

SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF AGRICULTURAL ENGINEERING

QUESTION BANK



VII SEMESTER

AG3761 FOOD AND DAIRY ENGINEERING

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DEPARTMENT OF AGRICULTURAL ENGINEERING

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SUBJECT:FOOD AND DAIRY ENGINEERING

SEM / YEAR: 07 /IV

Unit I: Basic Properties and Thermal Processing of Food Materials

Constituents of food and their energy values – rheological properties of food materials- texture of food materials -viscometry - Concentrations of foods - Thermal processing of foods - kinetics of microbial destruction - microwave and radio frequency heating in food processing - UHT Processing - sterilization of solid and liquid foods - Preservation by retort processing – Canning - Aseptic packaging.

PART - A

S.No	Question	BT Level	Competence
1	State the physiological energy value of carbohydrates and fats.	BTL 1	Remembering
2	Define rheology and list two rheological properties of food.	BTL 1	Remembering
3	Distinguish between Newtonian and non-Newtonian food materials.	BTL 2	Understanding
4	What is the principle behind a rotational viscometer?	BTL 1	Remembering
5	Differentiate between food texture and food rheology.	BTL 2	Understanding
6	Define decimal reduction time (D-value) in microbial destruction.	BTL 1	Remembering
7	Express the mathematical relationship between Z-value and F-value.	BTL 2	Understanding
8	Why is commercial sterilization different from absolute sterilization?	BTL 2	Understanding
9	List two advantages of microwave heating over conventional thermal processing.	BTL 1	Remembering
10	What is the frequency range allowed for industrial radio frequency heating?	BTL 1	Remembering
11	Define Ultra-High Temperature (UHT) processing of liquid foods.	BTL 1	Remembering
12	State the primary purpose of exhaust processing in canning operations.	BTL 2	Understanding
13	What is aseptic packaging and why is it coupled with UHT processing?	BTL 2	Understanding
14	Identify the type of retort used for processing high-viscosity foods.	BTL 2	Applying
15	Name two common materials used for fabricating flexible retort pouches.	BTL 1	Remembering
16	Define the term 'thermal death time' (TDT) in food microbiology.	BTL 1	Remembering
17	Why do liquid foods heat faster than solid foods in a retort system?	BTL 2	Understanding
18	Illustrate a typical microbial survival curve during thermal	BTL 2	Understanding

	processing.		
19	What is the role of continuous agitation during canned food sterilization?	BTL 2	Understanding
20	State the impact of high food concentration on its boiling point elevation.	BTL 2	Understanding
21	Define the term 'lethality factor' (F0) used in the canning industry.	BTL 1	Remembering
22	Classify food materials based on their pH values for thermal treatment.	BTL 2	Understanding
23	Why is deep-bed thermal conduction slow in solid canned foods?	BTL 2	Understanding
24	Mention two key quality attributes preserved by flash pasteurization.	BTL 1	Remembering
25	How does radio frequency heating minimize surface scorching in foods?	BTL 2	Understanding

