

Scheme and Syllabus

B.Tech. Food Technology

Batch 2014 onwards



By
Department of Academics

IK Gujral Punjab Technical University

IK Gujral Punjab Technical University
B.Tech. Food Technology Batch 2014 onwards

Semester third

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BTFT 301	Principles of Food Preservation	3	-	-	40	60	100	3
BTFT 302	Food Chemistry	3	-	-	40	60	100	3
BTFT 303	Food Microbiology	3	1	-	40	60	100	4
BTFT 304	Fluid flow operations and Rheology	3	1	-	40	60	100	4
BTFT 305	Fruits and Vegetable Processing Technology	3		-	40	60	100	3
BTFT 306	Food Hygiene and Plant Sanitation	3		-	40	60	100	3
BTFT 307	Principles of Food Preservation (Lab)			2	30	20	50	1
BTFT 308	Food Chemistry (Lab)			2	30	20	50	1
BTFT 309	Food Microbiology (Lab)	-	-	2	30	20	50	1
BTFT 310	Fruits and Vegetable Processing Technology (Lab)			2	30	20	50	1
	TOTAL							24

IK Gujral Punjab Technical University
B.Tech. Food Technology Batch 2014 onwards

Semester Fourth

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BTFT 401	Food Biochemistry and Nutrition	3		-	40	60	100	3
BTFT 402	Milk and Milk Products Technology	3		-	40	60	100	3
BTFT 403	Food Additives	3		-	40	60	100	3
BTFT 404	Heat and Mass Transfer	3	1	-	40	60	100	4
BTFT 405	Cereals and Pulses Processing Technology	3		-	40	60	100	3
BTFT 406	Process Instrumentation and control	3	1	-	40	60	100	4
BTFT 407	Food Biochemistry (Lab)			2	40	60	100	1
BTFT 408	Milk and Milk Products Technology (Lab)			2	30	20	50	1
BTFT 409	Heat and Mass Transfer (Lab)	-	-	2	30	20	50	1
BTFT 410	Cereals and Pulses Processing Technology (Lab)	-	-	2	30	20	50	1
	TOTAL							24

SEMESTER

THIRD

FT 301: Principles of Food Preservation

3L+1T

Unit I:

Basic consideration: Aim and objectives of preservation and processing of foods, Constituents of foods: Properties and significance; Nutritive aspects of food constituents; Concept of Water activity, osmosis and diffusion, Food Spoilage: Microbial, Physical, Chemical & Miscellaneous; Intermediate moisture Food

UNIT-II:

Preservation of foods by low temperatures

Considerations relating to storage of foods at low temperature, controlled and modified atmosphere storage of foods, Freezing process, freezing curve, slow and fast freezing of foods and its consequences, other occurrences associated with freezing of foods. Technological aspects of frozen storage and thawing of foods, freeze concentration.

UNIT-III

Preservation of foods by high temperature: Basic concepts in thermal destruction of micro-organisms-D, Z, F, values Heat resistance and thermophiles in micro-organisms. thermal processing of foods : Cooking, blanching, pasteurization and sterilization of foods, canning and spoilages in canned foods.

UNIT-IV

Preservation by water removal: Principles, technological aspects and applications of evaporative concentration processes, and membrane processes for food concentrations. Principles, technological aspects and applications of drying and dehydration of foods

Preservation by chemical:Use of preservative in foods: chemical and biopreservative including antibiotics, antimicrobial agents.

Books Recommended:

1. The Technology of Food Preservation by Desrosier & Desrosoer
2. Food Science by N.N.Potter
3. Food Processing Technology Principles & Practices by P J Fellows
4. Principles of Food Preservation by V.Kyzlink,Elsevier Press.
5. Modern Food Microbiology by James M.Jay, D.Van Nostrand.

FT 302: Food Chemistry

3L

Unit I:

Introduction: Development of food chemistry and its role in food processing.

Water: Importance of water in foods. Structure of water & ice. Concept of bound & free water and their implications.

Carbohydrates: Nomenclature and classification, structure, physical and chemical properties of carbohydrates – monosaccharide, disaccharides and polysaccharides (cellulose, starch, fructans, galactans, hemi-cellulose, pectic substances) and their functions; dietary fiber, changes in carbohydrates during processing.

