

Introduction to Food Technology

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Key concepts, processes, and career pathways

1. What Is Food Technology?

Aspect	Description
Definition	Application of scientific principles and engineering to the production, preservation, packaging, distribution, and safety of food.
Goal	Deliver safe, nutritious, affordable, and appealing food that meets consumer needs and regulatory standards.
Disciplines Integrated	Chemistry, microbiology, physics, engineering, nutrition, economics, and sensory science.

2. Core Areas of Food Technology

Area	Main Activities	Typical Tools & Techniques
Food Processing	Transform raw ingredients into finished products (e.g., canning, drying, extrusion).	Heat exchangers, mixers, reactors, high pressure processing (HPP).
Food Preservation	Extend shelf life while retaining quality.	Pasteurization, sterilization, refrigeration, freezing, fermentation, edible coatings.
Food Packaging	Protect food, convey information, and enhance convenience.	Barrier films, modified atmosphere packaging (MAP), active & smart packaging, biodegradable materials.
Food Safety & Quality Assurance	Detect and control hazards; ensure consistency.	HACCP, ISO 22000, microbial testing, sensory panels, rapid detection kits.
Product Development	Create new foods or improve existing ones.	Formulation software, prototype trials, consumer testing, market analysis.
Nutrition & Functional Foods	Enrich foods with health promoting components.	Fortification, probiotics, nutraceuticals, bioactive peptides.

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Sustainability & Waste Management	Reduce environmental impact of food systems.	Valorisation of by-products, up-cycling, life-cycle assessment (LCA), circular economy models.

3. Fundamental Scientific Principles

Principle	Relevance to Food Technology
Mass & Energy Balance	Design of processes (e.g., drying, evaporation) and scaling up from lab to plant.
Thermodynamics	Understanding heat transfer in cooking, pasteurization, and freezing.
Kinetics & Reaction Engineering	Controlling enzymatic and microbial reactions (e.g., ripening, spoilage).
Colloid & Surface Science	Stability of emulsions, foams, gels, and suspensions.
Microbiology	Pathogen control, fermentation, probiotic development.
Analytical Chemistry	Nutrient profiling, contaminant detection, authenticity testing.

4. Major Food Processing Techniques

Technique	Principle	Typical Applications
Thermal Processing	Heat inactivates microbes and enzymes.	Canning, pasteurization, UHT milk.
Mechanical Processing	Physical forces alter texture and shape.	Grinding, extrusion, high-shear mixing.
Drying & Dehydration	Water removal reduces activity of spoilage agents.	Fruit powders, instant soups, jerky.
Fermentation	Microbial metabolism creates flavor, texture, and bio-actives.	Yogurt, cheese, kimchi, soy sauce.
High-Pressure Processing (HPP)	Pressure disrupts microbial cells without heat.	Ready-to-eat meals, guacamole, juices.
Irradiation	Ionizing radiation damages DNA of microorganisms.	Spices, herbs, meat for shelf-life extension.

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Technique

Principle

Typical Applications

Membrane Separation

Selective permeation based on size/charge.

Milk