PART - B

S.No	Question	BT Level	Competence
1	(i) Explain the operational principles, setup, and equations used in capillary tube and rotational viscometers. (10) (ii) Detail the chemical constituents of food and explain how their specific energy values are determined using bomb calorimetry. (6)	BTL 3	Applying
2	(i) Derive the mathematical kinetics of microbial destruction, defining D, Z, and F values with neat graphical plots. (10) (ii) Explain how these values are utilized to calculate total process lethality in commercial canning. (6)	BTL 4	Analyzing
3	Describe the systematic technological steps involved in the commercial canning of a low-acid solid food material. Include detailed explanations of preparation, exhausting, retorting, cooling, and common container defects.	BTL 4	Analyzing
4	(i) Compare the mechanisms, plant equipment designs, and heating rates of microwave versus radio frequency heating systems. (10) (ii) Discuss their explicit industrial applications and operational limitations in modern food processing plants. (6)	BTL 4	Analyzing
5	(i) Elaborate on the layout, fluid dynamics, and thermodynamic cycles of a continuous UHT processing plant using direct steam injection.(10) (ii) Explain the structural and chemical engineering aspects of aseptic packaging lines that ensure commercial sterility. (6)	BTL 3	Applying
6	Evaluate the engineering mechanics of retort processing systems. Contrast static vertical retorts with continuous rotary retorts regarding heat penetration parameters, fluid convective flows, and overall processing efficiency for solid-liquid food mixtures.	BTL 5	Evaluating
7	(i) Formulate an analytical procedure to evaluate the mechanical and sensory texture profile analysis (TPA) of structural solid foods. (10) (ii) Explain how concentration processes alter the rheological behavior and flow curves of liquid fruit purees. (6)	BTL 4	Analyzing
8	(i) Explain the physical and thermal phenomena during the sterilization of large-sized particulate solid foods inside a thermal system.(8) (ii) Outline the engineering strategies used to minimize nutrient degradation while achieving complete target pathogen destruction. (8)	BTL 3	Applying
9	Provide a comprehensive review of the design criteria, fluid flow mechanics, and heat exchanger selections (plate vs. tubular) used for	BTL 3	Applying

	high-temperature short-time processing of high-solids fluid food concentrations.		
10	(i) Critically analyze the structural modifications and chemical shelf-life changes that occur in non-Newtonian fluid foods when subjected to high-shear viscometry.(8) (ii) Detail how these changes alter industrial pipe diameter calculations and pumping power demands. (8)	BTL 3	Applying
11	(i) Describe the construction, barrier film chemistry, and seal testing methods for flexible retortable pouches.(8) (ii) Contrast their heat penetration profiles with traditional three-piece tinplates. (8)	BTL 3	Applying
12	(i) Develop a mathematical model simulation outline to track cold-spot temperature profiles in a cylindrical can filled with a high-viscosity starch paste.(10) (ii) Describe how you would experimentally validate this model using thermocouples. (6)	BTL 4	Analyzing
13	Assess the operational challenges, system failures, and validation protocols associated with maintaining long-run system sterility in continuous aseptic food lines handling high-low acid variations.	BTL 5	Evaluating
14	(i) Explain the physical phenomena of dielectric loss factor and penetration depth during microwave interaction with high-moisture foods.(8) (ii) Discuss how salt concentrations modify these parameters. (8)	BTL 3	Applying
15	(i) Illustrate the layout of a modern automated food concentration plant.(8) (ii) Explain how structural rheological data determines your choice of processing steps, evaporators, and layout equipment. (8)	BTL 3	Applying
16	Write detailed technical notes on: (i) Critical factors affecting microbial heat resistance during thermal sterilization.(8) (ii) Destructive evaluation methods for assessing canned food seal integrity. (8)	BTL 3	Applying
17	Evaluate the impact of ultra-high thermal processing on the sensory attributes, vitamin retention, color pigments, and volatile flavor profiles of structural liquid foods against batch processing.	BTL 5	Evaluating

Unit II: Drying and Dehydration

Food spoilage - causes for spoilage -Moisture content – Types - equilibrium moisture content - Water activity - sorption behavior of foods - types of dryers – dehydration and its methods.

PART - A

S.No	Question	BT Level	Competence
1	Define food spoilage and list its two primary biological agents.	BTL 1	Remembering
2	Distinguish between wet basis and dry basis moisture content.	BTL 2	Understanding
3	What is free moisture content in food material?	BTL 1	Remembering
4	State the engineering definition of Equilibrium Moisture Content (EMC).	BTL 1	Remembering
5	Define water activity and write its mathematical equation.	BTL 1	Remembering
6	Why does a food material exhibit a moisture sorption isotherm?	BTL 2	Understanding
7	Differentiate between adsorption and desorption isotherms.	BTL 2	Understanding
8	What is the significance of the BET isotherm equation in food dehydration?	BTL 2	Understanding
9	Define the term 'hysteresis loop' in moisture sorption.	BTL 1	Remembering
10	Classify food materials into three distinct types based on sorption	BTL 2	Understanding

