

Scheme and Syllabus

B.Tech. Food Technology

Batch 2017 onwards



By
Department of Academics

IK Gujral Punjab Technical University

IK Gujral Punjab Technical University
B.Tech. Food Technology Batch 2017 onwards

Semester Third

Contact Hours: 28 Hrs.

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	18	2	8	360	440	800	24

IK Gujral Punjab Technical University
B.Tech. Food Technology Batch 2017 onwards

Semester Fourth

Contact Hours: 28 Hrs.

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	30	20	50	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	18	2	8	360	440	800	24

Semester Fifth

Contact Hours: 29 Hrs.

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BTFT 501	Meat, Poultry & Fish Processing Technology	3		-	40	60	100	3
BTFT 502	Food Packaging	3	1	-	40	60	100	4
BTFT 503	Food Regulations and Plant Management	3		-	40	60	100	3
BTFT 504	Food Analysis and Quality Control	3	1	-	40	60	100	4
BTFT 505	Oils & Fats Processing Technology	3		-	40	60	100	3
BTFT 506	Food Process Engineering	3	1	-	40	60	100	4
BTFT 507	Fish, Meat & Poultry Technology (Lab)	-	-	2	30	20	50	1
BTFT 508	Food Packaging (Lab)	-	-	2	30	20	50	1
BTFT 509	Food Analysis and Quality Control (Lab)	-	-	2	30	20	50	1
BTFT 510	Oils & Fats Processing Technology (Lab)	-	-	2	30	20	50	1
	TOTAL	18	3	8	360	440	800	25

Semester Sixth

Contact Hours: 23 Hrs.

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BTFT 601	Statistical Quality Control	3	-	-	40	60	100	3
BTFT 602	Bakery and Confectionary Technology	3	1	-	40	60	100	4
BTFT 603	Entrepreneurship and Agribusiness Management	3	-	-	40	60	100	3
BTFT 604	Fermentation Technology	3	1	-	40	60	100	4
BTFT 605	Spice and Flavor Technology	3	-	-	40	60	100	3
BTFT 606	Bakery and Confectionary Technology (Lab)	-	-	2	30	20	50	1
BTFT 607	Fermentation Technology (Lab)	-	-	2	30	20	50	1
BTFT 608	Spice and Flavor Technology (Lab)	-	-	2	30	20	50	1
	TOTAL	15	2	6	290	360	650	20

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Semester Seven

Contact Hours: 23 Hrs.

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BTFT 701	Food Plant Design and Project Engineering	3	1	-	40	60	100	4
BTFT 702	Advance Techniques in Food Processing	3	1	-	40	60	100	4
BTFT 703	Nutraceuticals and Functional Foods	3	-	-	40	60	100	3
BTFT 704	Waste Management of Food Industry	3	-	-	40	60	100	3
BTFT 705	Research Methodology	3	-	-	40	60	100	3
BTFT 706	Project	-	-	4	40	60	100	4
BTFT 707	Seminar	-	-	2	30	20	50	1
	TOTAL	15	2	06	270	380	650	22

Semester Eight

Contact Hours: 40 Hrs.

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BTFT 801	Industrial/Institutional Training	40 hrs/week			300	200	500	20
	TOTAL				300	200	500	20

SEMESTER THIRD

BTFT 301: PRINCIPLES OF FOOD PRESERVATION

Total Marks: 100

L	T	P
3	0	0

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 bio-preservative 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.

BTFT 302: FOOD CHEMISTRY

Total Marks: 100

L	T	P
3	0	0

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

Browning reaction: Enzymatic and non-enzymatic browning .

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

BTFT 303: FOOD MICROBIOLOGY

Total Marks: 100

L	T	P
3	1	0

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.

BTFT 304: FLUID FLOW OPERATIONS AND RHEOLOGY

Total Marks: 100

L	T	P
3	1	0

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-Poiseulle 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. Fundamentals of Fluid Mechanics by G. S. Sawhney,. I.K. International Publishing House Pvt. Ltd, new Delhi, 2008
2. Text book of Fluid Mechanics and Hydraulic machines by Bansal R. K A. Laxmi Publications (P) Ltd, New Delhi, 2009
3. Fluid Mechanics by Shiv Kumar Ane Books Pvt. Ltd, New delhi, 2010

4. Fluid Mechanics Hydraulic and Hydraulic machines by Arora K. R, Standard Publishers Distributors, New Delhi 1993

BTFT 305: FRUIT AND VEGETABLE PROCESSING TECHNOLOGY

Total Marks: 100

L	T	P
3	0	0

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.

BTFT 306: FOOD HYGIENE AND PLANT SANITATION

Total Marks: 100

L	T	P
3	0	0

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.

BTFT 307: PRINCIPLE OF FOOD PRESERVATION (LAB)

Total Marks: 50

L	T	P
0	0	2

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.

BTFT 308: FOOD CHEMISTRY (LAB)

Total Marks: 50

L	T	P
0	0	2

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.

BTFT 309: FOOD MICROBIOLOGY (LAB)

Total Marks: 50

L	T	P
0	0	2

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.

BTFT 310: FRUITS & VEGETABLES PROCESSING TECHNOLOGY (LAB)

Total Marks: 50

L	T	P
0	0	2

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

BTFT 401: FOOD BIOCHEMISTRY AND NUTRITION

Total Marks: 100

L	T	P
3	0	0

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.

BTFT 402: MILK AND MILK PRODUCTS TECHNOLOGY

Total Marks: 100

L	T	P
3	0	0

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.

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.

UNIT II

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

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 III

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 IV

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.

BTFT 403: FOOD ADDITIVES

Total Marks: 100

L	T	P
3	0	0

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 FSSAI Act.

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

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

UNIT II

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

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.

