

ALIGARH MUSLIM UNIVERSITY, ALIGARH

FACULTY OF AGRICULTURAL SCIENCES

SYLLABUS FOR

M.TECH. IN PROCESSING AND FOOD ENGINEERING

Heat and Mass Transfer in Food Processing

Modes of heat transfer; Dimensionless numbers in the study of heat transfer; Some important empirical correlations used for the determination of heat transfer coefficient; Introduction to condensing and boiling heat transfer; Heat Exchangers: General discussion, types and design; Application of different types of heat exchangers in dairy and food industry.

Mass transfer: Fick's laws of diffusion; Steady state diffusion of gases and liquids through solids; Equimolar diffusion; Isothermal evaporation of water into air; Mass transfer coefficient; Applications in dairy and food industry.

Unit Operations of Food Processing:

Size reduction, sieve/screen analysis, principle and mechanisms of comminution of food, Crushing laws, Size reduction equipment, Mixing, Mixing equipment, Mechanical Separations, Filtration: Filtration equipment, Membrane separation. Evaporation, Evaporation equipment, single and multiple effect evaporators, Food freezing, Principles of food freezing, freezing time calculation by using Plank's equation, Frozen food properties; Frozen food storage, Freeze drying, Expression and Extraction, liquid-liquid extraction processes, types of equipment, Leaching, Crystallization and dissolution, equipment for crystallization; Distillation, batch/differential distillation, fractional distillation, steam distillation, Baking, Pasteurization, Sterilization, Aseptic processing.

Fluid Mechanics:

Unit and dimensions, Types and properties of fluids, Dimensional analysis and Dimensionless numbers, Drag and Boundary Layer theory, Fluid static and kinematics, Fluid flow, Continuity equation, Bernoulli's theorem and its application, Pressure measuring devices, Flow meters, Pumps, Pipes, valves and fittings, Centrifugal pump and its performance characteristics.

Thermodynamics

Basic concepts and Laws of thermodynamics; Types of thermodynamic systems; Energy interactions; Reversed Carnot cycle; Ideal and Real Gases; Vapour-compression refrigeration cycle; Vapour absorption refrigeration system; Properties of pure substance; Refrigerants; Psychrometry.

Fruits and Vegetable Processing

Pre-Processing: Fresh fruits and vegetables – Handling, grading, cleaning, pretreatments, transportation, pre-cooling, chilling; Modified Atmosphere Packaging; Controlled Atmosphere Storage; Packaging; Transportation; Quality Assurance; Freezing of Fruits And Vegetables - Different Freezing Methods and Equipment; Problems associated with specific fruits and vegetables.

Meat and Meat Products Processing

Meat composition from different sources; muscle structure and compositions; post-mortem muscle chemistry; Factors influencing the quality of meat; Meat Microbiology and safety; Ante mortem inspection and handling; Modern abattoirs, typical layout and features; Offal handling and inspection; Grading of meat- retail and whole sale cuts; Operational factors affecting meat quality; Meat plant hygiene – GMP and HACCP; Poultry: methods of slaughtering; Slaughtering equipment and operations; dressing, handling, storage and preservation of poultry meat; Spoilage and its control; Freezing and chilling of poultry.

Food Analysis

Introduction to food analysis; Qualitative and Quantitative techniques used in the physical, chemical, sensory and instrumental examination of food products; Determination of moisture, ash, protein, fat, acidity, pH, reducing sugar and total sugar, ascorbic acid, pectin, chlorophyll, lycopene or gluten in a given food sample; Texture analysis and rheology.

Food Packaging

Packaging terminology–definition. functions of food package, packaging environment; Characteristics of food stuff that influences packaging selection; Aseptic packaging; Glass and Metal containers: Glass: Composition, properties, bottle making and closures for glass containers; Metal: Bulk containers; Food marketing and role of packaging-packaging aesthetics and graphic design; Packaging Laws and Regulations; Safety aspects of packaging materials; Sources of toxic materials and migration of toxins into food materials.

Transport Phenomena:

General introduction to Transport Processes; Equation of Continuity; Steady Flow of incompressible fluids in conduits and thin layers; Flow of falling film; flow between parallel plates; flow through circular pipes and annulus; adjacent flow of two immiscible fluids, etc. Fourier's law of Heat Conduction; steady one dimensional heat conduction without and with internal heat source; Conduction through plane wall, hollow cylinder, composite walls and multilayer tubes; critical thickness of insulation; Fick's Law of diffusion.

Quality Control

Definition and Importance of Quality Control; Principles of Quality Control; Quality attributes of Food – Nutritional quality, Microbial, Sensory; Sample and Sampling Methods of Quality Evaluation; Quality assurance in Food Services System; Sampling – objectives, Guidelines, Methods, Hazards- Microbial, Physical, Chemical. Analysis of Food – Chemical: Moisture, Fat, Protein, Crude Fibre. Microbial: DMC, Coliform determination. Food laws – HACCP, ISO/22000.

Bakery and Confectionery Technology:

Wheat- structure, quality, milling; Technology of bread, biscuit, cake, cookie, pastry, wafer, and rusk manufacture; Role of baking ingredients; Quality control tests; Faults and remedies; Losses in baking; Packaging of baked products; PFA rules; Bakery sanitation & hygiene; Cocoa processing, Sugar and Chocolate confectionary production.

Food Chemistry and Microbiology

Constituents and chemical composition of foods; Chemical, functional and nutritional aspects of food constituents; Digestion and assimilation of nutrients; Nutritional and calorific requirements and dietary allowance; Balanced diet; Role of microorganisms in nutrient

synthesis, malnutrition and food fortification; Nutritive values of different foods; Effect of blanching, pasteurization and cooking on nutritional value; Changes in nutritional value of food and food products during storage.

Definition, scope and history of Microbiology; Cellular organization of prokaryotic and eukaryotic cells; Difference between prokaryotic and eukaryotic cells; General characteristics and nature of Bacteria, Mycoplasma, Rickettsiae, Chlamydiae, Actinomycetes, Protozoa, Fungi, Algae and Viruses.

Food Preservation

Introduction and Principles of food preservation; Thermal and Non-thermal processing techniques; Nutritional losses due to thermal processing; Dehydration and Drying of foods; Canning; Intermediate moisture foods; Low temperature preservation; Food Fermentation; Food Irradiation; Hurdle technology.

Instrumentation and Process Control in Food Industry

Static and dynamic characteristics of instruments; Instrumentation for the measurement of temperature, pressure, flow, level, weight, moisture, humidity, viscosity, turbidity, color, density, brix and pH; Transmission: Pneumatic and electrical; Display and storage devices; Process control: Simple system analysis; Dynamic behavior of simple processes; Frequency response analysis; Stability analysis; Control actions and controller tuning; Process control hardware; Data acquisition system.