Test and Question Format

There will be two written tests namely PAPER-I and PAPER-II. PAPER-I will be on multiple choice type questions. Total marks of this paper are 120 and there will be a total 30 questions – of which five questions are from Statistics and the remaining 25 questions are from basic agriculture science. PAPER-II would be descriptive type and total marks are 90. There will be one compulsory group (A) with question(s) from agricultural statistics containing 18 marks. Besides this, there will be two parts B and C, of which the candidate must choose one group. A candidate will have to answer four questions from the chosen group (either group B or group C). Each question contains 18 marks and total marks of this portion is 72.

As the maximum number of JRFs to be taken this year in Biological Sciences Division is 3, so P1 value has been set for this year is 10. So, up to 30 students may be taken in account. P2 value has been set to 4 and total 12 candidates may be called for interview. P3 has been set to 2 i.e. the final list of the selected candidates after interview may be 6.

There may be a few more students belonging to SC/ST/PWD categories in each stage as per norms. However, the total number of finally selected students must not exceed 3.

Preparation of Score Lists and Stage-wise Shortlisting

First Score List:

N=3, p1=10

$p1 \times N = q1 = 10x3 = 30$

Second Score List:

$p2=4$, $p2 \times N = q2 = 4x3 = 12$

$WSSII = A_1$ x Written Test I Score + B_1 x Written Test II Score

Where $A_1 = 1$ and $B_1 = 2$

Third Score List:

$WSSIII = A_2$ x Written Test I Score + B_2 x Written Test II Score + C x Interview Score

Where $A_2 = 1$; $B_2 = 2$ and $C = 1$

Syllabus for Group A

Measures of central tendency and dispersion; Sampling methods; Probability distribution, Design of experiments; Correlation and regression analysis; Tests of significance; Analysis of variance; Probit analysis

Syllabus for Group B

Soil biota, Soil microbial ecology, Microbial metabolism, Types of organisms, Symbiotic and non symbiotic nitrogen fixation, Mycorrhizae, Elemental transformation and cycling: Carbon, nitrogen, phosphorous, potassium and sulphur, Bioremediation, Soil enzymes, Biofertilizers

Pedogenic processes and their relationships with soil properties; Rocks, minerals and other soil forming materials; Soil texture, Soil structure and classification, Bulk density and particle density of soils and porosity; Humus, Humic acid, Fulvic acid; Soil moisture, Soil erosion, Land degradation; Soil colloids, Chemical equilibria, Chemical kinetics, Clay minerals, Adsorption desorption, Cation and Anion exchange, Soil organic matter; Essential elements in plant nutrition, Nutrient cycles in soil, Macro and micro nutrients in soil, Manures and fertilizers, Soil fertility and fertiliser use, Integrated nutrient management; Sustainable land use systems, Soil, plant, water and atmosphere relationships, Lime and gypsum requirement; Acid, Acid sulphate, Saline and Alkali soils and their management; Irrigation water quality, Major soil groups of India, Soil and water pollution, Greenhouse gases, Methods of soil analysis, Instrumentation

Agronomic techniques of production of major agricultural and horticultural crops, Cropping systems, Agrometeorology, Growth and development of crops in adverse environmental conditions, Dryland agriculture, Weeds and their management, Principal and methods of seed production of major crops; Requirements and types of seed storage; Farm mechanisation and equipment; Tillage and Pesticide application equipment, Precision agriculture. Major pests, diseases (fungal, bacterial and viral) and disorders of major agricultural and horticultural crops, Cultural, physical, biological, biotechnological, chemical and integrated management of pests and diseases Host plant defence Plant-pest relationships.

Climate change, carbon cycle, greenhouse gases and aerosols; greenhouse effect: temp, radiation, & energy, linking human dimension to climate change; sequestrations of atmospheric CO_2; impacts of climate change; accelerated mineral carbonation, clean coal technology, coalbed methane produced water, inorganic and organic pollutants of water; concept of eutrophication, DO, BOD, COD, sewage and groundwater pollution; status of water pollution in different water bodies with reference to Indian context, thermal pollution, sources, effect of soil pollution on biota, fate and behavior of soil pollutants; trace element pollution, impact of different pesticides on soil; different kinds of synthetic fertilizer (NPK) and their interactions with different components of soil; management of soil pollution in India, management of municipal solid waste, sewage sludge, composting, vermicomposting etc.; general impacts of some effluents discharged from paper and pulp industry, sugar, distillery, tannery, mining, sponge-iron etc. on ecosystem, fly ash and flue gas, environmental sources, biochemical effects, and remedial measures

Syllabus for Group C

Proteins: Definition, importance and functions, amino acids as building blocks of proteins, essential amino acids, non-protein amino acids, structure of peptide bond, organizational levels of protein structure, relationship between primary and higher order structures, supramolecular assemblies of proteins, solubility, denaturation, functional diversity and species specificity of proteins, protein classification, chemical synthesis of polypeptides.

Mechanism of Enzyme Action: Nature of active site, identification of functional groups at active site, enzyme substrate complex, Factors responsible for catalytic efficiency of enzymes: Proximity and orientation, covalent catalysis, Acid base catalysis, Strain and distortion theory, Induced fit hypothesis. Mechanism of action of selected enzymes: Chymotrypsin, Lysozyme, Carbonic anhydrase, Ribonuclease, Involvement of co-enzymes in enzyme catalyzed reactions, RNA molecules as enzymes.

Enzyme Kinetics: A brief concept of bioenergetics and kinetics, Kinetics of single and bi-substrate enzyme catalyzed reactions, Michaelis Menten equation. Derivation of Michaelis Menten equation and determination of Km and Vmax values, Enzyme inhibition: reversible and irreversible inhibition, Kinetics of competitive, uncompetitive and non-competitive inhibition, Random.

Regulation of Enzyme Activity: Allosteric enzymes, control of metabolic pathways, Mechanism of Aspartate transcarbamylase, Sigmoidal behavior, sequential and concerted models, Reversible covalent modification and zymogen activation, Isozymes and their importance

DNA replication, repair and recombination: Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms.

RNA synthesis and processing: Structure and function of RNA polymerases. Transportation in prokaryotes Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination, RNA processing, RNAediting, splicing, polyadenylation, structure and function of different types of RNA, RNA transport.

Protein synthesis and processing: Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, translational proof-reading, translational inhibitors, posttranslational modification of proteins.