

RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER
SYLLABUS FOR COMPETITIVE EXAMINATION FOR THE POST
OF ASSISTANT PROFESSOR IN AGRICULTURE SOIL SCIENCE
FOR COLLEGE EDUCATION DEPARTMENT

PAPER – II

Unit 1: Soil Chemistry -

Chemical composition of soil; Soil colloids- structure, composition, constitution of clay minerals, amorphous clays and other non-crystalline silicate minerals, oxide and hydroxide minerals; Charge development on clays and organic matter; pH-charge relations; Buffer capacity of soils. Chemical equilibria, electrochemistry and chemical kinetics. Inorganic and organic colloids- surface charge characteristics, diffuse double layer theories, zeta potential stability, coagulation/ flocculation, peptization, electrometric and sorption properties of soil colloid. Soil organic matter- fractionation, clay-organic interactions. Cation exchange- theories, adsorption isotherms, Donnan-membrane equilibrium concept, clay-membrane electrodes and ionic activity measurement, thermodynamics, anion and ligand exchange- inner sphere and outer-sphere surface complex formation, fixation of oxyanions, sorption-desorption of oxyanions and anions. Nitrogen, potassium, phosphate and ammonium fixation in soils and management aspects.

Unit 2: Management of Problem of Soil and Water-

Area and distribution of problem soils- acidic, saline and sodic soil; origin of problematic soils, and factors responsible. Morphological features of saline, sodic and saline-sodic soil; characterization of salt-affected soils- soluble salts, ESP, pH; physical, chemical and microbiological properties. Management of salt-affected soils; salt tolerance of crops – mechanism and ratings; monitoring of soil salinity in the field; management principles for sandy, clayey, red lateritic and dry land soils. Acid soils- nature of soil acidity, sources of soil acidity; effect on plant growth, lime requirement of acid soils; management of acid soils; biological sickness of soils and its management. Quality of irrigation water; management of brackish water for irrigation; characterization of brackish waters; relationship in water use and quality. Agronomic practices in relation to problematic soils; cropping pattern for utilizing poor quality ground waters. Chemistry of submersed soil.

Unit 3: Methods of Soil Analysis-

Particle size distribution, bulk and particle density, moisture constants, Modern methods of soil, plant and water analysis; Flame photometry and inductively coupled plasma optical emission spectroscopy; Spectrophotometry - visible, ultra-violet and infrared; Atomic absorption spectrophotometry; Potentiometry and conductimetry; X-ray diffractometry; Mass spectrometry.

Unit 4: Remote Sensing and Land use Planning-

Remote sensing and its application in agriculture; GIS and GPS- basic features and uses in agriculture, Elementary concepts of radio isotopes and uses in agriculture. Application of Remote Sensing in Soil fertility mapping. Remote Sensing and GIS in Carbon sequestration studies. Concept and techniques of land use planning; factors governing present land use. Land evaluation methods and soil-site suitability evaluation for different crops; land capability classification and constraints in application. Agro-ecological regions/sub-region of India and their characteristics in relation to crop production. Status of LUP in India. Water harvesting – concept, significance, types, methodology; use of harvested water in agriculture to increase water productivity. Watershed development/ management – concept, objectives, characterization, planning, execution, community participation and evaluation; rehabilitation of watershed.

Unit 5: Nano-Technology -

General introduction: Basics of quantum mechanics, harmonic oscillator, magnetic phenomena, band structure in solids, Mössbauer effect and spectroscopy, optical phenomena, bond in solids, an isotropy.

Nanostructures: growth of compound semiconductors, super lattices, self-assembled quantum dots, Nano-particles, Nano tubes and nanowires, fullerenes (buck balls, graphene). Nanofabrication and Nano-patterning: Optical, X-ray, and electron beam lithography, self-assembled organic layers, process of synthesis of Nano-powders, electrode position, important Nano-materials.

Mechanical properties, magnetic properties, electrical properties, electronic conduction with nanoparticles, investigating and manipulating materials in the nanoscale: Electron microscopy. Nano-biology: Interaction between biomolecules and Nano-particle surface, different types of inorganic materials used for the synthesis of hybrid Nano-bio-assemblies, application of Nano- in agriculture, current status of Nano-biotechnology, future perspectives of Nano-biology and Nano-sensors.

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.