UNIT III

Antimicrobial agents: Introduction, Types of antimicrobial agents.

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.

UNIT IV

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

BTFT 404: HEAT AND MASS TRANSFER

Total Marks: 100

L	T	P
3	1	0

UNIT I

Introduction: Introduction of heat and mass transfer, importance of heat and mass transfer in food processing, 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.

Convection: Natural and forced convection, dimensional analysis of free and forced convection, dimensionless numbers used in convective heat transfer, important correlations for free and forced convection.

UNIT II

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.

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 III

Mass Transfer: Introduction to mass transfer, different modes of mass transfer, Mass flux and molar flux for a binary system, Fick's law of diffusion of mass transfer, Derivation of general diffusion mass transfer equation, Molecular diffusion in gases, liquids and solids having steady state equi-molar counter diffusion and through non diffusing body; Steady state equimolar counter diffusion, convective mass transfer coefficient, natural and forced convective mass transfer, dimensional analysis for free and forced convective mass transfer, important correlations of convective mass transfer; permeability of films and laminates.

UNIT IV

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.

Liquid-liquid extraction: Ternary liquid–liquid equilibrium and tie line data, choice of solvents, extraction equipment's. Leaching: principle of leaching, equipment's.

Note: Students can use the Non-Programmable scientific calculator.

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.
5. A course in Heat and Mass Transfer by Arora & D'kundwar Dhanpat Rai & Sons
6. Fundamentals of Engg. Heat & Mass Transfer by R.C. Sachdeva New Age
7. Fundamental of Heat and Mass Transfer by G.K. Roy Khanna Pub
8. Heat and Mass Transfer by D.S. Kumar Kataria & Sons
9. Unit Operation of Chemical Engineering by Mc Cabe, Smith & Harriot, McGraw Hill Inc.
10. Transport Processes and Unit Operations by Geankoplish,
11. Chemical Engineering (Vol. I & II) by Coulson, J. M. & Richardson, J. F.
12. Introduction to Chemical Engineering by Badger, W. L. & Bachero, J. T.
13. Chemical Engineering Handbook by Perry, A. S. and Wenzel, L. A.

BTFT 405: CEREALS AND PULSES PROCESSING TECHNOLOGY

Total Marks: 100

L	T	P
3	0	0

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.

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 II

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 III

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 IV

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

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.Dobraszez, Aspen Publication.
6. Development in Milling & Baking Technology by AFST (I), CFTRI, Mysore, India.
7. Food Industries of CEEDC, IIT, Madras.
8. Chemistry and Technology of Food and Food Products by M.B. Jacobs, Editor, Interscience, N.Y.
9. Manuals on Rice and its Processing by CFTRI.

BTFT 406: PROCESS INSTRUMENTATION AND CONTROL

Total Marks: 100

L	T	P
3	1	0

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.

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

UNIT II

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

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., McGraw Hill.

4. Chemical process control, by Stephanopoulos, G, PHI, NEW DELHI.
5. Principles of Industrial Instrumentation, by Patranabis D.,
6. Principles of Industrial instrumentation by Eckman D.P., Willey Eastern.

BTFT 407: FOOD BIOCHEMISTRY (LAB)

Total Marks: 50

L	T	P
0	0	2

- 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.

BTFT 408: MILK AND MILK PRODUCTS TECHNOLOGY (LAB)

Total Marks: 50

L	T	P
0	0	2

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.

BTFT 409: HEAT AND MASS TRANSFER (LAB)

Total Marks: 50

L	T	P
0	0	2

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.
11. Study of a distillation operation.

BTFT 410: CEREALS AND PULSES PROCESSING TECHNOLOGY (LAB)

Total Marks: 50

L	T	P
0	0	2

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 (NaHCO₃) 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.

SEMESTER

FIFTH

BTFT 501: MEAT, POULTRY & FISH PROCESSING TECHNOLOGY

Total Marks: 100

L	T	P
3	0	0

UNIT I

Introduction: Scope of meat, poultry and fish industry in India. Current levels of production, consumption and export of category products

Structure and Composition of Muscle and associated tissue: Muscle tissue, skeletal muscle, skeletal muscle fiber, myofibrils, myofilaments, smooth muscle, cardiac muscle, epithelial tissue, nervous tissue. Connective tissues. Connective tissue proper, adipose tissue. Muscle bundles and associated connective tissues. Muscle and fiber types. Chemical composition of skeletal muscle, health and hygienic considerations.

UNIT II

Conversion of muscle to meat: Homeostasis, Exsanguination, circulatory failure to muscle, postmortem pH decline, rigor mortis, Enzymatic degradation.

Properties of fresh meat: Water holding capacity, chemical basis of water holding capacity, color, pigments.

UNIT III

Meat: Ante-mortem examination of meat animals, scientific techniques of slaughtering, dressing, post-mortem inspection, storage, tenderization, cuts, packaging; beef, mutton, pork as human foods, cured meat products, sausages, by-products, frozen and canned meat products.

Poultry: Pre-slaughter care and consideration; Operations in preparation of dressed poultry, its storage and marketing; Quality and safety considerations; utilization of by-products. Poultry cuts.

UNIT IV

Egg: Structure, composition, nutritional and functional characteristics of eggs. Grading, spoilage, storage and transportation of whole eggs. Processing of eggs for liquid products (white, yolk and whole egg) and solid products (albumen, whole egg powder) for preservation through freezing & drying.

Fish: Types, catch, examination; care in handling & transportation; processing of shell-fish, crabs, oysters, lobsters, frog legs etc. for domestic and export markets. Filleting and freezing,

canning salting & drying of fish. Production of fish paste, fish oils, sauce, fish protein concentrates. By products of fish processing industry.

