

## Entrance Syllabus: M. Sc. Food Technology & M. Sc Nutritional Sciences

The question paper will be divided into three sections, Section A (General Awareness) and Section B (Chemistry) having 50 questions each is compulsory for all the candidates, whereas, candidates are required to attempt any one of the following subject groups from Section C having 50 questions:

1. Biology Group
2. Maths Group
3. Food and Dairy Technology Group
4. Agriculture Group
5. Home Science Group

(The questions will be of up to Graduate level)

---

### 1) General Awareness

#### 2) Food and Dairy Technology

**Food Processing:** Definition and scope of Food Science and Technology, Sources of food, scope and benefit of industrial food preservation, perishable, non perishable food. Methods of food preservation.

**Food Engineering:** Mass and energy balance, Principles operations and equipment for Processing of food materials, various unit operations, water and waste water treatment, biochemical engineering and thermo bacteriology. Food plant layout and design. Energy audit.

**Food Science:** Cereals and Pulses, Millets, Fats and Oils, Fruits and Vegetables, Meat, Poultry, Fish and egg – composition, nutritive value, processing, Preparation of Processed and preserved foods.

**Food Microbiology :** Food hygiene and sanitation, Classification of microbes, Structure of microbes, Metabolism of microbes, Food microbiology and spoilage of fruits and vegetables, milk and milk products, cereals and cereal products, Thermal inactivation of microbes: pasteurization, sterilization etc. concept of TDT, F, Z and D values. Factors affecting heat resistance.

**Food Packaging:** Packaging materials, Properties of packaging material, advantages and their applications.

**Sensory evaluation:** Objectives, type of food panels, characteristics of panel member, sensitivity tests, threshold value, paired comparison test, duo-trio test, triangle test, hedonic scale.

**Quality Control & Assurance, Food laws & Regulations, Auditing and Certification.**

**Food Business Management & Entrepreneurship.**

**General Biochemistry & Biotechnology.**

**Dairy Technology:** Definition, composition of milk, Present milk industry scenario and its future, Practices related to procurement, transportation and processing of milk, Technology of dairy products.

### 3) HOME SCIENCE

**Food & Nutrition.** Elements of Human Nutrition i.e. Food groups and the nutrients contributed by each group to the diet, composition and nutritive value of foods; functions of food nutrients, dietary allowances and nutritional requirements, meal planning i.e.

principles menu planning for normal individuals for different age groups and at different stages of life, diet modification of diets for different disease conditions- fever, diarrhoea, constipation, cardiovascular diseases, renal diseases, hepatic diseases, diabetes, community nutrition and health, , policy and programmes in India. Organic and genetically modified foods.

**Nutritional Biochemistry:** Carbohydrate, Lipids and Protein-Classification, functions, Metabolism of carbohydrates, lipids and protein, Enzymes and Hormones

**Food Science:** General chemistry of food constituents, physical properties of foods, Minerals in foods, food processing and preservation, physicochemical changes in foods during processing and storage, Biological value and PER. Food additives, contaminants and anti-nutritional factors. National and international food standards, food related laws, modern analytical techniques in food analysis.

**Human Development & Family Studies/Child Development.** Introduction to child/human development -meaning, concept, principles, prenatal development (conception to child birth), care of new born, prenatal 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.

**Home Management/ Family Resource Management:** 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.

**Clothing & Textiles: Introduction to clothing construction-** Sewing machine its parts and use, preparation of fabric for lay out textile fibre-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, dyeing & printing. Organic dyes.

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

#### **4) AGRICULTURE**

**Agrometeorology:** Elements of Weather-rainfall, temperature, humidity, wind velocity, Sunshine weather forecasting, climate change in relation to crop production.

**Genetics & Plant Breeding :** Cell and its structure, cell division-mitosis and meiosis and their significance, Organization of the genetic materials in chromosomes, Mendel's laws of inheritance. Quantitative inheritance, continuous and discontinuous variation in plants. Monogenic and polygenic inheritance. Role of Genetics in Plant breeding, self and cross-

pollinated crops, methods of breeding in field crops-introduction, selection, hybridization, mutation and polyploidy, tissue and cell culture. Plant Biotechnology-definition and scope in crop production.

**Biochemistry:** pH and buffers, Classification and nomenclature of carbohydrates; proteins; lipids; vitamins and enzymes.

