

HARCOURT BUTLER TECHNICAL INSTITUTE, KANPUR



Course Structure & Detailed Syllabus

(Effective from the Session 2013-14)

Bachelor of Technology

(CHEMICAL TECHNOLOGY-FOOD TECHNOLOGY)

Name of Programme: B.Tech. (Chemical Technology) Food Technology
Course Structure and Evaluation Scheme
[Effective from the Session 2013-14]

Year: I Semester: I Branch: Common to all branches of B.Tech.

S. No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Exam			ESE		
						CT	TA	Total			
Theory											
1	IMA101	Mathematics I	3	1	0	30	20	50	100	150	4
2	IPH101/ICY101	Physics/Chemistry	3	1	0	30	20	50	100	150	4
3	IEE101/IET101	Electrical Engg./Electronics & Instrumentation Engg.	3	1	0	30	20	50	100	150	4
4	IME101/ICS101	Engg. Mechanics/ Concepts of Computer and C programming	3	1	0	30	20	50	100	150	4
5	IHU101/ICE101	Professional communication/ Engineering Graphics	3	1	0	30	20	50	100	150	4
6	IHU102/ICE102	Remedial English/Environment and Ecology	2	0	0				50	50	Audit
Practical/Training/Project											
7	IPH151/ICY151	Physics/Chemistry Lab	0	0	3	10	10	20	30	50	1
8	IHU151/ICS151	Language Lab/Computer Lab	0	0	3	10	10	20	30	50	1
9	IEE151/IWS151	Electrical Engg. Lab/Workshop Practice	0	1	3	30	20	50	50	100	2
10	IGP101	General Proficiency						50		50	

Name of Programme: B.Tech. (Chemical Technology) Food Technology
Course Structure and Evaluation Scheme
[Effective from the Session 2013-14]

Year: I Semester: II Branch: Common to all branches of B.Tech.

S. No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Exam			ESE		
						CT	TA	Total			
Theory											
1	IMA201	Mathematics II	3	1	0	30	20	50	100	150	4
2	IPH201/ICY201	Physics/Chemistry	3	1	0	30	20	50	100	150	4
3	IEE201/IET201	Electrical Engg./Electronics & Instrumentation Engg.	3	1	0	30	20	50	100	150	4
4	IME201/ICS201	Engg. Mechanics/ Concepts of Computer and C Programming	3	1	0	30	20	50	100	150	4
5	IHU201/ICE201	Professional Communication/ Engineering Graphics	3	1	0	30	20	50	100	150	4
6	IHU202/ICE202	Remedial English/Environment and Ecology	2	0	0				50	50	Audit
Practical/Training/Project											
7	IPH251/ICY251	Physics/Chemistry Lab	0	0	3	10	10	20	30	50	1
8	IHU251/ICS251	Language Lab/Computer Lab	0	0	3	10	10	20	30	50	1
9	IEE251/IWS251	Electrical Engg./Workshop Practice	0	1	3	30	20	50	50	100	2
10	IGP201	General Proficiency						50		50	

Detailed Syllabus: B.Tech. (Chemical Technology) Food Technology

IFT-301: INTRODUCTION TO FOOD TECHNOLOGY

L : T : P
3 : 1 : 0

Objectives:

1. To understand the basic concepts of agricultural food produce and their effective management
2. To study the importance of food and human nutrition.
3. To understand the concept of mechanisms of living system.
4. To impart the knowledge of basic biochemistry, metabolic pathways and their inter-relationship.
5. To understand the morphology, structure and growth cycle of food microorganisms.

Unit-1

Basic consideration: World food problems, Introduction to food chemistry, Basic knowledge of major Indian crops, their total production, losses in storage and opportunity available for their processing to augment availability throughout the year, Scope of food technology: Prerequisite and challenges

Unit-2

Human nutrition and health, Recommended Dietary Allowances (RDA)., Factors affecting bioavailability of nutrients, Desirable and potentially undesirable food constituents and their importance. Common nutritional deficiencies such as PEM, iron, vitamin A, iodine, calcium and vitamin D, zinc etc. Emerging common degenerated disorders.

Unit-3

Basic Biology: Organization of living system, identifying characteristics, Biomolecules and Cells, Plant and animal diversity

Unit-4

Basic Biochemistry: Energy transformation in living cells, Bioenergetics, Metabolic pathways, Regulation and Control

Unit-5

Basic Microbiology: Characterization, classification and identification of microorganisms, Microscopy, microorganisms: Morphology and Structure, Pure culture and cultural characteristics, Reproduction Growth and Cultivation, Control of microorganisms, Beneficial uses of microbes in foods. General principles of food hygiene.

References:

Author

The Hindu
C. Gopalan
L.H. Mayer
Kramner & Twigg
Manay N.S.Shadakshasawamy M.
M.J.Pelczar
A.L.Lehninger

Title

Agriculture Survey of India
Nutritive value of Indian Foods
Food Chemistry
Quality control for Food Industry
Food facts and Principles
Microbiology
Principle of Biochemistry

IFT-351: BASIC MICROBIOLOGY & FOOD ANALYSIS LAB

L : T : P
0 : 0 : 6

S. No.	Name of Practical
1.	Microscope its parts and utility in identification and differentiation of bacteria, yeast and mold.
2.	Familiarization with Culture, Inoculation, Incubation and slide preparation
3.	Wet mount preparation and staining with basic dye.
4.	Preparation and sterilization of media and glass wares for microbial counts.
5.	Introduction to Food Analysis techniques.
6.	Sampling techniques and method of sample preparation.
7.	Determination of moisture content of foods.
8.	Determination of Total and Acid insoluble ash content in foods.
9.	Determination of Crude fat content by solvent extraction methods in foods.
10.	Determination of crude Protein in foods by Kjeldhal methods.
11.	Determination of reducing and total sugar content in foods.
12.	Determination of crude fibre content in foods.
13.	Determination of specific vitamin content of food such as ascorbic acid.
14.	Chromatographic Separation and identification of sugars and amino acids.
15.	Determination of specific mineral contents in foods such as Calcium, Iron, Phosphorus, Chloride etc.
16.	Analysis of foods for pesticides.
17.	Determination of various adulterants in foods.

