

School of Vocational Studies and Applied Sciences
Department of Food Processing and Technology
Course Structure for M.Tech Food Processing and Technology
Duration -2Year (4Semester)
(Effective from Session 2019-20)

CBCS Based M.Tech. Food Processing and Technology Course Structure					
S. No.	Code	Course Name	Category	L-T-P	Credits
Semester- I					
1.	MA-505	Statistical methods	C	3-1-0	4
2.	FT-503	Engineering Properties of Biomaterials and Applications	C	3-0-0	3
3.	FT-505	Advances in Food Process Technology	C	3-0-0	3
4.	FT-507	Food Safety and Standards	C	3-0-0	3
5.	FT- 518	Advanced Food Chemistry and Microbiology	C	3-0-0	3
6.	FT-511	Food Beverages	C	3-0-0	3
		PRACTICALS			
7.	FT-551	Advance Food Processing Lab-I*	C	0-0-8	4
		Total		19-0-8	23
		Total Contact Hours		27	
Semester- II					
1.	FT-502	Processing of Meat, Fish and Poultry Products	C	3-0-0	3
2.	FT-504	Nutraceutical and functional Foods	C	3-0-0	3
3.	FT-508	Advances in Cereal and Pulse Processing	C	3-0-0	3
4.		DSE-I	DSE	3-0-0	3
5.		DSE-II	DSE	3-0-0	3
6.		Generic Elective	GE	3-1-0	4
		PRACTICALS			
7.	FT-552	Advance Food Processing Lab II*	C	0-0-8	4
8.	FT-554	Seminar I	SEC1	0-0-2	1
		Total		18-0-10	23
		Total Contact Hours		28	

Semester- III					
1.	FT-601	Advanced Food Packaging	C	3-0-0	3
2.	FT-603	Instrumental Techniques in Food Analysis	C	3-0-0	3
3.	FT-611	Flavour Technology	C	3-0-0	3
4.		DSE-III	DSE	3-0-0	3
5.		DSE-IV	DSE	3-0-0	3
6.		DSE-V	DSE	3-0-0	3
		PRACTICALS			
	FT- 651	Seminar II	SEC2	0-0-2	1
	FT-653	Dissertation-I		0-0-10	5
		Total		18-0-12	24
		Total Contact Hours		30	
Semester- IV					
	FT654	Dissertation-II	-	-	15
MOOCS courses -I		Open elective			3
MOOCS courses-II		Open elective			2
	Total credits for all semester				90
*Generic Elective (GE)					
1.	FT- 514	Functional Foods and Ingredients	GE	3-0-0	4
2.	FT- 512	Engineering Properties of Food	GE	3-0-0	4
Discipline Specific Electives (DSE-I)					
1.	FT- 506	Food Texture and Rheology	DSE	3-0-0	3
2.	FT-501	Cryogenic Systems In Food Processing	DSE	3-0-0	3
Discipline Specific Electives (DSE-II)					
1.	FT- 500	Post-Harvest Processing Of Fruits & Vegetables	DSE	3-0-0	3
2.	FT-509	Food Supply Chain Management	DSE	3-0-0	3

Discipline Specific Electives (DSE-III)					
1.	FT- 605	Frozen Foods And Cold Chain Management	DSE	3-0-0	3
2.	FT- 607	Advances in Dairy Engineering and Technology	DSE	3-0-0	3
Discipline Specific Electives (DSE-IV)					
1.	FT 609	Food Industry Waste Management	DSE	3-0-0	3
2.	FT-617	Therapeutic Foods	DSE	3-0-0	3
Discipline Specific Electives (DSE-V)					
1.	FT 613	Fermented Foods and Bioprocess Engg.	DSE	3-0-0	3
2.	FT-615	IPR and Patenting in Food technology	DSE	3-0-0	3
<p><i>*Experiments will be based on Course contents.</i></p> <p><i>*New course structure will be effective from academic session 2018-19. School/Department will not be bound to run all the courses. Minimum number of students may be fixed to run any elective course.</i></p>					

M. Tech (Food Processing and Technology)
(Effective from 2019-20)

Semester-I

FT- 503 Engineering Properties of Biomaterials and Applications (3-0-0)

OBJECTIVES:

1. To understand the area of Food engineering
2. To elaborate the basic concepts of material and energy balance, fluid dynamics, thermal process calculations etc.

Unit – I

Introduction: Biomaterials and their properties in relation to processing, their role in the development of new products and processes **Physico-Chemical Characteristics:** Physico-chemical characteristics: shape, sphericity, size, volume, density, porosity, surface area, coefficients of friction, and angle of repose and influence of constituents on processing and design of equipments

Unit – II

Mechanical & Rheological Properties: Flow behaviour of granular and powdered food materials, textural profile analysis of food products

Aero and hydrodynamic characteristics: Concepts and application of drag coefficients, terminal velocity in agricultural products processing and handling

Unit – III

Thermal, Electrical and Optical Properties: Specific heat, thermal conductivity, thermal diffusivity, electrical resistance and conductance, dielectric constant, reflectivity, transmittivity and absorptivity of incident rays and Application of bioluminescence in food.

Unit – IV

Applications: Application of engineering properties in process development as well as design and operation of equipment and structures associated with handling, processing and storage of raw as well as processed food products. Development of **Space Food**.

OUTCOMES:

No. of Lecture: 45

After the completion of the course, the students will be able to:

- Understand various basic aspects of food engineering.
- Grasp the knowledge about fluid flow of foods.
- Comprehend the thermal process calculations.
- Understand the processing of foods by thermal and freezing process.

Books Recommended

1. M.A. Rao & S.S. H. Rizvi Engineering Properties of Foods
2. M. Aguilera & D. W. Stanley Micro-structural principles of food processing and Engineering
3. N. N. Mohsenin Physical properties of plant and animal materials

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Semester-I

FT- 505 Advances in Food Process Technology

OBJECTIVE

The course aim is to introduce the students to the area of food processing. This is necessary for effective understanding of a detailed study of food processing and technology subjects.

Unit – I

Modeling of Microbial Food Spoilages: Microbial growth dynamics models, partial differentiation equation models, application of models in thermal preservation, Concept, mechanism of microbial destructions, equipments etc. **Membrane Technology:** Introduction to pressure activated membrane processes, performance of RO/UF and NF and industrial application.

Unit – II

Supercritical Fluid Extraction: Property of near critical fluids (NCF), solubility and efficiency of NCF extraction, equipment and experimental techniques used in NCF extraction and industrial application.

Use of Microwave Energy in Foods: Theory of microwave heating, dielectric properties of food materials, working principle of magnetron, microwave blanching, sterilization and finish drying.