Books Recommended

1. Meat Science by R.A. Lawrie, Pergamon Press.
2. Poultry Products Technology by G.J. Mountney.
3. Meat, Poultry & Sea Food Technology by R.L. Henricksons.
4. Poultry Meat and Egg Production by Parkhurst & Mountney.
5. Principles of Meat Science by JC Forest, ED Aberle, HB Hedrick

BTFT 502: FOOD PACKAGING

Total Marks: 100

L	T	P
3	1	0

UNIT I

Basic concept of packaging, functions of a food package, package development factors, food package development, current status and trends in food packaging in India and abroad.

Properties of Packaging Materials: Selection of packaging materials, properties of materials such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, their methods of testing and evaluation.

UNIT II

Packaging materials and forms: Glass containers and closures tin-plate containers, tin free steel containers, aluminum and other metal containers. Protective lacquers and coatings for metal containers. Wooden crates, cellulosic papers, pouches, bags and card board / corrugated paper boxes.

Barrier properties of packaging materials: Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement, prediction of shelf life of foods, selection and design of packaging material for different foods.

UNIT III

Rigid and flexible plastics (polyamides, polyester, PVC, PVDC, PVA, polycarbonates, olefins, cellophane, inomers, copolymers, phenoxy, acrylic, and polyurethanes) containers and films (oriented, coextruded, laminates, metallized) and their mechanical sealing and barrier properties.

Retortable pouches, biodegradable and edibles packaging materials and films. Aseptic packaging.

Packaging equipment and machinery: Vacuum packaging machine, gas packaging machine, seal and shrink packaging machine, form and fill sealing machine, bottling machines, carton making machines.

UNIT IV

Food packaging systems: Different forms of packaging such as rigid, semi-rigid, flexible forms and different packaging system for (a) dehydrated foods (b) frozen foods (c) dairy products (d) fresh fruits and vegetables (e) meat, poultry and sea foods.

Specialized techniques in food packaging: Active and intelligent packaging system, retortable pouches, aseptic packaging, controlled and modified atmospheric packaging, irradiation in food packaging Package printing, packaging laws and regulations

Books Recommended

1. Principal of Food Packaging by Sacharow & Griffin, Van Nastrand Rainhold Company, New York.
2. Food Packaging Materials by Mahadeviah & Growramma
3. A Handbook of Food Packaging by Frank A. Paine
4. Food Packaging Materials by N.T.Crosby
5. Canning and Aseptic Packaging by Ranganna, TMH.
6. Food Packaging: Priciples and Practices by Gordon L.Robertson
7. Food Science and Processing Technology Vol. II by Mridula Mirajkar and Sreelata Menon.

BTFT 503 : FOOD REGULATIONS AND PLANT MANAGEMNT

Total Marks: 100

L	T	P
3	0	0

UNIT I

Quality Control, Production planning and Network analysis: Introduction, Evaluation of food quality; concept of total quality control (TQM). Objectives of production planning and procedure of production control. Requirement of good manufacturing process (GMP), good hygienic process (GHP), Codex alimentarius commission,

UNIT II

FSSAI, Use of hazard analysis critical control Point (HACCP) and its implication in food industries, ISO-9000 series, ISO 22000 series, ISO 19011. Agmark, FPO, PFA, BIS, consumer protection act, Vanaspati control order, MMPO, export quality control and inspection act.

UNIT III

Industrial Organization structure: Types of organization structure, Principles of development of organization structure, forms of business organization, Division of industries, industrial sectors (private and public), Problems associated to public sector industries, social obligations of industries towards society

UNIT IV

Industrial Legislation, Disputes and trade Unions: Industrial legislation and laws, acts and disputes. Industrial disputes act –1947, WTO, GATT, Patent Laws and IPR

Recommended Books

1. Quality Assurance for the Food Industry by J.Andres Vasconcellos
2. Food Safety Handbook by Ronald H.Schmidt and Gary E.Rodrick
3. Bioterrorism and food safety by Barbara A. Rasco & Gleyne E. Bledsoe
4. Quality control in food industry (Vol. I and II) by Kramer and Twingg
5. Various acts, orders, standards & specification.
6. The prevention of Food Adulteration Act, 1945, Universal Lws Publishing Co. Pvt. Ltd.

BTFT 504: FOOD ANALYSIS AND QUALITY CONTROL

Total Marks: 100

L	T	P
3	1	0

Unit I

Introduction: Quality Control and its importance, functions of quality control departments and quality control laboratories

Colour: Importance and need of colour determination, methods of colour determination with Spectrophotometer, Colorimeter, Hunter Colour lab, CIE system, Lovibond Tintometer, Munsell colour and colour difference meter, Disc colorometry and their applications.

Flavour: Importance of flavour, food flavours, factors affecting food product flavours, measurement of food flavours, theory of taste and smell

Unit II

Food Rheology and viscosity: Shear stress, shear rate, torque, Newtonian and Non-Newtonian flow and their further classification, measurement of rheology and its importance, Factors affecting consistency and viscosity, measurement of viscosity and consistency with Brookfield synchroelectric viscometer, Stormer viscometer, Ostwald viscometer, Bostwick consistometer, Adams consistometer.

Kinesthetics and Texture: Food texture, Physical characteristics of food, working of texture measuring instruments such as Texture Analyser, Instron Universal Testing machine, Fruit pressure tester, puncture tester, succulometer, tenderometer, texturometer, maturometer, fibrometer, Texture Profile Analysis (TPA).

Unit III

Non destructive methods: Near Infrared Spectroscopy (NIR), Nuclear Magnetic Resonance (NMR) and its application, Ultrasonic equipments, conductivity and resistivity meters.

Chromatography: Principle and working of Gas chromatography (GC), High pressure liquid chromatography (HPLC), types of detectors used in GC and HPLC, Thin layer chromatography (TLC), Column Chromatography, chromatographic methods applied as quality control.

