INDEX

BSC (Hons.) Food Technology (SEM- IV/V)

SEMESTER 4

UG Programme for Bachelor in B.Sc. Hons Food Technology

DISCIPLINE SPECIFIC CORE COURSE

DSC FT10: Food Quality Management

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
FOOD QUALITY MANAGEMENT	4	3	0	1	XII Pass with PCM/PCB	NIL

Learning Objectives

- To appreciate the significance of food quality assurance in food processing.
- To comprehend approaches to Food Quality Management.
- To understand Food Quality Management during food production.

Learning Outcomes

After completing this course, students will be able to:

- Apply knowledge of food quality management in food value chain.
- Understand the dynamics and Techno- managerial approaches in the agri- food chain.
- Apply food recall and traceability protocols to assure food quality.
- Identify different contaminants formed during food production.

SYLLABUS OF DSC FT10

THEORY
Credits: 3; Hours: 45

UNIT I: Introduction to Food Quality **15 Hours**

Unit Description: This unit will provide concept of food quality management and assurance in the agri- food chain.

Subtopics:

- Definition of food quality: concepts, perception, attributes.
- Quality control and quality assurance.
- Food quality management functions.
- Food quality relationship and its management in the agri- food production chain.

UNIT II: Approaches to Food Quality Management. **15 Hours**

Unit Description: This unit will provide insights on different approaches of quality management, food recall and traceability in the agri -food production chain.

Subtopics:

- Dynamics in the agri- food chain.
- Techno- managerial approach in Food Quality Management.
- Core developments in food quality management
- Food Recall
- Food Traceability

UNIT III: Food Quality Management during food production. **(15 Hours.)**

Unit Description: This unit will provide information on contaminants formed during processing and packaging of foods. Major focus will be on emerging concerns with food contaminants.

Subtopics:

- Contaminants formed during processing & packaging – nitrosamines, acrylamide, alloys, benzene, dioxins, 3- mono chloro 1,2-propanediol (3-MCPD), furans, and methyl furans, VOCs.
- Persistent organic pollutants, PAH (Polycyclic Aromatic Hydrocarbons), Heterocyclic amines (HCAs), fumigants, autoxidation products.
- Emerging concerns in food- Microplastics, Bisphenol A, Endocrine Disruptors, hypersensitivities from food additives.

PRACTICAL
Credit : 1, Hours: 30

1. Determination of quality standards and inspection of various food grains- cereals and -nutri - cereals/millets.
2. Determination of quality standards and inspection of pulses.
3. Determination of quality standards and inspection of spices and condiments.
4. Perform qualitative tests for fats and oils.
5. Determination of non-permitted colours in fruits and vegetables.
6. Estimation of ammonia nitrogen in water.
7. Prepare an effective HACCP plan for any food commodity or process in the food chain.

Essential Readings

- Pieternel A, Luning. &Willem, J. Marcelis. (2009). *Food Quality Management Technological and Managerial principles and practices*. Wageningen.
- Lawley, R., Curtis, L., & Davis, J. (2012). *The food safety hazard guidebook*. Royal Society of Chemistry.
- DeMan. (2007). *Principles of Food Chemistry*. Springer, 3rd edition.

Suggested Readings

- Carol, E., Steinhart, M. and Ellin, D. (1995). *Food Safety*, Food Research Institute. New York: Marcel Dekker, Inc
- Shapton, D.A. and Shapton, N.F. (1998). *Principles and Practices for the safe processing of Foods*. CRC Press.

DISCIPLINE SPECIFIC CORE COURSE

DSC FT11: Poultry & Egg Processing Technology

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Poultry & Egg Processing Technology	4	3	0	1	XII Pass with PCM/PCB	NIL

Learning Objectives

- To understand primary processing of poultry, chicken quality and by-product utilization.
- To understand HACCP models for poultry processing.
- To understand egg production practices, and egg preservation methods.
- To understand egg quality and development of value-added products.

Learning Outcomes

After completing this course, students will be able to:

- Understand the need and importance of egg and poultry industry.
- Comprehend egg production and poultry product processing.
- Acquire knowledge about application of HACCP model for poultry processing.
- Understand value-addition and by-product utilization

SYLLABUS OF DSC FT011

THEORY
Credits: 3; Hours: 45

Unit 1 Introduction **5 Hours**

Unit Description: The unit will provide an understanding of the status and development of the Poultry industry, chicken quality, and processing of poultry and by-products.