Unit II:

Proteins: Nomenclature, classification, structure, chemistry and properties of amino acids, peptides, proteins. essential and non- essential amino acids. Changes during processing.

Unit III

Lipids: Structure, classification, physical and chemical properties of fatty acids and glycerides, Auto-oxidation, photo oxidation and flavor reversion, Changes in fats & oils during processing.

Vitamins & Minerals: Types, chemistry and functions, source and deficiency diseases. Changes during processing

Unit IV:

Enzymes: Nomenclature, mechanism of enzyme action, factors affecting enzyme action, enzymes important in foods.

Pigments: Structure and properties of chlorophyll, anthocyanins, tannin, myoglobin and carotenoids, chemical changes during processing

Books Recommended

- 1) Food Chemistry by Meyer
- 2) Food Chemistry by Belitz
- 3) Food Chemistry by Lee
- 4) Principles of Biochemistry by Lehniger

FT 303: Food Microbiology

3L+1T

Unit I:

Introduction: Importance and historical developments in food microbiology, prokaryotic and eukaryotic cell, morphology, structure, microbiology and reproduction of Bacteria, Yeast, Mold, Actinomycetes and algae. Viruses-structure and replication with particular reference to food borne viruses.

Unit II:

Microbial growth and death kinetics: Definition, Growth curves (different phases), synchronous growth, doubling/generation time, intrinsic and extrinsic factors, relationship between number of generations and total number of microbes.

Techniques of pure culture: Definition, Serial Dilution, pour plate, streak plate, spread plate, slant, broth and enrichment culture, lyophilization.

Unit III:

Microorganism in Natural Products: Sources and prevention of contamination; Microbiology of atmosphere, water, influence of aw, milk and milk products; cereals and cereal products; meat and meat products; fish or fish products; poultry and eggs; sugars; spices and salt; canned foods.

Unit IV:

Food spoilage: Bacterial and fungal food spoilage, food poisoning, food borne infection, food borne intoxication. Toxins produced by staphylococcus, clostridium, aspergillus; bacterial pathogens-salmonella, bacillus, listeria, E. coli, shigella, campylobacter.

Microbial Control: Source of microorganism, Physical and chemical agents used in microbial control, disinfection agents and its dynamics.

Books Recommended

1. Microbiology by H.J. Pelczar, Smith & Chan.
2. Food Microbiology by Frazier
3. Industrial Microbiology by Casida
4. Introduction to Microbiology by Stainier.

FT 304: FLUID FLOW OPERATIONS AND RHEOLOGY

3L+1T

UNIT-I

Introduction to fluid, various physical properties of fluid, concept viscosity, units of viscosity, factors affecting the rheological parameters, fluid pressure and its measurement, pressure, manometers, concept of Reynolds's number, types of fluid flow, rate of flow or discharge, derivation of continuity equation, different types of energies of a liquid in motion, pressure energy, kinetic energy, potential head, derivation Bernoulli equation, hydraulic coefficients.

UNIT-II

Practical applications of Bernoullies equation, venturimeter, orifice meter, pitot tube, rotameter, loss of head due to friction in viscous flow, Darcy-Weisbach formula; energy losses in pipes; major losses; minor losses; coefficient of friction or fanning friction factor or skin friction factor; drag coefficient; different types of pumps.

UNIT-III

Introduction to Rheology; perfectly elastic (Hookean body), ideal plastic behaviour; ideal viscous behaviour; stress strain diagram of a biomaterial; rheological diagram; concept of apparent viscosity, time independent fluids (no memory fluids); power law (viscous) fluids; pseudo plastic or shear thinning fluids; shear thickening fluids; dilatant fluids; viscoplastic fluids: Bingham plastic (ideal plastic) fluids; non- bingham plastic fluids; Herchel-Bulkley fluids: Time dependent fluids (memory fluids) like thixotropic fluids; antithixotropic (or rheopectic) fluids.

UNIT-IV

Derivation of Hagen-Poiselle equation or theory of capillary viscometer; Stokes law; Viscometry, capillary tube viscometer; ostwald viscometer; falling sphere resistance method; rotational viscometer; cone and plate type viscometer; circular disc viscometer; oscilatory measurements method; textural profile analysis.

