

Introduction to Food Technology

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Key concepts, major areas, and practical applications

1. What Is Food Technology?

Aspect	Description
Definition	The scientific discipline that applies engineering, chemistry, microbiology, and nutrition to the production, processing, preservation, packaging, and distribution of food.
Goal	Deliver safe, nutritious, affordable, and appealing food that meets consumer needs and regulatory standards.
Scope	From raw material handling to the final product on the shelf, including waste reduction and sustainability.

2. Core Disciplines Integrated in Food Technology

Discipline	Role in Food Technology
Food Chemistry	Analyzes composition (proteins, lipids, carbohydrates, vitamins, minerals) and reactions (Maillard, oxidation).
Food Microbiology	Studies beneficial and harmful microorganisms; designs preservation (pasteurization, fermentation, biopreservation).
Food Engineering	Designs equipment and processes (heat exchangers, extrusion, drying, refrigeration).
Nutrition Science	Ensures products meet dietary guidelines and functional food claims.
Sensory Science	Evaluates appearance, aroma, texture, and taste to match consumer expectations.
Regulatory & Safety	Interprets food laws, HACCP, FSMA, labeling, and allergen management.

3. Major Stages of the Food Production Chain

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1. Raw Material Acquisition

- Sourcing, quality grading, initial cleaning.

2. Pre-Processing

- Sorting, washing, trimming, blanching.

3. Processing & Formulation

- Thermal (cooking, sterilization), non-thermal (high-pressure, pulsed electric fields), enzymatic, fermentation.

4. Preservation

- Methods: cooling, freezing, drying, canning, packaging atmosphere control.

5. Packaging

- Material selection (plastic, glass, metal, biodegradable), barrier properties, active/intelligent packaging.

6. Distribution & Retail

- Cold-chain logistics, shelf-life monitoring, traceability.

7. Consumption & Waste Management

- Portion control, consumer education, up-cycling, valorization of by-products.
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4. Key Processing Technologies

Technology	Principle	Typical Applications
Thermal Processing	Heat kills microbes & inactivates enzymes.	Canning, pasteurization, UHT milk.
High-Pressure Processing (HPP)	300–600 MPa pressure disrupts cell membranes.	Fresh juices, deli meats, guacamole.
Extrusion	High shear & temperature forces material through a die.	Breakfast cereals, snack pellets, meat analogues.
Drying (spray, freeze, drum)	Water removal to inhibit spoilage.	Milk powder, instant coffee, fruit chips.
Fermentation	Microbial metabolism transforms substrates.	Yogurt, cheese, kimchi, soy sauce, kombucha.
Encapsulation	Protects bioactives in micro- or nano-carriers.	Probiotic tablets, flavor oils, vitamins.

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Technology

Principle

Typical Applications

3D Food Printing

Layer-by-layer deposition of food inks.

Customized nutrition bars, decorative confectionery.

5. Food Safety & Quality Assurance

1. Hazard Analysis & Critical Control Points (HACCP)

- Identify hazards ? establish critical limits ? monitor ? corrective actions.

2. Good Manufacturing Practices (GMP)

- Facility design, hygiene, equipment