Subtopics:

- Development of Poultry industry in India and its need in nation's economy,
- Chicken Quality - Color, Flavor, Texture, Water-Holding Capacity (WHC), Emulsification capacity.

Poultry products processing **15 Hours**

- Primary processing of poultry,
- Inspection, Grading, Cut Up and Composition, ante-mortem and post-mortem inspection of poultry,
- A Generic HACCP model for poultry slaughter.
- Processing of enrobed poultry products, HACCP for a Cooked Product Model.
- Poultry by-products.

UNIT II: Egg Industry and Egg Production Practices **12 Hours**

Unit Description: The unit will provide knowledge on the status and development of the Egg industry, and management of poultry farms.

Subtopics:

- The egg industry , Production of shell eggs
- Laying stock, Brooding period
- General management of Poultry farm.

UNIT III: Quality identification of shell eggs **5 Hours**

Unit Description: The unit will provide an understanding of the factors that affect egg quality. Measures of egg quality will also be covered.

Subtopics:

- Grading of shell eggs
- Factors affecting egg quality
- Measures of Albumen and Yolk quality

UNIT IV: Preservation of eggs **8 Hours**

Unit Description: The unit will provide information on the functional properties of eggs and different egg product processing and preservation techniques.

Subtopics:

- Refrigeration and freezing, egg powder manufacture, egg coatings.
- Functional properties of eggs and development of value-added products

PRACTICAL
Credit : 1, Hours: 30

1. To study the shelf-life of eggs by different methods of preservation
2. Evaluation of eggs for quality parameters (market eggs, branded eggs)
3. To perform freezing of yolk/albumen
4. Egg product formulation.
5. Cut out analysis of canned chicken/retort pouches (external parameters).
6. Cut out analysis of canned chicken/retort pouches (internal parameters).
7. Planning generic HACCP model for poultry.
8. To prepare flow chart of enrobed chicken products/evaluate the quality of enrobed chicken products (chicken nuggets).

Essential Readings

- Shai, Barbut. (2016). Poultry Products Processing. An Industry Guide. CRC Press.
- Stadelman, W. J., Newkirk, D., & Newby, L. (2002). *Egg science and technology*. 4th ed. New Delhi: CBS Publication.
- Isabel Guerrero-Legarreta, Hui,Y.H .et.al.(2010)Handbook of Poultry Science and Technology, Volume 2:Secondary Processing. Wiley Publication

Suggested Readings

- Owens, C. M. (2010). *Poultry meat processing*. CRC Press.
- Richardson, R.I.,Mead,G.C(2005)Poultry meat Science New Delhi:CABI Publishing
- Parkhurst, C., &Mountney, G. J. (1997). *Poultry meat and egg production*. New Delhi: CBS Publishers

DISCIPLINE SPECIFIC CORE COURSE

DSC FT12: Food Engineering- I

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Food Engineering- I	4	3	0	1	XII Pass with PCM/PCB	Nil

Learning Objectives

- To understand the concept of unit operation, units and dimensions.
- To comprehend the different Heat and mass transfer, refrigeration and Freezing operations.
- To understand the fundamentals of food engineering systems and its process.

Learning Outcomes

After completing this course, students will be able to:

- Understand the principle of unit operation.
- Apprehend the different methods of separation in the food industry.
- Acquire the basic knowledge of thermal properties, methods of heat transfer and mass transfer, principles of refrigeration and freezing.
- Apply these principles for solving numerical problems.

SYLLABUS OF DSC FT12

THEORY
Credits: 3; Hours: 45

UNIT I: Introduction **6 Hours**

Unit Description: The unit will provide information on the concept of unit operation, mass balance and energy balance system.

Subtopics:

- Concept of Unit operation
- Units and dimensions, Unit conversions, dimensional analysis
- Mass and Energy Balance

UNIT II: Separation Processes 12 Hours

Unit Description: The unit will provide an insight into the principle and equipment design of various separation processes like distillation, extraction, centrifugation, filtration and sedimentation.