Books Recommended

- 1) G. S. Sawhney, Fundamentals of Fluid Mechanics. I.K. International Publishing House Pvt. Ltd, new Delhi, 2008
- 2) Bansal R. K A Text book of Fluid Mechanics and Hydraulic machines. Laxmi Publications (P) Ltd, New Delhi, 2009

- 3) Shiv Kumar Fluid Mechanics. Ane Books Pvt. Ltd, New delhi, 2010
- 4) Arora K. R Fluid Mechanics Hydraulic and Hydraulic machines, Standard Publishers Distributors, New Delhi 1993

FT 305: FRUIT AND VEGETABLE PROCESSING TECHNOLOGY

3L

UNIT-I

Current status of production and processing of fruits and vegetables. Structural, compositional and nutritional aspects. Post-harvest physiology, handling, losses and conservation of fruits and vegetables.

UNIT-II

Techniques of extension of shelf life of unmodified produce: use of adjuncts, novel packaging, controlled and modified atmosphere storages. Processing for conversion into products and preservation by use of chemical preservatives, chilling & freezing, sterilization & canning, concentration & dehydration and other special techniques.

UNIT-III

Technology of Products: juices & pulps, concentrates & powders, squashes & cordials, nectars, fruit drinks & beverages carbonated and its quality control. Fermented products (Cider, wine, brandy).

UNIT-IV

Jam, Jelly & Marmalades; candied fruits, dried fruits and fruit products (eg. Aam papads, bars); soup mixes; sauces & ketchups; puree & pastes; chutneys & pickles, Specialty fruit and vegetable products, Waste management in fruits & vegetable industry

Books Recommended

1. Food science by B.Srilakshami;New Age International.
2. Fundamentals of Foods and Nutrition by R. Madambi & M.V. Rajgopal.
3. Foods :Facts and Principles by N Shakuntala manay;New Age International (P) Ltd.
4. Preservation of Fruits and Vegetable by Girdhari lal and Sidappa; CBS Publications

5. Food Science and Processing Technology, Vol., 2 by Mridula and Sreelata
6. Food Preservation by Sandeep Sareen
7. Fruit and Vegetable Preservation by Shrivastava and Kumar.
8. Post-Harvest Physiology & Handling of Fruits & Vegetables by Wills, Lee, Graham, McGlasson & Hall (AVI)
9. Literature from Spice Board of India, etc.

FT 306: FOOD HYGIENE AND PLANT SANITATION

3L

UNIT-I

General principle of food hygiene, Hygiene in rural and urban areas in relation to food preparation, personal hygiene and food handling habits. Sanitary aspects of building and processing equipment. Establishing and maintaining sanitary practices in food plants.

UNIT-II

Safe and effective insect and pest control: Extraneous materials in foods, Principles of Insects and pest control. Physical and chemical control, Food contamination by microorganisms, effective control of micro-organisms, importance in food sanitation, micro-organisms as indicator of sanitary quality.

UNIT-III Sanitary aspects of water supply: Source of water, quality of water, water supply and its uses in food industries. Purification and disinfection of water preventing contamination of potable water supply.

UNIT-IV

Effective detergency and cleaning practices: Importance of cleaning technology, physical and chemical factors in cleaning, classification and formulation of detergents and sanitizers, cleaning practices. Role of sanitation, general sanitary consideration and sanitary evaluation of food plants. Sanitary aspects of waste disposal.

Books Recommended:

1. Principles of Food Sanitation by Marriott and Norman, G.
2. Hygiene and Sanitation in Food Industry by S. Roday, TMH
3. Guide to Improve Food Hygiene by Gaston and Tiffney, TMH.
4. Practical Food Microbiology & Technology by Harry H. Weiser, Mountney, J. and Gord, W.W.
5. Food Poisoning and Food Hygiene by Betty C. Hobbs, London publication.