Unit – III

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

High Pressure Processing of Foods: Concept of high-pressure processing, quality changes, effects of pressure on microorganisms and its application in food processing.

Unit – IV

Ultrasonic in Food Processing: Properties and generation of ultrasonic, ultrasonic imaging, application of ultrasonics as an analytical tool and processing techniques

Newer Techniques in Food Processing: Application of technologies of high intensity light, pulse electric field, ohmic heating, micronization in food processing and preservation

Nanotechnology: Principles, mechanism and applications in foods

OUTCOME

Number of Lectures : 45

On completion of the course the students are expected to

- Develop a clear understanding of the principles of different methods applied to the processing of foods
- Have a grasp of emerging processing technologies and hurdle concepts

Books Recommended

1. G. W. Gould. New Methods of Food Preservation (Non Thermal Processing of Foods)
2. R. P. Singh. Introduction to Food Engineering
3. Food processing technology. Fellows, P. J.

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Semester-I

FT-507 Food Safety and Standards (3-0-0)

OBJECTIVES:

- To characterize different type of food hazards, physical, chemical and biological in the industry and food service establishments
- To help become skilled in systems for food safety surveillance
- To be aware of the regulatory and statutory bodies in India and the world

Unit –I

Food Safety and Standards Act of India, 2006: Provision, definitions and different sections of the Act and implementation. FSS Rules and Regulations. Overview of other relevant national bodies (e.g. APEDA, BIS EIC, MPEDA, Spice Board etc.) International Food Control Systems/Laws, Regulations and Standards/Guidelines with regard to Food Safety – Overview of CODEX Alimentarius Commission (History, Members, Standard setting and Advisory mechanisms: JECFA, JEMRA JMPR): WTO agreements (SPS/TBT): Important national and international accreditation bodies

Unit –II

FSSAI : Genesis and Evolution of FSSAI Structure and Functions of Food Authority Overview of systems and processes in Standards, Enforcement, Laboratory ecosystem, Imports, Third Party Audit etc. Training and capacity building, Role of State Food Authorities.

Quality control and quality assurance functions.

Unit -III

Total Quality Management; General principles of food safety management systems including traceability and recall – sanitation, HACCP, Good production and processing practices (GMP, GAP, GHP, GLP, BAP, etc.); Various organizations dealing with inspection, traceability and authentication, certification and quality assurance (PFA, FPO, MMPO, MPO, AGMARK, BIS).

Unit –IV

Food safety management system: Introduction, prerequisite program of food safety management system, understanding and implementation of food safety management system in food industries, understanding and implementation of ISO 22000. Emerging Issues in Food Processing

OUTCOMES:**No. of Lecture : 45**

- Thorough Knowledge of food hazards, physical, chemical and biological in the industry and food service establishments
- Awareness on regulatory and statutory bodies in India and the world

Books Recommended:

1. Quality control in the food industry -S. M. Herschfoerfer
2. Quality control for the food industry -A. Kramer and B.A.Twigg
3. Principles of sensory evaluation of Foods -M. A. Amerine
4. Rheology and Texture in Food Quality -J. M. deMan, P. W. Vowsy
5. Analysis of Fruits and vegetables –Ranganna

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Semester-I

FT518- Advanced Food Chemistry and Microbiology

OBJECTIVE

The course is targeted to develop the knowledge of students in Food Chemistry at advanced level. This is necessary for effective understanding of food processing and technology subjects. This course will enable students to appreciate the similarities and complexities of the chemical components in foods.

Unit-I

Water Relations in Food: Water relationships in foods: water activity and its relevance to deteriorative processes in foods (chemical, enzymatic, physical and microbial changes) and sorption isotherm, Glass transitions and molecular mobility in foods, their relevance to quality and shelf life of food systems, anticaking agents: Definition, role in preventing spoilage, mode of action, permitted list of anticaking agents and food application.

Unit-II

Carbohydrates and Proteins: Carbohydrates: Structure, classification and chemistry of carbohydrates, Starch, Hydrocolloids and gums: Occurrence, functions and properties, Modified starches. Protein: Chemistry, structure and functions of amino acids and proteins, Role of enzyme in food processing, Functional properties of proteins: modified proteins, application in product formulation.

Unit-III

Food Lipids Chemistry of oils and fats, Antioxidants: Chemistry and mechanisms of action, Techniques of evaluation of antioxidant activity, Uses. Emulsifiers: Role of emulsifiers, different classes of emulsifiers and their chemical structure, Selection of emulsifier based on Hydrophilic and lipophilic balance (HLB) and its application, Role of different stabilizers and other substances in emulsion stability.

Unit-IV

Food Spoilage: Cause of spoilage, Biochemical changes caused by microorganisms, Types of microorganism associated with food spoilage and their controls.

Unit-V

Food Pathogens: Contamination of food, Sources of contamination, Food poisoning and microbial toxins, Use of antimicrobial chemicals: Organic acids, sugars, sodium chloride, nitrites, phosphates, sulphites, benzoates, sorbates/propionates naturally occurring antimicrobials-their mode of action.

OUTCOME

No. of Lecture : 45

On completion of the course the students are expected to

- Be able to understand the significant role of food biomolecules
- Grasp the functional role of food components and their interaction in food products in terms of color, flavor, texture and nutrient composition
- Understand the significance and role of microbe in fermentation, spoilage and food borne infectious diseases

Books Recommended

1. Chopra, H.K and Panesar, P.S. "Food Chemistry", Narosa, 2010
2. Damodaran, S., Parkin, K.L. and Fennema, O.R. "Food Chemistry", 4 th Edition, CRC / Taylor & Francis, 2008
3. Belitz, H.D., Grosch, W and Schieberle, P. "Food Chemistry", 3rd Edition, Springer, 2004
4. Walstra, P. "Physical Chemistry of Foods", Marcel Dekker, 2003
5. Adams, M.R. "Food Microbiology", New Age International, 1995
6. Frazier, William M.C and Dennis, C.W. "Food Microbiology", 4th Edition, Tata Mc-GrawHill, 1988
7. Vijaya, R.K. "Food Microbiology", MJP, 2007

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Semester-I

FT-511 Food Beverages

OBJECTIVE:

To provide an understanding of the science and technology for processing different types of beverages.

UNIT-I

Beverages, importance of beverages in our diet, treatment of water for food industry. Technology of alcoholic and non-alcoholic beverages- wine, cider, brandy, perry, toddy. Fruit juice beverages methods of production, preservation and packaging, physiological aspects of fruit juice production and methods of fruit juice clarification.

UNIT-II

Technology of soft drinks, mineral water, ingredients, and additives used in production of soft drinks. Manufacturing of carbonated and non-carbonated beverages, technology of carbonation, and application of CO₂ in juice preservation.