Subtopics:

- Distillation principles and methods: steam, batch, continuous distillation with rectification and stripping.
- Extraction : Hildebrandt, Bollman, SCF extraction
- Filtration : Plate and frame, pressure leaf, continuous rotary vacuum, batch and continuous filtration
- Centrifugation: Tubular, disc bowl and basket centrifuge
- Sedimentation : continuous thickener

UNIT III: Heat and Mass Transfer 15 Hours

Unit Description: The unit will provide knowledge of thermal properties of food, design and derivation of heat and mass transfer systems and applications.

Subtopics:

- Systems for heating and cooling food products
- Thermal Properties of Food
- Modes of heat transfer- Conduction, Convection and Radiation
- Applications of steady state heat transfer, estimation of conductive heat transfer coefficient, convective heat transfer coefficient, overall heat transfer coefficient and design of tubular heat exchanger
- Fick's Law of Diffusion
- Related basic numerical
- Membrane separation systems-Electrodialysis system , Reverse Osmosis, Ultra filtration, Microfiltration
- Membrane devices used for RO and UF: Plate and Frame, Tubular, Spiral wound and hollow fiber devices

UNIT IV: Refrigeration and Freezing 12 Hours

Unit Description: The unit will provide concept of refrigerants, VCR cycle, components of Refrigeration system and freezing time calculations

Subtopics:

- Concept, properties and selection of refrigerants
- Description of Vapor compression refrigeration (VCR) cycle
- Pressure Enthalpy charts and Tables
- Mathematical expressions useful in analysis of VCR cycle
- Numerical on VCR system using R -134a, R-717, R-12; Saturated cycle and deviations from the standard
- Freezing time calculation using Plank equation
- Frozen food storage

PRACTICAL
Credit : 1, Hours: 30

1. Mass and Energy Balance Calculations
2. Determination of alcohol insoluble solids using extraction process
3. Determination of the osmotic pressure of the given sample
4. Estimation of sedimentation rate
5. Determination of thermal properties of the given samples
6. Mathematical Design of Heat exchanger
7. Cooling refrigeration load calculations.
8. Determination of Convective heat transfer coefficient and freezing time
9. Determination of freezing point depression in given solution

Essential Readings

- Rao, D.G. (2010). *Fundamentals of food engineering*. PHI learning private ltd.
- Singh, R.P. and Heldman, D.R. (2009) *Introduction to food engineering*2nd edition. 4th edition Academic press.
- Singh, R.P. and Heldman, D.R. (2014) Introduction to food engineering 5th edition. Academic press

Suggested Readings

- Earle, R.L. (1983).*Unit Operations in Food Processing,* 2nd edition. Pergamon press.
- Fellows, P. (2009).*Food processing technology*. Woodhead publication, 3rd edition
- Garg, M., Chaturvedi, S., Sadhu, S.D. and Barwa, M. and Pani. B ., (2020) Practical Handbook of Food Engineering Aryush Education, ISBN NO. 978-81-930437-5-2

DISCIPLINE SPECIFIC ELECTIVE COURSE

DSE FT02 A: Bakery Technology

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Bakery Technology	**4**	**2**	0	**2**	**XII Pass with PCM/PCB**	**Nil**

Learning Objectives

- To understand the fundamentals of baking and technology of various bakery products.
- To understand basic knowledge, importance, quality and safety concerns in bakery industry.
- To understand technology used in modified bakery products for different health conditions.

Learning Outcomes

After completing this course, students will be able to:

- Understand the fundamentals of baking.
- Acquire the knowledge of technologies of bakery products.
- Understand trends in bakery industry.
- Get an overview of modified bakery products for different health conditions

SYLLABUS OF DSE FT03

THEORY
Credits: 2; Hours: 30

UNIT I: Introduction **5 Hours**

- Bakery industry, current status and economic importance of bakery Industry in India.

- Nutritional quality and safety, pertinent standards & regulations, safety concerns

UNIT II: Bakery products **18 Hours**

- Bread, Buns and Pizza base: Ingredients & processes for breads, buns, pizza base, changes taking place during baking, product quality characteristics, faults and corrective measures
- Cakes: Ingredients & processes for cakes, product quality characteristics, faults and corrective measures. Different types of icings.
- Pastry: Ingredients & processes for pastry, product quality characteristics, faults and corrective measures.
- Biscuits and Cookies: Ingredients & processes, product quality characteristics, faults and corrective measures.

UNIT III: Modified bakery products **7 Hours**

- Modification of bakery products for people with special nutritional requirements e.g. high fibre, sugar free, low sugar, low fat, gluten free bakery products, use of fat and sugar replacers, enzymes, egg replacers and natural preservatives in bakery products.

