

**SYLLABUS
OF
ENTRANCE EXAMINATION FOR
PG ADMISSIONS – M. Tech.
IN
FOOD PROCESSING TECHNOLOGY**



**Faculty of Food Processing Technology & Bio-Energy
Anand Agricultural University
Anand – 388 110, Gujarat**

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Food Processing Technology: Introduction, historical development, status of food processing in India, sources of food and their classification. Food preservation - definition, advantages, mechanisms and techniques of food preservations. Blanching, pasteurization and sterilization - definition, types and equipment. Effect of blanching/pasteurization/sterilization on food quality. Aseptic processing - definition, procedure and equipment. Chilling - principle, systems, chill injury and chill storage conditions for various fruits and vegetables. Freezing - principles, quick and slow freezing, cryogenic freezing, thawing and application of freezing in food. Irradiation – concept, mechanism, advantages, application, limitations and effect of ionizing radiation on food. Extrusion - definition, types, equipment, applications of extrusion and extruded products. Baking and Roasting - definition and food applications. Extraction – Leaching, solvent extraction, super critical extraction, equipment and applications. Crystallization - principle, equipment and applications. Frying - principle, types, food application, frying equipment and fried food products. Membrane processing - osmosis, reverse osmosis, ultrafiltration, types of membranes and their limitations and application of membrane processing in food. Hurdle Technology – concept, mechanism and application in food. Minimal processing, Pulsed electric field processing, High pressure processing and Ultrasound processing.

Processing Technology of Food Grains: Status of food grain production and its supply chain in India; structure, physico-chemical properties, thermal properties and biochemical properties of food grains, Effect of different factors on the physical, thermal and biochemical properties of grains. Parboiling- methods, effect of parboiling on milling, nutritional and cooking quality of rice; Paddy milling: operations, equipment, factors influencing final rice- milling outturn, processed rice products; Wheat milling: break system, purification system and reduction system, extraction rate, processed wheat products, quality characteristics of flour and their suitability. Pulse mill equipment, methods and milling process. Dry and wet milling of corn, Starch and gluten separation; Malting and milling of barley, Milling of millets; Oil milling mechanical oil expression, solvent extraction. processing of extracted oil-refining, hydrogenation, fractionation, transesterification, and interesterification. Processing of deoiled cakes.

Processing Technology of Fruits and Vegetables: Nutritive value of fruits, vegetables and their role in human diet. Production status of fruits and vegetables in India. Export potential of processed and raw fruits and vegetable produce; FSSI specifications of different processed products from fruits/vegetables; Canning of fruits and vegetables: process, equipment, parameters defects, cans and equipment; Freezing of fruits and vegetables: purpose, methods, quick freezing, individual quick freezing; Frozen storage, controlled atmosphere storage (CAS), modified atmosphere storage (MAS), controlled atmosphere packaging (CAP) and modified atmosphere packaging (MAP). Specification for various fruit and vegetable juices and beverages: Methods of preparation of juices, squashes, syrups, sherbet and cordials, extraction, deaeration and filtration, equipment for juice processing, aseptic processing, Jam, jelly and marmalade, crystallized fruits and fruit preserves.

Processing Technology of Milk and Milk Products: Historical development of dairy in India; National Dairy Development Board (NDDB); operation flood/ white revolution; production and utilization of milk; basis for pricing of milk; marketing

channel for milk in India; milk definition and composition; physico-chemical properties; grading and quality testing; defects in milk; standardized milk, skim milk; sterilized milk; reconstituted/ rehydrated milk; recombined milk; Butter; Ice cream; Cheese; dried milk; Malted milk and beverages; traditional Indian Dairy Products; fermented products; fat rich products; milk based puddings/ desserts etc.

Processing Technology of Meat, Fish & Poultry: Sources of meat, fish and poultry in India; development of meat, fish and poultry industries in India and its importance in national economy and their export potential; physico-chemical properties, conversion of muscle to meat, pre-slaughter handling, conditioning; meat-spoilage micro-organisms; preservation of meat; eating quality of meat; texture and tenderness, artificial tenderization; abattoir design and layout, meat plant sanitation and safety, by-products utilization. Egg- structure, composition, nutritive value and quality characteristics: Processing and preservation of eggs; poultry processing and fish processing

Processing Technology of Spices and Plantation Crops: Spices: classification, composition, structure and characteristics; production status of spices in India; preservation and processing of major and minor spices; processing of whole spice, spice powder, paste and extracts; spice mixtures; spice oils and oleoresins, functional role of spices, quality specification for spices; composition and processing of tea leaves; coffee cherries; cocoa bean etc.