FT 307: PRINCIPLE OF FOOD PRESERVATION (LAB)

1. Demonstration of various food processing equipment
2. Determination of moisture content of food sample by oven method
3. Determination of the ash content of food sample
4. Determination of total soluble solids of various food samples
5. Determination of pH of different food samples
6. Measurement of acidity by titration method
7. Assessment of adequacy of blanching of food sample (potato & apple)
8. Measurement of specific gravity of liquid sample
9. Identification of different food grains
10. Measurement of cooking quality of rice grains
11. Preparation of the sugar syrup of different degree brix
12. Preservation of vegetable with the help of fermentation technique (Sauerkraut)
13. Studies on the effect of boiling time on egg quality

FT 308 FOOD CHEMISTRY LAB

1. Qualitative tests for the presence of carbohydrates in food samples
2. Qualitative test for the presence of protein in food samples
3. Estimation of sugar in given food sample by Lane and Eynon and Nelson & Somogy method
4. Estimation of lactose in milk sample by titrimetric method
5. Determination of acid value of given oil or fat sample
6. Estimation of amount of fat in milk powder by Majonnier's method
7. Estimation of protein by micro-Kjeldhal method
8. Estimation of pectin in fruit (Guava)
9. Determination of saponification value and un-saponifiable matter
10. Determination of RM value of oil and fat.
11. Determination of Polenske value of oil and fat.
12. Determination of vitamin C in food sample.
13. Estimation of phosphatase activity.

FT 309: Food Microbiology Lab

1. Working study of various equipments related to Microbiology.
2. Isolation of pure culture using pour plate technique.
3. Isolating pure culture using spread plate technique.
4. Measurement the size of given microbial cell using micrometry.
5. Enumeration total viable count in a culture.
6. To perform Gram staining technique of bacteria.
7. Study the growth curve of microorganisms.
8. Quantitative analysis of food sample by standard plate count (SPC) method.
9. Study the quality of milk by methylene blue reductase test.
10. Preparation of curd using starter culture.
11. To perform presumptive test for coliforms in milk.
12. To study the microbial spoilage of given food sample.

FT 310: FRUITS & VEGETABLES PROCESSING TECHNOLOGY (LAB)

1. Preservation and processing of certain vegetables by drying.
2. Preparation of tomato ketchup and its preservation.
3. Preparation of tomato puree and its preservation.
4. Preparation of pickles.
5. Preparation of jam,
6. Preparation of jelly
7. Preparation of marmalades
8. Preparation of squash and cordial as per FPO specification.
9. Processing and Preservation of peas by use of high temperatures (Bottling of Peas).
10. Blanching of a given sample (pea) and assessment of its adequacy.
11. Enzymatic browning of fruits and vegetables and its control.
12. Osmotic dehydration of given sample (Carrot/Grapes).
13. Preparation of amla preserve and dried fruit product (Aam papad, bars)

SEMESTER

FOURTH

FT 401: Food Biochemistry and Nutrition

3L

UNIT-I

Nutrition: Function's and energy of foods, Basal Energy Metabolism, Dietary Allowances and Standards for different age groups. Nutritional Quality of foods and its assessments: Food proteins (Digestibility, Biological value, NPU, PER), Modifications of foods constituents due to processing and storage and their nutritional implications.

UNIT-II

Enzyme: Classification, nomenclature, activation energy, Michaelis-Menten equation, Lineweaver Burk Plot, factors affecting enzymes action, mechanism of enzyme action.

UNIT-III

Proteins: Utilization of protein in body proteins products of protein metabolism. Disorders in metabolism, clinical proteins associated with excess and deficiency of proteins.

UNIT-IV

Carbohydrates: Utilization of carbohydrates in body metabolism of carbohydrates and disorder in metabolism.

UNIT-V

Lipids: Utilization of fats, biosynthesis of fatty acids and fats, clinical disorders associated with fats.

Books Recommended :

1. Principles of Biochemistry by Lehninger, New York Publication.
2. Food: Facts and Principles by N. Shakuntala Manay, N.Shadksharawamis, New Age International Pvt. Ltd., New delhi.
3. Fundamentals of Nutrition by L Loyd , McDonald College of Mc gill University.

FT 402: Milk and Milk Products Technology

3L

UNIT-I

Introduction: Status of Dairy Industry in India. Cooperative Dairying. Operation Floods.

Milk : Definition, Composition, Chemical and functional properties of milk components: physicochemical properties of milk protein, aggregation of Casein, micelles, factors affecting milk composition, milk secretion and lactation.