PRACTICAL
Credit: 2, Hours: 60

1. Introduction of tools and equipment used in preparation of bakery products.
2. Quality assessment of wheat flour used in the preparation of baked products.
3. Preparation and acceptability of yeast leavened baked products (bread/ bun/ pizza base).
4. Preparation and acceptability of biscuits.
5. Preparation and acceptability of cookies.
6. Preparation of different types of cakes and their acceptability.
7. Preparation of different types of icings.
8. Development of any bakery product with special nutritional requirement.

Essential readings:

- Zhou, W., Hui, Y. H., Leyn, I. De., Pagani, M. A. , Rosell, C. M. , Selman, J. D., & Therdthai, N. . (2014). *Bakery Products Science and Technology* (Second ed.): John Wiley & Sons, Ltd.
- Dubey, S.C. (2007). Basic Baking 5th Ed. Chanakya Mudrak Pvt. Ltd.

Suggested readings:

- Khetarpaul, N. (2005). Bakery Science and Cereal Technology. India: Daya Publishing House.
- Edwards, W. P. (2015). The Science of Bakery Products. United Kingdom: Royal Society of Chemistry.
- Samuel, A. Matz (1999). Bakery Technology and Engineering. PAN-TECH International Incorporated
- Barndt, R. L. (1993). Fat & Calorie – Modified Bakery Products.US: Springer

DISCIPLINE SPECIFIC CORE COURSE

DSE FT 02 B: Agribusiness Management

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Agribusiness Management	4	2	0	2	XII Pass with PCM/PCB	NIL

Learning Objectives

- To develop an insight of agribusiness management
- To develop an insight for different types of marketing management
- To gain knowledge and acquired skills for setting up an agribusiness and its management.

Learning Outcomes

After completing this course, students will be able to:

- Understand the basic knowledge of Agri-business management
- Develop insight for Agricultural Supply Chain Management
- Examine the role of various type of marketing management in agri-business
- Understand the different support system for agri-business
- Skill Development- After studying this paper, students will be able to identify entrepreneurial potential in agribusiness and explore the scope of sustainable agricultural produce, marketing and supply chain management. This paper would also improve the skill set of the students, enhance their agribusiness managerial skills and leadership quality which will entitle them to work in industries.

SYLLABUS OF DSE FT05

THEORY
Credits 2 (30 Hours)

Unit 1 Concepts and application of agribusiness **15 Hours**

Unit Description: The unit will provide an understanding of the Concepts and application of agribusiness.

Subtopics:

- Nature and Characteristics of Agribusiness

- Agro-based Industries in India
- Agricultural Supply Chain Management
- Strategic Management in Agribusiness
- Contract Farming
- ICT In Agribusiness

UNIT II: Marketing Management **15 Hours**

Unit Description: The unit will provide knowledge on the concept of marketing management

Subtopics:

- Concepts of Marketing
- Marketing management: role of management in agri-business, attributes and responsibility of manager
- New product development and Product life cycle
- Product-mix, 4Ps of marketing

Practical
Credit : 2, Hours: 60

1. Study of various business models in agri-business
2. Case study of Agri business and its aspects
3. Study of farm records & inventory
4. Study of system of book keeping & accountancy
5. Study of farm planning techniques & situations
6. Study of farm budgeting techniques & types
7. Study of balance sheet financial ratio analysis
8. Study of preparation of cash flow plan
9. Visit of Agri business enterprise

Essential Readings:

- Baker, G.A., Grunewald, O. Gorman, W.D. (2002) Introduction to food and agribusiness management: Prentice Hall of India, New Delhi.
- Kottler (1994). Marketing Management: Prentice Hall of India, New Delhi.
- S.S.Johl, T.R.Kapoor (2017) Fundamentals of farm business management: Kalyani Publishers, Ludhiana
- David, D. & Erickson, S. (1987) Principles of Agri Business Management. New Delhi: Mc Graw Hill Book Co.