Design and Formulation of Foods: Concept and recent trends in food formulation, infant foods, weaning foods, Indian traditional sweet and snack food products; therapeutic foods for special demographic groups; geriatric food; foods for persons suffering from various ailments; antioxidant rich food products; foods for drought and disaster afflicted; defence services, sportsmen, space food etc.

Food Packaging Technology & Equipment: Functions and marketing consideration for a package; types of packaging materials; manufacturing of packaging materials and packages; properties of packaging material; selection criteria of packaging materials; machinery for packaging; package labelling; Shelf life of packaged food; quality testing of packaging material etc.

Bakery and Confectionery Products: Historical development and status of bakery industry in India; different bakery products; specifications of bakery products; role of major and minor ingredients; processes, problems associated and equipment for manufacturing of different bakery products; nutritional and quality aspect of bakery products. Confectionary - historical development; classification and technical considerations for confectionary products; raw materials and their role; batch and continuous method of manufacturing.

Functional Foods and Nutraceuticals: Concepts and definition; functional colonic foods; functional fats and spreads; functional confectionery; dietary fiber; manufacturing of functional foods and nutraceuticals; packaging and labelling; specific nutrient claims; disease-specific claims; dietary supplement Health and Education Act (DSHEA) etc.

Thermodynamics: Fundamental concepts, work and heat, laws of thermodynamics, basics of energy conversion cycles, entropy, properties of gas and gas mixtures, boilers and engines.

Fluid Mechanics: Properties of fluids, pressure and flow measurements, fluid static, fluid kinematics, fluid dynamics, fluid flow classification, Euler, Bernoulli's and Navier Stokes equations and applications, analysis of flow through pipes, open channel, mouth-piece and orifice, weir and notches, fluid machines.

Basic Civil Engineering: Foundation, elements of building construction, materials of construction, drawing scales and types of projections, design process and softwares, estimation and costing, safety measures..

Basic Mechanical Engineering: Engineering materials, measuring and gauging, heat treatment processes, machine tools, hand tools, carpentry, welding, smithy, sheet metal work etc.

Material Science and Engineering: Crystal geometry and structure, bonds in structure, polymer, plastics and ceramics, material properties, corrosion, design of moulds, stress-strain, combined stresses, stresses on inclined planes, statically indeterminate members, torsion, bending, transformation of stresses and strain, Mohr's circle.

Basic Electrical Engineering: Single phase and three phase systems, A.C. and D.C. machines, electric power economics, transformers, electrical wiring, electrical measuring equipment, safety and protection.

Basic Electronic and Instrumentation Engineering: Semiconductor physics and devices; PN junction diode and rectifier; bipolar junction transistors; number systems; logic gates & boolean algebra; measurement & instrumentation: instruments in processing plants, controller, recorder and measurement errors; construction, principle & applications of: resistive, strain gauges, capacitive, inductive, photoelectric & piezoelectric transducers.

Food Process Engineering: Basic principles, units and dimensions, dimensional ratios, material and energy balance, principles of heat transfers, heat transfer applications, thermal process calculations, drying and dehydration, EMC, sorption and desorption isotherms, water activity, freezing, mass transfer processes, mechanical separations, agitation and mixing, size reduction, cryogenic grinding, food processing equipment for blanching, baking, roasting, extrusion, frying, puffing, ionizing irradiation, heat exchangers, crystallizers, PEF, non-thermal processing, fermenter and bioreactors, dairy processing and packaging.

Process Equipment Design: Selection of material, design of heat exchangers, evaporators, pressure vessels, material handling equipment, dryers, agitators, freezing equipment and fermenters, hazard and safety considerations.

Process Control in Food Industry: Processing parameters (temperature, pressure, flow, humidity, viscosity, weight, moisture content etc.) measurements, sensors and transducers, process control systems, programmable logic controllers, DCS and

SCADA system. non-destructive quality evaluation techniques. Measurement techniques and instruments for food quality determination, destructive and non-destructive quality evaluation, UV VIS NIR spectroscopy, X-ray, CT, NMR, machine vision.