Unit IV

Sensory evaluation: Objectives, panel selection, Different test methods and their groups such as difference tests, rating tests, sensitivity tests, Sensory scores,

Microbial Examination of Food: Bacterial Count (Staining, TPC, Air flora), Coliform count. Yeast and Mould Count. Microbial standards for different food samples.

Books Recommended

1. Analysis of Fruits and vegetables by Ranganna. TMH.
2. Quality control in the food industry by Herschfoerfer S. M.
3. Quality control for the food industry by Kramer A. and Twigg B.A.
4. Principles of sensory evaluation of Foods by Amerine M. A.
5. Rheology and Texture in Food Quality by DeMan, J. M. and. Vowsy P. W.
6. Quality control and analysis “quality engineering Handbook” by Pyzdek,T,oxford puplication.

BTFT 505: OILS AND FATS PROCESSING TECHNOLOGY

Total Marks: 100

L	T	P
3	0	0

UNIT I

Sources; chemical composition; physical and chemical characteristics; functional and nutritional importance of dietary oils and fats. Post-harvest handling storage and processing of oilseeds for direct use and consumption.

Extraction of oil by mechanical expelling and solvent extraction and obtaining deoiled cakes suitable for edible purposes. Processing of other plant sources of edible oils and fats like coconut, cottonseed, rice bran, maize germ, etc.

UNIT II

Refining: Clarification, degumming, neutralization (alkali refining), bleaching, deodorization techniques / processes. Blending of oils.

UNIT III

Processing of refined oils: Hydrogenation, fractionation, winterization, inter-esterification etc. for obtaining tailor-made fats and oils.

UNIT IV

Production of butter oil, lard, tallow, Margarine, Cocoa butter equivalents, shortenings, low fat spreads, peanut butter etc. Speciality fats and designer lipids for nutrition and dietetics, especially by biotechnology.

Books Recommended

1. Bailey's Industrial Oil & Fat Products, 4th ed. John Wiley & Sons.
2. The Industrial Chemistry of Fats & Waxes 3rd. by Balliere, Tindall & Cox.
3. Handling & Storage of Oilseeds, Oils, Fats & Meal by Paterson, HBW.
4. Modern Technology in the Oils & Fats industry by S.C. Singhal, OTA (I).

BTFT 506: FOOD PROCESS ENGINEERING

Total Marks: 100

L	T	P
3	1	0

UNIT I

Geometrical, physical, functional and growth property of foods. Cleaning, sorting and grading of foods. Size Reduction: Principles and types of size reduction equipment, disintegration of fibrous materials, Mixing: Mixing of liquids and solids (powder), mixing equipments. Agitation, types of agitators.

UNIT II

Thermal Process Calculation: Microbial survivor curves, Influence of external agents, Thermal death time (F), spoilage probability, and Derivation and application of equation for determination of thermal process time for cans, evaluation of thermal process time for batch sterilization by graphical method; calculation of process time for continuous sterilization of liquid foods; factors affecting rate of heat penetration; effect of can size on sterility requirement; related numerical problems

Physical Separation Process: Filtration: Principle and types of filtration equipments, Settling classifiers, Flotation and Centrifugation, Types of centrifuge, Screening, types of screen and Mechanical separations. Calculation pertaining of processing time requirements in extractions and separation.

UNIT III

Psychrometry: Properties of air- water vapour mixture, psychometric chart, Humidification and dehumidification operations, Application of psychometry; related numerical problems; Cooling Tower.

Drying: water activity, Principle of drying and dehydration, concentration of foods rate of drying and drying equipments, Freeze drying, spray drying, prediction of drying time from drying data.

Crystallization & Freezing: Basic concepts, theories of crystallization; equipments, crystallization process; Depression in freezing point, Planks equation and other modified equations for prediction of freezing time, freezing time calculations for a product having uniform temperature (negligible internal resistance), different types of freezers

UNIT IV

Steam Properties: Properties of wet, saturated and superheated steam, use of steam

tables and Mollier diagram

Evaporation: Boiling point elevation, Duhring rule, basic principles of evaporators; capacity and economy of evaporator; multiple effect evaporator: operation and various feeding systems, calculation of heat transfer area in single and multiple effect evaporators; Thermal vapour recompression and Mechanical vapour recompression system to improve evaporator economy; related numerical problems

Books Recommended

1. Unit Operation of Chemical Engineering by Mc Cabe, Smith & Harriot
2. Mass Transfer Operation by Treybal, R. E., Mc Graw Hill.
3. Food Engineering Operation by Brennan, Butters, Cowell and Lilly.
4. Food Process Engineering by Heldman, D. R. and Singh, R. P., Academic Press.
5. Fundamental of Food Process Engineering by Romeo T. Toledo.
6. Chemical Engineering (Vol. I& II) by Coulson & Richardson, Butterworth Heinemann.

BTFT 507: MEAT, POULTRY & FISH PROCESSING TECHNOLOGY (LAB)

Total Marks: 50

L	T	P
0	0	2

1. Determination of Internal quality of eggs.
2. To Determine % of different components of egg.
3. Determination of egg constituents such as ash, total solid and moisture.
4. Specific gravity of eggs.
5. Preservation of internal quality of egg by different methods.
6. Effect of high temperature on coagulation time of egg contents.
7. To determine effect of different time and temperature combination condition on formation of iron sulfide in egg.
8. To prepare different egg products
9. To study slaughtering & dressing of poultry bird
10. To make retail cuts of dressed chicken and calculating % yields.
11. To determine meat to bone ratio of chicken
12. Preparation of tandoori chicken
13. Preparation of chicken pickle.
14. Preparation of cured chicken.

