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CUET · HOME SCIENCE · CLASS XII · CODE 315

Food Processing and Technology

CUET unit: Unit II — Nutrition, Food Science and Technology

By **UniDrill** · NCERT-grounded study material

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📌 Snapshot

- Introduces Food Processing and Technology as a discipline that converts raw plant/animal material into safe, shelf-stable, marketable foods.
- Traces history from prehistoric drying, fermentation and salting to Nicolas Appert's canning (1810) and Louis Pasteur's pasteurisation (1864).
- Establishes core distinctions between Food Science, Food Processing, Food Technology and Food Manufacturing.
- Covers significance for India (5th-largest food industry, ~6% of GDP), food fortification under FSSAI, classes of foods by perishability, classification of processed foods, and the knowledge/skills, careers and self-employment scope for food technologists.

📖 Detailed Notes

2.1 Core concepts

- **Why food is processed:** Since times immemorial grains were dried after harvest to extend shelf life; initially processing aimed at improving digestibility, palatability and ensuring continuous supply — Indian examples include pickles, murabbas and papads (NCERT Introduction, p. 61).
- **Modern drivers:** Improved transport, communication and industrialisation have made consumer needs more diverse; demand has shifted to "fresh," "organic," "safer and healthier" foods with adequate shelf life, retained nutrients, specific functional/ textural properties, and easy storage and transport (NCERT Introduction, p. 62).
- **Significance for India:** India has moved from an agro-deficit to an agro-surplus country; the Indian food industry is a major producer of processed foods, ranks **5th in size** and contributes **nearly 6 per cent of GDP** (NCERT Significance, p. 62; reiterated p. 71).
- **Food fortification:** Simple cereal-based diets are deficient in some nutrients, so the lacking nutrient is added to staple foods or condiments — e.g., **iodised salt, folic acid in flour, vitamins A and D in milk and oils/fats**; FSSAI has laid down fortification standards for salt, wheat flour, milk and oils (NCERT Significance, p. 62).
- **Wellness re-formulation:** To address heart disease and diabetes, scientists reduce Calorie content using artificial **sweeteners**; fat in ice cream is replaced by specially

treated proteins that mimic the smooth texture of fat with reduced energy value (NCERT Significance, p. 62).

- **Food Science:** A distinct field applying chemistry, physics, culinary arts, agronomics and microbiology; deals with the physico-chemical aspects of food from harvest/slaughter to cooking and consumption (NCERT Basic Concepts, p. 63).
- **Food Processing:** The set of methods and techniques used to **transform raw ingredients into finished and semi-finished products** with attractive, marketable and often long shelf-life characteristics (NCERT Basic Concepts, p. 63).
- **Food Technology:** Uses Food Science + Food Engineering plus socio-economic and legal knowledge to produce varied foods; covers selection, storage, preservation, processing, packaging and distribution, and promotes sustainability (NCERT Basic Concepts, p. 63).
- **Food Manufacturing:** Mass production of food products using principles of food technology — one of the largest manufacturing industries today (NCERT Basic Concepts, p. 64).
- **Historical milestones: Nicolas Appert** developed the **canning process in 1810**; **Louis Pasteur**, in **1864**, researched wine spoilage and developed **pasteurisation** (treating milk to destroy disease-producing organisms) — a major advance in microbiological safety of food (NCERT Development of Food Processing and Technology, p. 64).
- **20th–21st century evolution:** Food Technology was initially used for military needs; world wars, space exploration and changing consumer demand drove growth — instant soup mixes and ready-to-cook meals catered to working women; today the focus is health-oriented, safe and convenient foods (NCERT pp. 64–65).
- **Food deterioration causes:** Pests, insect infestation, inappropriate processing/storage temperatures, light/radiation, oxygen, moisture, micro-organisms (bacteria, fungi, moulds), chemicals like pesticides, and naturally present **enzymes** (protein catalysts) that accelerate spoilage (NCERT Importance of Food Processing and Preservation, p. 65).
- **Oldest preservation methods:** Sun drying, controlled fermentation, salting/pickling, candying, roasting, smoking, baking and using spices as preservatives — still in use alongside industrial-era methods (NCERT p. 65).
- **Classes of foods by perishability: Perishable** (spoil in 1–2 days, e.g., milk, curds, fish, meat); **Semi-perishable** (last 1–2 weeks, e.g., fruits and vegetables; onions and potatoes 2–4 weeks); **Non-perishable** (last about one year, e.g., rice, wheat, pulses, dals, oilseeds) (NCERT box, p. 66).
- **Five basic concepts to prevent spoilage:** (1) Application of heat, (2) Removal of water/moisture, (3) Lowering of temperature during storage, (4) Reduction of pH, (5) Controlling availability of oxygen (NCERT p. 66).