UNIT-III

Citrus beverages, whey beverages and utilization of whey in development of fortified drinks, use of low calorie sweeteners in beverages. Equipments and machineries for juice pressing, methods of bottling, enzymatic clarification and debittering of juices. Fruit juice beverages, squash, cordial, crush, RTS, nectar, syrups, their types and production, blending of juices.

UNIT-IV

Production, processing and chemistry of tea manufacturing, tea products such as soluble tea, tea concentrate, de-caffeinated and flavoured tea. Production, processing, roasting and brewing of coffee, soluble coffee manufacture, standards and specifications of coffee products, de-caffeinated coffee, and coffee brew concentrate and chicory. Cocoa processing and cocoa beverages.

OUTCOME:

Number of Lectures: 45

Students shall have thorough knowledge of processing of fruit juice beverages, carbonated beverages, citrus beverages, tea and coffee.

Books Recommended:

1. Rao, L. J. M. & Ramalakshmi, K. (2011). Recent trends in soft beverages: AFST, India.
2. Priest, F. G. & Campbell, I. (1996). Brewing Microbiology (2nd ed.): Chapman and Hall, London.
3. Hui, Y. H. (2004). Handbook of Food and Beverage Fermentation Technology: Marcel Dekker, New York.
4. Varnam, A. H. & Sutherland, J. P. (1994). Beverages: Technology, Chemistry and Microbiology: Chapman, London.
5. Varnam, A. H. & Sutherland, J. P. (2009). Beverages Technology, Chemistry and Microbiology: Springer, UK.

M. Tech (Food Processing and Technology)
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M.Tech Semester-II

FT-502 Processing of Meat, Fish and Poultry Products

OBJECTIVES:

- The course aims to develop the knowledge of students in the area of animal product processing and technology.
- This course will enable students to appreciate the application of scientific principles in the processing of these materials.

Unit-I

Meat and poultry industries in India – kinds of meat animals and poultry birds, Current levels of production, consumption and export of category products. Nutritional, safety, health and hygienic considerations.

Unit-II

Structure, composition and nutritive value of meat tissues, Postmortem changes, Pre-slaughter handling, Death of the Animal–stunning and bleeding, dressing and cutting, Post slaughter care and post mortem inspection – classification and quality of meat.

Aging, Curing, Smoking, Canning, Irradiation, Freezing and Dehydration of Meat and Meat Products, Formed and Sectioned Meat Production Method, Meat Sausages- Classification, Ingredients and Production Technology. Recent trends in meat processing.

Unit-III

Chemical composition and nutritive value of poultry meat, Pre-slaughter handling, Transport and Dressing of poultry, Antemortem and postmortem examination of poultry.

Egg: Structure, composition, and nutritional aspects of eggs. Grading, Storage and transportation of whole eggs. Microbial spoilage of eggs, Preservation and maintenance of eggs, Processing of eggs and egg products (liquid and solid products)

Unit-IV

Fish: Types of fish, Composition and Nutritive Value, Post-mortem changes in fish. Unit operations in fish processing. Canning, Smoking, Salting, Curing, Freezing and Drying/Dehydration of fishes. Fish spoilage, Fish sausages.

OUTCOME:

No. of Lecture: 45

On completion of the course the students are expected to

- Be able to understand and identify the specific processing technologies used for meat and such foods and the various products derived from these materials.
- Grasp the changes in the composition of foods with respect to the type of processing technology used.

Books Recommended:

1. Meat and Meat Products Technology (Including Poultry Products Technology) by B.D Sharma
2. Meat Science by R.A. Lawrie, Pergamon Press.
3. Poultry Products Technology by G.J. Mountney.
4. Meat, Poultry and Sea Food Technology by R.L. Henricksons.
5. Poultry Meat and Egg Production by Parkhurst and Mountney

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Semester-II

FT-504 Nutraceuticals and Functional Foods

OBJECTIVES:

- To understand the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction.
- To understand the role of Nutraceuticals and functional food in health and disease

Unit – I

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

Unit – IV

Processing, storage and interactions of various environmental factors of functional and nutraceutical foods. Marketing and regulatory issues for functional food and nutraceutical foods. Recent development and advances in the areas of functional and nutraceutical and foods.

OUTCOMES:

No of Lecture: 45

- Knowledge of the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction
- Understand the role of Nutraceuticals and functional food in health and disease

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. Handbook of Nutraceuticals and Functional Foods by Robert E.C.

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Semester-II

FT508 Advances in Cereal and Pulse Processing

OBJECTIVE The course aims to develop the knowledge of students in the area of Cereal, pulse and oilseed processing and technology. This is necessary for effective understanding specific aspects of food processing related to these foods.

Unit - I

Paddy Processing: Curing of paddy. parboiling processes, cold water soaking and hot water soaking processes, paddy dryer-LSU dryer. by products of paddy processing - paddy husk and its uses - as boiler fuel, husk ash, activated carbon, furfural and other by products, Production of flattened rice and puffed rice from paddy

Unit - II

Rice Milling: Components of modern rice mill, pre cleaners, shellers, under runner shellers and centrifugal shellers, paddy separators – Satake and Schule designs, Polishers-cone polishers and other types, bran and brokens separators, Rice mill yields and loss due to brokens at different stages of milling, Rice mill machinery handling. Methods of rice bran oil extraction

Unit - III

Milling of Pulses: Need for modernization, Traditional milling process, merits and demerits, Modern milling process, Mechanical hot air drying and conditioning, merits and demerits, Dehusking in Pulse Pearler, Water conditioning, splitting of pulses in Pulse splitter, process flow chart, Merits and demerits, Mini dal mill, working principle, advantages and disadvantages, Grinding of split pulses, pulse flour products, their applications, equipment used

Unit - IV

Milling and Processing of Maize : Dry milling of maize: Wet milling of Maize and corn: Modern methods of processing, Cleaning, Steeping, Degermination, Bran and Fibre separation, Gluten and Starch Separation, extraction process; Equipment needed for Degermination, Debranning and starch separation, Starch conversion into other value added products, Acid Hydrolysis, Enzyme Hydrolysis, Isomerization processes, Processing for Dextrose, Malto Dextrin and other products. Extraction and refining of Corn oil in brief.

