भारतीय कृषि अनुसंधान परिषद

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

कृषि भवन, डॉ॰ राजेंद्र प्रसाद मार्ग, नई दिल्ली – 110001

Krishi Bhavan, Dr Rajendra Prasad Road, New Delhi - 110 001

F.No.TS-19(6)/2024-EStt.IV (E-332924) **Dated: 28th September, 2026**

OFFICE MEMORANDUM

Subject :- Scheme & Syllabus for the posts of Technical Assistant(T-3) in respect of ICAR Institute and Senior Technical Assistant (T-4) in respect of KVKs of ICAR, through Centralized Recruitment Examination under Technical cadre of Indian Council of Agricultural Research - regarding.

The Scheme & Syllabus for the post of Technical Assistant(T-3) in respect of ICAR Institute and Senior Technical Assistant (T-4) in respect of KVKs of ICAR under Direct Recruitment in ICAR Technical Service Cadre of Indian Council of Agricultural Research are hereby notified with the approval of the Competent Authority with immediate effect for the information, guidance and necessary action to all concerned.

28/9/2026

(Gajanand Yadav)
Deputy Secretary (TS)

Encls: Annexure - I [Scheme for the posts of Technical Assistant(T-3) and Senior Technical Assistant (T-4)].
Annexure II [(Syllabus for Paper-I and Paper -II for different Functional Group under the posts of Technical Assistant(T-3) and Senior Technical Assistant (T-4)].

Distributions :-

1. The Directors of all the ICAR Institute/NRCs/Bureaux.
2. All Director/Deputy Secretaries/Director, ASRB/Under Secretaries, ICAR at Krishi Bhawan/Krishi Anusandhan Bhawan I & II/NASC Complex, Pusa, New Delhi.
3. PSO to DG, ICAR/PPS to Secretary/PPS to FA, DARE.
4. All subject matter Divisions (SMDs) of ICAR.
5. Secretary (SS), HJSC.
6. Secretary (SS), CJSC.
7. Media Unit, ICAR with the request to upload this OM on the ICAR website.
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Annexure- I

Centralized Recruitment Examination for Technical Assistant (T-3) in respect of ICAR Institutes and Senior Technical Assistant (T-4) in respect of KVKs of ICAR.

Scheme of Examination

A. Paper -I Preliminary Examination (Qualifying Paper)

Section	Subject	No. of Questions	Marks	Duration
1.	General Knowledge	25	25	I.00 Hour
2.	General English	25	25	
3.	Quantitative Aptitude	25	25	
4.	General Agriculture	25	25	

i. **Preliminary Examination** will consist of **objective Type, Multiple choice questions**. The questions will be set both in English & Hindi except for General English Section.
ii. In Preliminary Examination, there will be **negative marking of 0.25% per wrong answer.**

B. Paper II - Mains Examination

i. The Mains Examination will consist of **objective Type, Multiple choice questions**. The questions will be set both in English & Hindi.
ii. The **duration** of Mains Examination will be of **2 hours.**
iii. The Mains Examination will consist of **100 questions of 300 marks, with each question carrying 3 marks.**
iv. In the Mains Examination, there will be **negative marking of 1 mark i.e 0.33% per wrong answer**.
v. The Mains Examination is designed to test the domain/subject specific knowledge of the candidates based on the functional group.
vi. Selection of the candidates will be based on the performance in Mains Examination for the post of Technical Assistant (T-3) & Senior Technical Assistant (T-4), **no interview** will be held for these posts.
vii. The shortlisting of candidates for Mains Examination will be in ratio as decided by ASRB on the basis of qualifying paper (Preliminary Examination).

C. Other Provisions :-

i. Candidates may choose to apply for **either one or both posts – Technical Assistant (T-3) and/or Senior Technical Assistant(T-4) - based on their eligibility.**
ii. Functional Group wise vacancies will be mentioned in the notification issued by ICAR/ASRB.
iii. A candidate will be allowed to **apply for only one Functional Group/Sub Group, irrespective of his/her eligibility for more than one Functional Group/Sub-Group.**
iv. For the purpose of choosing functional group/sub group for the mains examination, classification of functional groups/sub group as under:-

S. No.	Functional Group/ Sub Group
1.	Field/Farm Technician & Laboratory Technician (Agriculture)
2.	Field/Farm Technician & Laboratory Technician (Animal Science)
3.	Field/ Farm Technician & Laboratory Technician (Fisheries Science)
4.	Field/ Farm Technician & Laboratory Technician (Home Science/Community Science)
5.	Workshop Staff (Civil Engineering)
6.	Workshop Staff (Agricultural Engineering)
7.	Workshop Staff (Electrical Engineering)
8.	Workshop Staff (Electronics& Instrumentation Engineering)
9.	Library Information Science/Documentation Staff
10.	Information Technology

Centralized Recruitment Examination for Technical Assistant (T-3) in respect of ICAR Institutes and Senior Technical Assistant (T-4) in respect of KVKs of ICAR.

SYLLABUS FOR PRELIMINARY EXAMINATION (PAPER-I)

1. GENERAL KNOWLEDGE

Question in this component will be aimed at testing the candidates general awareness of the environment around him/her and its application to society. Questions will also be designed to test knowledge of current events and of such matters of everyday observations and experience in their scientific aspect as may be expected of any person of graduate level. The test will also include questions relating to India and its neighbouring countries especially pertaining History, Culture, Geography, Economic Science, general Policy & Scientific Research.

2. GENERAL ENGLISH

Candidates' ability to understand correct English, his/her basic comprehension and writing ability, etc. would be tested.

3. QUANTITATIVE APTITUDE

The questions will be designed to test the ability of appropriate use of numbers and number sense of the candidate. The scope of the test will be computation of whole numbers, decimals, fractions and relationships between numbers. Percentage, Ratio & Proportion, Square Roots, Averages, Interest, Profit and Loss, Discount, Partnership Business, Mixture and Alligation, Time and Distance, Time & Work, Basic algebraic identities of School Algebra & Elementary surds, Graphs of Linear Equations, Triangle and its various kinds of centres, Congruence and similarity of triangles, Circle and its chords, tangents, angles subtended by chords of a circle, common tangents to two or more circles, triangle, Quadrilateral, regular Polygons, Circle, Right Prism, Right Circular Cone, Right Circular Cylinder, Sphere, hemispheres, rectangular Parallelepiped, Regular Right Pyramid with triangular or square base, Trigonometric ratio, Degree and Radian Measures, Standard Identities, Complementary angles, Heights and Distances, Histogram, Frequency polygon, Bar diagram & Pie Chart, etc.

4. GENERAL AGRICULTURE

1. Agro-ecosystems: Agronomic principles and practices and Argo-Meteorology, Dryland Farming and Agroforestry, Soils Testing and Fertility Management, Integrated Farming Systems, Climate Change and its impact on Indian agriculture. Diversity of Cereal Crops, Pulses, Oilseeds, Forage

crops, Horticultural Crops, Principles of Plant Breeding, Seed Production, Tissue Culture and Plant Propagation Techniques, Major diseases and their management of selected crop plants: Rice, Wheat, Maize. Sugarcane, Potato, Citrus and Papaya. Weeds and their management.

2. Concept of Animal Breeding, Animal Cloning, Basics of Animal Health, Animal Production:
3. Livestock, Poultry, Duckery. Small ruminants: Bee keeping; Fisheries - Fresh water and Marine fish resources,
4. Farm Machinery, Agri-energy; Ergonomics and Women-friendly equipment, Post-Harvest Technology; information and Communication Technologies in agriculture, Agri-business, Socio-economic aspects of agriculture and allied sectors, Types and systems of farming and factors affecting them. Agricultural price policy. Crop Insurance .
5. Role of ICAR, NAARM and Agricultural Universities in Indian Agriculture; Indigenous Knowledge Systems in Agriculture, Role of Krishi Vigyan Kendra's (KVK) in dissemination of Agricultural technologies. Non-Government Organization (NGO) and self-help group approach for rural development, Human Resource Development in Agricultural Research, Role of co-operatives in agricultural economy, New Education Policy 2020.

6. Regulation in agriculture, seed Act,1966, protection of Plant Varieties and Farmers Rights Act 2001, Biodiversity Act 2OO2 & its amendment 2023, Insecticide Act-1968, Plant Quarantine (Order) 2003, National Biodiversity Authority, DPV & FR Authority, DPPQ&S.

7. International organization globally: CIMMYT, IRRI, ICRISAT, IIAT, CIAT, IWMI, ICARDA.

SYLLABUS FOR MAINS EXAMINATION (PAPER-II)

FUNCTIONAL GROUP:

(A) FIELD/FARM TECHNICIAN & LABORATORY TECHNICIAN (AGRICULTURE)

1. Ecology and its relevance to man, natural resources, their sustainable management and conservation. Physical and social environment as factors of crop distribution and production. Agro ecology; cropping pattern as indicators of environments. Environmental pollution and associated hazards to crops, animals and humans. Climate change—International conventions and global initiatives. Green house effect and global warming. Advance tools for ecosystem analysis—Remote Sensing (RS) and Geographic Information Systems (GIS), Drones in Agriculture.

2. Cropping patterns in different agro-climatic zones of the country. Impact of high-yielding and short duration varieties hybrids on shifts in cropping patterns. Concepts of various cropping, and farming systems. Organic and Precision farming. Package of practices for production of important cereals, pulses, oil seeds, fibres, sugar, commercial and fodder crops.