References:

1. BIS and AOAC Methods of Food analysis.
2. Ranganna S (1986) Handbook of analysis and quality control for fruit and Vegetable Products-, 2nd edition, Tata McGraw-Hill Publishing Company Ltd. New Delhi
3. Neilson S.S., Food analysis, Aspen publishers. Gaithery Berg, Mary Land.
4. Pomeranz Y. and Meloan C. E (1996) Food Analysis-Theory and practice, 3rd edition, CBS Publishers & Distributors, New Delhi

IFT-401: FOOD MICROBIOLOGY

L : T : P
3 : 1 : 0

Objectives:

1. To provide knowledge of microorganisms in relation to contamination, spoilage and preservation of foods.
2. To introduce with various preservation techniques of foods from microbiological point of view.
3. To provide fundamental knowledge of micro-organisms in human and surroundings to understand the recent procedures adopted in various food products to prevent food-borne diseases and disorders and legal aspects involved in these areas.

Unit-1

Introduction to Food Microbiology, Incidence of microorganisms in foods, Microorganisms of importance in foods, Primary sources of contamination in foods, Intrinsic and Extrinsic parameters of foods that affect microbial growth, Food Spoilage, Causes of Food spoilage, Food Preservation.

Unit-2

Principles underlying preservation of foods, Methods of food preservation, Fitness of foods, Determination of thermal resistance of bacterial spores, Radiation-resistant bacteria, Mechanism of action of antimicrobial agents.

Unit-3:

Food Poisoning and Food borne infections, Screening, detection and enumeration techniques including rapid detection techniques for Food Microorganisms including pathogens

Unit-4:

Contamination, spoilage and preservation of Fruit and Vegetable products, Milk and Milk products, Cereal products, Sugar products, Meat products, Fish and Sea foods, Egg and Poultry products and other foods, Indicators of Food Safety and Quality, Microbiological Standards of foods.

Unit-5:

Food Plant Sanitation, inspection and control, Personnel Hygiene, HACCP in Food Industry in controlling microbial hazards. Beneficial microorganisms and their utilization in Food Fermentation. Introduction to abiotic, biotic and probiotics.

References:

1. James M. J. (2000) Modern Food Microbiology, 5th Edition, CBS Publishers, New Delhi.
2. Frazier W. C. & Westhoff D.C. (2006) Food Microbiology, 3rd edn., Tata McGraw Hill Publishing Company New Delhi
3. Adam M. R. & Moss M.O. (1995) Food Microbiology, New Age International Pvt. Ltd. Publishers.
4. Bibek Ray (1996) Fundamental Food Microbiology, CRC Press.

IFT-402: TRADITIONAL AND FERMENTED FOODS

L : T : P
3 : 1 : 0

Objectives:

1. To introduce the technology of traditional food products
2. To impart the knowledge of fermented food products.
3. To provide basic concepts of SCP and microbial production of biomolecules.

Unit-1

Indian traditional sweet, savory and snack food products: Sweetmeats, Namkins, potato products, Papads Idli and Dosa

Unit-2

Preparation and Maintenance of Bacterial, Yeast and Mold cultures for food fermentations. Lactic acid bacteria-activities and health-promoting effects. Mushrooms: Cultivation and preservation.

Unit-3

Fermented Dairy Products: Cheeses, Curd and Yoghurt, Butter milk and the fermented milks. Spoilages and defects of fermented dairy products and their control. Fermented meat and fish products.

Unit-4

Fermentative Production of Beer, Wines, Cider and Vinegar. Fermented Vegetables (Pickles).

Unit-5

Production of Baker's Yeast, Microbial Proteins and fats, Food enzymes, and Food additives. Oriental fermented foods.

References:

<i>Author</i>	<i>Title</i>
K.H. Steinkrus	Handbook of Indigenous Fermented Foods
Sukumar De	Outlines of Dairy Technology
Prescott & Dunn	Industrial Microbiology
L.E. Casida	Industrial Microbiology
W.C. Frazier and D.C. Westhoff	Food Microbiology

IFT-451: FOOD MICROBIOLOGY LAB

L : T : P
0 : 0 : 6

S. No.	Name of Practical
1.	Preservation techniques of cultures in laboratory.
2.	Micrometry and determination of size of micro-organisms.
3.	Simple and differential staining of microorganisms and their examination.
4.	Direct total, viable, and non-viable count of microorganisms in milk and other foods.
5.	Pure culture isolation techniques.
6.	Determination of Standard Plate Count (SPC) in natural and/or processed foods.
7.	Microbiological examination of some selected natural and processed foods.
8.	Microbiological examination of potable water and milk: Total and coliform count.
9.	Enumeration of coliform organism in some selected processed foods.
10.	Detection of Salmonella in foods.
11.	Determination of Phosphatase test in milk

References:

1. Refai M. K. (1979) Manuals of Food Quality Control- Microbiological Analysis, Food and Agriculture Organization of United Nations, Rome
2. Roberts D. & Greenwood M., Practical Food Microbiology, 3rd edn., Blackwell Publishing Co

IFT-501: FOOD CHEMISTRY

L : T : P
3 : 1 : 0

Objectives:

1. To get an insight into the proximate principles of food and their functions and briefly understand the effect of processing and storage on food constituents.
2. To understand the chemistry of food pigments and flavor components.
3. To provide awareness of the utility of additives in food industry.