Suggested Readings:

- Jakobsen, G. & Torp, J.E. (2001). Understanding Business systems in developing countries.
- Ahmad, S.M. (2000). Management Info Guide.
- Prasanna, C. (1996). Projects, Planning, Analysis, Selection, Implementation and Review. New Delhi:Tata McGraw-Hill Publishing Company Limited.
- K. Loknandhan, K. Mani, K. Mahendran (2015). Innovations in Agribusiness Management
- Tripathi (2012). Principles of Management: Tata McGraw-Hill Education

SEMESTER V

B.Sc. Hons Food Technology

DISCIPLINE SPECIFIC CORE COURSE

DSC FT13: Food Microbiology

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Food Microbiology	4	3	0	1	XII Pass with PCM/PCB	Nil

Learning Objectives

- To know the important genera of microorganisms associated with food and their characteristics.
- To understand the role of microbes in fermentation, spoilage and food borne diseases.

Learning Outcomes

Upon completion of this course, students are expected to:

- Recognize and describe the characteristics of important pathogens and spoilage microorganisms in foods.
- Understand the role and significance of intrinsic and extrinsic factors on growth and response of microorganisms in foods.
- Identify ways to control microorganisms in foods.
- Identify the conditions under which the important pathogens and spoilage microorganisms are commonly inactivated, killed or made harmless in foods.
- Describe the beneficial role of microorganisms in fermented foods and in food processing. 6. Utilize laboratory techniques to detect, quantify, and identify microorganisms in foods.
- Acquire, discover, and apply the theories and principles of food microbiology in practical, real-world situations and problems.

- Develop success skills in communication, critical thinking, interaction, information acquisition and interpretation and life-long-learning.

SYLLABUS OF DSC FT13

THEORY
Credits: 3; Hours: 45

UNIT I: Microorganisms in food **15 Hours**

Unit Description: The unit shall introduce students to the world of food microbiology. The structure and growth of bacteria, yeast, mold and virus in food as well as how the intrinsic and extrinsic factors affect the growth of microorganisms shall be taken up. The growth curve of bacteria will be covered to understand various phases of growth.

Subtopics:

- Introduction, history and scope of food microbiology.
- Morphological and physiological features of bacteria, yeast, mold. Introduction to bacterial endospores and capsules. Food borne viruses and their reproduction.
- Growth curve of bacteria.
- Factors affecting growth of microbes in foods.
- Role of microorganism in fermentation, spoilage and food borne diseases.

UNIT II: Cultivation of microorganism **10 Hours**

Unit Description: Isolation and cultivation is the heart of microbiology. Therefore, the various techniques related to their cultivation and enumeration shall be taught. Although some are already taken in practicals but not all of them. A theoretical insight is needed.

Subtopics:

- Principles of cultivation of microorganism (purity, activity etc.).
- Pure culture technique.
- Methods of isolation and enumeration (including latest ones).
- Rapid methods of bacteria detection.

UNIT III: Microbial food spoilage **10 Hours**

Unit Description: Food is the best substrate for the microorganism to grow, multiply and cause undesirable changes. The spoilage of raw as well as processed foods is very common. Therefore, as a food processor the understanding of food spoilage is very important for the students, in order to preserve the food.

Subtopics:

- Sources of microorganism in foods.
- Spoilage in milk, meat, cereals, fruits and vegetables (and few associated products).
- Spoilage in canned foods.

UNIT IV: Food preservation by novel technologies **10 Hours**

Unit Description: There are many convention and new methods of food preservation. The novel methods cause minimum changes in sensory and nutritive properties of food. It is imperative to teach such methods and their application in food preservation.

Subtopics:

- Conventional methods of food preservation- an overview.
- Non-thermal methods such as pulse electric field preservation, high hydrostatic pressure, ohmic heating, irradiation, biopreservation etc. to be familiarized.
- Hurdle concept and minimal processing.

PRACTICAL
Credit: 1; Hours: 30

1. Introduction to the Basic Microbiology Laboratory Practices and Equipment's
2. Functioning and use of compound microscope
3. Cleaning and sterilization of glassware
4. Preparation and sterilization of nutrient broth
5. Preparation of slant, stab and plates using nutrient agar
6. Cultivation and sub-culturing of microbes
7. Morphological study of bacteria and fungi using permanent slides
8. Simple staining
9. Gram's staining
10. Standard Plate Count Method

Essential Readings

- Frazier William C and Westhoff, Dennis C. Food Microbiology, TMH, New Delhi, 2004
- Jay, James M. Modern Food Microbiology, CBS Publication, New Delhi, 2000
- Garbutt, John. Essentials of Food Microbiology, Arnold, London, 1997
- Pelczar MJ, Chan E.C.S and Krieg, Noel R. Microbiology, 5th Ed., TMH, New Delhi, 1993
- W. M. Foster (2020) Food Microbiology. CBS Publishers & Distributors Pvt Ltd.