OUTCOME
45

Number of Lectures :

On completion of the course the students are expected to

- Be able to understand and identify the know-how technologies used for cereals, pulses, oilseeds
- Understand the application of scientific principles, processing and utilization of value added products
- Enable students to appreciate the application of scientific principles and technology in the processing of materials

Books Recommended

1. Post Harvest Technology of Cereals, Pulses and Oilseeds, Chakraverty, A
2. The Chemistry and Technology of Cereals as Food and Feed, Samuel Matz
3. Technology of Cereals, N. L. Kent and A. D. Evans
4. Maize-Recent Progress in Chemistry and Technology, George E Inglett

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Semester-II

FT-506 Food Texture and Rheology

OBJECTIVE:

- To expose the students to the fundamental knowledge of food, its properties and different methods of food processing

Unit – I

Fundamentals of Structuring: Polymer, Colloid, and Materials Science; Food Polymers, Polymer Solutions, Phase Transitions, Colloids and Surface Chemistry, Mechanical and Rheological Properties, Rheology of Foods, Mechanical Properties of Food Solids, Food Structure in the Mouth and Beyond

Unit – II

Food Structuring: Traditional Food Structuring and Texture Improvement, Approaches to Food Structuring, Extrusion and Spinning, Structuring Fat Products, Structure and Stability, Gels, Gelation Mechanisms, Mixed Gels, The Microstructure of Gels, Structure-Property Relations in Gels

Unit – III

Microstructural Components and Food Assemblies: Water and Ice, Proteins, Lipids, Carbohydrates, Cells and Cell Membranes, Structural Aspects of Animal Tissue, Structural Aspects of Plant Tissue

Food Microstructure and Quality: Measurement of Texture, Structural Aspects of Food Texture, Quality and Structure

Unit – IV

Microstructure and Mass Transfer: Solid-Liquid Extraction: Fundamental Aspects of Extraction, The Extraction process, Extraction of Food Materials, Modifying Microstructure, Modeling the Extraction Process

OUTCOMES:

No. of Lecture: 45

- Students will understand the importance of quality control and food packaging in shelf life of foods.
- Understand thermal processing of food and hygiene practices in food industry.

Books Recommended

1. Microstructural Principles of Food Processing Engineering	José Miguel Aguilera
3. Food Texture	Moskowitz
4. Principles of Food Processing	Richard W. Hartel
5. Phase Transitions in Foods	Yrjö H. Roos
6. Mass transfer	Thomas Kilgore Sherwood

7.An Introduction to Rheology
8.Fat Crystal Networks
9.Multidimensional Microscopy

H.A. Barnes
Alejandro G. Marangoni
Philip C. Cheng

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Semester-II

FT-501 Cryogenic Systems in Food Processing

OBJECTIVES:

1. To teach about the mechanism and operation of freezing.
2. To teach about various equipment and process used in freezing..
3. To impart knowledge about quality and safety aspect of various frozen products..

Unit-I

Introduction to cryogenics: Applications involving Cryogenic Engineering, Properties of Cryogenic Fluids: Oxygen, Nitrogen, Air, Argon, Neon, Fluorine, Hydrogen, Helium. Properties of Solids: Mechanical Properties, Thermal Properties, Electrical Properties, Superconductivity.

Unit-II

Refrigeration and Liquefaction: Refrigeration and liquefaction principles, Joule-Thomson expansion, isentropic expansion, Cascade processes, Ortho-Parahydrogen conversion, cold-Gas refrigerators, miniature refrigerators, Ultra-Low-Temperature refrigerators, Thermodynamic analyses of system.

Unit-III

Storage and Transfer Systems: Basic storage vessels and design issues of small and large storage dewars. Structural design of Inner vessel and outer vessels, Design of suspension system, Insulation systems, Surface evaporation, thermal overfill, thermo-acoustic oscillation, eddy current heating, Cooling of storage vessels, cool down time estimation. Transfer systems, Industrial storage and transfer of cryogenics, Cool down of Storage and Transfer System.

Unit- IV

Cryogenic Instrumentation.: Properties characterizing cryogenic Instrumentation, strain, displacement and position, Pressure, Flow, Liquid Level, Density, Temperature.

Unit-V

Safety Issues with Cryogenic Fluids: Cryogenic safety, General safety issues, cold damage, Asphyxiation, sudden thermal contraction and pressure build-up in cryogen systems, brittle failure, LNG safety, Properties – Flammability, auto ignition temperature, rapid phase transition, LNG storage tanks, Risk of LNG fires, Oxygen safety – General concept of ignition and combustion, ignition mechanisms of different types, Effect of operating parameters, Selection of materials for oxygen use, Design of systems with oxygen rich environment, International and national codes and standards of safe handling of cryogenic fluids.

OUTCOMES: :

No. of Lecture: 45

After the completion of the course, the students will be able to:

1. Understand about the concept of freezing.
2. Acquire knowledge about equipment and process used for food freezing.
3. Understand maintenance of quality of frozen food.

Books Recommended

1. Cryogenic Process Engineering By Klaus D. Timmerhaus
2. Cryogenic Systems by Randall F. Bar

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FT-509 Food Supply Chain Management (3-0-0)

OBJECTIVE

To provide an introduction to the concepts and tools of supply chain management in the food and beverage industry

UNIT I

INTRODUCTION: Building blocks of Food Supply Chain Management, Significance in Nation's Economy, International Food Supply Chains - Special emphasis to Indian Scenario and challenges thereof; Agricultural policy impacts, and problems in the modern food supply chain; Human Resource Development in Supply Chain, Understanding the changing customer needs: domestic and export; Food Disaster and Hunger relief

UNIT II

Inbound and outbound logistics, Supply Chain as a source of competitive advantage, Buyer – Vendor co-ordination, Procurement, Vendor development and evaluation, reduced sourcing and supplier partnership – benefits, risks and critical success factors, The Logistics/SC product: Nature and classification of products, the product life cycle, product characteristics, weight – bulk ratio, substitutability, risk characteristics, product packaging, product pricing, geographic pricing methods, legal concerns; Coordination and management of transportation, Inter model transportation and third party transportation services; Facility location, Transportation infrastructure and management

UNIT III

Multi-level supply control, Inventory control systems of stock replenishment, Cost elements, EOQ and derivative models; Order processing and information systems Defining order processing, order status reporting- industrial order processing, retail order processing, customer order processing; web – based channel order planning.

UNIT IV

Porter's industry analysis and value chain models; concept of total cost ownership; Use of stochastic models and combinatorial optimization in SC planning, layout, capacity planning, inventory optimization; Operation research models for operational and strategic issues in supply chain management, the Bullwhip effect and supply chain management game; Internet technologies and electronic commerce in SCM related to ERP, Q procurement, e-logistics, internet auctions

UNIT V

Specific supply chain practices (buy local vs. commodity supply chain)- Pre and Post Harvest Management of Fresh Produce; Food Manufacturing Restaurant and Hospitality Industry,

Controlling Food Safety and Insuring Quality, Sustainable and Organic Food Supply Chains and Certification Programs. Benefits and risks associated with FDI in retail sector of India.