UNIT-II

Fluid Milks: Physicochemical characteristics and factors affecting them. Production, collection, testing quality, cooling, storage, and transportation of liquid milks. Receiving and quality assessing of liquid milk in dairy industry for detection of adulteration, decision for acceptance/rejection, and determination of price of the milk.

Micro-organisms: importance in dairy science and technology. Microbial spoilage of milk, hydrolytic rancidity in milk and milk products, autooxidation of milk fats and effects on milk quality.

UNIT-III

Milk processing operations: Standardization and/or processing (pasteurization, homogenization, sterilization and UHT processing), storage, packaging and distribution of liquid milks: whole, standardized, toned, double-toned, and skim milk. Recombined, reconstituted, and flavored milks. Effect of processing of milk components and their functional properties.

UNIT-IV

Skimming of milk, Cream & Cream characteristics, manufacture of yoghurt and other fermented milk products, Ice cream manufacture, Butter making technology, technology of cheese, processing of evaporated and concentrated milks and dried milk powder.

UNIT-V

Indigenous product: Fermented milks (Curd, yogurt etc.) and milk-products (cheeses, butter milk, lassi etc.); other milk products (khoa, casein, whey proteins, lactose etc.); milk and milk product-based sweetmeats (burfi, rasogolla, milk-cake, kalakand, ruberii etc.)

Milk quality control, sanitation in the dairy plant, adulteration of milk, dairy equipment maintenance and waste disposal.

Books Recommended:

1. Outlines of Dairy Technology by Sukumar De, Oxford University Press.
2. Principles of Dairy Processing by James N. Warner, Wiley Eastern Ltd.
3. Milk and Milk Products by Eckles, Combs; and Macy, Tata McGraw Hill.
4. Technology of Indian Milk Products by Aneja et al. A Dairy India Publication.

FT 403: Food Additives

3L

UNIT-I

Introduction to Food Additives: Definition, Types of additives, Benefits of additives, risk of additives; Consume attitude towards food additives; Food Additive Intake Assessment: Scope and purpose of food additive intake assessment, regulation of maximum levels of food additives, method of estimating dietary intake of additives. Class I and Class II preservatives as per PFA Act.

UNIT – II

Nutritional Additives: Vitamins, Amino Acids, Fatty Acids, Minerals and trace minerals, dietary supplements.

Fat Substitutes and replacers: Introduction, Chemistry, application in foods, toxicology

Food Additives for special dietary purposes: Nutrition, palatability, manufacturing, stabilizers, thickeners, future development

UNIT III

Flavoring Agents and enhancers: Flavors, their nature, creation and production, function of flavors and their utilization, flavor regulations, flavor safety; definition, properties, function of flavor enhancers.

Sweeteners: Non-nutritive sweeteners, nutritive sweeteners, choice of sweetener

Antioxidants: Oxidation chemistry, mechanisms of oxidation inhibition, natural and synthetic antioxidant, antioxidant and health, toxicology.

Antimicrobial agents: Introduction, Types of antimicrobial agents.

UNIT IV

Colorants: Natural and synthetic food colorants, chemistry, sources, analysis, effect on foods applications, safety

Anti-browning agents: Chemistry of browning reactions in foods, browning inhibitors, special problems in control of enzymatic browning

pH Control agents and Acidulants: Introduction, mode of action of acids as antimicrobial agents, types of agents, chemical analysis and assay.

Enzymes: functional aspects, enzyme nomenclature, manufacturing of commercial enzymes, use in food industry

UNIT V

Emulsifiers: Chemistry, function, mechanism and application; Anti-caking agents, Firming agents.

Food Phosphates: chemistry, uses and applications, nutritional effects

Clarifying agents, Gases and Propellants. Tracers and other additives, Application of commercial starch and their potential.