Unit-1

Water in Foods: Structure, Properties, Interactions, Water activity, and molecular mobility in relation to food stability.

Carbohydrates: Functions, Reactions and properties of simple and complex carbohydrate, Selection of Natural or Modified carbohydrates for incorporation into processed food.

Unit-2

Lipids: Consistency of commercial fats Lipolysis, Auto oxidation, Thermal Decomposition and effect of ionizing radiation, refining of oils, Modification of oils and fats, Role of food lipids in flavor, Nutritional aspects of natural and modified fats.

Unit-3

Proteins: Food proteins, Nutritive value and its determination, Chemical reactions and interactions of amino acids and proteins, Denaturation and its implications, Functional properties of food proteins, Modification of food proteins in processing and storage and its implications.

Unit-4

Vitamins, Minerals, Pigments and Flavours: Chemistry and stability of water and fat-soluble vitamins, Chemical properties of minerals and their bioavailability, Enrichment and fortification. Natural pigments in foods and their retention in processed foods. Flavoring constituents in foods, Development of process and reaction flavour volatiles.

Unit-5

Definitions, uses and functions of additives used in food industry.

References:

Author

O.R.Fennema

Meyer LH

Belitz, HD and Grosch, W

Title

Food Chemistry

Food Chemistry

Food Chemistry

IFT-502: FOOD BIOCHEMISTRY

L : T : P
3 : 1 : 0

Objectives:

1. To give knowledge of fruit and vegetables tissues and various post-harvest factors responsible for biochemical changes in foods.
2. To provide the knowledge on current state of the art in the field of CAS/MAP applicable to a wide range of foods and affects a great number of biochemical reactions taking place during deterioration of foods.
3. To provide knowledge of animal tissues and biochemical reactions responsible for quality of the food.
4. To provide basic background to use enzymes in food processing.

Unit-1

Structure and composition of fruit and vegetables: Definition, cellular components, chemical composition and nutritional value.

Unit-2

Physiology and biochemistry of fruit and vegetables: Post-harvest handling, physiological development; growth, maturation and senescence, fruit ripening, physiology of respiration, effect and role of ethylene, biochemistry of respiration; aerobic and anaerobic metabolism, chemical changes during maturation.

Unit-3

Control atmosphere storages, effect of temperature, water loss and humidity, methods for modifying carbon dioxide and oxygen concentration, physiological disorders: low temperature disorders, mineral deficiency disorders.

Unit-4

Structure and growth of muscle, chemical and biochemical constitution of muscle, ante-mortem and post-mortem factors affecting quality of meat. Biochemical reactions leading to changes in composition, color, flavour and texture of meat.

Unit-5

Application of enzymes in food processing: Endogenous enzymes and their role in modification of foods, enzyme added to foods during processing sources, conversions and specific applications.

References:

1. Fennema O.R. (2002) Food Chemistry, Marcel Dekker Inc.
2. Lehninger A.L., Nelson D.L. and Cox MM (2008), Principles of Biochemistry, 5th edn., W. H. Freeman and Company, New York.
3. Salunkhe D.K. and Desai B. B. (1984) Post-Harvest Biotechnology of Vegetables, Vol. II, CRC Press Inc, Florida
4. Calderon M. and Golan R. V. (1990) Food Preservation by Modified Atmospheres, CRC Press Inc.
5. Whitehurst R. and Law B. A. (2002) Enzymes in Food Technology, CRC Press, Inc.

IFT-551: FOOD CHEMISTRY LAB

L : T : P
0 : 0 : 6

S. No.	Name of Practical
1.	Analysis of water for potable and food purposes
2.	Moisture content in foods in relation to their stability
3.	Non-enzymatic browning reactions and its determinations
4.	Determination of rate/extent of hydrolysis of sucrose/starch
5.	Determination of free fatty acid content in fats and oils
6.	Detection and estimation of oxidative rancidity in fats/oils
7.	Determination of heat stability of vitamin C
8.	Study of some reactions of proteins
9.	Study of some processing changes in proteins
10.	Study of some functional properties of proteins
11.	Detection/Estimation of some additives in foods
12.	Detection/Estimation of adulterants in some foods

References:

1. The chemical analysis of foods and food products, by Morris B. Jacobs, III Edition, CBS Publishers and distributors New Delhi.
2. ISI handbook of food analysis
3. Handbook of analysis and quality control for fruit and vegetable products, by S. Ranganna, II Ed., Tata McGraw Hill Publishing Co. New Delhi.
4. Official Method of analysis of AOAC

IFT-552: FOOD BIOCHEMISTRY LAB

L : T : P
0 : 0 : 6

S. No.	Name of Practical
1.	Determination of enzyme activity and specific activity (Enzyme assay)
2.	Determination of effect of temperature on enzyme activity
3.	Determination of effect of pH on enzyme activity
4.	Determination of effect of substrate concentration on enzyme activity and estimation of K_m .
5.	Estimation of enzymatic browning in food products.
6.	Estimation of enhancement in an enzyme activity during ripening of fruits.
7.	Estimation of enhancement in an enzyme activity during sprouting of grains.
8.	Detection/ estimation of catalase and peroxidase activity in vegetables.
9.	Application of enzymes: Amylase in hydrolysis of starch
10.	Invertase in hydrolysis of sucrose
11.	Protease in hydrolysis of protein
12.	Lipase in hydrolysis of fat
13.	Cellulase and hemicellulose for dehulling of a grain etc.