Suggested Readings

- Bibek Ray and Arun Bhunia. Fundamentals food microbiology, 5th Ed, CRC Press, 2014.
- K.R. Aneja. Experiments in microbiology, plant pathology, tissue culture and microbial biotechnology, New age international publishers, 2018.
- Roger Y. Stanier. General Microbiology, Macmillan,1987.
- K.R. Aneja. Modern Food Microbiology, Medtech, 2018

DISCIPLINE SPECIFIC CORE COURSE

DSC FT14: Food Engineering II

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Food Engineering II	4	3	0	1	XII Pass with PCM/PCB	Pass in DSC FT12 Food Engineering- I

Learning Objectives

- To understand the principle of size reduction and mixing unit operations
- To acquaint with fundamentals of fluid flow process and psychrometrics
- To understand the basics of designing of evaporator and dehydrator

Learning Outcomes

After completing this course, students will be able to:

- Apprehend the principles of size reduction and mixing unit operations.
- Comprehend the applications of fluid flow, steam and psychrometrics
- Understand basic design of evaporator and dehydrator used in food processing
- Apply these principles for solving numerical problems

SYLLABUS OF DSC FT14

THEORY
Credits: 3; Hours: 45

UNIT I: Introduction to Size Reduction and Mixing Operations 10 hours

Unit Description: The unit will provide information on the application of size reduction and mixing unit operations in food processing industry.

Subtopics:

- Introduction of size reduction and mixing operation
- Types of size reduction
- Size reduction equipment (crusher, grinding mill, pulveriser, roller mill, knife cutter)
- Application of size reduction
- Size separation, screening, screening equipment and applications
- Mixing equipment for solids and pastes (Planetary mixer, Kneader, Ribbon mixer, Double cone mixer)
- Applications of mixing in solids and fluids

UNIT II: Fluid Flow in food Processing 11 hours

Unit Description: The unit will provide knowledge of fluid characteristics, viscometers and pressure measuring devices

Subtopics:

- Liquid Transport systems
- Newton's Law of Viscosity
- Principle and operation of Capillary tube and rotational viscometer
- Properties of Non-Newtonian fluids
- Flow characteristics, Reynolds Number, Bernoulli's Equation
- Concept of Flow Measurement devices

UNIT III: Steam and Evaporation 12 hours

Unit Description: The unit will provide an understanding of generation of steam process, functioning and designing of evaporators

Subtopics:

- Generation of steam
- Construction and functions of fire tube and water tube boilers
- Thermodynamics of Phase change
- Steam tables
- Boiling point elevation
- Types of evaporators
- Design of single effect evaporators

UNIT IV: Psychrometrics and Dehydration 12 hours

Unit Description: The unit will provide knowledge of the psychrometrics, dehydration process and designing of dehydrator

Subtopics:

- Properties of dry air, water vapour, air vapour mixture
- Psychrometric Chart and its application
- Basic Drying Process
- Moisture content on wet basis and dry basis
- Dehydration systems
- Dehydration system Design

PRACTICAL
Credit: 1; Hours: 30

1. Screen analysis of food sample
2. Study the effect of temperature on viscosity of Newtonian / non-Newtonian fluids
3. Operation of pressure measuring instrument
4. Study properties of moist air using Psychrometer and psychrometric chart
5. Determination of evaporation rate of given food sample
6. Determine elevation in boiling point of given solution
7. Study steam table and its application
8. Operation of tray dryer and drying process calculations
9. Determination of drying characteristics of given food sample

Essential Readings

- Fellows, P. (2009). *Food processing technology*. Woodhead publication, 3rd edition
- Rao, D.G. (2010). *Fundamentals of food engineering*. PHI learning private ltd.
- Singh, R.P. and Heldman, D.R. (1993) *Introduction to food engineering* 2nd edition. Academic press
- Singh, R.P. and Heldman, D.R. (2014) *Introduction to food engineering* 5th edition. Academic press

Suggested Readings

- Earle, R.L. (1983). *Unit Operations in Food Processing,* 2nd edition. Pergamon press.
- Garg, M.**,** Chaturvedi, S., Sadhu, S.D. and Barwa, M. and Pani. B ., (2020) *Practical Handbook of Food Engineering* Aryush Education, ISBN NO. 978-81-930437-5-2
- Jafari, Seid Mahdi, ed. (2021) Engineering Principles of Unit Operations in Food Processing: Unit Operations and Processing Equipment in the Food Industry. Woodhead Publishing.