Refrigeration and Air Conditioning: Definitions, general gas law, Dalton's law, heat engine, heat pump and refrigerating machine, reversed Carnot cycle, vapour compression system, vapour absorption system, refrigerants, applications of refrigeration in food processing and preservation: cold store, freezing, freeze drying, refrigeration load estimation, air conditioning and psychrometric processes in air conditioning.

Food Plant Utilities and Services: classification, commercial energy, electrical systems: electrical motors, compressed air systems, HAVAC and refrigeration systems, fans and blowers, DG set, thermal systems: fuels and combustion, boilers, steam system, waste heat recovery, lighting, CIP, fire protection etc.

Food Plant Design and Layout: Concepts and general design considerations, plant location, product and process design, process flow charts, equipment selection, plant layout, selection of machinery for handling utilities like water, steam, fuel etc. and disposal of effluents and residues, feasibility and project report.

Computer Application in Food Processing: Spreadsheet applications, computer programming using C and C++, data structure, web hosting and webpage design, SCADA system and applications, MATLAB in food processing, introduction to CFD applications in food industry.

General Microbiology: Introduction and history of microbiology; classification identification and characteristics of microorganisms; microbial ultrastructure and functions: structures external to cell wall, cell wall, structures internal to cell wall, spores and cysts; Microbial morphology, metabolism and growth; lytic cycle and lysogenic of virus; cultivation and preservation of micro-organisms: media, nutritional requirements and enumeration; control of microorganisms: physical and chemical agents; Bacterial genetics.

Food Chemistry: Introduction, water, carbohydrates, fats and oils, essential fatty acids, amino acids, proteins, enzymes, food flavours, food colorants, food additives, food toxins etc.

Food Microbiology: Microorganisms important for food industry; source of microorganisms in food and their control; growth of microorganisms in food; microbial metabolism; food spoilage; food borne diseases; food preservation etc.

Food Nutrition and Biochemistry: Basic food groups, nutrients supplied by food and requirements of RDA; enzyme and coenzymes, derivation of Michaelis-Menten equation and enzyme inhibition; nucleic acids; functions, sources, digestion, absorption, assimilation and transport of carbohydrates, proteins and fats; carbohydrates and lipid metabolism; functions, sources, absorption and deficiency of minerals and vitamins; hormones & relation between vitamins and hormones; physicochemical and nutritional changes during processing.

Food Plant Sanitation: Importance of sanitation in food plants, sanitation laws, guidelines and sanitary practices; food contamination and spoilage: classification of food on the basis of shelf life; personal hygiene and safety; cleaning compounds and sanitizers; sanitization methods; pest control in food plant; sanitary design and construction for food processing plant; water quality and treatment; regulatory agencies in sanitation.

Food Regulations & Quality Assurance: Introduction; quality attributes and their role; sensory assessment; Measuring responses; total quality management; quality assessment of food materials; food Laws and Standards; food safety management systems; various ISO standards; laboratory accreditation systems.

Bioprocess Technology and Engineering: Overview; industrial fermentations; Industrially important microorganisms; strain improvement and preservation of cultures; fermentation media; microbial growth; bioreactor design; upstream and downstream processes; methods of cell destruction; methods of purification of enzyme/product, enzyme engineering, process modelling, etc.

Food Biotechnology: Primary and secondary metabolites; metabolic pathways; techniques for isolation and screening of microorganism; fermented food; process of enzymes, alcohol, organic acids, amino acids & vitamins. food borne infections and diseases; significance to public health, food hazards and risk factors; food Borne pathogens; conventional microbiological methods:

Post-Harvest Engineering: Post harvest technology of crops; post-harvest losses; decorticating & shelling; psychrometry; field drying; parboiling; cleaning; sorting and grading; separation; milling; conveying; storage.

Project Management & Entrepreneurship Development: Overview of project management; project formulation; network scheduling: resource consideration; project costing; entrepreneurship in food processing; development of enterprise.

Marketing Management & International Trade: Overview of marketing management; market structure and consumer buying behaviour; marketing opportunities analysis; market measurement; product policy and planning; pricing decisions; promotion-mix decisions; international marketing and international trade; exports.

Bioenergy: Classification of energy sources; renewable energy sources; characterization of biomass; Types, construction, working principle, uses and safety/environmental aspects of different renewable energy devices; biogas plants; solar heating devices; photovoltaic cells and arrays; wind energy, hydroelectric energy, ocean energy, briquetting and baling of biomass, biomass combustion, biodiesel preparation and energy conservation in agriculture.