References:

1. Plummer D. T. An introduction to practical biochemistry, III Ed. Tata McGraw Hill Publishing Co. New Delhi
2. Whitaker J. R. Principles of Enzymology for Food Science, Marcel Dekker Inc
3. Colwick S. P and Kaplan N. O., Methods in Enzymology by, Academic Press

IFT-601: PRINCIPLES OF FOOD PRESERVATION

L : T : P
3 : 1 : 0

Objectives:

1. To educate about food quality deterioration/spoilage and fundamentals of food preservation.
2. To provide awareness about the various techniques/methodology and equipments used in food preservation and processing.

Unit-1

Aims and objectives of preservation of foods, Degree of perishability of unmodified foods, Causes of quality deterioration and spoilage of perishable foods, wastage of foods.

Unit-2

Preservation of foods by low temperatures: Chilling temperatures: Consideration relating to storage of foods at chilling temperatures, Applications and procedures, Controlled and Modified atmosphere storage of foods, Post storage handling of foods. Freezing temperatures: Freezing process, Slow and fast freezing of foods and its consequence, other occurrences associated with freezing of foods. Technological aspects of pre freezing, Actual freezing, Frozen storage and thawing of foods.

Unit-3

Preservation of foods by high temperatures: Basic concepts. Lethality requirement and assessing the adequacy of a thermal process. Blanching: functions, disadvantages and ways of minimizing them. Pasteurization: Batch and continuous. Commercial sterilization of foods: Conventional canning process, batch and continuous retards. Aseptic processing

Unit-4

Preservation by water removal: Principles, Technological aspects and application of evaporative concentration process; Freeze concentration and membrane process for food concentrations. Principles, Technological aspects and application of drying and dehydration of foods, Cabinet, tunnel, belt, bin, drum, spray, vacuum, foam mat, fluidized bed and freeze drying of foods.

Unit-5

Preservation by Non-thermal methods: Principles, Technological aspects and application of sugar and salt, Antimicrobial agents, Biological agents, non-ionizing and ionizing radiations in preservation of foods. Hurdle technology.

References

<i>Author</i>	<i>Title</i>
O.R.Fennema	Principles of Food science
V.Kyzlink	Principle of Food Preservation
James M.Jay	Modern Food Microbiology
C. J. Stumbo	Thermal bacteriology
Mircea Enachescu Dauthy '	Fruit & Vegetable Processing', FAO Agricultural Services

IFT-602: TECHNOLOGY OF CEREALS, PULSES AND OILSEEDS

L : T : P
3 : 1 : 0

Objectives:

1. To develop competence in processing of Cereals, Pulses and Oilseeds technology.
2. To recognize the significance of quality parameters in selection, product development and value
3. To provide the knowledge of baked goods and edible oil processing.

Unit-1

Composition, Structure and Processing characteristic of Cereal grains, Legumes and oilseeds, Post-harvest, Post processing practices for their safe storage. Parboiling and Milling of paddy, Quality characteristics, Curing and aging of rice, Processed rice products.

Unit-2

Wheat and its quality characteristics for milling into flour and semolina, Flour milling, Turbo grinding and air classification, Flour grades and their suitability for baking purposes, Assessment of flour quality and characteristics, Milling of Durum wheat, Macaroni products.

Unit-3

Ingredients, Technology and quality parameters for baked products: Bread, Biscuits and cakes; Breakfast cereals.

Unit-4

Dry and Wet milling of corn, Starches and its conversion products, Malting of barley, Pearling of Millets, Milling of legume-pulses by traditional and improved processes.

Unit-5

Processing of oil seeds for direct use and consumption, Oil and protein products. Processing of extracted oil refining, hydrogenation, interesterification. Processing of deoiled cake into protein concentrates and isolates, Textured protein, Functional protein preparations. Peanut butter, Margarine and Spread.

References

Author

C.F.T.R.I.
N. N. Potter
S.A.Matz
S.A.Matz
Dendy & Dobrzaczyk
Kent

Title

Mysore Manuals on Rice and its Processing
Food Science
Cereal Technology
Bakery Technology
Cereal Processing: Chemistry & Technology
Cereal Technology

IFT-651: FOOD PRESERVATION AND PROCESSING LAB

L : T : P
0 : 0 : 6

- | S. No. | Name of Practical |
|--------|--|
| 1. | Extension of shelf life/ preservation of foods by use of low temperature. |
| 2. | Processing and preservation of Peas by use of high temperature. |
| 3. | Preservation and processing of certain vegetables by drying and dehydration (water removal). |
| 4. | Osmotic concentration/dehydration of certain fruits and vegetables using concentrated sugar and salts solutions (reduction in water activity). |
| 5. | Preparation of Jam/Jelly and its preservation by sugar. |
| 6. | Preparation of tomato puree/ketchup and its preservation by chemical preservatives. |
| 7. | Preparation of fruit juice/pulp and its preservation by chemical preservatives/thermal processing. |
| 8. | Preparation of cordials and squash as per FPO specification. |
| 9. | Preparation of Bread/test baking. |
| 10. | Pre-treatment and milling of legume-pulses / dehulling of oil seeds. |
| 11-14. | Preparation of certain baked products – Buns, Biscuits, Cookies, Cakes Pizza etc. |

References:

<i>Author</i>	<i>Title</i>
G.Lal, G.S.Siddappa & G.L.Tondan	Preservation of Fruits and Vegetables
S.C.Dubey	Basic Baking: Science and Craft
E.J.Pyler	Baking Science and Technology

IFT-652: SEMINAR

L : T : P
0 : 0 : 3

The student will be required to prepare and deliver a seminar as well as submit a written report on the topic assigned to him/her.