	behavior.		
11	Name two physical causes of food degradation during storage.	BTL 1	Remembering
12	State the primary driving force for moisture migration during drying.	BTL 2	Understanding
13	List the two distinct drying rate periods observed in food materials.	BTL 1	Remembering
14	What is critical moisture content in a typical drying rate curve?	BTL 1	Remembering
15	Why does the drying rate drop during the falling rate period?	BTL 2	Understanding
16	Mention the core working principle of a fluidized bed dryer.	BTL 2	Understanding
17	What type of food materials are best processed using a spray dryer?	BTL 2	Understanding
18	State the primary advantage of vacuum drying for heat-sensitive foods.	BTL 1	Remembering
19	Define 'case hardening' in dried food materials.	BTL 1	Remembering
20	How can you prevent case hardening during industrial drying?	BTL 2	Understanding
21	State the basic principle of freeze-drying (lyophilization).	BTL 2	Understanding
22	Identify the thermodynamic condition required for sublimation in freeze dryers.	BTL 3	Applying
23	What is the role of an atomizer in a spray drying system?	BTL 2	Understanding
24	Define the term 'rehydration ratio' of dried food products.	BTL 1	Remembering
25	List two main operational differences between tray dryers and tunnel dryers.	BTL 2	Analyzing

PART - B

S.No	Question	BT Level	Competence
1	(i) Elaborate on the primary biochemical, chemical, and enzymatic causes of food spoilage during storage.(8) (ii) Explain how moisture content and water activity levels control these destructive reactions. (8)	BTL 3	Applying
2	(i) Sketch and explain a standard food drying rate curve. Define the constant rate period, falling rate period, and critical moisture content points. (10) (ii) Formulate mass transfer equations for moisture removal in each phase. (6)	BTL 4	Analyzing
3	(i) Describe the classification, molecular mechanisms, and mathematical modeling of moisture sorption isotherms in foods. (10) (ii) Discuss the structural causes and practical implications of the hysteresis loop in food processing. (6)	BTL 3	Applying
4	Explain the design, layout, co-current/counter-current air flow configurations, and atomization mechanics of industrial spray dryers used for converting liquid foods into powder form.	BTL 3	Applying
5	(i) Detail the process of freeze-drying (lyophilization). Focus on the triple point of water, sublimation mechanics, structural chamber design, and vacuum configurations. (10) (ii) Outline its economic and quality advantages for premium foods. (6)	BTL 3	Applying
6	Evaluate the engineering performance, material handling mechanisms, and thermal efficiencies of fluidized bed dryers versus drum (roller) dryers for high-moisture particulate food matter.	BTL 5	Evaluating
7	(i) Compare the structural arrangements, air-circulation fans, and thermodynamic loading cycles of tray dryers, tunnel dryers, and rotary dryers. (10)	BTL 3	Applying

	(ii) Select the appropriate system for processing sliced root vegetables, justifying your choice. (6)		
8	(i) Derive the analytical conversions between wet basis (WB) and dry basis (DB) moisture contents. (6) (ii) Solve a mass balance problem: 500 kg of fresh sliced fruit at 85% moisture (WB) is dried to 12% moisture (WB). Calculate the total weight of water removed and final product yield using Python validation concepts. (10)	BTL 3	Applying
9	(i) Explain the phenomenon of case hardening, solute migration, and thermal shrinkage during rapid hot-air drying of high-sugar foods. (10) (ii) Suggest practical process optimization techniques to mitigate these structural defects. (6)	BTL 4	Analyzing
10	Discuss the design principles and application setups of advanced dehydration methods, specifically detailing microwave-assisted vacuum drying and osmotic dehydration pre-treatments.	BTL 3	Applying
11	Assess the structural, color, nutritional, and flavor quality degradations that occur during the dehydration of leafy green vegetables, and evaluate how different drying methods influence these parameters.	BTL 5	Evaluating
12	(i) Formulate the structural steps required to construct a laboratory setup for measuring the equilibrium moisture content (EMC) of grains using the static salt solution method. (10) (ii) Explain how the data fits into the Henderson equation. (6)	BTL 4	Analyzing
13	(i) Describe the working mechanism and mass flow configuration of pneumatic flash dryers. (8) (ii) Illustrate how air temperature, humidity, and food particle size govern final product quality. (8)	BTL 3	Applying
14	(i) Analyze the structural stability zones of dried foods as mapped out on a classic water activity stability map. (10) (ii) Link specific water activity thresholds to lipid oxidation and non-enzymatic browning. (6)	BTL 4	Analyzing
15	Explain the structural assembly, solar collector thermodynamics, and airflow management of indirect forced-convection solar food dryers designed for rural agricultural cooperatives.	BTL 3	Applying
16	(i) Develop an experimental validation protocol to evaluate the rehydration characteristics, porosity, and bulk density of spray-dried versus freeze-dried fruit powders. (10) (ii) Critique their structural differences. (6)	BTL 4	Analyzing
17	Evaluate the energy metrics, heat transfer coefficients, specific energy consumptions, and environmental carbon footprints of continuous conveyor band hot-air dryers against batch-type industrial tray ovens.	BTL 5	Evaluating