3. Agroforestry involving sustainable land use by integrating trees with crops/livestock, including Silviculture, Forest Ecology, Agroforestry Systems, Wildlife Management, Forest Mensuration, Soil Science, Climatology, Extension. Important features, and scope of various types of forestry plantations such as social forestry, agroforestry, and natural forests: Propagation of forest plants. Forest products. Agro-forestry and value addition. Conservation of forest flora and fauna.

4. Weeds, their characteristics, dissemination and association with various crops; their multiplications; cultural, biological, and chemical control of weeds.

5. Soil—physical, chemical and biological properties. Processes and factors of soil formation. soils of India. Mineral and organic constituents of soils and their role in maintaining soil productivity. Essential plant nutrients and other beneficial elements in soils and plants. Principles of soil fertility, soil testing and fertilizer recommendations, integrated nutrient management Biofertilizers. Losses of nitrogen in soil, nitrogen-use efficiency in submerged rice soils, nitrogen fixation in soils. Efficient phosphorus and potassium use. Problem soils and their reclamation. Soil factors affecting green house gas emission. Soil conservation, integrated watershed management. Soil erosion and its

management. Dry land agriculture and its problems. Technology for stabilizing agriculture production in rainfed areas.

6. Water-use efficiency in relation to crop production, criteria for scheduling irrigations, ways and means of reducing run-off losses of irrigation water. Rainwater harvesting. Drip and sprinkler irrigation. Drainage of water-logged soils, quality of irrigation water, effect of industrial effluents on soil and water pollution. Irrigation projects in India.

7. Farm management, scope, importance and characteristics, farm planning. Optimum resource use and budgeting. Economics of different types of farming systems. Marketing management strategies for development, market intelligence. price fluctuations and their cost; role of co-operatives in agricultural economy; types and systems of farming and factors affecting them. Agricultural price policy. Crop Insurance.
8. Agricultural extension, its importance and role, methods of evaluation of extension programmes, socio-economic survey and status of big, small and marginal farmers and landless agricultural labourers; Training programmes for extension workers. Role of Krishi Vigyan Kendra's (KVK) in dissemination of Agricultural technologies. Non-Government Organisation (NGO) and self-help group approach for rural development.

9. Agricultural Engineering: Farm power and machinery and equipment design, soil & water conservation irrigation and drainage, agricultural structure, food processing, renewable energy, crop production techniques and agricultural automation.

10. Cell structure, function and cell cycle. Synthesis, structure and function of genetic material. Laws of heredity. Chromosome structure, chromosomal aberrations, linkage and cross-over, and their significance in recombination breeding. Polyploidy, euploids and aneuploids. Mutation—and their role in crop improvement. Heritability, sterility and incompatibility, classification and their application in crop improvement. Cytoplasmic inheritance, sex-linked, sex-influenced and sex-limited characters.

11. History of plant breeding. Modes of reproduction, selfing and crossing techniques. Origin, evolution and domestication of crop plants, center of origin, law of homologous series, crop genetic resources—conservation and utilization. Application of principles of plant breeding, improvement of crop plants. Recombinant DNA technology, Molecular markers and their application in plant improvement. Pure-line selection, pedigree, mass and recurrent selections, combining ability, its significance in plant breeding. Heterosis and its exploitation. Somatic hybridization. Breeding for disease and pest resistance. Role of interspecific and intergeneric hybridization. Role of genetic engineering and biotechnology in crop improvement, Genetically modified crop plants, CRISPR – Cas9 technology and Genome editing, doubled haploids, apomixis, genomic selections, predictive breeding, speed breeding, tissue culture and its application, genomics, proteomics, use of bioinformatics in agriculture.

12. Seed production and processing technologies. Seed certification, Seed testing and storage. DNA

finger printing and seed registration. Role of public and private sectors in seed production, and marketing. Intellectual Property Rights (IPR) issues, WTO issues and its impact on Agriculture.

13. Principles of Plant Physiology with reference to plant nutrition, absorption, translocation and metabolism of nutrients. Soil-water-plant relationship.

14. Enzymes and plant pigments; photosynthesis—modern concepts and factors affecting the process, aerobic and anaerobic respiration; C_3, C_4 and CAM mechanisms. Water, pH, Carbohydrate, protein and fat metabolism. Growth and development; photoperiodism and vernalization. Plant growth substances and their role in crop production. Physiology of seed development and germination; dormancy. Stress physiology—draught, salt and water logging.

15. Major fruits, plantation crops, vegetables, spices and flower crops. package practices of major horticultural crops. Protected cultivation and high tech horticulture. Post-harvest technology and value addition of fruits and vegetables. Landscaping and commercial floriculture. Medicinal and aromatic plants. Role of fruits and vegetables in human nutrition.

16. Diagnosis of pests and diseases of field crops, vegetables, orchard and plantation crops and their economic importance. Classification of pests and diseases and their management. Integrated pest and diseases management. Storage pests and their management. Biological control of pests and diseases. Epidemiology and forecasting of major crop pests and diseases. Plant quarantine measures. Pesticides, their formulation and modes of action.

17. Food science and technology: Food's physical, chemical and biological make-up Food processing, preservation and packaging, quality control-nutrition and specific product technologies like cereals and fruits-functional foods, sustainability and AI in food systems.

18. Food production and consumption trends in India. Food security and growing population—vision 2020. Reasons for grain surplus. National and International food policies. Production, procurement, distribution constraints. Availability of foodgrains, per capita expenditure on food. Trends in poverty, Public Distribution System and Below Poverty Line population, Targeted Public Distribution System (PDS), policy implementation in context to globalization. Processing constraints. Relation of food production to National Dietary Guidelines and food consumption pattern. Food based dietary approaches to eliminate hunger. Nutrient deficiency—Micro nutrient deficiency: Protein Energy Malnutrition or Protein Calorie Malnutrition (PEM or PCM), Micro nutrient deficiency and HRD in context of work capacity of women and children. Food grain productivity and food security.

19. Biotechnology including application of biological principles for technological innovation, covering topics like cell biology, genetics, molecular biology, bioinformatics, and genetic engineering

20. Food Microbiology, Food Chemistry, Food Processing Techniques (production, processing, and preservation of food), Food and Safety, Principles of Food Science, Fundamentals of Food Technology, Epidemiology, Engineering in the Food Business.

SYLLABUS FOR
MAINS EXAMINATION (PAPER-II)

FUNCTIONAL GROUP:

(B) FIELD/FARM & LABORATORY TECHNICIAN

(ANIMAL SCIENCE)

1. Animal Nutrition:

1.1 Partitioning of food energy within the animal. Direct and indirect calorimetry. Carbon—nitrogen balance and comparative slaughter methods. Systems for expressing energy value of foods in ruminants, pigs and poultry. Energy requirements for maintenance, growth, pregnancy, lactation, egg, wool, and meat production.
1.2 Latest advances in protein nutrition. Energy protein inter-relationships. Evaluation of protein quality. Use of NPN compounds in ruminant diets. Protein requirements for maintenance, growth, pregnancy, lactation, egg, wool and meat production.
1.3 Major and trace minerals—Their sources, physiological functions and deficiency symptoms. Toxic minerals. Mineral interactions, toxicity, antagonism. Role of fat soluble and water—soluble vitamins in the body, their sources and deficiency symptoms.
1.4 Feed additives—methane inhibitors, probiotics, enzymes, antibiotics, hormones, oligosaccharides, antioxidants, emulsifiers, mould inhibitors, buffers etc. Use and abuse of growth promoters like hormones and antibiotics—latest concepts.
1.5 Conservation of fodders. Storage of feeds and feed ingredients. Recent advances in feed technology and feed processing. Anti-nutritional and toxic factors present in livestock feeds. Feed analysis and quality control. Digestibility trials—direct, indirect and indicator methods. Predicting feed intake in grazing animals.
1.6 Advances in ruminant nutrition. Nutrient requirements. Balanced rations. Feeding of calves, pregnant, work animals and breeding bulls. Strategies for feeding milch animals during different stages of lactation cycle. Effect of feeding on milk composition. Feeding of goats for meat and milk production. Feeding of sheep for meat and wool production.
1.7 Swine Nutrition. Nutrient requirements. Creep, starter, grower and finisher rations. Feeding of pigs for lean meat production. Low cost rations for swine.
1.8 Poultry nutrition. Special features of poultry nutrition. Nutrient requirements for meat and egg production. Formulation of rations for different classes of layers and broilers.

2. Animal Physiology:

2.1 Physiology of blood and its circulation, respiration; excretion. Endocrine glands in health and disease.
2.2 Blood constituents. —Properties and functions-blood cell formation—Haemoglobin synthesis and chemistry-plasma proteins production, classification and properties, coagulation of blood; Haemorrhagic disorders—anti-coagulants—blood groups—Blood volume—Plasma expanders-Buffer systems in blood. Biochemical tests and their significance in disease diagnosis.
2.3 Circulation. —Physiology of heart, cardiac cycle, heart sounds, heartbeat, electrocardiograms.

Work and efficiency of heart—effect of ions on heart function-metabolism of cardiac muscle, nervous and chemical regulation of heart, effect of temperature and stress on heart, blood pressure and hypertension, osmotic regulation, arterial pulse, vasomotor regulation of circulation, shock. Coronary and pulmonary circulation, Blood-Brain barrier Cerebrospinal fluid-circulation in birds.

2.4 Respiration.—Mechanism of respiration, Transport and exchange of gases-neural control of respiration-Chemo-receptors-hypoxia-respiration in birds.

