

Introduction to Food Technology

Introduction to Food Technology

Key concepts, processes, and career pathways

1. What Is Food Technology?

Aspect	Description
Definition	The scientific and engineering discipline that applies principles of chemistry, biology, physics, and engineering to the production, preservation, packaging, distribution, and safety of food.
Goal	Deliver safe, nutritious, affordable, and appealing food to consumers while minimizing waste and environmental impact. - Raw material handling - Processing & formulation - Preservation & storage
Scope	- Packaging design - Quality control & assurance - Regulatory compliance - Product development & innovation

2. Core Scientific Foundations

Discipline	Relevance to Food Technology
Food Chemistry	Understanding composition (proteins, lipids, carbohydrates, vitamins, minerals) and reactions (Maillard browning, oxidation, enzymatic changes).
Food Microbiology	Control of beneficial (fermentation) and harmful microorganisms; development of hygienic processes and shelf life extension.
Food Physics	Heat & mass transfer during cooking, drying, freezing; texture analysis; rheology of sauces and doughs.
Nutrition Science	Balancing macro and micronutrients; designing functional foods and fortified products.
Engineering	Design of equipment (extruders, pasteurizers, mixers), process scale up, automation, and energy efficiency.

Introduction to Food Technology

3. Major Processing Operations

Operation	Primary Purpose	Typical Technologies
Cleaning & Sorting	Remove debris, foreign matter, and defective items.	Water washes, air classifiers, optical sorters.
Milling & Grinding	Reduce particle size, modify functional properties.	Hammer mills, roller mills, jet mills.
Mixing & Blending	Homogenize ingredients, develop doughs/batters.	Planetary mixers, ribbon blenders, high shear mixers.
Thermal Processing	Kill pathogens, inactivate enzymes, extend shelf life.	Pasteurization, sterilization, UHT, blanching, baking.
Non-thermal Processing	Preserve nutrients & fresh-like qualities.	High-pressure processing (HPP), pulsed electric fields (PEF), irradiation, cold plasma.
Fermentation	Produce flavors, textures, and functional compounds.	Yogurt, cheese, sourdough, kombucha, tempeh.
Drying & Dehydration	Reduce water activity for stability.	Spray drying, freeze-drying, drum drying, hot-air drying.
Freezing & Cryogenic	Preserve raw state, control texture.	Blast freezing, cryogenic liquid nitrogen freezing.
Packaging	Protect product, convey information, extend shelf life.	Aseptic cartons, modified-atmosphere packaging (MAP), biodegradable films.

4. Food Safety & Quality Assurance

1. Hazard Analysis & Critical Control Points (HACCP)

- Identify hazards (Biological, Chemical, Physical).
- Determine critical control points (CCPs) and set limits.
- Monitor CCPs, establish corrective actions, verify system.

2. Good Manufacturing Practices (GMP)

- Facility design, sanitation, personnel hygiene, equipment maintenance.

Introduction to Food Technology

3. Food Safety Standards

- **International:** Codex Alimentarius, ISO 22000.
- **Regional/National:** FDA (US), EFSA (EU), FSSAI (India), etc