Unit III: Milk Processing

Physical, chemical, thermal and rheological properties of milk - storage tanks. Receiving handling and testing of milk - storage.

Pasteurization – and milk products. Types – equipments – application. Filling and packaging of milk

PART - A

S.No	Question	BT	Competence
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		Level	
1	State the average chemical composition of standard bovine milk.	BTL 1	Remembering
2	Why does milk exhibit an amphoteric reaction profile?	BTL 2	Understanding
3	Define the specific gravity of milk and state its normal range.	BTL 1	Remembering
4	How does fat content influence the thermal conductivity of raw milk?	BTL 2	Understanding
5	Define the freezing point of milk and explain how it helps detect adulteration.	BTL 2	Analyzing
6	What is the viscosity profile of milk cream at different fat percentages?	BTL 2	Understanding
7	State the purpose of using insulated silos or storage tanks in milk plants.	BTL 1	Remembering
8	List four primary platform tests performed on raw milk at receiving docks.	BTL 1	Remembering
9	What is the principle behind the Clot on Boiling (COB) test?	BTL 2	Understanding
10	Name the dye used in the rapid dye reduction test for milk grading.	BTL 1	Remembering
11	State the time-temperature combination for Low-Temperature Long-Time (LTLT) pasteurization.	BTL 1	Remembering
12	Define High-Temperature Short-Time (HTST) pasteurization.	BTL 1	Remembering
13	Why is an alkaline phosphatase test conducted after milk pasteurization?	BTL 2	Analyzing
14	What is the function of the Flow Diversion Valve (FDV) in an HTST system?	BTL 2	Understanding
15	Define 'regeneration efficiency' in milk heat exchangers.	BTL 1	Remembering
16	Mention two distinct types of packaging materials used for liquid milk pasteurization.	BTL 1	Remembering
17	What is the primary operational objective of milk chilling at 4°C?	BTL 2	Understanding
18	Define standardized milk according to food safety regulations.	BTL 1	Remembering
19	List two structural changes that occur in milk when it is held at freezing temperatures.	BTL 2	Understanding
20	State the mechanical purpose of a dump tank at a milk collection hub.	BTL 2	Understanding
21	Why is mechanical air agitation necessary inside milk storage silos?	BTL 2	Understanding
22	Classify the chemical pigments responsible for the characteristic white and yellowish color of milk.	BTL 2	Understanding
23	What is the legal fat and SNF requirement for toned milk?	BTL 1	Remembering
24	State the principle of the Gerber method used in dairy analysis.	BTL 2	Understanding
25	Identify the enzyme targeted during pasteurization to confirm process completion.	BTL 2	Understanding

PART - B

S.No	Question	BT Level	Competence
1	(i) Provide an analytical report on the physical, chemical, thermal, and rheological properties of raw milk, explaining how these properties change with temperature and composition variations. (10) (ii) Explain how these parameters dictate the design of fluid pumping pipelines. (6)	BTL 4	Analyzing
2	Explain the complete, step-by-step raw milk reception dock operations. Detail the automated handling systems, sampling protocols, and execution of platform tests (including COB, alcohol,	BTL 3	Applying