2.5 Excretion.—Structure and function of kidney-formation of urine-methods of studying renal function- renal regulation of acid-base balance: physiological constituents of urine-renal failure-passive venous congestion-Urinary secretion in chicken-Sweat glands and their function. Bio-chemical test for urinary dysfunction.

2.6 Endocrine glands.—Functional disorders—their symptoms and diagnosis. Synthesis of hormones, mechanism and control of secretion—hormonal receptors-classification and function.

2.7 Growth and Animal Production.—Prenatal and postnatal growth, maturation, growth curves, measures of growth, factors affecting growth, conformation, body composition, meat quality.

2.8 Physiology of Milk Production, Reproduction and Digestion.—Current status of hormonal control of mammary development, milk secretion and milk ejection. Male and Female reproductive organs, their components and functions. Digestive organs and their functions.

2.9 Environmental Physiology.—Physiological relations and their regulation; mechanisms of adaptation, environmental factors and regulatory mechanisms involved in animal behaviour, climatology— various parameters and their importance. Animal ecology. Physiology of behaviour. Effect of stress on health and production. Climate change, effect of climate change on physiological parameters, stress amelioration, biomarkers of stress

3. Animal Reproduction:

Semen quality.—Preservation and Artificial Insemination—Components of semen, composition of spermatozoa, chemical and physical properties of ejaculated semen, factors affecting semen *in vivo* and *in vitro*. Factors affecting semen production and quality, preservation, composition of diluents, sperm concentration, transport of diluted semen. Deep freezing techniques in cows, sheep, goats, swine and poultry. Detection of oestrus and time of insemination for better conception. Anoestrus and repeat breeding.

4. Livestock Production and Management:

4.1 Commercial Dairy Farming. —Comparison of dairy farming in India with advanced countries. Dairying under mixed farming and as specialized farming, economic dairy farming. Starting of a dairy farm, Capital and land requirement, organization of the dairy farm. Opportunities in dairy farming, factors determining the efficiency of dairy animal. Heard recording, budgeting cost of milk production, pricing policy; Personnel Management. Developing Practical and Economic rations for dairy cattle; supply of greens throughout the year, feed and fodder requirements of Dairy Farm. Feeding regimes for young stock and bulls, heifers and breeding animals; new trends in feeding young and adult stock; Feeding records.

4.2 Commercial meat, egg and wool production. —Development of practical and economic rations for sheep, goats, pigs, rabbits and poultry. Supply of greens, fodder, feeding regimes for young and mature stock. New trends in enhancing production and management. Capital and land requirements and socio-economic concept.

4.3 Feeding and management of animals under drought, flood and other natural calamities.

5. Genetics and Animal Breeding:

5.1 History of animal genetics. Mitosis and Meiosis: Mendelian inheritance; deviations to Mendelian genetics; Expression of genes; Linkage and crossing over; Sex determination, sex influenced and sex limited characters; Blood groups and polymorphism; Chromosome aberrations; Cytoplasmic inheritance, Gene and its structure; DNA as a genetic material; Genetic code and protein synthesis; Recombinant DNA technology. Mutations, types of mutations, methods for detecting mutations and mutation rate, Transgenesis.

5.2 Population Genetics applied to Animal Breeding—Quantitative Vs. Qualitative traits; Hardy Weinberg Law; Population Vs. Individual; Gene and genotypic frequency; Forces changing gene frequency; Random drift and small populations; Theory of path coefficient; Inbreeding, methods of estimating inbreeding coefficient, systems of inbreeding; Effective population size; Breeding value, estimation of breeding value, dominance and epistatic deviation; Partitioning of variation; DSD Genotype X environment correlation and genotype X environment interaction; role of multiple measurements; Resemblance between relatives.

5.3 Breeding Systems.—Breeds of livestock and Poultry. Heritability, repeatability and genetic and phenotypic correlations, their methods of estimation and precision of estimates; Aids to selection and their relative merits; Individual, pedigree, family and within family selection; Pregnancy testing; Methods of selection; Construction of selection indices and their uses; Comparative evaluation of genetic gains through various selection methods; Indirect selection and correlated response; Inbreeding, out breeding, upgrading, cross-breeding and synthesis of breeds; Crossing of inbred lines for commercial production; Selection for general and specific combining ability; Breeding for threshold characters. Sire index.

6. Extension:

Basic philosophy, objectives, concept and principles of extension. Different Methods adopted to educate farmers under rural conditions. Generation of technology, its transfer and feedback. Problems and constraints in transfer of technology. Animal husbandry programmes for rural development.

7. Anatomy, Pharmacology and Hygiene:

7.1 Histology and Histological Techniques : Paraffin embedding technique of tissue processing and H.E. staining—Freezing microtomy—Microscopy Bright field microscope and electron microscope. Cytology-structure of cell organelles and inclusions; cell division-cell types—Tissues and their classification-embryonic and adult tissues—Comparative histology of organs—Vascular, Nervous, digestive, respiratory, musculo-skeletal and urogenital systems—Endocrine glands—Integuments—sense organs.

7.2 Embryology.—Embryology of vertebrates with special reference to aves and domestic mammals gametogenesis-fertilization-germ layers-foetal membranes and placentation-types of placenta in domestic mammals-Teratology-twins and twinning-organogenesis-germ layer derivatives endodermal, mesodermal and ectodermal derivatives.

7.3 Bovine Anatomy.—Regional Anatomy : Paranasal sinuses of OX— surface anatomy of salivary glands. Regional anatomy of infraorbital, maxillary, mandibuloalveolar, mental and corneal nerve block. Regional anatomy of paravertebral nerves, pudental nerve, median, ulnar and radial nerves

tibial, fibular and digital nerves—Cranial nerves-structures involved in epidural anaesthesia superficial lymph nodes-surface anatomy of visceral organs of thoracic, abdominal and pelvic cavities-comparative-features of locomotor apparatus and their application in the biomechanics of mammalian body.

7.4 Anatomy of Fowl.—Musculo-skeletal system-functional anatomy in relation to respiration and flying, digestion and egg production.

7.5 Pharmacology and therapeutics drugs.—Cellular level of pharmacodynamics and pharmacokinetics. Drugs acting on fluids and electrolyte balance. Drugs acting on Autonomic nervous system. Modern concepts of anaesthesia and dissociative anaesthetics. Autocoids. Antimicrobials and principles of chemotherapy in microbial infections. Use of hormones in therapeutics—chemotherapy of parasitic infections. Drug and economic concerns in the Edible tissues of animals—chemotherapy of Neoplastic diseases. Toxicity due to "insecticides, plants, metals, non-metals, zootoxins and mycotoxins".

7.6 Veterinary Hygiene with reference to water, air and habitation.—Assessment of pollution of water, air and soil—Importance of climate in animal health—effect of environment on animal function and performance relationship between industrialization and animal agriculture—animal housing requirements for specific categories of domestic animals viz. pregnant cows and sows, milking cows, broiler birds—stress, strain and productivity in relation to animal habitation.

8. Animal Diseases :

8.1 Etiology, epidemiology pathogenesis, symptoms, post-mortem lesions, diagnosis, and control of infectious diseases of cattle, sheep and goat, horses, pigs and poultry.

8.2 Etiology, epidemiology, symptoms, diagnosis, treatment of production diseases of cattle, horse, pig and poultry.

8.3 Deficiency diseases of domestic animals and birds.

8.4 Diagnosis and treatment of non-specific conditions like impaction, Bloat, Diarrhoea, Indigestion, dehydration, stroke, poisoning.

8.5 Diagnosis and treatment of neurological disorders.

8.6 Principles and methods of immunization of animals against specific diseases—hard immunity—disease free zones—'zero' disease concept—chemoprophylaxis.

8.7 Anaesthesia —local, regional and general-prenesthetic medication. Symptoms and surgical interference in fractures and dislocation. Hernia, choking abomassal displacement—Caesarian operations. Rumenotomy—Castrations.

8.8 Disease investigation techniques.—Materials for laboratory investigation—Establishment. Animal Health Centres—Disease free zone.

9. Veterinary Public Health :

9.1 Zoonoses.—Classification, definition, role of animals and birds in prevalence and transmission of zoonotic diseases—occupational zoonotic diseases.

9.2 Epidemiology.—Principle, definition of epidemiological terms, application of epidemiological measures in the study of diseases and disease control. Epidemiological features of air, water and food borne infections. OIE regulation, WTO, sanitary and phytosanitary measures.

9.3 Veterinary Jurisprudence.—Rules and Regulations for improvement of animal quality and

prevention of animal diseases—State and Central Rules for prevention of animal and animal product borne diseases—S.P. C.A.—Veterolegal cases—Certificates—Materials and Methods of collection of samples for veterolegal investigation.

10. Milk and Milk Products Technology :

10.1 Market Milk.—Quality, testing and grading of raw milk. Processing, packaging, storing, distribution, marketing defects and their control. Preparation of the following milks : Pasteurized, standardized, toned, double toned, sterilized, homogenized, reconstituted, recombined and flavoured milks. Preparation of cultured milks, cultures and their management, yoghurt, Dahi, Lassi and Srikhand. Preparation of flavoured and sterilized milks. Legal standards. Sanitation requirement for clean and safe milk and for the milk plant equipment.