- **Did You Know:** Protein-rich foods like meat, fish, poultry, eggs and dairy are **High Risk Foods** because bacteria prefer them; bacteria grow between **5–60 ° C**, the **Danger Zone** (NCERT p. 66).
- **Seven classes of processed foods:** Minimally processed; Preserved; Manufactured; Formulated; Food derivatives; Functional foods; Medical foods (NCERT p. 67).
- **Knowledge & skills (Table 5.1):** Three stages — Food as a material, Food product development, Recipe development — each demanding specific competencies including HACCP, sensory assessment, labelling/packaging, IT for production, food hygiene and safety (NCERT pp. 68).
- **Careers:** Need knowledge of food chemistry, microbiology, GMP, product specifications, sensory evaluation, packaging/labelling, IT, etc.; after 10+2 one can join certificate/diploma courses, CFTRI Mysore, or graduate/postgraduate programmes including **NIFTEM, Sonepat** (NCERT Preparing for a Career, p. 69).
- **Scope & self-employment:** Career avenues include Production, QA, R&D, Sensory Evaluation, Project Appraisal, Consultancy, Entrepreneurship. Indian food industry: **61 billion US dollars**, ranks 5th, ~6% of GDP, **13% of exports**, **6% of total industrial investment**, growing at **20% p.a.** with the processed food segment at 25% (NCERT Scope, pp. 70–71).

Food Processing and Technology is the engineering-and-chemistry-heavy area of Class XII Nutrition. Its taxonomy — Food Science → Food Processing → Food Technology → Food Manufacturing — moves from pure research (chemistry of starch gelatinisation, protein denaturation, lipid oxidation, microbial growth kinetics) to applied transformation (drying, fermentation, freezing, canning) to integrated production (factory operations under GMP, HACCP, FSSAI norms) to mass commerce (Britannia, Amul, Nestlé India, ITC Foods, MTR, Haldiram's). Indian Home Science graduates contribute at every layer — R&D scientists at NIN/CFTRI, product developers in industry, QA managers in factories, sensory evaluators in product launches.

Historical milestones to commit to memory: 1810 — Nicolas Appert (France) develops canning, enabling Napoleon's army to be fed; 1864 — Louis Pasteur (France) develops pasteurisation, demonstrating that controlled heat treatment of milk and wine destroys disease-causing microbes; 20th century — refrigeration, freezing, freeze-drying, irradiation, aseptic packaging, retort pouches, modified-atmosphere packaging (MAP), high-pressure processing (HPP), pulsed electric fields, ohmic heating. Indian industrial milestones include Amul's cooperative dairy revolution (1946, Anand, Verghese Kurien), Operation Flood (1970), and the Green Revolution that produced the agro-surplus base for processed-food industry growth.

The five spoilage agents (pests, light/radiation, oxygen, moisture, microbes, enzymes) and the five preservation principles (heat, water removal, low temperature, low pH, controlled oxygen) form a 5×5 matrix for choosing techniques. Heat-based methods include blanching (short heat treatment to inactivate enzymes), pasteurisation (mild,

destroys pathogens, retains nutrition — for milk, juice), sterilisation (severe, kills all microbes — for canned food, UHT milk). Water-removal methods include sun drying, hot-air drying, drum drying, spray drying (instant coffee, milk powder), freeze drying (best nutrient retention, expensive). Low-temperature methods include chilling (1-7°C) for milk/curd/cut vegetables, and freezing (below -18°C) for ice cream, frozen vegetables, ready-to-cook items. pH-reduction methods include fermentation (curd, idli batter, dosa batter, dhokla, sauerkraut, pickles) and direct acidification. Oxygen-control methods include vacuum packaging, MAP, and antioxidant addition (BHA, BHT, tocopherols).