	MBRT, and sediment tests).		
3	(i) Draw a detailed, labeled process flow schematic for a modern industrial High-Temperature Short-Time (HTST) milk pasteurization plant. (10) (ii) Detail the working mechanics of the regeneration section, holding tubes, flow diversion valves, and control automation loops. (6)	BTL 4	Analyzing
4	(i) Compare the design, insulation profiles, internal structural supports, and agitation mechanisms of horizontal storage tanks versus vertical bulk milk silos. (10) (ii) Explain how sanitation and drainage are managed in these systems. (6)	BTL 4	Analyzing
5	Describe the engineering designs, film handling, sealing mechanisms, and volumetric filling systems of automated rotary pouch filling machines and aseptic brick carton fillers used for liquid milk packaging.	BTL 3	Applying
6	Evaluate the thermal efficiency, utility demands, regeneration rates, and operational maintenance of Plate Heat Exchangers (PHE) versus Triple-Tube Corrugated Heat Exchangers for handling high-fat milk cream pasteurization.	BTL 5	Evaluating
7	(i) Formulate a standardization problem: Standardize 5000 kg of raw milk containing 5.0% fat and 8.5% SNF to market milk containing 3.0% fat and 8.5% SNF using skim milk (0.1% fat). Show calculations using Pearson's Square method. (10) (ii) Draft a raw milk receiving protocol based on these parameters. (6)	BTL 4	Analyzing
8	(i) Detail the biochemical changes that occur in the lipid, protein (casein micelle), and lactose structures of liquid milk during heat processing. (8) (ii) Explain how these alterations relate to cook flavor development and fouling in processing equipment. (8)	BTL 3	Applying
9	Provide an in-depth review of the engineering requirements, refrigeration loads, and component selections for chilled water cooling networks used at bulk milk chilling centers in rural areas.	BTL 4	Analyzing
10	(i) Analyze how microbial growth curves and chemical rancidity progress in raw milk when chilling is delayed past two hours from milking. (8) (ii) Outline the downstream processing challenges this delay creates. (8)	BTL 3	Applying
11	(i) Describe the construction, working principles, and safety interlocks of continuous bulk milk pasteurizers. (8) (ii) Detail the operational adjustments required when switching from whole milk to high-viscosity flavored milk lines. (8)	BTL 4	Analyzing
12	(i) Design a layout for a milk receiving platform capable of handling 50,000 liters of milk per day arriving via both cans and road tankers. (10) (ii) Outline the primary sanitation steps for this area. (6)	BTL 4	Analyzing
13	Assess the operational hazards, process line failures, and safety protocols associated with automated CIP operations in high-capacity milk pasteurizing lines, focusing on preventing chemical cross-contamination.	BTL 5	Evaluating
14	(i) Explain the operational theory behind centrifugal air elimination units used ahead of bulk milk meters during tanker unloading. (8) (ii) Discuss how air entrainment errors can affect milk inventory accounting. (8)	BTL 3	Applying
15	(i) Illustrate the structural flow mechanics of liquid milk inside a	BTL 3	Applying

	plate heat exchanger's channels. (8) (ii) Explain how fluid pressure differentials prevent unpasteurized milk from leaking into the pasteurized milk stream. (8)		
16	Write technical specifications and descriptions for: (i) Form-Fill-Seal (FFS) multi-layer poly-film milk pouch packaging systems. (8) (ii) Inline electronic fat and SNF testing instruments used at raw milk reception terminals. (8)	BTL 4	Analyzing
17	Evaluate the pasteurization efficiency, chemical alterations, nutrient retention indexes, and operating costs of Low-Temperature Long-Time (LTLT) vat pasteurizers versus continuous HTST plate systems for boutique organic cheese milk lines.	BTL 5	Evaluating

Unit IV: Dairy Equipment and Products

Homogenisation - theory and working of homogenisers – Types and design criteria for homogenizing equipment- cream separators - Clarifiers - butter churner cream freezers - milk products manufacture – Ghee – ice Whey - condensed milk – milk powder - paneer - casein - probiotic dairy products - kefir-milk plant sanitation requirements - Cleaning in-place and its functions.