10.2 Milk Products Technology.—Selection of raw materials, processing, storing, distributing and marketing milk products such as Cream, Butter, Ghee, Khoa, Channa, Cheese, condensed, evaporated, dried milk and baby food, Ice cream and Kulfi; by-products, whey products, butter milk, lactose and casein. Testing, grading, judging milk products—BIS and Agmark specifications, legal standards, quality control nutritive properties. Packaging processing and operational control. Costing of dairy products.

11. Meat Hygiene and Technology :

11.1.1 Meat Hygiene

11.1.1.1 Ante mortem care and management of food animals, stunning, slaughter and dressing operations; abattoir requirements and designs; Meat inspection procedures and judgement of carcass meat cuts—grading of carcass meat cuts—duties and functions of Veterinarians in wholesome meat production.

11.1.1.2 Hygienic methods of handling production of meat.—Spoilage of meat and control measures—Post- slaughter physicochemical changes in meat and factors that influence them—Quality improvement methods—Adulteration of meat and detection—Regulatory provisions in Meat trade and Industry.

11.1.2 Meat Technology

11.1.2.1 Physical and chemical characteristics of meat.—Meat emulsions—Methods of preservation of meat—Curing, canning, irradiation, packaging of meat and meat products, processing and formulations.

11.1.2.2 By-products.—Slaughter house by-products and their utilisation—Edible and inedible by products—Social and economic implications of proper utilisation of slaughter house by-products—Organ products for food and pharmaceuticals.

11.1.2.3 Poultry Products Technology.—Chemical composition and nutritive value of poultry meat, preslaughter care and management. Slaughtering techniques, inspection, preservation of poultry meat and products. Legal and BIS standards. Structure composition and nutritive value of eggs Microbial spoilage. Preservation and maintenance. Marketing of poultry meat, eggs and products.

11.1.2.4 Rabbit/Fur Animal farming.—Rabbit meat production. Disposal and utilization of fur and wool and recycling of waste by products. Grading of wool.

SYLLABUS FOR
MAINS EXAMINATION (PAPER-II)

FUNCTIONAL GROUP:

(C) FIELD/FARM & LABORATORY TECHNICIAN
(FISHERIES SCIENCE)

1. **Aquaculture:** Principles of aquaculture. Different aquaculture systems. Major species farmed globally and in India. Production trends and prospects. Criteria for selection of candidate species for aquaculture. Different culture systems and practices in freshwater- culture of carps, catfishes, freshwater prawn, freshwater mussels, trout and other species; Farming of brackishwater species - shrimp, crab and finfishes; Mariculture of finfishes, mussels, oysters and seaweeds. Cage Aquaculture, Integrated farming, Sewage-fed farming, Flow-through and Recirculatory aquaculture systems, Aquaponics and other farming practices. Management measures in different culture systems: pre-stocking and post-stocking management, including water quality, feed and fish health. Site selection, Design of fish farm and culture systems.

2. **Fish Breeding and Seed Production:** Natural seed resources and collection methods. Sexual maturity, gonadal development and breeding seasons of important cultivable finfish and shellfish species. Broodstock development, induced breeding, hatchery management of important freshwater, brackishwater and marine finfishes and shellfishes. Use of pituitary and other synthetic hormones for induced breeding. Design and management of hatcheries for important finfish and shellfish species. Indoor and outdoor nursery rearing. Production of fingerlings and juveniles. Broodstock and fish seed transportation. Culture of micro-algae and other live-food organisms.

3. **Ornamental Fish Farming and Aquarium Management:** Status of ornamental fish trade in the world and India. Important indigenous ornamental fishes of India. Broodstock management, breeding and rearing of important ornamental freshwater, brackishwater and marine ornamental fishes. Trait improvement through genetic improvement and genetic engineering. Management practices of ornamental fish hatchery and farms. Water quality management. Ornamental fish food and feeds. Common diseases and their control. Aquarium plants and their propagation methods. Aquarium setting - fabrication, setting up and maintenance of freshwater and marine aquarium. Water filtration system-biological, mechanical and chemical. Aquarium accessories – filters, aerators, skimmers etc. Biotope-based aquarium.

4. **Fish Genetics and Biotechnology:** Principles of fish genetics. Chromosome and genes. Chromosomal structure and aberrations. Chromosome manipulation techniques - androgenesis, gynogenesis and polyploidy. Hybridization, Cross-breeding. Inbreeding and its consequences. Sex determination. Production of monosex population. Cryopreservation of gametes. Introduction to population genetics. Selective breeding. Genetic engineering, Genome editing.

5. **Fish Nutrition and Feed Technology**: Fundamentals of fish nutrition and growth in fish. Principal nutrients and nutritional requirements of cultivable fish and shellfish. Conventional and non-conventional feed ingredients. Antinutritional factors. Feed formulation. Feed production

methodologies. Feed analysis. Feed additives - binders, antioxidants, enzymes, pigments, growth promoters, feed stimulants. Forms of feeds and their production. Feed storage: use of preservatives and antioxidants. Larval feed - microparticulate and micro-encapsulated feed. Feed evaluation: feed conversion ratio, feed efficiency ratio, protein efficiency ratio, net protein utilization and biological value. Feed digestion and assimilation. Factors affecting digestibility. Feeding management - feeding methods and devices.

6. **Fish Diseases Management:** Fundamentals of microbiology: microorganism types, growth pattern and role in environmental processes. General characteristics, life cycle, and diagnosis of pathogens. Fish immunology: innate and specific immune systems. Prevention and treatment of parasitic, bacterial, fungal and viral diseases of finfish and shellfish. OIE-listed diseases. Disease surveillance and reporting. Quarantine and health certification in aquaculture. Health management strategies: Bioremediators, Probiotics, Immunomodulators. Specific pathogen-free (SPF), Specific pathogen-resistant (SPR) and Specific pathogen-tolerant (SPT) fish. Good aquaculture practices (GAP), Hazard analysis and Critical control point (HACCP) and Biosecurity principles in aquaculture. Zoonotic diseases. Principles of disease diagnosis: Conventional, molecular and antibody-based diagnostic methods. Rapid diagnostic methods. Vaccines. Nutritional deficiency diseases.

7. **Inland Fisheries:** Status of global inland fish production. Inland open-water fishery resources of India – rivers, estuaries, reservoirs, lakes, wetlands, etc. and their status and fisheries potential. Major riverine and estuarine systems of India and their ecology and fisheries. Fisheries of major reservoirs and lakes. Culture-based fisheries. Flood-plain capture fishery-status and prospects. Major brackishwater lakes/lagoons and their fisheries. Coldwater fisheries in high altitudes. Fishing crafts and gears. Fish biodiversity in important aquatic ecosystems and its management, including conservation measures. Sanctuaries and protected areas.

8. **Marine Fisheries**: Marine global fish production – status and trends. Marine resources of India – EEZ, Coastline, continental shelf, continental slope, etc. and their fisheries potential. Status and trends of marine fish production in India. Classification of marine environments - pelagic, benthic, euphotic, aphotic, etc. Marine fisheries resources of India – finfish, shellfish, seaweed and other important groups. Distribution and abundance of commercially-important species. Traditional, motorized and mechanized fisheries. Conservation and management of marine fisheries resources in India. Impact of climate change in fisheries. GIS and Remote sensing in marine capture fisheries.

9. **Aquatic Ecology:** Ecology and ecosystems – structure and functions. Inland water types, their characteristics and distribution; ponds, lakes and reservoirs; streams, rivers and estuaries; dynamics of lentic and lotic environments. Lakes - their origin and diversity. Aquatic plants: characteristics, classification and zonation. Seaweed and seagrass. Mangroves and salt-marshes. Plankton: planktonic organisms; classification of plankton; distribution of plankton: geographic, vertical, horizontal and seasonal distribution of phytoplankton and zooplankton. Blooms, and red tides: cause and effects. Benthos: classification. Periphyton. Nekton: composition, distribution, movements. Lotic environments: classification of lotic environments, biological conditions and productivity. Primary productivity. Nutrient cycles – Nitrogen and phosphorus cycle. Pollution – types, impacts and amelioration measures. Food chain and food web. Factors influencing the productivity in freshwater and marine ecosystems.

10. **Soil and Water Chemistry**: Water chemistry: properties of fresh water and sea water. Acid, base, salts, Hydrogen ions, modern concept of pH and buffer. Water quality parameters - temperature. transparency, turbidity, pH, electrical conductivity, salinity, chlorinity, total solids, dissolved oxygen, free carbon dioxide, total alkalinity, total hardness, calcium, magnesium, inorganic Nitrogen (Ammonium and Nitrate), phosphorus, etc. Physical properties of soil. Soil type and their distribution. Soil-water interactions. Soil chemistry: organic carbon, carbon - nitrogen ratio, soil fertility. Determination of physical and chemical properties of soil and water. Water and soil quality requirements and their management for aquaculture in different environments.

11. **Taxonomy of Finfishes and Shellfishes:** Principles of taxonomy. Nomenclature, types. Classification and interrelationships. Criteria for generic and specific identification. Morphological, morphometric and meristic characteristics of taxonomic significance. Major taxa of inland and marine fishes. Taxonomy of commercially important shellfishes – crustaceans (freshwater prawn, shrimps, lobsters, crabs), molluscs (bivalves, gastropods and cephalopods). Other commercially important aquatic organisms. Introduction to modern taxonomic tools: karyo-taxonomy, DNA barcoding. Methods of fish preservation.