BTFT 508: FOOD PACKAGING (LAB)

Total Marks: 50

L	T	P
0	0	2

1. Test the thermal shock resistance of glass container.
2. Determine the WVTR of some packaging materials.
3. To estimate wax content of wax paper.
4. To determine the bursting strength of a carton board.
5. To determine the amount of tin coating in a can plate.
6. Testing of lacquered tin plate steel for following: -
 - i). Continuity of tin layer
 - ii). Resistance of lacquer to acid.
7. Determination of iron content in canned foods.
8. Test for alkalinity on the surface of glass jar.
9. To study the compression strength of a box.
10. To study the puncture resistance of a cardboard.
11. To study the drop resistance of a given packaging material.
12. To determine thickness of plastic film using gauge meter.
13. To determine tensile strength of a given test material
14. To determine moisture content and shelf life of a given product.

BTFT 509: FOOD ANALYSIS AND QUALITY CONTROL (LAB)

Total Marks: 50

L	T	P
0	0	2

1. Determination of acid soluble, water soluble, insoluble acid, ash fractions.
2. Determination of carotenoids.
3. Determination of ascorbic acid by titrimetric and photometric methods.
4. Determination of lycopene content of tomato & its products.
5. Determination of iron, phosphorous & sulphur in foods.
6. Determination of pigment in food sample.
7. Determination of lead, arsenic, and tin content in food.
8. Analysis of canned and processed products available in the market
9. Cut out analysis of canned product.
10. Estimation of Vit A, D in desi ghee
11. Determination of viscosity liquid food
12. Determination of FFA and Acid value of given sample
13. Analysis of ice cream for fat, acidity, total solids, foreign fat
14. Evaluate the given food sample using different sensory test methods.
15. Study of pH meter, conductivity meter, spectrophotometer.
16. Study of HPLC, GLC, and TLC for analysis of different food constituents.

BTFT 510: OILS AND FATS PROCESSING TECHNOLOGY (LAB)

Total Marks: 50

L	T	P
0	0	2

1. Determination of moisture content in fat.
2. Determination of melting point of fat.
3. Determination of specific gravity of fat.
4. Determination of % impurities / gum in fat.
5. Qualitative checking of various adulterants in labs.
6. Extraction of oil from rice brain, pellets and spent wash.
7. Determination of iodine value.
8. Determination of saponification value.
9. Determination of free fatty acids.
10. Determination of un-saponifiable matter.
11. Colour measurement of fat.
12. Determination of RM &P value.
13. Determination of refractive index of fat.
14. Effect of particle size on the amount of oil extracted
15. To visit oil processing industry

SEMESTER

SIXTH

BTFT 601: Statistical Quality Control

Total Marks: 100

L	T	P
3	0	0

UNIT I

Introduction: The meaning of quality and quality improvement, quality control programs, quality control tools, problems with tool selection, Statistical methods for quality control and improvement.

Food Quality System: The formalized quality system, quality system guidelines, Total quality management, team quality systems, computer network quality systems; The link between quality and productivity; Quality costs; Legal aspects of quality; implementing quality improvement.

UNIT II

Fundamental: Analysis of data, probability, binomial distribution, the normal distribution, t-distribution, F-distribution, Analysis of variance

Control Charts for Variables: Importance of charting, Procedure for constructing X-bar and R Charts, and σ chart. Procedures for constructing attributes charts (p-chart, np Chart, c chart, u Chart). Interpretation and modified charts.

UNIT III

Sampling: Sampling plans, sample size, samples from different distributions, sample procedures, types of samples, sample plans, types of inspection, classes of defects, sampling risks, selection of population to be sampled, selection of sample frequency and location, HACCP, Attribute sampling plans.

Sensory testing and Product Specifications:

Process Capability: Capability Index, Benchmarking; Process control; sensory control; Net content control. Statistical process control

Vendor Quality assurance; Implementing a quality control program

UNIT IV

The Computer and Process Control

Computer integrated management, Artificial Intelligence and expert systems, computer controlling processing.

Six Sigma

Introduction, Six-sigma control chart, Six-sigma quality performance

Books Recommended

1. Statistical Quality Control for the Food Industry by Merton R. Hubbard
2. Introduction to Statistical Quality Control by D.C. Montgomery
3. Introductory Statistics by P.S.Mann
4. Fundamentals of Statistical Quality Control by Jerome D. Braverman

BTFT 602: BAKERY CONFECTIONARY TECHNOLOGY

Total Marks: 100

L	T	P
3	1	0

UNIT I

Current status, growth rate, and economic importance of Bakery and Confectionary Industry in India. Product types, nutritional and safety of products, standards & regulations.

Rheological testing of dough-Farinograph, Mixograph, Extensograph, Amylograph / Rapid Visco Analyzer, Falling number, Hosney's dough stickiness tester and interpretation of the data

UNIT II

Bakery Products: Ingredients & processes for breads, biscuits, cookies & crackers, cakes & pastries; doughnuts; rusks; other baked products. Staling and losses in baking.

UNIT III

Confectionary Products: Characteristics and processing of raw material; Technology of manufacturing of Hard-boiled candies, toffees, fruit drops, chocolates and other confections:- ingredients, equipments & processes, product quality parameters, defects and corrective measures.

