

Ph.D. Entrance Exam Syllabus for Food Technology

Unit 1: Introductory Food Technology

Introduction to food technology. Food processing industries/institutions/food scientists of importance in India. Food attributes *viz.* colour, texture, flavour, nutritive value and consumer preferences. Causes of food spoilage, sources of microbial contamination of foods, food borne illnesses, water activity and its relation to spoilage of foods. Spoilage of processed products and their detection. Principles and methods of food preservation. Food fortification, Composition and related quality factors for processing. Methods of food preservation such as heat processing, pasteurization, canning, dehydration, freezing, freeze drying, fermentation, microwave, irradiation and chemical additives. Refrigerated and modified atmosphere storage. Aseptic preservation, hurdle technology, hydrostatic pressure technology and microwave processing. Use of non-thermal technologies (microfiltration, bacteriofugation, ultra high voltage electric fields, pulse electric fields, high pressure processing, irradiation, thermosonication), alternate-thermal technologies (ohmic heating, dielectric heating, infrared and induction heating) and biological technologies (antibacterial enzymes, bacteriocins, proteins and peptides) in food processing.

Unit 2: Technology of Foods of Plant Origin

(a) Fruits and Vegetable Processing: Post harvest handling and storage of fresh fruits and vegetables. Preparation of fruits and vegetables for processing. Minimally processed products. Cold chain logistics. ZECC (Zero Energy Cool Chambers), CCSR (Charcoal cool storage Rooms) Thermal processing and process time evaluation for canned products, process optimization, aseptic canning, methods for canning of different fruits, and vegetables; Dehydration and associated quality changes during drying and storage of dehydrated products. Solar drying. Intermediate moisture foods. Preparation and utilization of fruits and vegetables juices in non-fermented/fermented/ aerated beverages, health drinks. Membrane technology. Chemistry and manufacture of pectin, role in gel formation and products like jellies and marmalades. Technology of preservatives, pickles, chutney's and sauces. Nature and control of spoilage in these products. Re-structured fruits and vegetables. By products utilization of fruits and vegetable processing industry. Processing methods of frozen fruits and vegetables, IQF products, packaging, storage and thawing. Role of Pectinases. Tomato products such as juice, puree, paste, soup, sauce and ketchup. Other convenience foods from fruits and vegetables. Beverages, tea, cocoa and coffee processing. Medicinal and aromatic plants: their therapeutic values. Spice Processing *viz.* cleaning, grading, drying, grinding, packaging and storage. Oleoresins and essential oils.

(b) Food grain Processing: Structure, composition of different grains like wheat, rice, barley, oat, maize and millets. Anti-nutritional factors in food grains and oilseeds. Milling of grains. Wheat flour/semolina and its use in traditional/non-traditional foods like breads, biscuits, cakes, doughnuts, buns, pasta goods, extruded, confectionary products, breakfast and snack foods. Rheology of wheat and rice flour. Preparation of vital wheat gluten and its utilization. Instant ready mixtures. Enzymes (amylases and proteases) in milling and baking. Milling and parboiling of rice; by-products of rice milling and their utilization. Processed products from rice. Pearling, malting, brewing and preparation of malted milk feeds from barley. Significance of β -glucans. Milling of oats and its processing into flakes, porridge and oatmeal. Wet and dry milling of corn, manufacture of corn flakes, corn syrup, corn starch, corn steep liquor and germ oil. Structure and composition of pulses and their importance in

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Indian diet. Milling and processing of pulses viz. germination, cooking, roasting, frying, canning and fermentation. Use in traditional products, protein concentrates and isolates. Modified starches and proteins. Oilseeds: edible oilseeds, composition and importance in India. Oilseed processing. Oil extraction and its processing, by-products of oil refining. Production, packaging and storage of vanaspati, peanut butter, protein concentrates, isolates and their use in high protein foods. Export of oilseed cakes. International market and consumer preferences for quality in cakes for use in textured vegetable proteins. Millets: composition, nutritional significance, structure and processing. Dairy analogues based on plant milk. Spices Processing: Oleoresin and essential oil extraction

Unit 3: Technology of Foods of Animal Origin

(a) Technology of Milk and Milk Products: Milk and Milk production in India. Importance of milk processing plants in the country. Handling and maintenance of dairy plant equipment. Dairy plant operations viz. receiving, separation, clarification, pasteurization, standardization, homogenization, sterilization, storage, transport and distribution of milk. Problems of milk supply in India. UHT, toned, humanized, fortified, reconstituted and flavoured milks. Technology of fermented milks. Milk products processing viz. cream, butter, *ghee*, cheese, condensed milk, evaporated milk, whole and skimmed milk powder, ice-cream, butter oil, *khoa*, *channa*, *paneer* and similar products. Judging and grading of milk products. Cheese spreads by spray and roller drying techniques. EMC (Enzyme modified cheese), Enzymes in dairy processing. Insanitization viz. selection and use of dairy cleaner and sanitizer. In plant cleaning system. Scope and functioning of milk supply schemes and various national and international organizations. Specifications and standards in milk processing industry. Dairy plant sanitation and waste disposal.

(b) Technology of Meat / Fish / Poultry Products: Scope of meat, fish and poultry processing industry in India. Chemistry and microscopic structure of meat tissue. Ante mortem inspection. Slaughter and dressing of various animals and poultry birds. Post mortem examination. Rigor mortis. Retail and wholesale cuts. Factors affecting meat quality. Curing, smoking, freezing, canning and dehydration of meat, poultry and their products. Sausage making. Microbial factors influencing keeping quality of meat. Processing and preservation of fish and its products. Handling, canning, smoking and freezing of fresh water fish and its products. Meat tenderization and role of enzymes in meat processing. Utilization of by-products. Zoonotic diseases. Structure and composition of egg and factors effecting quality. Quality measurement. Preservation of eggs using oil coating, refrigeration, thermo stabilization and antibiotics. Packing, storage and transportation of eggs. Technology of egg products viz. egg powder, albumen, flakes and calcium tablets. Industrial and food user physiological conditions and quality of fish products.

Unit 4: Food Engineering

Properties of solid food materials - shape, density, porosity and others; Angles of friction/repose, relations and simple calculations; Pressure drops and pressure, head and energy relationships; Flow properties of liquid foods, pulps and slurries; Viscosity, consistency, simple rheological models; Heat transfer, conduction, convection and radiation with examples; steady and unsteady heat transfer, overall heat transfer coefficient and its significance, heat exchange equipment, types, relative merits and demerits; Radiation heating; Infra red and solar heating - principles, applications and equipment; Freezing and thawing, principles, applications and equipment; Evaporation: classification and uses of evaporators, multiple effect evaporation, vapour recompression, basic calculations; Extraction and leaching: principles, equipment, types and applications; Mass and momentum transfer operations: theory and applications in food processing; Distillation: principles, equipment and applications, steam distillation and molecular distillation; Drying: theory of drying, types of driers and their applications

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