**Microbiology:** Microbial cell structure, Micro-organisms- Algae, Bacteria, Fungi, Actinomycetes, Protozoa and Viruses. Role of micro-organisms in respiration, fermentation and organic matter decomposition

**Livestock Production:** Scope and importance, Important breeds Indian and exotic, distribution of cows, buffaloes and poultry in India.

**Care and management :** Systems of cattle and poultry housing, Principles of feeding, feeding practices. Balanced ration-definition and ingredients. Management of calves, bullocks, pregnant and milch animals as well as chicks crows and layers, poultry. Signs of sick animals, symptoms of common diseases in cattle and poultry, their prevention and control.

**Artificial Insemination:** Reproductive organs, collection, dilution and preservation of semen and artificial insemination, role of artificial insemination in cattle improvement.

**Livestock Products:** Processing and marketing of milk and Milk products.

**Crop Production:** Introduction: Targets and achievements in food grain production in India since independence and its future projections, sustainable crop production, commercialization of agriculture and its scope in India. Classification of field crops based on their utility-cereals, pulses, oils seeds, fiber, sugar and forage crops.

**Soil, Soil fertility, Fertilizers and Manures:** Soil, soil pH, Soil texture, soil structure, soil organisms, soil tilt, soil fertility and soil health. Essential plant nutrients, their functions and deficiency symptoms. Soil types of India and their characteristics. Organic manure, common fertilizers including straight, complex, fertilizer mixtures and bio fertilizers; integrated nutrient management system.

**Irrigation and Drainage:** Sources of irrigation (rain, canals, tanks, rivers, wells, tube wells). Scheduling of irrigation based on critical stages of growth, time interval, soil moisture content and weather parameters. Water requirement of crops. Methods of irrigation and drainage. Watershed management

**Weed Control:** Principles of weed control, methods of weed control (cultural, mechanical, chemical, biological and integrated weed management).

**Crops:** Seed bed preparation, seed treatment, time and method of sowing planting, seed rate; dose, method and time of fertilizer application, irrigation, intercultural and weed control; common pests and diseases, caused by bacteria, fungi virus and nematode and their control, integrated pest management, harvesting, threshing, post-harvest technology: storage, processing and marketing of major field crops.

**Horticulture:** Importance of fruits and vegetables in human diet, Crop diversification & processing Industry. Orchard-location and layout, ornamental gardening and kitchen garden. Planting system, training, pruning, intercropping, protection from frost and sunburn, Trees, shrubs, climbers, annuals, perennials-definition and examples. Propagation by seed, cutting, budding, layering and grafting. Cultivation practices, processing and marketing of: Fruits, Vegetables, and Flower, Principles and methods of fruit and vegetable preservation.

## 5) PHYSICS

Simple Harmonic Motion, Doppler effect, Diode and triode valves, Electromagnetism and magnetism, Thermometry, Archimedes principle, Capacity and condenser, Elasticity surface tension, Photometry Photo-electric effect, Chemical effect of current and thermo-electricity,

Gravitation, Nuclear structure and nuclear energy, Reflection at plane and spherical surface, Refraction through spherical surface, Kinetic theory of gases, Eye optical instrument aberration and defect of vision, Atomic models and spectra, Transmission of heat, X-rays, Work power and Energy, Electric field and potential

Thermodynamics, Adiabatic changes, Semi-conducting devices, Alternating current, Universe, Refraction at plane surface, Wave nature of light, Electromagnetic induction, Isothermal changes, Expansion of solids, liquids and gases, Rotatory motion of rigid bodies, Cathode rays and positive rays, Viscosity and Bernoulli's principle, Calorimetry, Motion in one, two and three dimension, Radio-activity, Electric conduction and heating effect of current

Matter waves, Uniform circulation motion, Simple circuits, Wave motion, Superposition of waves (beats, interference and stationary waves), Vibration of columns and strings, Solids, Newtons law of motion.

## 6) MATHEMATICS

**Algebra:** (a) Groups, homomorphisms, cosets, Lagrange's Theorem, Sylow Theorems, symmetric group  $S_n$ , conjugacy class, rings, ideals, quotient by ideals, maximal and prime ideals, fields, algebraic extensions, finite fields.

(b) Matrices, determinants, vector spaces, linear transformations, span, linear independence, basis, dimension, rank of a matrix, characteristic polynomial, eigenvalues, eigenvectors, upper triangulation, diagonalization, nilpotent matrices, scalar (dot) products, angle, rotations, orthogonal matrices,  $GL_n$ ,  $SL_n$ ,  $O_n$ ,  $SO_2$ ,  $SO_3$ .