IFT-701: FOOD SAFETY AND QUALITY CONTROL

L : T : P
3 : 1 : 0

Objectives:

1. To introduce the fundamental knowledge of quality control in food industry
2. To understand the use of quality control instruments.
3. To provide basic knowledge of modern non-destructive methods of quality control.

Unit-1

Ways of describing of Food Quality, Quality control and Quality Assurance functions. Total Quality Control (TQC) and the role of management/ TQM. Statistical quality control. Quality costs. Instrumental measurements of sensory attribute of foods: Engineering properties. Textural characteristics. Texture profile analysis. Correlation between instrumental and Sensory analysis of food quality attributes.

Unit-2

Operational sense of food safety, Potential Food derived health hazard- Microbial contamination, Nutritional Imbalance. Pesticide residues, Environmental Contamination. Naturally occurring compounds and permitted food additives. Consumer awareness about food safety, safety of various food categories: Fruits and vegetables, milk and milk products, meat Fish, Sea foods, Egg and poultry products.

Unit-3

Food standards and Specifications: Compulsory and voluntary trade and Company standards. Consumer, company, In-process and finished product specifications. Relevant Food laws: PFA, FPO, SWMA, MPO, AgMark, and BIS Standards.

Unit-4

Food Safety and Standards Act (2006), Codex Alimentarius, ISO series, Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), Good Agricultural Practices (GAP), Genetically Modified Foods (GMF). HACCP systems: General standards for contaminants and toxins in foods.

Unit-5

Non-Destructive Methods of quality control: Near Infrared Spectroscopy (NIR), Nuclear Magnetic Resonance (NMR) and its applications, 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.

References:

Author

J.M.DeMan
Y.Pomeranz
M.A. Amerine

Title

Rheology and Texture in Food Quality
Food Analysis : Theory and practice IS: 6273 (Part-1& Part-2)
Principles of Sensory Analysis of Food

IFT-702: FRUITS, VEGETABLES AND PLANTATION PRODUCTS

L : T : P

3 : 1 : 0

Objectives:

1. To impart knowledge about various preserved & processed products of fruits and vegetables.
2. To study the methodology of processing of plantation products.
3. To understand the concepts of manufacturing chocolate & other related products.

Unit-1

Chemical composition; pre-and post-harvest changes, harvesting and maturity standards for storage and desirable characteristics of fruits and vegetable processing. Post-harvest treatment to enhance shelf-life, cold chain and low temperature preservation. Types of cold preservation, freezers and freeze concentrates.

Unit-2

Thermal processing: Canning and bottling, spoilage of canned foods, detection and control. Drying and dehydration of fruits and vegetables, composition structure and characteristics of Cashew nut and other dry fruits.

Unit-3

Technology of fruits and vegetable products: Juices and pulps, Concentrates and powders, Squashes and cordials. Beverage: Still and carbonated. James, Jellies and Marmalades. Preserves, candies and crystallized fruits. Tomato products: Puree, Paste, Ketchup, Sauce and soup. Chutneys, pickles and other products.

Unit-4

Spices: Composition, Structure and characteristics. Preservation and processing of major and minor spices of India; whole spice, Spice powder, Paste and extracts, Spice oils and oleoresins.

Composition, Production and processing of Tealeaves: Black tea, Green tea and Oolong tea. Instant tea. Production and processing of coffee cherries by wet and dry methods to obtain coffee beans, grinding, storage and preparation of brew, Soluble/Instant coffee, Use of chicory in coffee, decaffeinated coffee.

Unit-5

Production, processing and chemical composition of cocoa beans. Cocoa Processes: Cleaning, roasting, alkalization, cracking and fanning, Nib grinding for cocoa liquor, cocoa butter and cocoa powder. Manufacturing process for chocolate: Ingredients, Mixing, Refining, Conching, Tempering, Moulding etc. to obtain chocolate slabs, chocolate bars. Enrobed and other confectionary products.

References:

Author

Lal, Siddappa and Tondan
B.L. Amla
B. Shrilakshimi
Bernard. W. Minifie

Title

Preservation of fruits & vegetables.
Food Industry.
Food Science.
Chocolate, Cocoa & Confectionary: Science & Technology.
An introduction to the Post-harvest physiology and handling of fruits and vegetables.

ELECTIVE-I

IFT-703: FOOD PACKAGING AND STORAGE ENGINEERING

L : T : P

3 : 1 : 0

Objectives:

1. To introduce basic concepts of packaging and package developments.
2. To provide basics of different types of packaging materials and their forms used in food industries.
3. To provide knowledge about manufacturing techniques of various packages, selection of package for specific product.
4. To impart knowledge on safety of packages and packaging laws and regulations.

Unit-1

Concept of packaging, Important functions of package, Packaging laws and regulations: Printing techniques; Package labeling functions and regulations; Environmental aspect of food packaging

Unit-2

Glass containers and closures, Metal containers: tin-plate containers, tin free steel containers, aluminum and other metal containers. Protective lacquers and coatings for metal containers. Wooden crates, plywoods, cellulosic papers, pouches, bags and cardboard / corrugated paper boxes. Rigid and flexible plastics containers and films and their mechanical sealing and barrier properties.