UNIT IV

Production & quality of chewing and bubble gums, cocoa products, breakfast cereals, macaroni products, sprouted grains, colour, flavour and texture of confectionary; standard and regulations

Equipment used in Bakery and Confectionary Industry: Working of various equipments like Mixers, proofing chambers, dough dividers, moulder and sheeter, baking ovens, cooling chamber, sealing and packaging machines, Rolling and cutting machines project profile of bakery and confectionary unit

Books Recommended

1. Bakery Technology and Engineering by Samuel a. Matz, CBS Publications.
2. Cereals as Food and Feed by Samuel A.Matz, CBS Publications
3. Industrial Chocolate Manufacture by Beckette.
4. Dough rheology and baked product texture by Faridi Faubion, CBS Publications.
5. Chocolate, Cocoa and Confectionary by Minifie B.W.
6. Cookies & Cracker Technology by S.A. Matz.
7. Baking Science and Technology by Pylar

BTFT 603: ENTREPRENEURSHIP AND AGRI-BUSINESS MANAGEMENT

Total Marks: 100

L	T	P
3	0	0

UNIT I

Introduction, The scope and size of the agri-food system; Changing perception of food; Evolution and future of the Agri-Food System; The Future of the Agri-Food System: The Input Sector, Production Sector; Shifting roles of exports and imports; agriculture and the environment; Commodity processing and food manufacturing sector

The Role of Management in Successful Businesses; Business Decision Making; Element in Enterprise Management: Basic management concepts, personnel, production, materials, financing and marketing managements, agribusiness management challenge

UNIT II

Environmental analysis, project selection, project appraisal, modification/ finalization of project, collaborations, preparations for launching, trial run and test marketing.

UNIT III

The Role of Marketing, Marketing of Agricultural input and Marketing of Agricultural product. Market research for agribusiness.

UNIT IV

Commodity trading and forecasting for agribusiness. Retail and supply chain management. Management of cooperation.

Management of agribusiness projects and enterprise. Management of agribusiness trade in WTO environment. Agricultural and food policy. Rural environment and institution.

Books Recommended

1. Principles of Agribusiness Management by James G.Beierlein, Kenneth C.Schneeberger and Donald D. Osburn
2. Marketing Management by Philip Kotler, Pearson Education Publishers
3. Marketing Management by Dr. P. K. Srivastava, Sterling Pub. Pvt. Ltd.
4. Marketing Management by Dr. S. C. Jain, IBP (International Business Press)

BTFT 604: FERMENTATION TECHNOLOGY

Total Marks: 100

L	T	P
3	1	0

UNIT I

Introduction to fermentation technology: Definition, importance of fermentation, substrate of fermentation, growth kinetics of microorganism; Isolation, Preservation and improvement of industrially important microorganism, Sterilization process, media for industrial fermentation, development of inocula for industrial fermentations.

Equipment's: Types of fermenters: Batch fermentation, Fed-batch fermentation process, continuous fermentation process,, Construction of fermenters, Basic function of fermenters, Design and operation, scale up of fermentation, Instrumentation and control, Aeration and agitation.

UNIT II

Product recovery operations: Recovery and purification of fermentation products using filtration, centrifugation, precipitation, solvent extraction, reverse osmosis, ultrafiltration, microfiltration, pervaporation. Cell disruption.

UNIT III

Fermented Foods: Alcoholic beverages (beer, wine, cider) and IMFL/distilled spirits (Rum, gin, whisky, vodka). Mushroom cultivation, Oriented Fermented Products, soy sauce, pickles, fermented milks & cheeses, Idli, Dosa, Dhokla.

UNIT IV

Industrial Fermentation: Production of bakers yeast, food yeast, SCP, vinegar, organic acids (eg. Citric and lactic acids), solvents and enzymes (eg. Amylases, protease, lipases, pectinases, celluloses, hemicellulose Immobilized Enzymes.). Microbial fats.

Books Recommended

1. Industrial Microbiology by Prescott & Dunn, CBS Publications, New Delhi.
2. Industrial Microbiology by L.E. Casida, New Age Publications, New Delhi.
3. Principle of Fermentation Technology by Whittaker and Stanbury, Aditya Books Pvt.Ltd.
4. Handbook of Indigenous Fermented Foods by K.H. Steinkrus
5. Food Microbiology by Adams and Moss, Panima Publication Corporation, Delhi.
6. Mushroom Cultivation by J. N. Kapoor, ICAR.

BTFT 605: SPICES AND FLAVOR TECHNOLOGY

Total Marks: 100

L	T	P
3	0	0

UNIT I

Introduction: Status and scope of spice and flavour processing industries in India; Spices, Herbs and seasonings: sources, production, selection criteria; flavours: commercially available materials, classification on the basis of origin, physical characteristic.

UNIT II

Processing technology of Spices: Chemical composition of spices; processing methods: equipment's used in the processing of spices; spice encapsulation; recent developments in production, retention and recovery of spices; effect of processing on spice quality: contamination of spices with micro-organisms and insects.

Spice Essential Oils: Definition, methods of extraction, isolation, separation equipments.

UNIT III

Flavour Technology: Essence (flavour) recovery techniques from fruits,spices and herbs along with the equipment used: liquid and Solid flavour production; Flavouring remixing:flavour intensifiers:synthetic flavours;effect of processing on flavour quality.

UNIT IV

Spice Oleoresins: Definition, method of extraction, isolation, separation equipment.

Spices and flavour quality evaluation: Criteria for assessment of flavour quality; identification of natural food flavours; methods of flavour evaluation (chemical, instrumental, sensory); PFA standards for flavouring materials and flavours.