**Complex Analysis:** Holomorphic functions, Cauchy-Riemann equations, integration, zeroes of analytic functions, Cauchy formulas, maximum modulus theorem, open mapping theorem, Louville's theorem, poles and singularities, residues and contour integration, conformal maps, Rouché's theorem, Morera's theorem.

### Calculus and Real Analysis:

(a) Real Line: Limits, continuity, differentiability, Riemann integration, sequences, series, limsup, liminf, pointwise and uniform convergence, uniform continuity, Taylor expansions.

(b) Multivariable: Limits, continuity, partial derivatives, chain rule, directional derivatives, total derivative, Jacobian, gradient, line integrals, surface integrals, vector fields, curl, divergence, Stoke's theorem.

(c) General: Metric spaces, Heine Borel theorem, Cauchy sequences, completeness, Weierstrass approximation.

**Topology:** Topological spaces, base of open sets, product topology, accumulation points, boundary, continuity, connectedness, path connectedness, compactness, Hausdorff spaces, normal spaces,

Urysohn's lemma, Tietze extension, Tychonoff's theorem.

## 7) CHEMISTRY:

### (a) Inorganic Chemistry

1. Periodic table: Periodic classification of elements, periodicity in properties. General methods of isolation and purification of elements.
2. Chemical bonding: Types of bonding. VSEPR theory and shapes of molecules. Hybridization, dipole moment. Ionic solids - lattice energy. Structure of diamond and graphite.
3. Main group elements (s and p blocks): Chemistry with emphasis on group relationship and gradation in properties; structure of electron deficient compounds of main group elements and application of main group elements.
4. Transition metals (d block): Characteristics of d-block elements. Coordination compounds of first row transition elements, bonding in coordination compounds – VBT and CFT of tetrahedral and octahedral complexes. Application of CFT to spectral and magnetic properties. Electronic spectra of coordination compounds.
5. Organometallic compounds: Concept of hapticity, 18 electron rule. Carbonyl compounds of first row of transition metals.
6. Non aqueous solvents: General characteristics, reactions with reference to ammonia and liquid sulphur dioxide.
7. Acids and Bases: Lewis and HSAB concepts
8. Nuclear Chemistry: Radioactivity, nuclear reactions, applications of isotopes.

### (b) Organic Chemistry

1. Nomenclature of Organic compounds.
2. Mechanism of Organic reactions: Electronic effects in Organic molecules – Inductive effect, polarizability effect, resonance, hyperconjugation. Formal charge. Generation, structure and general reactions of reactive intermediates – Carbocation, carbanion, carbon radical.
3. Stereochemistry: Types of isomerism. Projection formulae, chirality, assigning stereochemical descriptors to chiral centres and geometric isomers. Optical isomerism in compounds containing one and two asymmetric centers. Conformations of cyclohexanes.
4. Aromaticity and Huckel's rule: Mono and bicyclic carbocyclic aromatic hydrocarbons and their electrophilic substitution reactions.
5. Synthetic chemistry: Methods of preparation and characteristic reactions of alkanes, alkenes, alkynes (including their cyclic analogues), arenes and their simple functional derivatives, such as alkyl, halo, nitro, hydroxyl, alkoxy, formyl, carboxyl (and carboxylic acid derivatives). Functional group interconversions. Grignard reagents, acetoacetic and malonic ester chemistry. Synthesis of simple compounds. Structure determination and synthetic problems using chemical reactions.
6. Mechanism (with stereochemistry): Aliphatic nucleophilic substitution, elimination, enolate reactions, Claisen condensation, esterification and ester hydrolysis, Cannizzaro reaction, benzoin condensation, Perkin reaction, Claisen rearrangement, Beckmann rearrangement, Wagner-Meerwein rearrangement.
7. Carbohydrates: Classification, nomenclature. Open and cyclic formulae. Chemistry of glucose.
8. Amino acids and peptides: Structure, stereochemistry, and characteristic reactions of amino acids. Structure of peptides.
9. Heterocyclic chemistry: Monocyclic 5- and 6-membered aromatic compounds with one hetero atom (S,O,N). Their nomenclature, electronic structure, aromaticity, characteristic

properties and general reactions.