OUTCOME

No of Lecture 45

- To demonstrate an awareness of the role of supply chain management in competitive strategy in the food and drinks industry
- To get a critical understanding of the buyer-supplier relationship debate
- To be aware of the challenges involved in identifying, acquiring and managing the various resources required in food supply chains
- To develop a conceptual appreciation of the key supply chain management processes and their role in satisfying customer demands

Books Recommended

1. Pullman, M. and Wu, Z. “Food Supply Chain Management: Economic, Social and Environmental Perspectives”, 2011
2. Chopra, S and Meindl, P. “Supply Chain Management Strategy, Planning and Operation”, Pearson Education, 2004
3. Janat, S. “Supply Chain Management: Text and Cases”, Pearson, 2009
4. Raghuram, G and Rangaraj, N. “ Logistics and Supply Chain Management: Cases and Concepts” , Macmillan, 2000
5. Simchi, L.D., Kaminski. P., Simchi, L.E. “Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies” , 2nd edition, Irwin/McGraw- Hill, 2003

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Semester-II

FT-500 Post Harvest Processing Of Fruits & Vegetables

OBJECTIVE

The course aims to develop the knowledge of students in the area of vegetable and fruit processing and technology. This course will enable students to appreciate the application of scientific principles in the processing of these materials.

Unit-I

Post Harvest of Fruits & Vegetables: Fruit and vegetable production, classification, structure and composition, Importance and scope of pre harvest and postharvest management of fruits and vegetables in Indian economy, post-harvest losses, Maturity indices and standards for selected fruits and vegetables, instrumental methods of maturity determination, standards and specifications for fresh fruits and vegetable, Assessment of fruit quality, Advances in non-destructive quality measurement of fruits and vegetables.

Unit-II

Post Harvest Changes in Fruits & Vegetables and their Primary Processing Operations:

Post-harvest physiological and biochemical changes in fruits and vegetables, ripening of climacteric and non-climacteric fruits, changes during ripening, role of ethylene in fruit ripening, ripening chambers, Field heat of fruits and vegetables and primary processing operations postharvest treatments, Advances in pre-cooling, equipment commodity pretreatments-chemicals, types of coating, pre-packaging, irradiation, blanching, peeling and other pre-processing operations, transportation and storage operations, Mechanism and advances in CA and MA, hypobaric storage, cold storage design, Zero energy cool chamber.

Unit-III

Harvesting Tools and Post-Harvest Handling Operations: Advanced harvesting tools and their design aspects, advances in Post-harvest handling operations, Cleaning, washing of fruits and vegetables, types of cleaners, screens, types of screens, rotary screens, vibrating screens, machinery for cleaning of fruits and vegetables (air cleaners, washers), cleaning efficiency, care and maintenance, Sorting and grading: Sorting, grading, methods of grading, Size grading, color grading, specific gravity grading, screening, equipment for grading of fruits and vegetables, grading efficiency, care and maintenance, Separation: Magnetic separator, de stoners, electrostatic separators, pneumatic separators.

Unit-IV

Post-Harvest Diseases & Disorders and their Remedies: Post-harvest disorders chilling injury and diseases, Biological, Physical and Chemical control of post-harvest diseases, Advances in drying and packaging of fruits and vegetables, Cushioning materials used in packaging of fresh fruits, Minimal processing.

Unit-V

Post-Harvest Handling of Grains: Crop drying principles and methods, Grain storage: principle and structures, Design of storage bins, Storage quality attributes of stored produce, Causes of wastes and pretreatments for minimizing losses during storage.

OUTCOME**No. of Lecture: 45**

On completion of the course the students are expected to

- Be able to understand and identify the specific processing technologies used for vegetables and fruits and the various products derived from these materials.
- Understand the application of scientific principles in the processing technologies, product specification and regulations.
- Grasp the changes in the composition of foods with respect to the type of processing technology used

Books Recommended:

1. Postharvest Biology and Handling of Fruits and Vegetable by N.F. Haard and D.K. Salunkhe
2. Post-harvest Technology of Horticultural Crops by A.A. Kader
3. Handbook of Fruit Science and Technology, Production by D.K. Salunkhe and S.S. Kadam
4. Post-Harvest Technology of Fruits and Vegetables by A.K. Thompson
5. Advances in Postharvest Fruit and Vegetable Technology by B.H. Wills-Ron and J.B. Golding

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Semester-II

FT- 514 Functional Foods and Ingredients (3+1+0)

OBJECTIVE:

To impart the concept of nutraceuticals, functional ingredients and foods and their role in health and disease

UNIT I

Need For Functional Foods: Lifestyle changes & diet, lifestyle diseases like cardiovascular diseases, diabetes, cancer and effects of diet in their control

UNIT II

Nutraceuticals & Phytochemicals: Definition of Nutraceuticals and difference from nutrients. Traditional Health Sciences including Ayurveda, Unani, Chinese etc. Benefits of Nutraceuticals in controlling certain diseases; Natural Occurrence of certain phytochemicals and their usefulness in functional foods with following examples: Antioxidants and Flavonoids; Omega-3 Fatty Acids; Carotenoids; Dietary Fibre; Phytoestrogens; Glucosinolates; Organosulphur Compounds etc. their effectiveness in specific disease conditions; other functional ingredients in foods such as peptides, fatty acids, antimicrobial compounds; Clinical Studies including Structure-Activity relationship of active compound. Dosage for effective control of disease or health benefit with adequate safety; Studies with animals and humans; acute and chronic studies. Sea weeds as functional foods and as source of functional ingredients.

UNIT III

Pre- & Probiotics: Usefulness of Probiotics & Prebiotics in gastrointestinal health and other benefits. Examples of useful microbes and their benefits; Prebiotic ingredients in foods; types of prebiotics and their effects on gut microbes.

UNIT IV

Preparation Of Phytochemicals From Plant Materials: Care in handling and storage of raw material with minimal damage to sensitive bioactive compounds; Extractive methods for maximum recovery and minimal destruction of active material; Stability studies.

UNIT V

Development Of Functional Foods: Developing Functional Foods; Use of bioactive compound in appropriate form with protective substances and activators; Effect of environmental conditions in food matrix on activity of bioactive compound; Effects of processing conditions and storage; Development of biomarkers to indicate efficacy of functional ingredients; Research frontiers in functional foods; delivery of immunomodulators / vaccines in functional foods.