Books Recommended:

1. Food Additives by A. Larry Branen, P.Michael Davidson, Seppo Salminen, John H. Thorngate
2. Food Chemistry by Fennema, Food Science & technology series, 4th edition.
3. Food Chemistry by Belitz, Grosch, Springer.
4. Various acts, orders, standards & specification
5. Rheology and Texture in Food Quality by J.M.DeMan
6. Food Analysis : Theory and practice, IS: 6273 (Part-1& Part-2) by Y. Pomeranz
7. Principles of Sensory Analysis of Food by M.A. Amerine

FT 404: Heat and Mass Transfer

3L+1T

Kindly merge the heat and mass transfer syllabus

Heat Transfer

UNIT-I

Introduction: Introduction of heat transfer, importance of heat transfer, modes of heat transfer, thermal conduction in solids, liquids and gases.

Conduction :Fourier's law, thermal conductivity, steady state conduction of heat through a composite solid, cylinder and sphere, steady-state heat conduction in bodies with heat sources, plane wall, cylinder and sphere. Insulation and its purpose, critical thickness of insulation for cylinders and sphere, general heat transfer equation for extended surfaces.

UNIT-II

Convection :Natural and forced convection, Nusselt number ,dimensional analysis of free and forced convection, dimensionless numbers used in convective heat transfer, important correlation's for free and forced convection.

UNIT-III

Radiation :Introduction, reflection, absorption and transmission of radiation, characteristics of black, gray and real bodies in relation to thermal radiation, Stefan Boltzman Law, Kirchoff's Law, Wein's displacement law, Intensity of radiation, radiation exchange between black bodies and diffuse gray surface.

UNIT-IV

Heat exchangers :Overall heat transfer coefficient, fouling factors, log mean temperature, difference for parallel and counter flow, heat exchangers, shell and tube type heat exchangers, effectiveness of parallel and counter flow heat exchangers by general and NTU method, Applications of plate heat exchanger in HTST pasteurizer with regeneration.

UNIT-V

Evaporators: Types of evaporators -natural circulation evaporators, force circulation evaporators, falling film evaporators, climbing film evaporators, agitated thin-film evaporators and plate evaporators, principles of evaporation and evaporators.

Books Recommended:

1. Heat Transfer :Principles and Applications, by Dutta, B.K. PHI. New Delhi,2001.
2. Heat Transfer, by Holman, J.P., 8th Ed., McGraw-Hill,New York.
3. Heat Transfer, by A.J.Chapman, Maxwell Macmillan,1984.
4. Process Heat Transfer, by Hewitt, G.F.,Shires, G.L.and Bott,T.R., CRC Press,1994.

Mass transfer

UNIT-I

Introduction to mass transfer and molecular diffusion, Molecular diffusion in gases, Liquids & Solids. Diffusivity and mass transfer coefficients and theories.

Interphase mass transfer: Mass transfer equilibrium, Diffusion between two phases, local two phase mass transfer and over all mass transfer coefficients. Material balance for steady state co-current and counter current processes. Cross flow and counter current cascades.

UNIT-II

Gas Absorption: Equilibrium solubility of gases in liquids, ideal and non ideal solutions. Equipments: Gas dispersed- bubble columns, tray towers, liquid dispersed-venturi scrubbers, wetted wall towers, spray tower, packed towers. Concept of NTU, HTU and HEPT. Ideal stage and stage efficiency.

UNIT-III

Distillation: Vapour liquid equilibria, boiling point diagram, relative volatility, enthalpy concentration diagram, flash vapourization, differential distillation, steam distillation, azeotropic distillation and extractive distillation for binary system. Continuous rectification, McCabe Thiele method, bubble cap distillation column.

UNIT-IV

Liquid-

liquid extraction: Ternary liquid–liquid equilibrium and tie line data, choice of solvents, extraction equipments. Leaching: principle of leaching, equipments.

UNIT-V

Adsorption and Ion Exchange: Types of Adsorption, nature of adsorbents, adsorption equilibrium,adsorption of a single component from a gas mixture/liquid solution. Multistage cross current and counter current adsorption,continuous contact adsorption. Principle of ion-exchange, equilibria and rate of ion-exchange.

Books Recommended:

1. Unit Operation of Chemical Engineering by Mc Cabe, Smith & Harriot, McGraw Hill Inc.
2. Transport Processes and Unit Operations by Geankoplish,
3. Chemical Engineering (Vol. I & II) by Coulson, J. M. & Richardson, J. F.
4. Introduction to Chemical Engineering by Badger, W. L. & Bachero, J. T.
5. Chemical Engineering Handbook by Perry, A. S. and Wenzel, L. A.