(c) Physical chemistry

1. Atomic structure: Fundamental particles. Bohr's theory of hydrogen atom; Wave-particle duality; Uncertainty principles; Schrodinger's wave equation; Quantum numbers, shapes of orbitals; Hund's rule and Pauli's exclusion principle.
2. Theory of gases: Kinetic theory of gases. Real and ideal gases, critical phenomenon.
3. Chemical thermodynamics: Reversible and irreversible processes. First law and its application to ideal and nonideal gases. Thermochemistry. Second law. Entropy and free energy, Criteria for spontaneity.
4. Chemical and Phase equilibria: Law of mass action;  $K_p$ ,  $K_c$ ,  $K_x$  and  $K_n$ ; Effect of temperature on  $K$ ; Ionic equilibria in solutions; pH and buffer solutions; Hydrolysis; Solubility product; Phase equilibria– Phase rule and its application to one-component and two-component systems; Colligative properties.
5. Electrochemistry: Conductance and its applications; Transport number; Galvanic cells; EMF and Free energy. Liquid junction potential and concentration cells. Application of emf measurement for determination of  $K$ ,  $\Delta G$ ,  $\Delta H$ ,  $\Delta S$ . Stability of complexes.
6. Chemical kinetics: Reactions of various order, Arrhenius equation, Collision theory; Theory of absolute reaction rate; Chain reactions - Normal and branched chain reactions; Enzyme kinetics; Photophysical and photochemical processes; Catalysis.
7. Quantum chemistry: Elementary quantum chemistry, state function, operators, eigen values

and eigen functions. (d)

Analytical Chemistry

Classification of analytical methods. Performance characteristics of analytical methods. Errors and their types. Acid-base titrations and acid-base indicators, redox titrations, conductometric and potentiometric titrations.

**8) Biology:**

Introduction, scope and general principles of classification of fungi.

Introduction: A brief idea of microbial diversity; scope of microbiology; a general account of Archaea.

Classification of Bryophytes.

Classification of Pteridophytes.

Classification of Gymnosperms.

Lower Non Chordata , Higher Non Chordata , Cell Biology and Genetics

Chordata , Animal distribution, Evolution and Developmental Biology , Physiology and Biochemistry.

Applied and Economic Zoology, Biotechnology, Immunology, Biological Tools & Techniques and Biostatistics , Ecology, Microbiology, Animal Behavior, Pollution and Toxicology.

Structure and properties of biomolecules: Carbohydrates - monosacharids, disaccharides, polysaccharides, lipids, amino acids, proteins, vitamins and hormones.

Enzymes: active sites, specificity, mechanisms, factors, general aspects of enzyme kinetics. Bioenergetics: Laws of thermodynamics, concept of Gibb's free energy, high energy compounds.

Biodiversity and Phytogeography : biotic communities and populations, their characteristics and population dynamics. Natural vegetation of India, static and dynamic plant geography, basic principles governing geographical distribution of plants, endemism.

Plant Physiology- Water relations, Transport of water and solutes, Photosynthesis, Plant growth regulators.

Plant cell and animal cell; Cell envelope, cell membrane, cell wall; Cell organelles- structure and function. Chemical constituents of living cells. Cell cycle, mitosis, meiosis and their significance. Structure and function of cell organelles with special emphasis on mitochondria, golgi bodies, nucleus, ribosome and endoplasmic reticulum.

Animal Physiology – Integumentary system, Digestive system circulatory system, Skelton system Respiratory system, Circulatory system, Excretory system Nervous system, Endocrine system , Reproductive Biology, Process of Blastulation & Gastrulation. Fate Map. Development of Chick up to formation of Primitive streak and mammal, Extra embryonic membranes of chick. Placentation and types of Placenta.

Plant cell and animal cell; Cell envelope, cell membrane, cell wall; Cell organelles- structure and function. Chemical constituents of living cells. Cell cycle, mitosis, meiosis and their significance. Structure and function of cell organelles with special emphasis on mitochondria, golgi bodies, nucleus, ribosome and endoplasmic reticulum.

Genetic diseases and abnormalities, chromosomal aberrations, Eugenics.

Modern Synthetic theory of Evolution; Mechanism of evolution - Variation (Mutation and Recombination) and Natural Selection with examples, types of natural selection.

Genetic engineering (Recombinant DNA technology).

Environmental Biology -Atmosphere: Major zones and its importance, composition of air, Hydrosphere, Lithosphere, Ecosystem - Definition and types , Food chain, food web and ecological pyramids , Energy flow in an ecosystem Biodiversity and its conservation , Causes of reduction of biodiversity , Wildlife conservation acts, Introductory study of national parks and sanctuaries, Hots-pots of biodiversity in India.