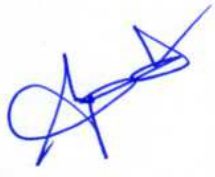
12. **Fishery Biology**: Study of the external and internal anatomy of important groups. Study of oral region and associated structures. Digestive system and associated digestive glands. Food and feeding habits of commercially important species. Qualitative and quantitative methods of analysis of gut contents. Reproductive biology – maturity stages, gonad somatic index, ponderal index, fecundity, sex ratio and spawning. Eggs and larval stages and developmental biology. Age and growth determination by direct and indirect methods, length-weight relationship. Fish migration - type and significance. Tagging and marking.

13. **Fishing Crafts and Gears**: Traditional fishing crafts. Classification of fishing crafts based on fabrication dimension, nature of fishing, depth of operation. Boat building materials: choice of construction materials. Deck fitting. Maintenance of fishing vessels. Basic classification of fishing gears - principal, subsidiary and auxiliary gears. Fishing gear materials: natural and synthetic. Types and properties of netting materials. Structure and operation of various commercial fishing gears – trawlers, gill netters, liners and seiners. Fish finding devices - sonar, eco-sounder, net sonde, etc. Preservation of crafts and gears construction materials.

14. **Fish Processing, Products and Byproducts:** Principles of fish processing and preservation. Processing of fish by traditional methods– salting, curing, drying, smoking, and fermentation. Principles and practices of cold and thermal processing; cold processing methods - icing, chilling and freezing; thermal processing - canning. Fish ham and sausage. Value Added products; Ready-to-cook and Ready-to-eat fish products; fish and prawn pickles, fish cake, fish finger, fish cutlet, fish wafer, fish soup powder and other products. Fish protein concentrates and fish hydrolysate. Production and uses of different byproducts including chitin and chitosan, fish maws and isinglass, fish collagen, fish gelatin, pearl essence, shark fin rays, beach-de-mer, etc. Packaging and storage. Types of spoilage and quality standards of fish and fish products. HACCP for safe production. Nutraceuticals from seaweeds and other aquatic sources.

15. **Fisheries Economics, Extension, Policy, Marketing and Trade:** Basic economic terminologies. Contribution of the fisheries sector to economic development. Production economics. Role of fisheries extension in fisheries development. Extension methodologies. Fisheries Co-operatives, NGOs, SSGs and FFPOs. Fisheries co-management. Central and State-level organizations associated with fisheries research and

development. Important developmental schemes of the Central & State governments. Fisheries policies. National and International agencies/organizations for the promotion of fisheries. Market dynamics. Fish markets and marketing channels. Fish transportation and cold chains. Export of fish and fisheries products.



SYLLABUS FOR
MAINS EXAMINATION (PAPER-II)

FUNCTIONAL GROUP:

(D) FIELD/FARM TECHNICIAN & LABORATORY TECHNICIAN (HOME SCIENCE / COMMUNITY SCIENCE)

1. Importance of agriculture in national economy; basic principles of crop production; cultivation of rice, wheat, chickpea, pigeon-pea, sugarcane, groundnut, tomato, and mango. Major soils of India; role of NPK and their deficiency symptoms. General structure and function of cell organelles; mitosis and meiosis; Mendelian genetics. Elementary knowledge of growth, development, photosynthesis, respiration and transpiration; Elements of economic botany. General structure and function of carbohydrates, proteins, nucleic acids, enzymes and vitamins. Major pests and diseases of rice, wheat, cotton, chickpea, sugarcane and their management. Organic farming; biofertilizers; biopesticides. Recombinant DNA technology; transgenic crops. Natural Resources: forest, water, mineral, food, energy and land resources. Ecosystems. Biodiversity & its conservation. Environmental pollution. Environmental ethics. Important rural development programmes in India; organizational set up of agricultural research, education and extension in India. Elements of Statistics.

2. Elements of Human Nutrition i.e. Food groups and the nutrients contributed by each group to the diet, composition and nutritive value of foods; food processing and preservation, meal planning i.e. principles menu planning for normal individuals for different age groups and at different stages of life, diet therapy, institutional food management, community nutrition and health, food related laws, policy and programmes in India. Organic and genetically modified foods.

3. Introduction to child/human development-meaning, concept, principles, prenatal development (conception to child birth), care of new born, pre- natal and post natal care of mother, development of child in early and late childhood, early childhood education, adolescence, development and relationship with peers & family, marriage and family dynamics, meaning, definition of family life cycle, family welfare programmes in India, community education, child studies methods, participation in pre-school/crèche.

4. Concept and principles of management, management process, work, work environment, work simplification, fundamentals of housing, principles of design & home furnishing-selection, care and maintenance of accessories, equipments, furniture, paintings, family finance/ economics and consumer education. Functional interiors for special needs.

5. Introduction to clothing construction- sewing machine its parts and use, preparation of fabric for lay out textile fiber-classification, processing/manufacturing method, clothing need of family members, household textile and consumers, weaving and hosiery, traditional textiles and embroideries of India, care of clothing and textile finishes, dying & printing. Organic dyes.

6. Introduction to Home Science Education communication and extension methods, programme planning & evaluation, entrepreneurial education, projected and non- projected aids (audio-visual aids) rural development programmes in India. Empowerment of women.

SYLLABUS FOR
MAINS EXAMINATION (PAPER-II)

FUNCTIONAL GROUP:

(E) WORKSHOP STAFF
(CIVIL ENGINEERING)

1. **Engineering Mathematics:**

   Matrix theory, Eigen values & Eigen vectors, system of linear equations, Numerical methods for solution of non-linear algebraic equations and differential equations, integral calculus, partial derivatives, maxima and minima, Line, Surface and Volume Integrals. Fourier series, linear, non-linear and partial differential equations, initial and boundary value problems, complex variables, Taylor's and Laurent's series, residue theorem, probability and statistics fundamentals, Sampling theorem, random variables, Normal and Poisson distributions, correlation and regression analysis.

2. **Building Materials:**

   Stone, Lime, Glass, Plastics, Steel, FRP, Ceramics, Aluminum, Fly Ash, Basic Admixtures, Timber, Bricks and Aggregates: Classification, properties and selection criteria; Cement: Types, Composition, Properties, Uses, Specifications and various Tests; Lime & Cement Mortars and Concrete: Properties and various Tests; Design of Concrete Mixes: Proportioning of aggregates and methods of mix design.

3. **Solid Mechanics:**

   Elastic constants, Stress, plane stress, Strains, plane strain, Mohr's circle of stress and strain, Elastic theories of failure, Principal Stresses, Bending, Shear and Torsion.

4. **Structural Analysis:**

   Basics of strength of materials, Types of stresses and strains, Bending moments and shear force, concept of bending and shear stresses; Analysis of determinate and indeterminate structures; Trusses, beams, plane frames; Rolling loads, Influence Lines, Unit load method & other methods; Free and Forced vibrations of single degree and multi degree freedom system; Suspended Cables; Concepts and use of Computer Aided Design.

5. **Design of Steel Structures:**

   Principles of Working Stress methods, Design of tension and compression members, Design of beams and beam column connections, built-up sections, Girders, Industrial roofs, Principles of Ultimate load design.

6. **Design of Concrete and Masonry structures:**

   Limit state design for bending, shear, axial compression and combined forces; Design of beams, Slabs, Lintels, Foundations, Retaining walls, Tanks, Staircases; Principles of pre-

stressed concrete design including materials and methods; Earthquake resistant design of structures; Design of Masonry Structure.

7. **Construction Practice, Planning and Management:**

Construction - Planning, Equipment, Site investigation and Management including Estimation with latest project management tools and network analysis for different Types of works; Analysis of Rates of various types of works; Tendering Process and Contract Management, Quality Control, Productivity, Operation Cost; Land acquisition; Labour safety and welfare.

8. **Flow of Fluids, Hydraulic Machines and Hydro Power:**

- **Fluid Mechanics, Open Channel Flow, Pipe Flow:**
- Fluid properties; Dimensional Analysis and Modeling; Fluid dynamics including flow kinematics and measurements; Flow net; Viscosity, Boundary layer and control, Drag, Lift, Principles in open channel flow, Flow controls. Hydraulic jump; Surges; Pipe networks.
- Hydraulic Machines and Hydro power -

  Various pumps, Air vessels, Hydraulic turbines – types, classifications & performance parameters; Power house –classification and layout, storage, pondage, control of supply.

9. **Hydrology and Water Resources Engineering:**

Hydrological cycle, Ground water hydrology, Well hydrology and related data analysis; Streams and their gauging; River morphology; Flood, drought and their management; Capacity of Reservoirs.

Water Resources Engineering: Multipurpose uses of Water, River basins and their potential; Irrigation systems, water demand assessment; Resources - storages and their yields; Water logging, canal and drainage design, Gravity dams, falls, weirs, Energy dissipaters, barrage Distribution works, Cross drainage works and head-works and their design; Concepts in canal design, construction & maintenance; River training, measurement and analysis of rainfall.

10. **Environmental Engineering:**

- **Water Supply Engineering:**

  Sources, Estimation, quality standards and testing of water and their treatment; Rural, Institutional and industrial water supply; Physical, chemical and biological characteristics and sources of water, Pollutants in water and its
  effects, Estimation of water demand; Drinking water Standards, Water Treatment Plants, Water distribution networks.

- **Waste Water Engineering:**

  Planning & design of domestic waste water, sewage collection and disposal; Plumbing Systems. Components and layout of sewerage system; Planning & design of Domestic Waste-water disposal system; Sludge management including treatment, disposal and re-use of treated effluents; Industrial waste waters and Effluent Treatment Plants including institutional and industrial sewage management.