High Risk Foods (protein-rich animal foods — meat, fish, poultry, eggs, dairy) are bacteria-friendly; bacteria multiply in the Danger Zone of 5-60°C. FSSAI norms therefore mandate cold-chain integrity below 5°C and hot-holding above 60°C for catering. The 'two-hour rule' (perishable foods cannot stay at room temperature beyond two hours) governs restaurant practice.

Seven classes of processed foods (NCERT p. 67): (1) Minimally processed — cleaned cut packaged fresh produce; (2) Preserved — sun-dried, canned, frozen; (3) Manufactured — pickles, jams, sauces, papads, namkeen; (4) Formulated — bread, biscuits, cake (mixed and baked); (5) Food derivatives — vanaspati from oil (hydrogenation), sugar from sugarcane; (6) Functional foods — probiotics (curd, yoghurt with specific cultures), prebiotics, fortified foods, omega-3 enriched eggs; (7) Medical foods — lactose-free milk, low-sodium salt, gluten-free flour, infant formulas for metabolic disorders. CUET routinely tests example-category matching.

FSSAI fortification standards are the policy anchor here. Iodised salt (NIDDCP, mandatory since 1992 in India), double-fortified salt (iodine + iron), folic-acid-fortified wheat flour, vitamin-A and vitamin-D fortified milk and edible oils — these are the operational interventions of the Anaemia Mukt Bharat strategy.

Indian food industry size: USD 61 billion (NCERT cited figure), 5th rank globally, ~6% of GDP, 13% of exports, 6% of total industrial investment, growing 20% p.a. (processed food segment 25%). Key institutions for training: CFTRI Mysore (Central Food Technological Research Institute, CSIR), NIFTEM Sonepat (National Institute of Food Technology Entrepreneurship and Management — Ministry of Food Processing Industries), IICPT Thanjavur, NDRI Karnal, IGNOU Food Science programmes, and HEFS departments at agriculture universities.

2.2 Definitions to memorise

Term	Definition	Page
Food Science	Distinct field applying chemistry, physics, culinary arts, agronomics and microbiology to study physico-chemical aspects of food from harvest/slaughter to consumption	63
Food Processing	Set of methods and techniques used to transform raw ingredients into finished and semi-finished products	63

Term	Definition	Page
Food Technology	Application of scientific, socio-economic and legal knowledge using Food Science and Food Engineering to produce varied foods	63
Food Manufacturing	Mass production of food products using principles of food technology to meet diverse needs of the population	64
Pasteurisation	Process developed by Louis Pasteur (1864) of treating milk to destroy disease-producing organisms	64
Food Fortification	Adding the nutrient that is lacking in the foodstuff or condiment so that minimum dietary requirements are met	62
Enzymes	Specific class of protein molecules that act as biological catalysts to accelerate chemical reactions, causing spoilage	65
High Risk Foods	Protein-rich foods (meat, fish, poultry, eggs, dairy) preferred by bacteria	66
Danger Zone	Temperature range 5–60 °C in which bacteria grow	66
HACCP	Hazard Analysis and Critical Control Point — a knowledge area required for Food Product Development	68

2.3 Diagrams / processes to remember

- **Photographs of processed foods (pp. 63–64):** noodles, orange juice/oranges, ready-to-eat trays and biscuits — illustrating outputs of food processing and technology.
- **Box "Classes of Foods Based on Perishability" (p. 66):** perishable (1–2 days), semi-perishable (1–2 weeks; roots 2–4 weeks), non-perishable (~1 year).
- **"Did You Know?" box (p. 66):** High Risk Foods + Danger Zone (5–60 °C).
- **Table 5.1 (p. 68):** three-column matrix mapping competencies under Food as a material / Food Product Development / Recipe Development.
- **Career Avenues box (p. 70):** lists 11 career roles such as Production Manager, QA, R&D, Project Appraisal, Consultancy, Technical Marketing.