OUTCOME

No of Lecture: 60

- To understand the different nutrient and non-nutrient functional ingredients and their sources
- To understand the role of phytochemicals and nutraceuticals in health and their therapeutic applications

Books Recommended

1. Wildman, Robert E.C. "Handbook of Nutraceuticals and Functional Foods", 2nd Edition, CRC/Taylor & Francis, 2007

2. Schmidl, M.K. and Labuza, T.P. "Essentials of Functional Foods", Aspen Publications, 2000
3. Vaclavik, V.A. and Christian, E.W. "Essential of Food Science", 2nd Edition, Springe

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Semester-III

FT-512 Engineering Properties of Food (3+1+0)

OBJECTIVES:

1. To understand the area of Food engineering
2. To elaborate the basic concepts of material and energy balance, fluid dynamics, thermal process calculations etc.

Unit-I: Physical properties of Foods

Mass-Volume-Area–Related Properties: size, shape, roundness, sphericity, geometric mean diameter, surface area, projected surface area, resemblance to geometric bodies, volume, bulk density, true density, specific gravity, porosity and their measurement. Particle Size Distribution, Acoustic properties of foods.

Unit-II: Rheological Properties of Foods

Stress, strain, elastic limit, modulus of elasticity, poisson's ratio, shear strength, compressive strength, tensile strength, yield point, yield strength, deformation, bio yield point, rupture point, stiffness, elasticity, plasticity, degree of plasticity, toughness, resilience, mechanical hysteresis, viscoelasticity, stress relaxation, relaxation time, creep, retardation time, Mechanical models, Newton's Law of Viscosity; Newtonian Fluids; Non-Newtonian Fluids; ideal and non-ideal Plastic Fluids; ideal and non-ideal viscous Fluids; ideal and non-ideal solids, Viscometry, Texture profile analysis, Dough Testing Instruments

Unit-III: Thermal, Hydrodynamics and aerodynamic Properties of Foods

Thermal conductivity, Heat capacity, specific heat, thermal diffusivity, methods of determination steady state and transient heat flow. **Hydrodynamics and aerodynamics properties of foods:** Terminal velocity, drag coefficient, Reynold's number, application of aerodynamic properties to food products.

Unit-IV: Electromagnetic Properties of Foods

Colour, reflectance, diffraction, absorption, radiation, lightness, hue, chroma, saturation, value, gloss, tristimulus values of colour, CIE and Lab colour system, application of optical properties in food processing. **Dielectric properties:** dielectric constant, dielectric loss, power factor, dielectric heating, dielectric loss tangent, application of dielectric properties in food processing.

Module-V: Sorption & Surface Properties of Foods

Criteria of equilibrium, Raoult's and Henry's Law, colligative properties, water activity, effect of temperature on water activity, sorption isotherms, Hysteresis, Empirical equations such as GAB, BET, Peleg models etc. Surface tension, Laplace, Kelvin, Young & Dupre equation, colloidal systems of foods.

OUTCOMES:

No. of Lecture: 60

After the completion of the course, the students will be able to:

- Understand various basic aspects of food engineering.
- Grasp the knowledge about fluid flow of foods.

Reference Books

Engineering Properties of Foods M. A. Rao and others

Physical Properties of Foods Sahin S. and Sumnu

Physical Properties of Plant and Animal Materials N.N. Mohesnin

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Semester-III

FT-601 Advanced Food Packaging (3+0+0)

OBJECTIVE

The course aims to develop the knowledge of students in the area of packaging of foods and the related technology used. This course will enable students to appreciate the application of scientific principles in the packaging of foods.

Unit – I

Active Packaging Techniques and intelligent Packaging Techniques, current use of novel Packaging Techniques, consumers and novel Packaging.

Oxygen Scavenging Technology: Selecting right types of Oxygen Scavenger, Ethylene Scavenging Technology, Carbon Dioxide and other Scavengers, Antimicrobial Food Packaging: Antimicrobial agents, Constructing an antimicrobial packaging system, Factors affecting the effectiveness of antimicrobial packaging.

Unit – II

Non-migratory bioactive polymers (NMBP) in food packaging: Advantages of NMBP, Inherently bioactive synthetic polymers: types and application, Polymers with immobilized bioactive compounds and their applications.

Time-temperature indicators (TTIs): Defining and classifying TTIs, Requirerments for TTIs, Development of TTIs, Maximizing the effectiveness of TTIs, Using TTIs to monitor shelf life during distribution.

Unit – III

The use of freshness indicator in packaging: Compounds indicating the quality of packaged food products, Methods for Spoilage Detection: Biosensors, Electronic nose.

Packaging-flavour interaction: Factors affecting flavour absorpstion, role of food matrix, role of differing packaging materials, **flavour modification and sensory quality. Moisture regulation: Silica gel, clay, molecular sieve, humectants, salts, irreversible adsorption**

Developments in modified atmosphere packaging (MAP): Novel MAP applications for fresh prepared produce, Novel MAP gas, testing novel MAP applications, Applying high oxygen MAP, **Combining MAP with other preservative techniques.**

Unit – IV

Recycling packaging materials: Recyclability of packaging plastics, improving the recyclability of plastics packaging, testing safety and quality of recycled materials, using recycled plastics in packaging. Green plastics for food packaging: Problems of plastic

packaging wastes, range of biopolymers, developing novel biodegradable materials. Creating Intelligent packaging, storage and distribution: alarm systems and TTIs, Traceability: radio frequency identification, Safety and legislative aspects of packaging: Regulatory considerations, plastic, metal, paper and glass packaging

OUTCOME:

Number of Lectures : 45

The students will gain knowledge on

- The different types of materials and media used for packaging foods.
- Hazards and toxicity associated with packaging materials and laws, regulations and the monitoring agencies involved in food safety, labeling of foods
- Methods of packaging, shelf life and food factors affecting packaging

Books Recommended

1. Novel Food Packaging Techniques by Ahvenainen
2. Food Packaging by Robertson
3. Handbook of Package Engineering by Hanlon, Kelsey & Forcinio
4. A Handbook of Food Packaging by Paine and Paine

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Semester-III

FT-603 Instrumental Techniques in Food Analysis (3+0+0)

OBJECTIVE To enable the students to understand the principles and methods of advanced techniques in the analysis of foods

Unit – I

Principles of techniques used in food analysis: Classical methods: Titrimetric analysis, Gravimetric procedures, Solvent extraction methods, Refractometry, Polarimetry.

Methods of analysis: Proximate constituents: Total fat, crude fiber, protein, moisture, minerals analysis. Adulterations, Rheological analysis, Textural profile analysis of foods.