- **Solid Waste Management:**

  Sources & classification of solid wastes along with planning & design of its management system; Disposal system, Beneficial aspects of wastes and Utilization by Civil

Engineers.

- **Air, Noise pollution and Ecology:**
- Concepts & general methodology.

11. Geo-technical Engineering and Foundation Engineering:

- **Geo-technical Engineering:** Soil exploration - planning & methods, Properties of soil, classification, various tests and inter- relationships; Permeability & Seepage, Compressibility, consolidation and Shearing resistance, Earth pressure theories and stress distribution in soil; Properties and uses of geo-synthetics.
- **Foundation Engineering:** Types of foundations & selection criteria, bearing capacity, settlement analysis, design and testing of shallow & deep foundations; Slope stability analysis, Earthen embankments, Dams and Earth retaining structures: types, analysis and design, Principles of ground modifications.

12. Surveying and Geology:

- **Surveying:** Classification of surveys, various methodologies, instruments & analysis of measurement of distances, elevation and directions; Field astronomy, Global Positioning System; Map preparation; Photogrammetry; Remote sensing concepts; Survey Layout for culverts, canals, bridges, road/railway alignment and buildings, Setting out of Curves.
- **Geology:** Basic knowledge of Engineering geology & its application in projects.

13. Transportation Engineering:

Highways - Planning & construction methodology, Alignment and geometric design; Traffic Surveys and Controls; Principles of Flexible and Rigid pavements design.

Tunneling - Alignment, methods of construction, disposal of muck, drainage, lighting and ventilation.

Railways Systems – Terminology, Planning, designs and maintenance practices; track modernization.

Harbours – Terminology, layouts and planning.

Airports – Layout, planning & design.

14. Emerging Technologies and Digital Tools in Civil Engineering:

- Basics of Building Information Modelling (BIM) and its applications in design and execution.
- Geographic Information System (GIS) and its role in planning and monitoring agricultural infrastructure.
- Use of Drones and UAVs for land surveying, construction monitoring, and mapping.
- Introduction to Smart Sensors, IoT in civil infrastructure (e.g., structural health monitoring).
- Basics of 3D Printing in construction – potential applications in rural/agri-infrastructure.
- Use of Augmented Reality (AR) / Virtual Reality (VR) for construction training and safety.

- Awareness of Digital Twins and automation in civil project management.

15. Sustainability and Green Infrastructure:

- Principles of Green Building Concepts and certifications (e.g., GRIHA, LEED).
- Use of recycled and eco-friendly construction materials (e.g., fly ash bricks, GGBS).
- Rainwater harvesting systems and their design for institutional campuses and farms.
- Bioengineering techniques for erosion control and slope stabilization.
- Design and implementation of climate-resilient infrastructure in agricultural contexts.
- Energy-efficient building design and passive cooling techniques.

16. Agricultural Structures and Rural Infrastructure (Specific to ICAR & KVK Systems):

- Design and layout of farm roads, godowns, rural housing, cattle sheds, etc.
- Basic knowledge of grain storage structures – godowns, silos, CAP storage.
- Design and construction of farm ponds, check dams, recharge pits.
- Polyhouse and greenhouse construction techniques.
- Site selection and development for Krishi Vigyan Kendras (KVKs) and Research Stations.
- Use of pre-fabricated structures for remote agri-infrastructure.

SYLLABUS FOR
MAINS EXAMINATION (PAPER-II)

FUNCTIONAL GROUP:

(F) WORKSHOP STAFF
(AGRICULTURAL ENGINEERING)

1. Elementary Statistics and theory of probability; differential and integral calculus; linear algebra and Fourier series; differential equations; vector algebra & vector calculus; elementary numerical analysis.

2. Electric motors: types, performance, selection, installation and maintenance; measuring instruments; fundamentals of computers; power distribution.

3. Thermodynamic principles; fluid mechanics; theory of machines.

4. Soil mechanics; soil classification; compaction & shear strength of soils; engineering mechanics; strength of materials.

5. Importance of farm equipment and role of mechanization in enhancing productivity & profitability of Indian agriculture; analysis of forces; design and production of farm machinery and power units; mechanics of tillage & traction operation; repair and maintenance of farm machines and equipment; farm engines, tractors and power tillers; tractor stability and operators comfort; field capacity and cost analysis; test codes and procedure; safety and ergonomic principles. Role of energy in economic development; solar, wind and bio-energy; biogas plants & gasifiers; biofuels from biomass; collection, characterization and storage of biomass; solar cookers & solar refrigerators.

6. Biochemical and engineering properties of biological materials; quality control & safety of raw and finished products. Principles, practices and equipment for drying, milling, separation and storage of agricultural produce and by-products; material handling equipment and operations; farmstead planning; heating & cooling load calculation; seed processing practices and equipments; food preservation methods and products development; refrigeration and air conditioning; cold stores; waste management; cost analysis & food processing plants layout; feasibility reports.

7. Surveying and levelling; hydrology; water resources in India; efficiency in water use; irrigation system and equipment; water conveyance and associated efficiency; soil-plant-water relationship; estimation of evaporation and water requirements of crop; water harvesting and use; farm ponds and reservoir; command area development; land use capability classification; ground water development; wells and pumping equipment; soil erosion and its control; land shaping and grading equipment and practices; hydraulic structures; drainage of irrigated and humid areas; salt balance and reclamation of saline and alkaline soils.

SYLLABUS FOR
MAINS EXAMINATION (PAPER-II)

FUNCTIONAL GROUP:

(G) WORKSHOP STAFF
(ELECTRICAL ENGINEERING)

1. Engineering Mathematics

Matrix theory, Eigen values & Eigen vectors, system of linear equations, Numerical methods for solution of non-linear algebraic equations and differential equations, integral calculus, partial derivatives, maxima and minima, Line, Surface and Volume Integrals. Fourier series, linear, non-linear and partial differential equations, initial and boundary value problems, complex variables, Taylor's and Laurent's series, residue theorem, probability and statistics fundamentals, Sampling theorem, random variables, Normal and Poisson distributions, correlation and regression analysis.

2. Electrical Materials

Electrical Engineering Materials, crystal structures and defects, ceramic materials, insulating materials, magnetic materials – basics, properties and applications; ferrities, ferro-magnetic materials and components; basics of solid state physics, conductors; Photo-conductivity; Basics of Nano materials and Superconductors.

3. Electric Circuits and Fields

Circuit elements, network graph, KCL, KVL, Node and Mesh analysis, ideal current and voltage sources, Thevenin's, Norton's, Superposition and Maximum Power Transfer theorems, transient response of DC and AC networks, Sinusoidal steady state analysis, basic filter concepts, two-port networks, three phase circuits, Magnetically coupled circuits, Gauss Theorem, electric field and potential due to point, line, plane and spherical charge distributions, Ampere's and Biot- Savart's laws; inductance, dielectrics, capacitance; Maxwell's equations.

4. Electrical and Electronic Measurements:

Principles of measurement, accuracy, precision and standards; Bridges and potentiometers; moving coil, moving iron, dynamometer and induction type instruments, measurement of voltage, current, power, energy and power factor, instrument transformers, digital voltmeters and multi-meters, phase, time and frequency measurement, Q-meters, oscilloscopes, potentiometric recorders, error analysis, Basics of sensors, Transducers, basics of data acquisition systems

5. Computer Fundamentals:

Number systems, Boolean algebra, arithmetic functions, Basic Architecture, Central Processing Unit, I/O and Memory Organisation; peripheral devices, data represenation and programming, basics of Operating system and networking, virtual memory, file systems; Elements of programming languages, typical examples.

6. Basic Electronics Engineering:

Basics of Semiconductor diodes and transistors and characteristics, Junction and field effect transistors (BJT, FET and MOSFETS), different types of transistor amplifiers, equivalent circuits and frequency response; oscillators and other circuits, feedback amplifiers.

7. Analog and Digital Electronics:

Operational amplifiers – characteristics and applications, combinational and sequential logic circuits, multiplexers, multi- vibrators, sample and hold circuits, A/D and D/A converters, basics of filter circuits and applications, simple active filters; Microprocessor basics-interfaces and applications, basics of linear integrated circuits; Analog communication basics, Modulation and de-modulation, noise and bandwidth, transmitters and receivers, signal to noise ratio, digital communication basics, sampling, quantizing, coding, frequency and time domain multiplexing, power line carrier communication systems.

8. Systems and Signal Processing:

Representation of continuous and discrete-time signals, shifting and scaling operations, linear, time-invariant and causal systems, Fourier series representation of continuous periodic signals, sampling theorem, Fourier and Laplace transforms, Z transforms, Discrete Fourier transform, FFT, linear convolution, discrete cosine transform, FIR filter, IIR filter, bilinear transformation.

9. Control Systems:

Principles of feedback, transfer function, block diagrams and signal flow graphs, steady-state errors, transforms and their applications; Routh-hurwitz criterion, Nyquist techniques, Bode plots, root loci, lag, lead and lead-lag compensation, stability analysis, transient and frequency response analysis, state space model, state transition matrix, controllability and observability, linear state variable feedback, PID and industrial controllers.

10. Electrical Machines:

Single phase transformers, three phase transformers - connections, parallel operation, auto-transformer, energy conversion principles, DC machines - types, windings, generator characteristics, armature reaction and commutation, starting and speed control of motors, Induction motors - principles, types, performance characteristics, starting and speed control, Synchronous machines - performance, regulation, parallel operation of generators, motor starting, characteristics and applications, servo and stepper motors.