Unit-3

Selection of Packaging materials, forms and machinery for various food commodities: Fruits and vegetable and their products, Milk and milk products, Meat, fish, egg etc., cereals, pulses and oil seeds products, confectionery etc. Evaluation of quality, safety and interaction with foods of various types of packaging materials. Gas, vacuum, CAP, MAP and aseptic packaging, Tetra packing, Smart packaging, Intelligent Packaging, Active Packaging and Antimicrobial packaging, Retortable pouches, biodegradable and edibles packaging materials and films.

Unit-4

Destructive & Nondestructive test of rigid, semi rigid and flexible packaging material: tensile strength, compression, bursting, tear and impact test for packages, integrity testing. Cushioning effect on packaged foods, deterioration of packaged foods, shelf life study for packaged foods. Corrosion and toxicity of packaging material.

Unit-5

Design parameter for different storage bins for different grains, Milk silo, Design parameter, selection of parameter for designing cold storage for foods different storage. Spoilage of fruits & vegetables during transportation & storage and its prevention. Factors affecting quality of grain during storage. Causes and prevention of spoilage of grain during storage.

References:

Author

Robertson G.L.

Mahadeviah & Gowramma R.V.

Saclarow S. and Griffin R.C.,

Scott A. Morris

Title

Food Packaging: Principles and Practice

Food Packaging Materials

Principles of Food Packaging

Food and Package Engineering

IFT-704: RHEOLOGICAL AND SENSORY ANALYSIS OF FOODS

L : T : P
3 : 1 : 0

Objectives:

1. To introduce students regarding food microstructure and its effect on rheology of food products.
2. To train the students for texture and rheological measurement of various food products.

Unit-1

Mechanical properties of foods. Mechanical models to visualize Behaviour of foods. Basic and applied rheological considerations and their application to foods.

Unit-2

Food Microstructure and its study by light, Scanning and Transmission Electron microscopy. Implications of micro-structure in determining mechanical and sensory characteristics of foods.

Unit-3

Requirement of test systems for measuring food texture. Types of texture Instrument and their operating mechanisms, Calibration, Performance of test and measurements of test parameters. Interpretation of test results.

Unit-4

Textural properties of fruits & vegetables; Dough, Pasta and Baked products; dairy products; Meat; Fat and fat products; and their instrumental Measurements.

Unit-5

Rheology of chocolate, Textural characteristics of food emulsions, Functions of emulsifiers in relation to food texture, Sensory measurement of food texture and texture profile.

References:

Author

Sarpil Sarin
Jacobs, Morris B
Nollet, Leo M.L.
Nollet, Leo M.L

Title

Physical properties of foods
Chemical Analysis of Food and Food Products
Handbook of Food Analysis, 2nd edition
Food Analysis by HPLC. 2nd Edition

IFT-705: SPECIALITY FOODS

L : T : P
3 : 1 : 0

Objectives:

1. To provide knowledge regarding requirement of foods for different age groups.
2. To study the concept of balanced diet and nutrient disorders.

Unit-1

Infant and baby foods, Adolescent/Teen-age foods, Geriatric foods, Foods for pregnant ladies and nursing mothers. Functional foods and Probiotics.

Unit-2

Foods / Diets in metabolic disorders and disturbances.

Unit-3

Foods and Diets recommended and restricted in Gastrointestinal disorders; Fever and Infection; Liver, gallbladder and pancreatic disturbances.

Unit-4

Foods and Diets recommended and restricted in blood, Circulatory and Cardiac diseases; urinary and Musculoskeletal diseases. Allergies.

Unit-5

Beneficial Effects of Spices, gamma-linolenic acid, Spirulina, antioxidants and other food constituents. New Developments.

References:

Author

Benzamin T. Burton
Shubhangini A. Joshi
B. Srilakshmi
Arnold E. Bender
AFST(I) & CFTRI
Periodicals by AFST(I), CFTRI
P. S. Howe, W.B. Saunders

Title

Human Nutrition
Nutrition and Dietetics
Dietetics
Nutrition and Dietetic foods
Proceedings of IFCON 98
Indian Food Industry
Basic Nutrition in Health & Disease

IFT-741 (OE): NUTRITIONAL ASPECTS OF NATURAL AND PROCESSED FOODS
(Open elective for other department students)

L : T : P
3 : 1 : 0

Objectives:

1. To provide the overview of food in relation to nutritional aspects to the students which are not from food technology background.
2. To understand the basic concepts of food nutrition, food habits, sources of nutrients and nutritional requirements.
3. To provide the knowledge about balance diet, dietary recommendations and calorific value determination of foods.

Unit-1

Food and its functions, Role of nutrients, Effects of deficient or excess intake of the individual essential nutrients. Recommended Dietary Intakes (RDI) and its uses. Factors affecting nutritional requirement of an individual.

Unit-2

Composition of Foods: General and Specific for different foods of plant and animal origin. General causes of loss of nutrients. Nutritional changes during processing & storage and their implications. Potentially undesirable constituents in foods. Restoration, Enrichment, Fortification and Supplementation of foods.

Unit-3

Digestion, Absorption and Metabolism of Carbohydrate: Glycolytic pathway, TCA cycle, ETP, PPP. Protein & lipid digestion, absorption and metabolism. Digestion, absorption and metabolism of Vitamins and Minerals.

Unit-4

Balanced diets for normal individuals. Therapeutic diets for people suffering from various ailments and disorders. Functional foods.

Unit-5

Assessment of calorific value and nutritional quality of natural and processed foods by chemical and biological means. Sensory qualities and acceptability of foods.

