

RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS OF COMPETITIVE EXAMINATION FOR THE POST OF AGRICULTURE RESEARCH OFFICER (AGRICULTURE BOTANY) AGRICULTURE DEPARTMENT

Part-A

- 40 Questions

General Knowledge of Rajasthan

Unit-I: History, Culture & Heritage of Rajasthan -

Pre & early history of Rajasthan. Age of Rajputs: Major dynasties of Rajasthan and the achievements of prominent rulers. Emergence of Modern Rajasthan: factors of socio-political awakening of 19th century; Peasants and tribal movements of 20th century; Political struggle of 20th century and the integration of Rajasthan.

Visual Art of Rajasthan - Architecture of forts and temples of Rajasthan; Sculpture traditions of Rajasthan and various schools of painting of Rajasthan.

Performing Arts of Rajasthan - Folk music and musical instruments of Rajasthan; folk dance and folk drama of Rajasthan.

Various religious cults, saints and folk deities of Rajasthan.

Various dialects and its distribution in Rajasthan; literature of Rajasthani language.

Unit-II: Geography, Natural Resource & Socio-Economic Development of Rajasthan -

Geography of Rajasthan: Broad physical features- Mountains, Plateaus, Plains & Desert; Major rivers and lakes; Climate and Agro-climatic regions; Major soil types and distribution; Major Forest types and distribution; Demographic characteristics; Desertification, Droughts & Floods, Deforestation, Environmental Pollution and Ecological Concerns.

Economy of Rajasthan: Major Minerals- Metallic & Non- Metallic; Power Resources- Renewable and Non-Renewable; Major agro based industries- Textile, Sugar, Paper & Vegetable oil; Poverty and Unemployment; Agro food parks.

Unit-III: Current Events and Issues of Rajasthan and India -

Important Persons, Places and Current events of the State. National and International events of importance. New Schemes & Initiatives taken recently for welfare & development in Rajasthan.

- 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, Chromosome manipulations in wide hybridization, Introduction to techniques for karyotyping; Chromosome banding and painting in situ hybridization and various applications.
- 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, genetics of mitochondria and chloroplasts. 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), objectives 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, organic

breeding, speed breeding, shuttle 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, Principles and methods for formulating core and mini core collections and their validation. 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, Factors responsible for genetic deterioration of varieties—safeguards during 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, seed village concept.

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), allele mining. biochemical and molecular markers: morphological, biochemical and DNA-based markers (RFLP, RAPD, AFLP, SSR, SNPs, ESTs etc.), mapping populations (F₂s, 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, genetic consequences of selfing, sibbing and crossing in self and cross-pollinated and asexually propagated crops, prediction of heterosis from various

crosses, inbreeding depression, coefficient of inbreeding and its estimation, residual heterosis in F₂ and segregating populations. 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, Apomixis, in fixing heterosis – concept of single line hybrid, 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; Concept and impact of climatic change, classification of biotic stresses, concept of signal transduction and other host-defence mechanisms against viruses and bacteria, 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, use of mutagen in genomics, allele mining, TILLING, Use of toxins, protease inhibitors, chitinases and Bt diseases and insect pest management, Transgenic in management of biotic and abiotic stresses.

- 7. Mutation breeding:** History and achievements, nature and classification, mutagenic agents, effect of mutation on DNA, DNA repair mechanisms, Treatment methods using physical and chemical mutagens and validation of mutants, observing mutagen effect in M₁ and M₂ generations, estimation of mutagenic efficiency and effectiveness – spectrum of chlorophyll and viable mutations, factors influencing the mutant spectrum, use of mutagens in creating oligogenic and polygenic variations, in vitro mutagenesis.

| Scheme of the examination | | | | |
|----------------------------------|---|-------------------------|--------------------|-----------------------------|
| S. No. | Subject | No. of Questions | Total Marks | Examination Duration |
| Part-A | General Knowledge of Rajasthan | 40 | 40 | 2.30 Hours |
| Part-B | Concerned Subject (as prescribed in qualification) | 110 | 110 | |
| | Total | 150 | 150 | |

1. The competitive examination shall carry 150 marks and 150 questions of Multiple Choice Type questions.
 2. There shall be one paper. Duration of Paper will be Two hours and Thirty Minutes.
 Negative marking shall be applicable in the evaluation of answers. For every wrong answer one-third of the marks prescribed for that particular question shall be deducted.
 Explanation: - Wrong answer shall mean an incorrect answer or multiple answers.
उक्त पद हेतु आयोजित की जाने वाली परीक्षा के लिए ओ.एम.आर. उत्तरपत्रक में प्रश्नों के विकल्प भरने के संबंध में विशेष निर्देश:-

1. Each question has five options marked as 1, 2, 3, 4, 5. You have to darken only one circle (bubble) indicating the correct answer on the Answer Sheet using BLUE BALL POINT PEN.
2. It is mandatory to fill one option for each question.
3. If you are not attempting a question then you have to darken the circle '5'. If none of the five circles is darkened, one third (1/3) part of the marks of question shall be deducted.
4. After solving question paper, candidate must ascertain that he/she has darkened one of the circles (bubbles) for each of the questions. Extra time of 10 minutes beyond scheduled time, is provided for this.

A candidate who has not darkened any of the five circles in more than 10% questions shall be disqualified.