PART - A

S.No	Question	BT Level	Competence
1	State the primary purpose of homogenization in milk processing.	BTL 1	Remembering
2	Explain the underlying theory of size reduction in a mechanical homogenizer valve.	BTL 2	Understanding
3	Why is two-stage homogenization preferred over single-stage for high-fat dairy products?	BTL 2	Analyzing
4	State the fundamental working principle of a centrifugal cream separator.	BTL 2	Understanding
5	What is the main structural difference between a milk clarifier and a cream separator?	BTL 2	Analyzing
6	Define the term 'churning' in butter manufacture.	BTL 1	Remembering
7	What is the function of a scraper blade assembly inside a continuous ice cream freezer?	BTL 2	Understanding
8	Define overrun in ice cream manufacturing and state its formula.	BTL 1	Remembering
9	List the traditional steps involved in the manufacture of Ghee from butter.	BTL 1	Remembering
10	What is whey and name its primary protein fractions?	BTL 1	Remembering
11	State the principle of working of a multi-effect vacuum pan evaporator for condensed milk.	BTL 2	Understanding
12	Why is lactose crystallization critical in the manufacture of condensed milk?	BTL 2	Understanding
13	Name two types of atomizers used in industrial milk spray dryers.	BTL 1	Remembering
14	State the steps for acid-coagulation during Paneer manufacturing.	BTL 2	Understanding
15	Define Casein and name its commercial industrial forms.	BTL 1	Remembering
16	What are probiotic dairy products? Give one example.	BTL 1	Remembering
17	Identify the primary microbial starter culture strains used in Kefir production.	BTL 2	Understanding
18	State the regulatory definition of a clean-in-place (CIP) system in dairy plants.	BTL 1	Remembering
19	What is the standard concentration and temperature for caustic wash in a dairy CIP cycle?	BTL 2	Understanding
20	State the mechanical function of a homogenization pressure gauge.	BTL 2	Understanding

21	List two common defects found in spray-dried milk powder.	BTL 1	Remembering
22	Why is continuous butter making more efficient than batch churning?	BTL 2	Understanding
23	State the role of stabilizers in an ice cream mix formulation.	BTL 2	Understanding
24	What is the purpose of the clarification step prior to milk pasteurization?	BTL 2	Understanding
25	Define 'dairy plant sanitation' and name two common sanitizing agents.	BTL 1	Remembering

PART - B

S.No	Question	BT Level	Competence
1	(i) Explain the underlying theory of milk homogenization based on shear, cavitation, and micro-turbulence forces. (10) (ii) Detail the structural design criteria, valve geometries, and mechanical configurations of high-pressure industrial homogenizers. (6)	BTL 4	Analyzing
2	(i) Derive Stokes' Law as applied to centrifugal cream separation. (6) (ii) Describe the internal disk-stack configuration, bowl design, sludge discharge mechanisms, and flow control systems of continuous centrifugal cream separators and clarifiers. (10)	BTL 3	Applying
3	Describe the manufacturing technology of butter using continuous butter makers. Include detailed explanations of cream ripening, aging, phase inversion mechanics, churning, washing, working, and moisture-salt adjustment steps.	BTL 4	Analyzing
4	(i) Discuss the process engineering, heat exchange setups, scraper blade kinematics, and aeration control mechanisms of continuous ice cream freezers. (10) (ii) Formulate an equation for ice cream mix overrun calculations. (6)	BTL 4	Analyzing
5	(i) Detail the systematic processing stages for mass manufacturing ghee using the cream-burning and pre-stratification methods. (10) (ii) Describe the design of ghee boiling kettles, clarifying setups, and modern packaging systems. (6)	BTL 3	Applying
6	Evaluate the process steps, drying profiles, and powder characteristics of milk powder manufactured using a multi-stage spray drying system equipped with an integrated fluid bed dryer versus traditional single-stage spray dryers.	BTL 5	Evaluating
7	(i) Detail the chemical coagulation kinetics, filtration mechanics, pressing system designs, and yield optimization parameters for commercial Paneer processing lines. (10) (ii) Contrast this with industrial casein manufacture. (6)	BTL 4	Analyzing
8	(i) Map out a standard 5-step Clean-In-Place (CIP) cycle for a dairy processing line, specifying the flow velocities, chemical formulations, temperature benchmarks, and contact times for each stage. (10) (ii) Discuss the design of spray balls. (6)	BTL 3	Applying
9	Explain the complete technical processing scheme for manufacturing sweetened condensed milk, focusing on pre-heating protocols, sugar addition systems, vacuum evaporation physics, and controlled lactose crystallization cooling profiles.	BTL 4	Analyzing
10	(i) Analyze the microbiological fermentation kinetics, pilot-scale plant design, and temperature management profiles required for the production of probiotic dairy drinks and Kefir. (10) (ii) Explain how you would maintain cultures against contamination.	BTL 4	Analyzing