References:

<i>Author</i>	<i>Title</i>
Shubhangini A.Joshi	Nutrition and Dietetics
Gopalan C and others	Nutritive Value of Indian Foods
Fennema O.R	Food Chemistry
Howe & Saunders	Basic Nutrition in Health & disease
Swaminathan M	Food and Nutrition

IFT-751: FOOD QUALITY EVALUATION LAB

L : T : P
0 : 0 : 6

S. No.	Name of Practical
1.	Sensitivity tests (Threshold/Dilution) to measure individual ability for sensory analysis
2-3.	Difference tests to evaluate qualitative and quantitative differences and/or preference between test products.
4-5.	Assessment of quality of wheat flour (Water Absorption Power, Gluten Content, Sedimentation Value etc.).
6.	Evaluation of quality of Bakery Products: Bread, Biscuits, Cakes etc.
7-8.	Evaluation of quality of Dairy Products: Over ran and fat content in Ice-cream, Specific gravity of Milks etc.
9-10.	Assessment of quality of Fruit & Vegetable Products: Tomato Products, Jam, Jelly, Marmalades, Squashes& Cordials, Canned Products.
11-12.	Assessment of Quality of Beverages: Tea & Coffee, Carbonated and RTS Beverages.

References:

Author	Title
BIS Specifications	The Chemical Analysis of Foods & Food Products
Morris B. Jacobs	Handbook of Analysis and Quality Control for Fruit & Vegetable Products
S. Ranganna	Official Method of Analysis of AOAC.

IFT-752: PROJECT (Dissertation)

L : T : P
0 : 0 : 3

The student(s) will be required to search literature pertaining to design of equipment/processing of a food commodity/production of food product, comprehend it and prepare a report for assessment.

IFT-753: INDUSTRIAL/PRACTICAL TRAINING AND REPORT PRESENTATION

L : T : P
0 : 0 : 3

The student(s) will be required to undertake training in the food industry after III year B. Tech.VI semester for a specified period and submit its report after completion for evaluation and oral examination in the VII semester of his studies in Final B.Tech.

IFT-801: TECHNOLOGY OF ANIMAL FOODS

L : T : P
3 : 1 : 0

Objectives:

1. To educate the students about milk procurement and their processed products.
2. To impart knowledge for the preservation and processing techniques of meat, fish, poultry and egg products.

Unit-1

Fluid Milk: Composition of milk and factor affecting it. Physico-chemical characteristics of milk and milk constituents. Production and collection, cooling and transportation of milk. Packaging storage and distribution of pasteurized milk.: Whole, Standardized, Toned, Double toned and skim milk. Test for milk quality and Adulteration. UHT processed milk, flavoured, Sterilized milk. Cleaning and sanitization of dairy equipments.

Unit-2

Definition, Classification, Composition and physico-chemical properties of cream. Production processes and quality control. Butter: Definition, Classification, Composition and methods of manufacture, Packaging and storage. Butter oil/Ghee. Ice cream: Definition, Classification and Composition, Constituents and their role. Preparation of mixes and freezing of Ice cream, Overrun, Judging, Grading, and defects of Ice cream.

Unit-3

Evaporated and Condensed milk: Method of manufacture, Packaging and storage. Defects, Causes and prevention. Roller and Spray Drying of milk solids. Instantization. Flow ability, Dustiness, Reconstituability, Dispersibility, Wet ability, Sink ability and appearance of milk powders. Manufacture of casein, Whey protein, Lactose from milk or use in formulated foods.

Unit-4

Chemical and nutritional composition of meat. Slaughtering techniques; post-mortem and anti-mortem factors affecting carcass quality, meat preservation, tendering and curing of meat, product and by products of meat industries and their utilization. Catch, handling and transportation of fish. Fish spoilage, processing and preservation of fish. Fish meal and fish flour.

Unit-5

Poultry processing, factors affecting quality of poultry products, composition and nutritional value of poultry meat, spoilage and control. Egg structure, physical, chemical, nutritional and functional characteristics of egg, causes of deterioration of quality of egg, preservation and processing of egg. Egg solid and egg-based products.

References:

<i>Author</i>	<i>Title</i>
H.V.Athortone	Chemistry and testing of dairy products
N.Warner	Principles of dairy processing
Sukumar De	Outlines of dairy technology
R.A.Lawrie	Meat Science.
G.J.Mountney	Poultry Products Technology
B.Srilakshmi	Food Science

IFT-802: INNOVATIVE TECHNIQUES IN FOOD PROCESSING

L : T : P
3 : 1 : 0

Objectives:

1. To understand the necessity of food safety.
2. To introduce students with food laws, standards and its regulatory framework.
3. To educate about the various food safety and hygiene system.

Unit-1

Membrane technology: Introduction to pressure activated membrane processes: microfiltration, UF, NF and RO and their industrial application.
Supercritical fluid extraction: Concept, property of near critical fluids NCF, extraction methods.

Unit-2

Microwave and radio frequency processing: Definition, Advantages, mechanism of heat generation, application in food processing: microwave blanching, sterilization and finish drying.

Unit-3

High Pressure processing: Concept, equipments for HHP treatment, mechanism of microbial inactivation and its application in food processing.
Ultrasonic processing: Properties of ultrasonic, application of ultrasonic as processing techniques.

Unit-4

Newer techniques in food processing: Application of technologies of high intensity light, Ohmic heating, IR heating, inductive heating and pulsed X-rays in food processing and preservation

Unit-5

Hurdle technology: Types of preservation techniques and their principles, concept of hurdle technology and its application.

References:

Author

Y.Pomeranz
Shapton DA

Title

Food Analysis : Theory and practice
Principles and practices of safe processing of foods

ELECTIVE-II

IFT-803: QUALITY MANAGEMENT OF FROZEN FOODS

L : T : P

3 : 1 : 0

Objectives:

1. To understand various aspects of freezing process and their impact on tissue and non-tissue foods.
2. To develop skills in the students to produce safe, hygienic and nutritious frozen foods.

