

## **Syllabus for Entrance Test for Ph.D. (Tech) in Food Biotechnology**

1. **Fundamentals of Food Biotechnology and Genetics:** Role of enzymes in various food processing sectors, fermentative production of enzymes used in food industry. Chemical structure of nucleic acids, introduction to Genetics, DNA replication, transcription and translation; DNA repair mechanism; modifying enzymes; recombinant DNA technology; mutation and polymorphism and their detection; PCR, RT-PCR, electrophoresis, electro blotting and capillary blotting; genetically modified foods.
2. **Basics of Food Science and Technology:** Basics of food chemistry, nutrition, microbiology, biochemistry; chemical composition of foods, standards of identity, purity and methodology for analysis of cereals, legumes, oil seeds, tubers, fruits, vegetables and their products, tea, coffee, cocoa, chocolate, spices, condiments; the effect of food constituents on quality of foods; different forms of water present in foods and their effect on quality and preservation of foods; chemical and enzymatic changes affecting the above properties during harvesting, preparation, storing, processing etc.; Introduction to processing of various foods including dairy, bakery, fruit and vegetable, confectionary, beverages etc.
3. **Basics of Human Nutrition:** Energy value of foods, calculation of energy value based on proximate composition of foods, daily energy need of body for basal metabolism, physical activity and diet induced thermogenesis, energy balance, B. M. I.; role of carbohydrates in nutrition including dental caries, lactose intolerance, galactosemia, dietary fiber, resistant starch, glycemic index of foods, prebiotics including oligosaccharides; role of proteins in nutrition including essential amino acids, protein quality, complete proteins, animal and plant sources of proteins, protein calorie malnutrition, protein quality estimation methods including in vivo and in vitro; role of lipids in nutrition including fat digestion, absorption, saturated fats, medium chain triglycerides, PUFAs as essential fatty acids, omega 6 and omega 3 fats, cholesterol, plant sterols; role of micronutrients in nutrition including fat and water soluble vitamins and minerals; role of water and electrolytes, rehydration therapy; assessment of nutritional status; lifecycle nutrition; sports nutrition; food

- fortification; effect of food processing and storage on nutrients; nutraceuticals and functional foods; nutrigenomics
4. **Biotechnology of Fermented Foods:** Fermented foods like dairy products, baked goods, oriental fermentations, Indian fermented foods, fermented meat and fish products, alcoholic beverages etc.; biochemistry and microbiology of fermented foods, role of enzymes, the role of biotechnology in fermented food products; Starter culture development, process development.
  5. **Fundamentals of Food Process Engineering and Food Preservation:** Transport phenomenon; heat transfer, mass transfer in food processing; problems of equipment design with reference to common food processing unit operations such as drying, freezing, evaporation, membrane filtration. Principles of thermal processing; calculation of process time- temperature schedules. Other important principles of preservation of food. Processing of fruits, vegetables, grains etc.; emerging non-thermal methods of processing.
  6. **Principles of Bioprocess Engineering:** Microbial growth and death kinetics, batch and continuous fermenter, Monod growth kinetics, Michaelis- Menten kinetics, concept of upstream and downstream processing methods in bioprocesses.
  7. **Cell Culture Technology:** Introduction to plant and animal tissue cultures and cell cultures in general. Plant tissue culture: Concept of totipotency, differentiation and re-differentiation; callus growth patterns/ characteristics, organogenesis, hairy root culture; soma clonal variations, somatic embryogenesis, synthetic seeds, anther and pollen culture, embryo culture and significance of haploid plants; Plant tissue culture techniques for crop improvement; protoplast technology: isolation & fusion, somatic hybridization; production of virus free plants; production of secondary metabolites indexing for plant pathogens. Animal, mammalian and other cell lines and therapeutic and other biomolecule production. Technological aspects for commercial utilization of cell cultures.
  8. **Techniques in Food Analysis:** Principles of chromatographic and spectroscopic analysis of foods: UV-Visible, IR, fluorescence, AAS, GC, GCMS, HPLC, LCMS; Compositional analysis of foods: moisture, ash, fat, protein, carbohydrates; Chemical and physical properties of foods: fat and protein characterization, detection of

contaminants/adulterants, rheological and thermal analysis, measurement of colour and texture; Sensory evaluation of foods

9. **Food Packaging Science and Technology:** Functions of packaging, levels of packaging, materials used, their properties, food applications of these materials, factors affecting shelf life of packaged foods, food package labelling, package testing methods for different properties, retort packaging, aseptic packaging, MAP, active packaging, intelligent packaging, microwaveable packaging, edible coatings and films, biodegradable packaging, migration and scalping.
10. **Food Safety and Toxicology:** Types of food hazards: biological, chemical and physical; risk assessment; existing and emerging pathogens due to globalization of food trade; newer systems of safety evaluation such as HACCP; testing of food ingredients & additives; animal studies including LD50; Ames test for teratogenicity; natural toxic constituents in plant foods; shellfish poisoning; chemicals from processing such as fumigants, chlorinated solvents, autoxidation products, carcinogens in smoked foods and pyrolysis, pesticides and herbicides. Intentional and unintentional additives; toxicity due to microbial toxins including botulinum, staphylococcal toxins, mycotoxins and due to other food pathogens; food allergy and intolerance; detoxification strategy.
11. **Food Safety Standards and Regulations in India:** About FSSAI, FSSAI prescribed standards for various categories of foods such as milk and milk products, fats and oils, fruit and vegetable products, cereal products, meat and fish products, sweets and confections etc.

\*\*\*\*\*