Unit – II

Spectroscopy: UV-Visible spectroscopy, Atomic absorption spectroscopy, Flame photometry, Fluorescence spectroscopy, Emission spectroscopy, Mass-spectroscopy, Fourier Transform Infra-Red. Methods of separation and analysis of biochemical compounds and macromolecules: Principles and applications of Gas Chromatography, Mass Spectroscopy, High Performance Liquid Chromatography, HPTLC (high-performance thin layer chromatography), Thin layer chromatography, gel permeation, ion-exchange,

Unit – III

Microscopic techniques: Light microscopy, Scanning electron microscopy, Transmission electron microscopy, particle size analysis, Thermal techniques in food analysis: Differential scanning calorimetry and Thermo gravimetric analysis.

Unit – IV

Electrophoresis: Different kinds of electrophoresis, western blotting, gel documentation, DNA analysis: DNA purification, PCR-based analysis, DNA fingerprinting.

OUTCOME

Number of Lectures : 45

The students will learn the following skills:

- To apply different methods of extracting food components
- To use different types of spectrophotometers
- To use instruments that analyze the physical properties of foods

Books Recommended:

1. Pare, J. R. J. and Bélanger, J. M. R. (2015). *Instrumental Methods of Food Analysis*: Elsevier
2. Pomeranz, Y. and Meloan, C. E. (1996). *Food Analysis: Theory and Practice* (3 ed.): CBS Publications, New Delhi.
3. Winton, A. L. (2001). *Techniques of Food Analysis*: Agrobios, Jodhpur.
4. Sharma, B. K. (1994). *Instrumental Methods of Chemical Analysis*: Krishna, Meerut.
5. Skoog, D. A., Holler, F. J. and Nieman, T. A. (1998). *Principles of Instrumental Analysis* (5 ed.): Harcourt, Singapore.
6. Spectral method in food analysis by Magdi Mossoba, 1999

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Semester-III

FT-611 Flavour Technology (3+0+0)

OBJECTIVE This course aims to explain the flavour, Spice and Plantation crops application in food industry

Unit I

Introduction: Fundamentals of flavour, Classification of food flavour, flavour profile, factors affecting flavours, bioflavour and reconstituted flavour, flavour release from foods, interaction of flavour compounds with foods. Flavour Extraction: Methods of flavour extraction, isolation, separation and equipment

Unit – II

Flavour Precursors: Flavour Compounds from Carbohydrates and Proteins, Lipid oxidation
Flavour intensifiers: Flavour intensifiers and their effects, Chemistry and technology of various flavour intensifiers. Flavour Biogenesis: Fruit aroma, vegetable aroma, Methyl ketones, diacetyl, acetaldehyde, lactones, terpenes, esters, pyrazines, vanilla flavour, enzyme and fermentation flavours

Unit – III

Process Flavours: Effect of processing on flavour compounds, Non enzymatic browning, heat reaction flavours. Food Flavours: Flavour constituents: Onion, garlic, cheese, milk, meat, wine, coffee, tea, chocolate etc.

Unit – IV

Flavour encapsulation and stabilization: Principles and techniques of flavour encapsulation, types of encapsulation, factors affecting stabilization of encapsulated flavour and their applications in food industry, Packaging and flavour compounds interaction, Storage, processing, transportation and environmental effects on flavour components / constituents.

OUTCOME

Number of Lectures: 45

- To understand the flavor profiling, analytical and processing techniques, quality aspects of flavor, spices and plantation products
- To acquire knowledge about stability studies on storage, processing, transportation

Books Recommended:

1. Source Book of Flavours by Reineccius, G.
2. Flavour chemistry and technology by Heath, H. B.
3. Food Flavour by Morton, I. D., Macleod A. J.
4. Bioprocess Production of Flavour, Fragrance, and Color Ingredients by Gabelman, A.
5. Food Flavours by Ashurst P. R.

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Semester-III

FT-605 Frozen Foods and Cold Chain Management(3+0+0)

OBJECTIVE

To provide an introduction to the concepts and tools of supply chain management in the food and beverage industry

Unit -I

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

Unit -II

Cold chain management system: 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. Stages and points of control in cold storages and structures. Cryogenic system in food application: introduction to cryogenic system, low temperature properties of engineering materials, cryogenic fluid storage and transfer systems.

Unit-III

Quality and safety of frozen foods: 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 of 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: 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. Time indicators (TTI), Time, Temperature, Correlation, The kinetic approach, Effective temperature Transportation regulation

Unit-V

Packaging of frozen foods: 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. Role of packaging in cold chain, MAS, MAP, CAS, CAP etc.

OUTCOME

No. of Lecture : 45

- To demonstrate an awareness of the role of supply chain management in competitive strategy in the food and drinks industry
- To get a critical understanding of the buyer-supplier relationship debate
- To be aware of the challenges involved in identifying, acquiring and managing the various resources required in food supply chains
- To Develop a conceptual appreciation of the key supply chain management processes and their role in satisfying customer demands

Books Recommended:

Food Processing Technology –Principles and application by Fellows, P.J
The Freezing Preservation of Foods by Tressler D.K.& EversC.F
Cold and Chilled Storage Technology by Clive DellinoD.J
Frozen Food Technology by Ed.Mallet C.P

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Semester-III

FT-609 Food Industry Waste Management (3+0+0)

OBJECTIVE: To create awareness about environmental issues in food industry

Unit-I

Characterization and utilization of by-products from cereals, pulses, oilseeds, fruits, vegetables, plantation, dairy processing industries, and fermented food industries

Unit-II

primary treatments: Screening, sedimentation, floatation, Various types of biological reactions occurring in biological oxidation (Methanogenesis, nitrification, denitification, biomass synthesis, endogenous respiration, photosynthesis, type of air diffusers, lagoons, oxidation ditches, rotating biological contactor, trickling filters.

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 management 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 and disposal of sludge.

Unit-V

Standards for emission or discharge of environmental pollutants from food processing industries covered under PFA Act., 1986.