Unit-I

Fundamentals of freezing: Glass transition in frozen foods and biomaterial, microbiology of frozen foods, thermo-physical properties of frozen foods, Freezing load and freezing time calculations, Innovation in freezing process

Unit-II

Facilities for the cold chain: freezing methods and equipment, cold store design and maintenance, transportation of frozen foods, retail display equipment and management, household refrigerators and freezers, monitoring and control of the cold chain.

Unit-III

Quality and Safety of Frozen Foods: Quality and Safety of frozen meat and meat product, Quality and safety of frozen poultry and poultry products, Safety and quality fish, Shellfish and related products, Quality and safety of frozen vegetables, fruits, dairy products, ready meads , bakery products, Eggs and eggs products.

Unit-IV

Monitoring and measuring techniques for quality and safety: Chemical measurements, sensory analysis of frozen foods, Food borne illnesses and detection of pathogenic microorganisms, shelf life prediction of frozen foods.

Unit-V

Packaging of frozen foods: Introduction to frozen food packaging, plastic packaging of frozen foods, paper and card packaging of frozen foods, Packaging of frozen foods with other materials, Packaging machinery.

References:

Author

O.R.Fennema

V.Kyzlink

Kramner & Twigg

Title

Principles of Food science

Principle of Food Preservation

Quality control for Food Industry

IFT-804: FOOD PROCESSING WASTE MANAGEMENT

L : T : P
3 : 1 : 0

Objectives:

1. To educate the students about environment protection acts.
2. To train the students for food industry waste utilization and management.

Unit-1

Basic considerations: Standards for emission or discharge of environmental pollutants from food processing Industries as per the updated provision of Environment (Protection) Act, 1986. Elements of importance in the efficient management of food processing wastes.

Unit-2

Characterization and utilization of by-products from Cereal Pulses, Oilseeds, Fruits and vegetables, Plantation products, Fermented foods, Milk, Fish, Meat, Egg and poultry processing industries.

Unit-3

Characterization of food Industry effluents, Physical and chemical parameters, Oxygen demands and their inter-relationships, Residues (solids), Fats, Oils and grease, Forms of Nitrogen, Sulphur and Phosphorus, Anions and cations, Surfactants, Colour, Odour, Taste, Toxicity. Unit concept of treatment of food industry effluent, Screening, Sedimentation Flootation as pre - and primary reactants.

Unit-4

Biological oxidations: Objects, Organisms, Reactions, Oxygen requirements, Aeration devices Systems: Lagoons, activated sludge process, Oxidation ditches, rotating biological containers and their Variations and advanced modifications.

Unit-5

Advanced wastewater treatment systems. Physical separations, Micro-strainers, Filters, Ultra filtration and reverse osmosis. Physico-chemical separations: activated carbon adsorption, Ion-exchange electro-dialysis and magnetic separation. Chemical oxidations and treatment Coagulation and flocculation. Disinfection. Handling disposal of sludge.

References:

<i>Author</i>	<i>Title</i>
J.H. Green	Food Processing Waste Management
	Environment (Protection) Act
AFST(I) & CFTRI	Proceedings of the Symposium on By-products from food Industries: Utilization and Disposal

IFT-805: FOOD PRODUCT AND PROCESS DEVELOPMENT

L : T : P
3 : 1 : 0

Objectives:

1. To understand various aspects of food product development.
2. To develop skills in the students to produce nutritionally rich and safe food products.

Unit-1

Innovation and product development concept. Generation of ideas. Desk Research. Screening/appraisal of initial ideas.

Unit-2

Detailed study of product, process and market, Planning and developmental activities and evaluating them.

Unit-3

Development of prototype product and its testing for acceptance.

Unit-4

Development of process and planning for production trials. Planning the test market. Actual production trials and test marketing. Evaluation of test results.

Unit-5

Launching of the product. Advertising and marketing plans. Suggestions for improving success.

References:

Author

Chicago: Arlington

Title

Food Product Development

IFT-851: MILK PRODUCTS AND FERMENTED FOODS LAB

L : T : P
0 : 0 : 6

S. No.	Name of Practical
1	Preparation of Khoa and its texture profile analysis.
2	Osmotic cum freeze drying of mushroom.
3	Preparation of curd and its texture profile analysis.
4	Determination of proteolytic activity of lactic acid bacteria.
5	Preparation and quality assessment of potato chips.
6	Preparation and quality assessment of Namkeen
7	Preparation of Paneer and its texture profile analysis
8	Preparation of flavored milk/whey beverages.
9	Preparation and quality assessment of Pickles.
10	Preparation and quality assessment of Sauerkraut.
11	Preparation of oriental fermented foods.
12	Studies on effect of granule size on texture profile of Idli.

References:

<i>Author</i>	<i>Title</i>
Sukumar De	Outlines of Dairy Technology
Prescott & Dunn	Industrial Microbiology
Nduka Okafor	Modern Industrial Microbiology and Biotechnology
	Potato Science and Technology

IFT-852: PROJECT (Dissertation)

L : T : P
0 : 0 : 12

The student (s) will be required to submit a detailed project report on the topic pertaining to design of equipment / processing of a food commodity / production of food product as assigned in seventh semester for the evaluation and oral examination in eighth semester of his/her studies in final B. Tech.

IFT-853: EDUCATIONAL TOUR (Audit)

L : T : P
0 : 0 : 3

The student (s) will be taken for the visit of Industrial/Research organization, in their field of specialization, during the vacation period.