	(6)		
11	(i) Describe the processing stages, concentration methods, and membrane filtration operations (Ultrafiltration/Reverse Osmosis) utilized for industrial whey powder recovery from cheese waste streams. (10) (ii) Outline its economic benefits. (6)	BTL 3	Applying
12	(i) Formulate a factory scale layout and process line configuration for an integrated liquid milk plant handling homogenization, clarification, and standardizing options in a continuous loop. (10) (ii) Outline your capacity constraints. (6)	BTL 4	Analyzing
13	Assess the operational parameters, mechanical failure points, and product loss vectors in automated high-capacity disk-stack cream separation lines processing cold raw milk versus warm pasteurized streams.	BTL 5	Evaluating
14	(i) Explain how homogenization pressures influence milk fat globule size distribution and the surface protein layer composition. (8) (ii) Discuss how these changes relate to the oxidative stability of stored market milk. (8)	BTL 3	Applying
15	(i) Illustrate the layout of an automated dairy CIP substation, detailing the fresh water, acid, alkali, and recovery tank circuits. (10) (ii) Detail how chemical recovery is tracked using conductivity sensors. (6)	BTL 3	Applying
16	Provide detailed technical descriptions of: (i) Mechanical scraping and chilling parameters inside scraped-surface heat exchangers used for ice cream freezing. (8) (ii) Vacuum pans and moisture balancing control loops in condensed milk plants. (8)	BTL 4	Analyzing
17	Evaluate the structural texture profiles, moisture-binding capacities, yields, and shelf-lives of paneer produced via continuous chemical injection loops versus traditional manual batch pressing systems.	BTL 5	Evaluating

Unit V: Advanced Technologies in Food Processing

Non-thermal and other alternate thermal processing in Food processing – Nanotechnology - Nanomaterials - applications in food packaging and products – implications – nanotechnology. Impact in environment and global economy - regulation of nanotechnology.

PART - A

S.No	Question	BT Level	Competence
1	Define non-thermal food processing and list two major advantages.	BTL 1	Remembering
2	State the primary mechanism of microbial inactivation in High-Pressure Processing (HPP).	BTL 2	Understanding
3	What is Pulsed Electric Field (PEF) processing of liquid foods?	BTL 1	Remembering
4	Define nanotechnology within the context of food science applications.	BTL 1	Remembering
5	Distinguish between top-down and bottom-up approaches in nanomaterial synthesis.	BTL 2	Understanding
6	What are nanoemulsions and state their average droplet size range?	BTL 1	Remembering
7	Give two examples of inorganic nanomaterials utilized in food antimicrobial packaging.	BTL 1	Remembering
8	State the role of nano-silver (Ag) in active food packaging matrices.	BTL 2	Understanding
9	Define 'smart packaging' and explain how nanosensors function	BTL 2	Understanding