OUTCOME

Number of Lectures : 45

To acquire knowledge about Environmental pollutions, its measurements and management
To initiate projects on methods of utilizing wastes to make value added products
To understand and design Air duct and room air distribution for the basic control of Air Quality,
Waste Water Treatment

Books Recommended:

1. Water technology by N.F.Gray.
2. Environmental pollution by K.C.Agrawal.
3. Industrial microbiology by L.E.Casida Jr
4. Environmental pollution control engineering by C.S. Rao.
5. Food processing waste management by Green and Kramer (AVI)

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Semester-III

FT-607 Advances in Dairy Engineering and Technology (3-0-0)

OBJECTIVE To provide in-depth knowledge in various unit operations and basic concepts in dairy processing

Unit – I

Introduction: Physico-thermal properties of milk and milk products and its application in processing and equipment design

Homogenization of milk: Principle of homogenization, single and double stage homogenizers, care and maintenance of homogenizers, design principles of homogenizers, application of homogenization in dairy industry

Unit – II

Tanks, Pumps, Stirrer mixtures: Designs and equipment of tank, types of tanks, pumps in dairy industry, Agitation and mixing, construction of agitators, patterns of flow & power consumption

Thermal processing of milk: Pasteurization of milk; batch, flash and continuous pasteurizer, HTST pasteurizer and design principle and thermal death kinetics, care and maintenance, UHT processing of milk, quality changes during processing of milk

Unit – III

Concentration of milk: Evaporator, types of evaporator, machineries, heat and mass balance in single and multiple effect evaporator, performance characteristics of evaporators and their selection criteria, steam economy

Unit – IV

Spray and drum drying: Theory of drying, estimation of drying rates and drying time, drying equipments, particle size calculation, design of spray and drum dryer

Dairy products: Frozen dairy products, Cheese, Casein and its derivatives, Lactose their composition, standards, manufacturing, process control and quality control parameters

OUTCOME

Number of

Lectures : 45

To understand the principle and significance of

- Various Processing Methods (both thermal and emerging non-thermal) of market milk and milk product in dairy plant
- Dairy engineering inputs to dairy plant

- Dairy products analysis, Sanitation and Hygiene requirements

Books Recommended:

1. Dairy products by Lampart, Lincoln M.
2. Milk and Milk Products by Eckles, Comb and Macy
3. Dairy Engineering by John T Bowen

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Semester-III

FT-617 Therapeutic Foods (3+0+0)

OBJECTIVE

To impart the concept of nutraceuticals, functional ingredients and foods and their role in health and disease

Unit I

Nutrition and therapeutic foods. RDA / RDI. Utilization of nutrients in Human body. Balanced Diets, Therapeutic diets, Infant and baby foods, Adolescent / Teen-age foods.

Unit II

Geriatric foods, Functional foods and Probiotics. Calorie, and Sodium modified/ restricted foods/ diets. Amino acids and purine restricted foods/ diets. Foods / Diets in metabolic disorders and disturbances. Foods for allergic and ulcerous conditions.

Unit III

Foods for pregnant ladies and nursing mothers. Foods in Gastrointestinal disorders; Fever and Infection; Liver, gallbladder and pancreatic disturbances.

Unit IV

Foods and Diets in blood, circulatory and cardiac diseases; Urinary and Musculoskeletal diseases.

OUTCOME

No. of Lectures: 45

- To understand the different nutrient and non-nutrient functional ingredients and their sources
- To understand the role of phytochemicals and nutraceuticals in health and their therapeutic applications

Books Recommended:

1. Human Nutrition : Ben-Zamin T. Burton
2. Dietetics : B. Srilakshmi
3. Nutrition and Dietetics: Shubhangini A. Joshi
4. Nutritive value of Indian Foods : C. Gopalan :

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Semester-III

FT-613 Fermented Foods and Bioprocess Engineering (3-0-0)

OBJECTIVES:

- To understand the Enzyme kinetics, Inhibition kinetics, Immobilization
- To understand the concept of basic fermentation processes and its control systems etc.
- To help students acquire a sound knowledge on diversities of foods, food habits and patterns in India with focus on traditional foods.

Unit-I

Fermentation process. Importance of Fermented products. Isolation and maintenance of pure culture. Preparation of substrates/media, inoculums. Rate of microbial growth and death. Fermentation kinetics, Mushroom cultivation

Unit-II

Types of fermentation sub-merged/solid state, Batch /continuous fermentation. Fermenter design, operation, measurement and control in fermentation. Process variables and its control, recovery of fermentation products and conversion into marketable /storage forms. Aeration and agitation in fermentation: Oxygen requirement, measurement of adsorption coefficients, sterilization of air and media; scale up in fermentation.

Unit-III

Production of bakers yeast, food yeast, Single Cell Protein, beer, wine, cider, vinegar, organic acids and enzymes Lactic acid fermentation of milk, vegetables, cereals and meat, mixed fermentation of cereal legumes and milk. Alcoholic fermentation of fruit juices, sugar and starch substrates.IMFL/ distilled spirits.

Unit-IV

Oriented Fermented Products, soy sauce, pickles, fermented milks and cheeses. Microbial fats.

Indian traditional sweet, savoury and snack food products: Sweets, Namkins, Papads, wari, Idli, Dosa, Dhokla etc.

OUTCOMES:

No. of Lecture: 45

The student will be able to

- Understand the fundamentals of Enzyme kinetics, Inhibition kinetics and Immobilization
- Understand the concept of basic fermentation processes and its application during scaleup operations.

Books Recommended:

1. Industrial Microbiology - Prescott and Dunn
2. Industrial Microbiology - L.E. Casida
3. Principle of Fermentation Technology - Whittaker and Stanbury
4. Handbook of Indigenous Fermented Foods - K.H. Steinkrus
5. Food Microbiology - Adams and Moss
6. Mushroom Cultivation - J. N. Kapoor, ICAR

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Semester-III

FT-615 IPR and Patenting in Food technology (3-0-0)

OBJECTIVES:

- Follow research ethics
- Understand relevance and significance of IPR

Unit-I

Concept of property, rights, duties and their correlation; History and evaluation of IPR; Copyrights and related rights. Distinction among various forms of IPR.

Unit-II

Patent rights/protection and procedure; Infringement or violation; Remedies against infringement; Indian Patent Act 1970 and TRIPS; Geographical indication and Industrial design.

Unit-III

International Registration systems; WIPO treaties; Unfair competition; Protection of new plant varieties;

Unit-IV

Legal implications and public concerns in genetic modification of foods; National policies on food security.

OUTCOMES:

Number of Lectures : 45

At the end of this course, students will be able to

- Understand research problem formulation.
- Analyze research related information

Books Recommended:

1. Santaniello, Evenson, Ziberman, Carlson – Agriculture and Intellectual Property Rights, Univ. Press, 1998
2. S. K. Chakraborty : Values and Ethics in Organization, OUP
3. A. N. Tripathi : Human Values, New Age International
4. Economic Reforms And Food Security: The Impact of Trade and Technology in South Asia by Suresh Chandra Babu, Haworth Press
5. Intellectual property rights in Agricultural Biotechnology; Edited by Erbisch, Maredia; CABI

FT651 Seminar II

(1Credit)

FT653-Dissertation-I

(5Credit)

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DEPARTMENT OF FOOD PROCESSING AND TECHNOLOGY
M. Tech (Food Processing and Technology)
(EFFECTIVE FROM SESSION 2019-20)

Semester-IV

FT654-Dissertation-II
(15Credit)

1. MOOCS courses –I (3+0+0)
2. MOOCS courses –II (3+0+0)