DISCIPLINE SPECIFIC CORE COURSE

DSC FT 15: Food Chemistry I

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Food Chemistry I	4	3	0	1	XII Pass with PCM/PCB	Nil

Learning Objectives

- To understand the composition of food.
- To learn the structure, interaction, importance & stability of macro & micro components.
- To understand the functional aspects of food components and to study their role in food processing.

Learning Outcomes

After completing this course, students will be able to:

- Understand and describe the general chemical structures of the major & minor components of foods.
- Give a molecular rationalization for the observed physical properties and reactivity of the food components.
- Provide a theoretical explanation for observed extent and rates of reactions that are common to foods
- Predict how processing conditions are likely to change the reactivity of food components

THEORY

Credits: 3; Hours: 45

Unit I: Introduction to Food Chemistry **2 Hours**

Unit II: Water **8 Hours**

- Definition of water in food
- Structure of water and ice
- Types of water
- Sorption phenomenon
- Water activity and packaging

- Water activity and shelf-life

Unit III: Macronutrients **26 Hours**

Lipids

- Classification of lipids
- Physical properties-melting point, softening point, specific gravity, refractive index, smoke, flash and fire point, turbidity point.
- Chemical properties-reichert meissl value, polenske value, iodine value, peroxide value, saponification value.
- Effect of frying on fats
- Changes in fats and oils- rancidity, lipolysis, flavor reversion
- Auto-oxidation and its prevention
- Technology of edible fats and oils- Refining, Hydrogenation and Interesterification, Fat Mimetics

Proteins

- Protein classification and structure
- Properties of proteins (electrophoresis, sedimentation, amphoterism and denaturation,)
- Functional properties of proteins eg. organoleptic, solubility, viscosity , binding gelation / texturization , emulsification , foaming.

Carbohydrates

- Classification (mono, oligo and poly saccharides)
- Structure of important polysaccharides (starch, glycogen, cellulose, pectin, hemicellulose, gums)
- Chemical reactions of carbohydrates –oxidation, reduction , with acid & alkali
- Modified celluloses and starches

Unit IV : Micronutrients **11 Hours**

Vitamins

- Structure ,Importance and Stability
- Water soluble vitamins
- Fat soluble vitamins

Minerals

- Major and minor minerals
- Metal uptake in canned foods
- Toxic metals

PRACTICALS
Credit: 1; Hours: 30

1. Preparation of primary and secondary standard Solutions.
2. Estimation of moisture content.
3. Determination of gelatinization temperature range (GTR) of different starches and effect of additives on GTR.
4. Determination of refractive index and specific gravity of fats and oils.
5. Determination of smoke point and percent fat absorption for different fat and oils.
6. Determination of percent free fatty acids.
7. Estimation of saponification value.
8. Estimation of total ash content.

Essential Readings

- DeMan, J.M.(2018).Principles of Food Chemistry.NewYork: AVI.
- Fennema, Owen R. (2017).Food Chemistry. 3rd Ed..NewYork: Marcell Dekker
- Whitehurst and Law.(2002).Enzymes in Food Technology. Canada: CRC Press.

Suggested Readings

- Potter, N.N. and Hotchkiss, J.H. (1999). Food Science, 5th Ed., Chapman & Hall.
- Wong, Dominic WS. (2018). Food Enzymes. New York: Chapman and Hall.
- Meyer, L.H. (2004). Food Chemistry. CBS Publishers & Distributors Pvt Ltd, India.

DISCIPLINE SPECIFIC ELECTIVE COURSE

DSE FT03 A: Food Fermentation Technology

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/ Practice		
Food Fermentation Technology	4	2	0	2	XII Pass with PCM/PCB	Nil

Learning Objectives

- To understand the concept and significance of fermentation
- To understand the principles of food fermentation technology
- To study the types of starters used in the food industry
- To study the production of various fermented foods

Learning Outcomes

- An understanding of the basic components of Food Fermentation Technology and their principles.
- An understanding of the concept of the different fermentation processes.
- Develop insight into common types of starters used in the Food Industry.
- Apply acquired skills in the production of various fermented foods.