2.5 Key data / food-processing table (Indian context)

Item	Value / fact	Source
Canning developer / year	Nicolas Appert / 1810	NCERT p. 64
Pasteurisation developer / year	Louis Pasteur / 1864	NCERT p. 64
Danger Zone temperature	5°C – 60°C	NCERT p. 66
	Five	

Item	Value / fact	Source
Number of basic preservation principles		NCERT p. 66
Five preservation principles	Heat; Water removal; Low temp; Low pH; Controlled O_2	NCERT p. 66
Perishable foods shelf-life	1–2 days	NCERT p. 66
Semi-perishable shelf-life	1–2 weeks (roots 2–4 weeks)	NCERT p. 66
Non-perishable shelf-life	~1 year	NCERT p. 66
Number of classes of processed foods	Seven	NCERT p. 67
FSSAI fortification staples	Salt; Wheat flour; Milk; Oils/oats	NCERT p. 62
Indian food industry size	USD 61 billion	NCERT p. 71
Indian food industry rank	5th globally	NCERT p. 71
Food industry % of GDP	~6%	NCERT p. 71
Food industry % of exports	13%	NCERT p. 71
Food industry growth rate	20% p.a.	NCERT p. 71
Processed-food segment growth	25%	NCERT p. 71
Top training institute (PG, named)	NIFTEM, Sonepat	NCERT p. 69
Top training institute (certificate/ diploma, named)	CFTRI, Mysore	NCERT p. 69
Indian dairy cooperative landmark	Amul, Anand (1946) — Operation Flood 1970	India context
HACCP	Hazard Analysis and Critical Control Point	NCERT p. 68
GMP	Good Manufacturing Practices	India context
FSSAI parent Act	Food Safety and Standards Act 2006	India context

2.4 Common confusions / NTA trap points

- Students confuse **Food Science vs Food Technology vs Food Processing vs Food Manufacturing** — remember Science = physico-chemical study; Processing = methods to transform raw → finished; Technology = applied science + legal/socio-economic for varied foods; Manufacturing = mass production.
- **Canning vs Pasteurisation:** Canning was developed by **Nicolas Appert in 1810**, pasteurisation by **Louis Pasteur in 1864** — dates and names are often swapped in distractors.
- **Danger Zone is 5–60 ° C**, not 0–60 °C or 5–65 °C.
- **Fortification examples** are fixed: iodised salt, folic acid in flour, vitamins A and D in milk and oils/fats — distractors often substitute iron in salt or vitamin C in milk.
- Onions and potatoes are **semi-perishable (2–4 weeks)**, not non-perishable.
- India ranks **5th** in food industry size (not 1st or 3rd) and contributes **~6% of GDP**, **13% of exports**.
- **Vanaspati from oil** is an example of a **Food derivative** (via hydrogenation), while **probiotics** are **Functional foods** and **lactose-free milk / low-sodium salt** are **Medical foods** — categories are frequently muddled.
- **Pasteurisation ≠ sterilisation** — pasteurisation kills pathogens only; sterilisation kills all microbes.
- **Blanching is NOT pasteurisation** — blanching's purpose is enzyme inactivation, not microbial kill.
- **CFTRI = certificate/diploma; NIFTEM = postgraduate** — don't swap.
- Pasteur worked on **wine spoilage** first, then milk — a detail sometimes tested.

🎯 Practice MCQs

📊 PYQ Alignment

This chapter is a high-yield source for CUET Home Science Unit II MCQs, regularly producing direct factual recall questions on definitions (Food Science vs Processing vs Technology vs Manufacturing), historical milestones (Appert 1810; Pasteur 1864), the Danger Zone (5–60 °C), perishability classes, FSSAI fortification examples, and the seven classes of processed foods. Numerical questions on India's food industry (5th rank, 6% of GDP, 13% exports) and named-entity items like NIFTEM Sonepat and CFTRI Mysore also appear frequently.