	within it.		
10	What is the purpose of using nano-titanium dioxide (TiO ₂) in food product packaging?	BTL 2	Understanding
11	Mention two potential toxicological risks of nanomaterials to human health.	BTL 1	Remembering
12	State the primary environmental impact of nano-plastic residues from discarded food wraps.	BTL 2	Understanding
13	Identify the regulatory agency responsible for monitoring nanotechnology in global food products.	BTL 2	Understanding
14	What is Cold Plasma technology and how does it disinfect food surfaces?	BTL 2	Understanding
15	Define 'nanoclay' and state its function in improving gas barrier properties of films.	BTL 1	Remembering
16	Why is ozone processing classified as an alternate thermal preservation system?	BTL 2	Understanding
17	State the core mechanism behind ultrasonic food preservation.	BTL 2	Understanding
18	List two explicit economic benefits of adopting nanotechnology in global food transport.	BTL 2	Understanding
19	What is a nano-biosensor?	BTL 1	Remembering
20	How do carbon nanotubes (CNTs) enhance the mechanical properties of biopolymer films?	BTL 2	Understanding
21	State the primary limitation of PEF processing for solid food pieces.	BTL 2	Understanding
22	Define 'nanocapsules' and give one example of a nutrient encapsulated within them.	BTL 1	Remembering
23	Mention one global regulatory challenge in labeling nano-containing foods.	BTL 2	Understanding
24	Identify the structural changes that occur in bacterial cell walls when exposed to cold plasma.	BTL 2	Understanding
25	What is the purpose of a migration test for nanomaterials used in packaging?	BTL 2	Understanding

PART - B

Q.No	Question	BT Number	BT Level
1	Elaborate on the principles, working mechanisms, and processing merits of high-pressure processing (HPP) over traditional thermal methods.	BT3	Applying
2	Describe the construction, working setup, and critical process parameters of Pulsed Electric Field (PEF) technology in liquid food preservation.	BT3	Applying
3	Classify the various types of nanomaterials used in food systems and explain their unique structural properties at the atomic scale.	BTL 4	Analyzing
4	Explain the operational mechanisms of cold plasma technology and its target efficiency against microbial biofilms on food surfaces.	BTL 3	Applying
5	Illustrate how active and intelligent nano-packaging systems respond to internal and external environmental changes to extend food shelf life.	BTL 4	Analyzing
6	Apply the concepts of ultrasound processing to design an extraction protocol for bioactive compounds from plant matrices.	BT3	Applying
7	Analyze the migration kinetics of nanoparticles from commercial polymeric packaging materials into food stimulants under varied storage conditions.	BT4	Analyzing

8	Compare and contrast the technological efficiency, energy consumption, and product quality of ozone processing versus UV radiation.	BT4	Analyzing
9	Evaluate the global economic impacts, market penetration challenges, and industrial scalability of adopting non-thermal technologies.	BT5	Evaluating
10	Critically assess the environmental footprint, life-cycle impact, and waste management safety protocols of commercialized nanomaterials.	BT5	Evaluating
11	Appraise the current global regulatory frameworks, toxicological safety assessment protocols, and labeling policies for nano-functionalized foods.	BT5	Evaluating
12	Formulate a comprehensive conceptual design for an automated, smart nano-packaging system that detects meat spoilage using volatile amines.	BT4	Analyzing
13	Develop an optimized processing line integrating continuous UV-C light treatment for the surface decontamination of fresh produce.	BT4	Analyzing
14	Design a specific nano-encapsulation delivery vehicle using biopolymers to enhance the thermal stability and bio-accessibility of probiotics.	BT4	Analyzing
15	Analyze the mechanisms of membrane processing (Ultrafiltration and Reverse Osmosis) as alternate non-thermal concentration steps for fruit juices.	BT4	Analyzing
16	Evaluate the biological safety concerns, potential cytotoxicity, and human health risks associated with the ingestion of inorganic nanoparticles.	BT5	Evaluating
17	Propose a scale-up strategy and system layout for an industrial-scale Oscillating Magnetic Field (OMF) system to pasteurize fluid milk.	BT4	Analyzing