FT 405: Cereals and Pulses Processing Technology

3L

UNIT-I

General introduction to cereals and pulses; Production and utilization trends of various cereals and pulses; Grain classification, structure and composition; Importance of cereals and pulses, Post-harvest quality and quantity losses. Recommended pre-processing practices for handling of cereals and pulses for their safe storage, including control of infestation, National and International quality and grading standards.

UNIT-II

Structure, types, composition, quality characteristics and physicochemical properties of wheat. Cleaning, tempering and conditioning, and milling processes for different wheat's. Turbo-grinding & Air Classification. Blending of flours. Milling equipments and milling products (Dalia, Atta, Semolina and flour). Flour grades and their suitability for baked goods. Quality characteristics and rheological properties of wheat milling products and its assessment. By-product utilization.

UNIT-III

Structure, types, composition, quality characteristics and physicochemical properties of rice. Milling and parboiling of paddy, Curing and ageing of paddy and rice. Criteria in and assessment of milling, cooking, nutritional and storage qualities of raw & parboiled rice. Processed rice products (flaked, expanded and puffed rice). By-product (husk and rice bran) utilization.

UNIT-IV

Structure, types and composition of corn. Dry and wet milling of corn. Starch and its conversion products. Processed corn products (popped corn, corn flakes etc.) Structure and composition of barley, bajra, jowar and other cereal grains and millets. Malting of barley. Pearling of millets. Parched and snack products.

UNIT-V

Pulses: Anti-nutritional factors and methods of inactivation; pre-treatments; Traditional and modern milling methods and equipment involved; Byproducts of pulse milling and their utilization

Books Recommended

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1. Cereals Technology by Samuel A.Matz. CBS Publications.
2. Technology of Cereals by N.L.Kent, Pergamon Publications.
3. Food Facts and Principles by Mannay;New age International (P) Ltd.
4. Food Science by Norman N.Potter;CBS Publications.
5. Cereals & Cereals Products-Chemistry & Technology by DAV Dendy & B.J.Dobraszezck, Aspen Publication.
6. Development in Milling & Baking Technology by AFST (I), CFTRI, Mysore, India.
7. Food Industries of CEEDC, IIT, Madras.
8. Articles on Pulse Milling in India Food Industry & JFST,both Publications of AFST (I).
9. Chemistry and Technology of Food and Food Products by M.B. Jacobs, Editor, Interscience, N.Y.
10. Manuals on Rice and its Processing by CFTRI.

FT 406: Process Instrumentation and control

3L +1T

UNIT I

Introduction to Process Instrumentation and Control: An Industrial process, process parameters, batch and continuous process, process instrumentation and control, selection of controller; Introduction to process variables, statics and dynamics characteristic of instruments and their general classification.

UNIT II

Measuring and Controlling Devices: Elements of measuring system and their function, role of transducers in food industry, classification of transducers, Actuating and controlling devices

Measurement in Food Processing: Moisture content measurement, water activity measurement, Humidity measurement, Turbidity and color measurement, Food and process temperature measurement, Level and Food flow measurement, Viscosity of liquid foods, inline and online rheology measurement, Brix of food, pH values of food, food enzymes measurement, flavor measurement, food texture and particle size, food constituents analysis

UNIT III

Controllers and Indicators: Temperature control in food dehydration and drying, electronic controllers, flow ratio control in food pickling process, atmosphere control in food preservation, timers and indicators in food processing, food sorting and grading control, discrete controllers, adaptive and intelligent controllers

UNIT IV

Chemo sensors, biosensors, immune-sensors and DNA probes base devices; Biosensors for process monitoring and quality assurance in the food industry; commercial devices based on biosensors; new biosensors

UNIT V

Computer based monitoring and control; Advanced instruments: microwave measurements of product variables, ultrasonic instrumentation, conductance/impedance techniques for microbial assay

Books Recommended

1. Measurement and Control in Food Processing by Manabendra Bhuyan

2. Instrumentation and Sensors for the Food Industry by Erika Kress-Rogers And Christopher J.B. Brimelow
 3. Process Systems Analysis and Control, by Coughanowr, D. R., 2nd edition McGraw Hill 1991.
 4. Chemical process control, by Stephanopoulos, G , PHI,1984 ,NEW DELHI.
 5. Principles of Industrial Instrumentation, by Patranabis D.,
 6. Principles of Industrial instrumentation by Eckman D.P., Willey Eastern,1978
-