11. Power Systems:

Basic power generation concepts, steam, gas and water turbines, transmission line models and performance, cable performance, insulation, corona and radio interference, power factor correction, symmetrical components, fault analysis, principles of protection systems, basics of solid state relays and digital protection; Circuit breakers, Radial and ring-main distribution systems, Matrix representation of power systems, load flow analysis, voltage control and economic operation, System stability concepts, Swing curves and equal area criterion. HVDC transmission and FACTS concepts, Concepts of power system dynamics, distributed generation, solar and wind power, smart grid concepts, environmental implications, fundamentals of power economics.

12. Power Electronics and Drives:

Semiconductor power diodes, transistors, thyristors, triacs, GTOs, MOSFETs and IGBTs - static characteristics and principles of operation, triggering circuits, phase control rectifiers, bridge converters - fully controlled and half controlled, principles of choppers and inverters, basis concepts of adjustable speed DC and AC drives, DC-DC switched mode converters, DC-AC switched mode converters, resonant converters, high frequency inductors and transformers, power supplies.

13. Instrumentation and Automation in Agriculture

Growing use of sensors and automation in agricultural machinery and research infrastructure

- Sensors for temperature, humidity, soil moisture, pressure, and flow
- Data acquisition systems (DAQ), PLCs, SCADA – basic architecture and operation
- Signal conditioning and remote data logging
- Basics of automation in irrigation and fertigation
- Electrical wiring and control of greenhouse, storage, and food processing facilities

SYLLABUS FOR
MAINS EXAMINATION (PAPER-II)

FUNCTIONAL GROUP:

(H) WORKSHOP STAFF
(ELECTRONICS AND INSTRUMENTATION ENGINEERING)

1. Engineering Mathematics

Matrix theory, Eigen values & Eigen vectors, system of linear equations, Numerical methods for solution of non-linear algebraic equations and differential equations, integral calculus, partial derivatives, maxima and minima, Line, Surface and Volume Integrals. Fourier series, linear, non-linear and partial differential equations, initial and boundary value problems, complex variables, Taylor's and Laurent's series, residue theorem, probability and statistics fundamentals, Sampling theorem, random variables, Normal and Poisson distributions, correlation and regression analysis.

2. Electrical Engineering and Network Theorems & Machines

Electrical Engineering: Basic principles of electricity: Ohm's law, Kirchhoff's laws, Ideal voltage source, Ideal current source and its conversions.
Network theorems & Machines: Node voltage and Mesh current analysis, Crammers rule, Reciprocating theorem for impedance matching, Superposition theorem, Thevenin's and Norton's theorems, DC Maximum power transfer theorem, Resonance in series circuits, Q-factor, Motors and generators.
AC Machines: Alternator, Induction motor, Synchronous motor.

3. ELECTRONICS

Resistors, Capacitors and Inductors and their specifications. Conductors, Semiconductors and Insulators, Formation of P-N junction, Forward and Reverse biasing voltages, Zener diode, Varactor diode, Tunnel diode and their applications, Diode as rectifier, Half wave rectifier, Full wave rectifier, Need for filter, Classification of filters, Working of clipper and clamper using diodes, Working and Configurations of PNP and NPN transistors, UJT, FET, Photo Diode & Photo Transistors, LED, LCD.

Amplifiers: h-parameter model of CE, CB and CC amplifiers, RC coupled amplifier, Transformer coupled amplifier, Darlington and Cascode amplifiers, Class-A and Class- B push-pull amplifier, Complementary type power amplifier, Heat sinks, Oscillator principle, RC phase shift oscillator, Hartley oscillator, Colpitt's oscillator, Bootstrap sweep circuit, Current sweep circuit using transistor, Transistor as an amplifier in different configurations, AC and DC load line, Operating points, Direct coupled amplifier, Differential amplifier, Positive and Negative feedback amplifiers.

4. DIGITAL ELECTRONICS

Number systems, Different postulates, De-Morgan's theorems, Simplification of Boolean expressions, K-map (up to 3 variables reductions), Logic families – TTL NAND and CMOS NAND gates - Logic gates, Half adder, Full adder, Serial adder, Parallel adder, 2's complement subtractor – Tristate Buffer. RS, T, D and Master- slave JK type flip-flops, Encoders, Decoders, 4x1 Multiplexer, 1x4 De-multiplexer, Counters, Modulus of counter, Synchronous, Asynchronous counters and their working, Decade counter, Ripple counter, Binary counter, up down counter. Registers, Shift registers, Universal shift register, Basic memories (RAM and ROM). Types of memories - EEPROM, UVPROM, Applications of flash ROM.

5. PROCESS INSTRUMENTATION

Fundamentals of Instrumentation: Basic transducer theory for the measurement of displacement (LVDT, Potentiometer, inductive, capacitive, RVDT) Angular velocity (Moving iron, Moving coil type), AC & DC tacho generators, Photoelectric tachometer. Temperature (Thermometers, RTD, Thermo couple, Thermistor, Pyrometers) Pressure (Elastic elements, Strain gauge, Piezoelectric transducer, Dead weight tester), Variable capacitance pressure transducer, Mcleodguage, Flow (Bernoulli's theorem, Head type flow meters, Rotameter, Electromagnetic flow meter, Anemometers, Ultrasonic flow meter, thermal flow meters), Level measurement (Resistive method, capacitive method, gamma rays method, ultrasonic method), Force and torque-working of load cell, column type, proving ring, hydraulic, pneumatic, piezo electric, digital force transducers. Density and viscosity-displacement type, fluid dynamic type, ultrasonic type density measurement, capillary viscometer, falling ball viscometer and rotational viscometer. Humidity-Hair hygrometer. Nuclear instrumentation-Types of ionization radiation, radiation detectors (Geiger Muller, Ionization chamber, Scintillation counter method). Smart sensors-Evolution of smart sensors (1st, 2nd, 3rd, 4th and 5th generation)-Proximity sensors, IR sensors, Motion detection sensors, accelerometer sensors, Gyroscope sensors.

Instrumentation in process industries: Power plant, Petro chemical, Iron and Steel, Paper and Pulp plant, cement plant, textile industry

6. Control Engineering

Control Engineering: Basics of open loop and closed loop control systems. Process Control: Different process variables, Process characteristics, Control system parameters, ON-OFF Control, Proportional, Integral and Derivative Controllers, PID Controller, Tuning of PID Controller, Flapper nozzle system Actuators (Pneumatic, Electro-Pneumatic, Hydraulic) P to I and I to P converters, Solenoid valve, Stepper motor actuator, Basics of control valves, Classification of control valves-Sliding stem control valve-Single seat plug, Rotating shaft, Butterfly control valves, Cascade Controller, Ratio Controller, Feed forward control systems, Adaptive Control, Line Diagrams, Letter Codes, Standards.

7. LINEAR IC APPLICATIONS

Types of ICs: Based on integration (SSI, MSI, LSI and VLSI). Characteristics of Operational Amplifier: Applications of Operational Amplifier like Summer, Integrator, Differentiator, Inverter, Voltage follower, Voltage to Current Converter, Current to Voltage Converter, Op-amp based LPF, HPF, Square wave Generator, Triangular wave generator, Mono Stable Multi-vibrator, Astable multi- vibrator, Wien-bridge Oscillator, Schmitt Trigger, ADC(Counter type & Successive approximation type) and DAC(R-2R ladder method & weighted resistor method), Applications of 555 timer IC (Mono stable multi vibrator, Astable multi vibrator, Square wave generator) Regulated power supply using 78XX regulator, PLL-LM565.

8. MICROCONTROLLER AND PLC'S

Architecture and Instruction set of 8051 Microcontroller, Programming concepts of 8051, interfacing peripherals (8255, 8251 and 8257) and Applications of 8051. PLCs: Basics of PLC architecture, Instruction set of PLC and PLC ladder diagrams of various applications, Basic concepts of SCADA, DCS, DAS, ROBOT, CNC.

9. ELECTRONIC MEASURING INSTRUMENTS: ANALOG INSTRUMENTS

PMMC movement, Ammeter, Voltmeter and Ohm meter using PMMC movement. Extension of range of Ammeter and Voltmeter, Rectifier type Voltmeter and Ammeter, Principle of Moving Iron instruments, FET input voltmeter, Differential voltmeter, Wheatstone bridge, Maxwell bridge, Schering bridge, Megger. Digital instruments: Digital multi meter, Digital LCR meter, Ramp type digital voltmeter, Successive approximation type digital voltmeter, Digital frequency meter. Cathode Ray Oscilloscope: CRT, Time base generator, Deflection sensitivity, Triggered sweep circuits, CRO applications, Storage oscilloscopes, Digital oscilloscopes, Dual trace oscilloscope.

10. ANALYTICAL AND BIO-MEDICAL INSTRUMENTATION

Analytical instrumentation: Electromagnetic Spectrum, Beer Lambert's Law, Monochromator, Light Sources and Detectors, Spectrophotometer (UV, Visible, IR), Flame Photometer, Spectrofluorometer, Interferometer, Refractometer, Polari meter, Different types of Gas Analyzers, Mass Spectrometer, Liquid Chromatography and Gas Chro matography, Auto analyzer

Bio-medical Instrumentation; Bio electricity – Resting and action potential, Types of Bio Potential signals generated in human body, Electrodes used for Bio potential measurement, Analysis & measurement of ECG, EEG, EMG. Blood Pressure-Types of measurement, Electromagnetic Blood flow meter, Ultrasonic Blood flow meter.