Books Recommended

1. Handbook of Spices by Peter K.V., Woodhead Publishers,UK.
2. Spices and Condiments by Pruthi, J.S., NBT India.
3. Spice Statistics by Spices Board, GOI, Cochin.
4. Source book of flavor by Reineccius,G, CBS
5. Food Flavours by Morton,I.D., Macleod ,A.J, AVI Publishers

BTFT 606: BAKERY AND CONFECTIONARY TECHNOLOGY (LAB)

Total Marks: 50

L	T	P
0	0	2

1. Perform the quality test on wheat flour /maida for bakery applications on different parameters (moisture, Total ash, gluten content, sedimentation value etc.)
2. Prepare the Bread rolls and assessment of its quality
3. Prepare the cake and assessment of its quality.
4. Perform the quality test on fat/butter for bakery applications on different parameters
5. Carry out the assessment of market Candy and Chewing gum.
6. Prepare Candy (orange and mango flavour)and to perform its quality assessment tests.
7. Perform the quality assessment test on yeast and skimmed milk powder for bakery application.
8. Preparation of toffee from apple and tomato pulp and to perform its quality assessment tests.
9. Prepare Chocolate cookies and assessment of its quality.
10. Prepare the French bread and assessment of its quality.
11. Preparation of bread by straight dough methods with and without dough improvers and to study the difference.
12. Visit to Bakery and Confectionery Industries

BTFT 607: Fermentation Technology (LAB)

Total Marks: 50

L	T	P
0	0	2

- a) Study of fermenter
- b) Inoculation of culture
- c) Production, recovery and control tests for the following fermentation products.
 - 1) Alcohol
 - 2) Baker's yeast
 - 3) Citric acid
 - 4) Amylases
 - 5) Pectinase
 - 6) Yoghurt
 - 7) Wine
 - 8) Cider
 - 9) Dahi
 - 10 Sauerkraut

BTFT 608: SPICES AND FLAVOR TECHNOLOGY (LAB)

Total Marks: 50

L	T	P
0	0	2

- 1. Quality analysis of spices.
- 2. Identification of whole spices.
- 3. Determination of Essential oil in spices.
- 4. Detection of adulteration in spices.
- 5. Sensory analysis of flavoured foods.
- 6. Correlation of subjective and objective methods.
- 7. Formulation of Compound Flavorings.
- 8. Application of spices and compound flavourings in processed food products.
- 9. Visit to spice processing unit.

SEMESTER

SEVEN

BTFT 701: PLANT DESIGN AND PROJECT ENGINEERING

Total Marks: 100

L	T	P
3	1	0

UNIT I

Overview of Food Process and Plant Design: Food process design, Food plant design, Food plant utilities, Food plant economics; Economic and technical context of food plant design; Optimization of food plant processes.

UNIT II

Documentation of Food Plant Design: Preliminary studies of food products and raw materials, Laboratory studies, Pilot plant studies, Food plant preliminary and final projects, Information handling in flow chat form; Processing system alternatives: Process synthesis; Food processing system alternatives analysis.

UNIT III

Experimentation in pilot plant: Pilot plant Size and structure, types, application and design; Materials for construction of food equipment; Hygienic design of processing system and auxiliary system: Basic principles for hygienic design of food equipment and auxiliary systems in contact with foods, external design of processing equipment and auxiliary systems, CIP system design.

Process Engineering Economics: Money flow in food business enterprise, Capital cost, Manufacturing cost, Cash flow analysis, Plant profitability, Sensitivity analysis.

UNIT IV

Operating cost of food plant; Project analysis of food preservative plants (like Tomato paste plant, Orange juice concentrate plant, Sterilized milk plant, Fruit canning plant, Vegetable freezing plant, Vegetable dehydration plant); Food manufacturing plants (like Bread manufacturing plant, Yogurt manufacturing plant); Food ingredients plants (like Beet sugar plant and other additives plant)

Books Recommended

1. Food Plant Design, by Antonio Lopez-Geomez and Gustavo V. Barbosa-Canovas, CRC press, Taylor & Francis, New York
2. Food Plant Economics, by Zacharias B. Maroulis and George D. Saravacos, CRC press, Taylor & Francis, New York
3. Plant Design and Economics for Chemical Engineers by Peter, M.S. and Timmerhaus, K.D. McGraw Hill

BTFT 702: ADVANCE TECHNIQUES IN FOOD PROCESSING

Total Marks: 100

L	T	P
3	1	0

UNIT I

Method of Food Preservation: Irradiation, Thermo-sonication, Hurdle Technology, Hydrostatic Pressure Technology, Microwave Processing.

UNIT II

Non-thermal Techniques: Ultra High Voltage Electric Field, Ohmic Heating, Dielectric Heating, Induction Heating and Infrared, Oscillating Magnetic Field, Intense Light Pulses.

UNIT III

Membrane Based Separation Techniques: Introduction to membrane based separation techniques, reverse osmosis, ultra-filtration, micro filtration, pervaporation, dialysis, electro-dialysis.

UNIT IV

Supercritical fluid extraction: Principles, methodology, area of application.

Extrusion Technology: Mechanisms, Types and uses.

Micro encapsulation, Computerization in food industry, Image processing. New researches in food processing, preservation, packaging and new product development.

Books Recommended

1. Trends in Food Science and Technology, by Natrajan C..P. & Ranganna S.
2. Ultrasound in Food Processing, by Mason T.J. and Povey M.J.W. Blackie Academic & Professional
3. Novel Food Processing Technologies (Food Science and Technology), by Gustavo V. Barbosa-Canovas, Maria S. Tapia, and M. Pilar Cano, CRC Press
4. Membrane Separations Technology (Membrane Science and Technology), by Noble R.D. and Stern S.A., Elsevier Publication

BTFT 703: NUTRACEUTICAL AND FUNCTIONAL FOODS

Total Marks: 100

L	T	P
3	1	0

UNIT I

Defining nutraceuticals and functional foods. Nature, type and scope of nutraceutical and functional foods.

Nutraceutical and functional food applications and their health benefits. Nutraceutical compounds and their classification based on chemical and biochemical nature with suitable and relevant descriptions.

UNIT II

Nutraceuticals for specific situations such as cancer, heart disease, stress, osteoarthritis, hypertension etc.

