as a source of resistance to biotic and abiotic factors in major field crops.

**7. Mutation breeding:** History, nature and classification, mutagenic agents, effect of mutation on DNA, DNA repair mechanisms, observing mutagen effect in M<sub>1</sub> and M<sub>2</sub> generations, factors influencing the mutant spectrum, use of mutagens in creating oligogenic and polygenic variations, use of mutagen in genomics, allele mining, TILLING.

**- 120 Questions**

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**Pattern of Question Paper:**

1 Objective Type Paper

2 Maximum Marks: 150

3 Number of Questions: 150

4 Duration of Paper: 2.30 Hours

5 All Questions carry equal marks

6 Medium of Screening Test: Bilingual in English & Hindi

7 There will be **Negative Marking**

*(For every wrong answer, one-third of marks prescribed for that particular question will be deducted).*

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