FT 407: Food Biochemistry (Lab)

- 1 Estimation of ascorbic acid in lemon juice.
 - 2 Preparation of sample for mineral estimation by ashing method.
 - 3 Qualitative estimation of a Calcium in given sample.
 - 4 Estimation of cholesterol in a given sample by zak s method.
 - 5 Determine the iso-electric point of peas.
 - 6 Study the effect of enzyme concentration on enzyme kinetics.
 - 7 Determination of reducing sugar from unknown solution by using 3, 5- di-nitro salicylic Acid (DNS).
 - 8 Determine the Protein content of a given sample by Lowry's method.
 - 9 Detect the presence of protein in urine by sulfosalicylic acid test.
 - 10 Check the presence of Glucose (Carbohydrate) in urine sample by conducting benedict test.
 - 11 Detect the presence of protein by heat coagulation test.
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FT 408 Milk and Milk Products Technology (Lab)

1. Determination of quality of raw milk (eq. COB, MBRT, Resazurin Test, Lactometer reading, pH & acidity, fat contents, SNF content, specific gravity etc).
 2. Determination of adequacy of pasteurization (Phosphatase test).
 3. Determination of microbiological quality (TPC/SPC) of pasteurized and sterilized/ flavored milk samples & some milk products like ice cream.
 4. Preparation of certain dairy products (eg. Khoya, paneer, flavoured milk, yogurt, cream, ice cream, srikhand etc.) and assessment of yield and quality of the prepared products
 5. Determination of solubility, dispersibility of dried milk powders (spray & drum-dried samples).
 6. Determination of certain key parameters in dairy products (eg overrun in ice cream, salt content in butter, moisture content in ghee etc.)
 7. Visit to a dairy/ice cream factory.
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FT 409: Heat and Mass Transfer (Lab)

Note : Mass Transfer experiments are missing.

1. Determine the overall heat transfer coefficient for shell and tube heat exchanger.
 2. Determine the experimental and theoretical value of heat transfer coefficient for natural convection process.
 3. Determine the theoretical and experimental value of heat transfer coefficient for forced convection process.
 4. Determine the individual thermal conductivities and overall thermal conductivity for composite wall apparatus.
 5. Determine the value of surface conductance for given finite geometry shapes (unsteady state heat transfer).
 6. Find the emissivity of a given test plate with respect to the black plate.
 7. Calculate the heat transfer coefficient for heat transfer in packed bed.
 8. Observe boiling phenomena and to determine the heat flux and surface heat transfer coefficient as a function of the temperature excess at constant pressure.
 9. Study heat transfer rate, overall heat transfer coefficient and effectiveness of Finned Tube Heat Exchanger.
 10. Determine heat transfer from condensing vapors for Dropwise and Filmwise condensation.
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FT 410: Cereals and Pulses Processing Technology (Lab)

1. Determination of physical properties of different cereal grains
 2. Determination of sedimentation value of the Maida.
 3. Determination of alcoholic acidity of the sample of the wheat flour / Maida.
 4. To determine the water absorption capacity of the wheat flour / Maida.
 5. Determination of adulterant (NaHCO_3) in wheat flour/ Maida.
 6. Estimation of Protein content of different Cereals and Legumes.
 7. Assessment of market samples of wheat, rice, and pulses for conforming to some PFA specifications.
 8. Storage studies of cereal and legume grains having different moisture levels.
 9. Determination of Gluten content in wheat flour samples.
 10. Determination Polenske value of wheat flours.
 11. Visit to a working modern roller flour mill and FCI godowns.
 12. Visit to working rice mill, collection of samples at various steps of milling and analysis for efficiency of cleaning, shelling, paddy separation, and degree of polish.
 13. Preparation of expanded & puffed rice from raw and parboiled materials and assessment of quality of products including expansion in volume.
 14. Traditional and improved pretreatments and its effect on dehusking of some legumes.
 15. Determination of dry and wet gluten of a given flour sample
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