Antioxidants and other phytochemicals, (isoflavones, lycopenes), their role as nutraceuticals and functional foods. Dietary fibers and complex carbohydrates as functional food ingredients.

Protein as a functional food ingredient. Probiotic foods and their functional role. Herbs as functional, health promoting activity of common herbs.

UNIT III

Cereal products as functional foods – oats, wheat bran, rice bran etc.

Functional vegetables products, oil seeds and sea foods.

Coffee, tea and other beverages as functional foods/drinks and their protective effects.

UNIT IV

Effects of processing, storage and interactions of various environmental factors on the potentials of such foods.

Marketing and regulatory issues for functional foods and nutraceuticals.

Recent development and advances in the areas of nutraceutical and functional foods.

Books Recommended

1. Functional Foods by R. Chadwick, S. Henson, B. Moseley, G.
2. Methods of Analysis for Functional Foods and Nutraceuticals by W. Jeffrey Hurst
3. Functional Foods by Mazza
4. Handbook of Nutraceuticals and Functional Foods by Robert E.C. Wildman

BTFT 704: WASTE MANAGEMENT IN FOOD INDUSTRY

Total Marks: 100

L	T	P
3	0	0

UNIT I

Characterization and utilization of by-products from cereals, pulses, oilseeds, fruits, vegetables, plantation, dairy, eggs, meat, fish and poultry processing industries.

Elements of importance in efficient management of wastes from aforesaid food industries.
Standards for emission or discharge of environmental pollutants from food processing industries
Characterization of food industries effluents, in terms of parameters of importance

UNIT II

Unit concept of treatment of food industry effluents: Screening, sedimentation, floatation as per and primary treatments, biological oxidations:– objectives, organisms, reactions, oxygen requirements, aeration devices.

UNIT III

Effect on characteristic parameters of effluents in treatments using lagoons, trickling filters, activated sludge process, oxidation ditches, rotating biological contractors and their variations and advanced modifications.

UNIT IV

Advanced waste water treatment systems: physical, physicochemical and chemical treatments. Coagulation and flocculation, disinfection, handling and disposal of sludge and treated effluents conforming to EPA provisions.

Books Recommended

1. Water and waste water Tech. 5th Ed. By Mark & Hammer, PHI.
2. Industrial microbiology by L.E.Casida, New Age Publication.
3. Environmental pollution by K.C.Agrawal.
4. Environmental pollution control engineering by C.S. Rao.
5. Food processing waste management by green and Kramer (AVI)
6. By- products from food industries: utilization and disposal by AFSI(I)

BTFT 705: RESEARCH METHODOLOGY

Total Marks: 100

L	T	P
3	0	0

UNIT I

Introduction: Definition, general and specific characteristics of research Kind, classification, Types and objective of Research, Research Process, Criteria of good research, basic concept of experiments and research, significance of research;

Principles of research design and methodology, Checklist of research related concept and consideration. Planning and Designing a Research Study: Choosing a research topic, literature review, formulation a research problem, articulating hypothesis, choosing variable to study, research participants.

UNIT II

Data Collection, Assessment Methods, and Measurement Strategies: need for data collection, meaning, nature, type and method of data, precautions in data collection, organization of data, Measurement, measurement strategies for data collection.

General Types of Research Designs and Approaches: Experimental designs, Quasi-experimental designs, non-experimental or qualitative designs.

UNIT III

Data Analysis: descriptive statistics, central tendency, dispersion, measures of association, inferential statistics, T-test, ANOVA, Chi-square, regression, interpreting data and drawing inferences

UNIT IV

Ethical considerations in research: Fundamental ethical principles, informed consent, data safety monitoring, Adverse and serious adverse events.

Disseminating research result & distilling principles of research design and methodology: sharing the result of research studies, presentation of result.

Research report: need of research report, overall structure of research report, tips on writing specific sections

Writing review and research papers: overall structure of review and research report, general guidelines

Books Recommended

1. DRM, a design research methodology by Luciene TM Blessing and Amaresh Chakrabarti

2. Fundamental of Research Methodology and Statistics by Yogesh Kumar Singh
3. Essential of Research Design and Methodology by Geoffrey Marczyk, David DeMatteo,
David Festinger

BTFT 706: PROJECT

Total Marks: 100

L	T	P
0	0	2

The candidate will be required to undertake a Project work on the relevant topic in reputed Food Industries/ R & D Center/ Organization/ Institute for one semester. Duration of project work would be 4-5 months. Project work may be:

1. Research work in the new field of food technology.
2. New product development.
3. Supplementation and fortification of food products.
4. Study and calibration of instruments and their comparisons with standard methods.
5. Implementation of new technologies for food processing and preservations.
6. Food safety and quality analysis

Evaluation of Project Work: Coordinator and advisor (s) shall assess the quality of the work along with the written report and shall award marks out of 60. The evaluation for remaining 40 marks shall be done by an examiner.

BTFT 707: SEMINAR

Total Marks: 100

L	T	P
0	0	2

Students will be required to prepare a report on a given topic related to latest developments in Food Technology and deliver a power point presentation on that topic along with seminar report. The evaluation will be done by an examiner and award marks out of 60 for presentation and out of 40 marks for viva-voce.

SEMESTER

EIGHT

BTFT 801: Industrial/Institutional Training

Total Marks: 500

L	T	P
0	0	40

It is compulsory to submit the certificate of completion of the said dissertation/training report issued by the organization where the student has done his/her work. The said organization will award internal marks and hand it over to the Parent institute in a sealed envelope along with the duly signed attendance record and the certificate of completion. The external marks will be awarded by the external examiner on the day of external evaluation in which student has to be present along with the certificate of completion and project report. The copy of the project report should be kept in the departmental library as well as Central library of the college.

Note: The college representative has to visit the organization where the student is doing his/her training twice in one semester.