Therapeutic Instruments such as Cardiac Pacemakers, Defibrillators, Dialysis machine and Modern imaging systems such as X-Ray CAT, MRI.

11. INTERNET OF THINGS (IoT) IN INSTRUMENTATION

- Basics of IoT architecture: Sensors, actuators, communication protocols (MQTT, CoAP, HTTP)
- Integration of sensors with IoT platforms (e.g., Arduino, Raspberry Pi, ESP32)

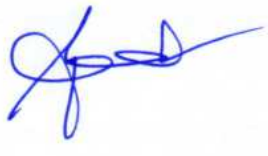
- Applications in agriculture, health care, industrial automation, and environmental monitoring
- Data acquisition using cloud (e.g., Thing Speak, Blynk)
- Case study: IoT-based real-time temperature, humidity or pressure monitoring system

12. ARTIFICIAL INTELLIGENCE & MACHINE LEARNING IN INSTRUMENTATION

- Introduction to AI/ML for instrumentation and automation
- Basics of data acquisition and preprocessing for ML
- Supervised vs. unsupervised learning
- Applications: Predictive maintenance, anomaly detection, quality control
- Case study: ML-based signal classification or image-based inspection system
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13. CYBER-PHYSICAL SYSTEMS AND INDUSTRY 4.0

- Concepts of Cyber-Physical Systems (CPS)
- Smart factories and intelligent process control
- Role of PLCs, SCADA, and IoT in CPS
- Real-time data analytics and edge computing
- Communication standards for automation (e.g., OPC-UA, Modbus TCP)



SYLLABUS FOR
MAINS EXAMINATION (PAPER-II)

FUNCTIONAL GROUP:

(I) LIBRARY/INFORMATION SCIENCE/DOCUMENTATION STAFF

1. Library and Society

Historical Development of Libraries in India, Committees and Commission on Libraries in India; Concept, Functions & Objectives of a Library; Five Laws of Library Science; Types of Libraries: Academic (School, College, University), Public, Special; Role of Libraries in Modern Society; Professional Ethics and Library Associations (e.g., ILA, ALA, IFLA, IASLIC, AALDI etc); National and International organizations: UGC, RRLF (Raja Ram Mohan Library Foundation) and UNESCO; Library Legislation; The Press and Registration of Books Act; The Delivery of Books and Newspapers (Public Libraries) Act.

2. Knowledge Organization

Organization of knowledge/Information. Modes of formation of Subjects. Classification Schemes: Colon Classification, Dewey Decimal Classification (DDC), Universal Decimal Classification (UDC); Cataloguing Codes: AACR-II (Anglo-American Cataloguing Rules), CCC (Classified Catalogue Code); Canons and Principles of cataloguing; Types of Catalogues: Dictionary and Classified; Subject Heading Lists (e.g., Chain Indexing, Sears List of subject headings, Library of Congress Subject Heading); CCF & MARC, Indexing Systems and Techniques: Pre & Post coordinate Indexing etc.; Standards of Bibliographic Information Interchange & Communication – ISO 2709, Z39.50, Z39.71; Metadata Standards: Dublin Core, MARC21 etc.

3. Library & Information Management

Library Organization and Staff Structure; Acquisition of Library Resources: Print and e-resources, Book selection Tools and Principles; Technical Processing; Circulation Services and serial control; Maintenance, Stock Verification, Binding; Budgeting and Record Keeping; Marketing of Library Products and Services; Preservation and Conservation, Hazards and Control Measures of Library Materials; Total Quality Management (TQM); Evolution of Services of Libraries and Information Centres.

4. Reference and Information Services

Concept, definitions and Types of reference Services: Ready Reference and Long-range Reference Service; CAS (Current Awareness Services); SDI (Selective Dissemination of Information); Types of Reference Sources: Primary, Secondary & Tertiary; Reference Sources: Dictionaries, Encyclopaedias, Yearbooks; Directories, Almanacs, standards, Bibliographies, Electronic Information resources, online Information resources, Open Access Resources (Repositories, journals, databases). Evaluation of Reference Sources and Web Resources.

5. Information Technology in Libraries

Computer Technology: Hardware, Software, Storage Devices, Input and Output Devices; System and Application Software; Programming Languages; Telecommunication; Computer Networks and its

Types; Internet Protocols and Standards; Data Security; Network Security; Data Mining; Data Harvesting; Big Data.

6. Library Automation

Library Automation: Concept, definition and application in libraries; Library Management Software (e.g., KOHA, SOUL and other software); Barcode, QR code, DOI, and RFID Technology; Internet and Web Resources for Libraries; Digital Libraries and Institutional Repositories (e.g., NDLI, NDLTD, E-shodhSindhu, KrishiKosh); Plagiarism Software (Turtin, Urkund etc); Cloud Computing; Web 2.0 and 3.0 – Library 2.0; Digital Preservation.

7. Library Networks and Resource Sharing

Concept and Importance of Library Networks; Major Library Networks in India: INFLIBNET, DELNET, NICNET, ERNET etc; International Information Systems and Networks: INIS, AGRIS, MEDLARS, BIOSIS, ERIC, INSPEC, Patent Information Systems (PIS) etc, Library resource sharing and Library Consortia (e.g., CeRA e-ShodhSindhu, N-List etc.); PM-ONOS (One Nation One Subscription).

8. Research Methodology

Research: Basic, definitions, types of Research; Research design; Methods of Research: Historical, Descriptive, Case study, Survey, Comparative & Experimental; Statistical Methods, Bibliometics, Scientometrics, Webometrics, etc.

SYLLABUS FOR
MAINS EXAMINATION (PAPER-II)

FUNCTIONAL GROUP:

(J) INFORMATION TECHNOLOGY

1. Operating System Concepts

- Process Management: Inter-process communication, process scheduling
- Memory Management: Swapping, virtual memory, paging, segmentation
- Device Management: Deadlocks, semaphores
- File Systems: Files, directories, security and protection mechanisms
- Distributed Operating Systems

2. Computer Networking

- Types of networks and topologies
- Network management and data transmission
- ISO-OSI and TCP/IP reference models
- Internet standards and services
- Cryptography, data compression
- Authentication and firewalls

3. Database Management Systems (DBMS)

- DBMS definition, features, and data models
- Relational databases: structure, algebra, calculus
- Database design and normalization
- Concurrency control, security, integrity
- Query processing, optimization, indexes
- Backup and recovery
- Distributed databases: concepts, architecture, design
- SQL and PL/SQL

4. Software Engineering

- Requirement analysis and specification
- Software development phases and process models
- Project and team structure
- Metrics and measurement
- Software quality factors
- Coding tools, testing, maintenance
- Gantt charts, PERT, CPM
- CASE tools

5. Data Structures & Programming Languages (C++ / Java / Python)

- Character and string manipulation
- Linear lists, stacks, queues, heaps
- Linked lists, arrays, trees, graphs
- Sorting and searching algorithms
- Flowcharts and computer algorithms
- OOP concepts: encapsulation, inheritance, polymorphism
- Control structures, pointers, dynamic memory
- File management

6. Website Development (HTML, JavaScript, CSS, CMS, .NET, JSP, PHP)

- Web technologies overview
- HTML: Structure, formatting, tables, forms, semantic HTML5
- CSS: Syntax, selectors, styling, layout, responsive design
- JavaScript: Functions, DOM, events, async operations, data formats
- CMS: WordPress, Joomla, Drupal basics
- .NET: Web development framework overview
- JSP: Syntax and role in Java web apps
- PHP: Server-side scripting, database interaction
- Web security and performance optimization

7. Mobile Application Development

- Mobile computing and platforms (Android, iOS, cross-platform)
- Application development life cycle (ADLC)
- UI/UX design principles
- Cross-platform frameworks: React Native, Flutter
- Development tools: Android Studio, Xcode, IDEs, SDKs
- Programming languages: Java, Kotlin, Swift
- Networking, APIs, database integration
- Multimedia, graphics, app security
- Testing, debugging, deployment, monetization

8. Linux / Windows Server System Administration

- OS fundamentals and command-line proficiency
- Server roles, installation, configuration
- User/group management, networking, security
- System logging, monitoring
- Backup, recovery, virtualization
- Troubleshooting and debugging

9. Database Administration

- Database types: relational, NoSQL
- Data models, modelling, architecture
- SQL fundamentals and advanced concepts
- DBMS management, installation, configuration
- Performance tuning, security
- Backup, recovery, monitoring, troubleshooting
- Platforms: Oracle, MySQL, SQL Server, PostgreSQL



10. Artificial Intelligence (AI) Technologies

- AI concepts, applications, ethics, challenges
- Machine Learning Algorithms:
  - Regression: linear, logistic
  - Classification: decision trees, k-NN, SVM, Naïve Bayes
  - Clustering: k-means, hierarchical
  - Ensemble methods: Random Forest, Gradient Boosting
- Model Evaluation: Accuracy, precision, recall, F1-score, ROC-AUC, cross-validation
- Neural Networks & Deep Learning: CNN, RNN, LSTM, GRU, Transformers
- Frameworks: TensorFlow, PyTorch, Keras
- Image Processing: OpenCV, YOLO, Faster R-CNN
- AI Tools & Platforms: Python (NumPy, Pandas, Matplotlib, Scikit-learn), Google AI, AWS AI, Azure AI, AutoML
- Emerging AI Technologies: Generative AI (text, image, video), LLMs, AI workflows, agents.