SYLLABUS OF DSE FT 03

THEORY
Credits: 2; Hours: 30

UNIT I: Introduction to fermentation **10 Hours**

Unit description: This unit introduces the concept of fermentation as a process ,its basic requirements and types . It also covers the types of microbes required in the process resulting in the formation of different products along with the emphasis on the significance of fermentation

Subtopics:

- Definition of Fermentation
- Types of fermentation process: submerged/solid state, Batch/continuous fermentation
- Requirements for the fermentation process
- Role of Starter cultures and their types commonly used in fermentation
- Importance of Fermentation

UNIT II: Fermentation Technology **10 Hours**

Unit description: This unit covers Food Fermentation Technology with a focus on fermenters and their operations. Both the concept of upstream and downstream processing will be taught along with coproduct recovery

Subtopics:

- Fermenter: design and its operation
- Measurement and control of fermentation
- Upstream processing- screening and identification of microorganisms, media preparation, multiplication of microbes
- Downstream processing -Recovery of fermentation products and conversion into commercially viable products, Co-product recovery, and valorization

UNIT III: Fermented Products **10** Hours

Unit description: This unit describes the fermentation process of various products and their classification with an emphasis on the Indian traditional fermented products.

Subtopics:

- Types of fermented products and their classification
- Fermentation of milk, vegetables, cereals
- Industrial Production of selected products -Baker's yeast, Cider, Vinegar, and Cheese
- Traditional Indian Fermented products

PRACTICAL
Credit: 2, Hours: 60

1. To study the design and operation of a lab scale fermenter
2. To study the sugar utilization patterns by microorganisms
3. To determine β-galactosidase activity of microorganisms
4. To perform Solid State Fermentation using byproducts as a substrate at lab scale.
5. To produce Baker's Yeast
6. To prepare Sauerkraut
7. To prepare Curd /Yogurt
8. To develop a fermented food/drink utilizing plant products or their by- products
9. To develop a fermented food/drink utilizing animal products or their by-products

Essential Readings

- Brian, J. Wood. (1997).*Microbiology of Fermented Foods*. Volume II and I. Elsevier Applied Science Publication.
- Joshi, V.K. & Pandey. A. (2009). *Biotechnology: Food Fermentation Microbiology, Biochemistry and Technology*. Volume I and II. Asiatech Publishers Inc.
- Stanbury, P.F., Whitekar A. and Hall (2013). *Principles of Fermentation Technology*. Reed Elsevier India Pvt.Ltd.

Suggested Readings

- Adams, M. & Moss, M. (2008). Food Microbiology. 2nd Edition. RSC Publishing.
- John, Garbutt. (1997).Essentials of Food Microbiology. Arnold International Students Edition.
- Arnold L. Demain & Julian E. Davis. Industrial Microbiology & Biotechnology, ASM Press. (2004).

DISCIPLINE SPECIFIC CORE COURSE

DSE FT 03 B: Traditional Indian Foods

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
TRADITIONAL INDIAN FOODS	4	2	0	2	XII Pass with PCM/PCB	NIL

Learning Objectives

- To understand the evolution, cultural, regional diversity and health benefits of traditional Indian foods.
- To understand the processing and preservation methods used for traditional Indian foods.

Learning Outcomes

After completing this course, students will be able to:

- Upon successful completion of this course students will gain knowledge of the diverse traditional Indian foods from the vedic times, states, regions, cultures and religion.
- The course aims to provide hands-on training to students in processing of different traditional Indian foods for setting enterprise, promotion of healthy forgotten traditional foods for research and development.

SYLLABUS OF DSE FT 06

THEORY

Credits 2 (30 Hours)

Unit 1 Introduction to Traditional Indian foods **15 Hours**

Unit Description: This unit will be covering the history and tradition of Indian foods from various cultures, regions and religions.

Subtopics:

- History of Indian Food Culture and Traditional Foods

- The journey of food from various Indian civilizations to Vedic period and modern era
- Categories of traditional foods of India: Traditional foods from different regions/states and different cultures and weaning foods in Indian tradition
- Concepts of Ayurvedic foods, classification of food based on Ayurveda: Grain based, fruits and vegetable based, milk-based traditional foods in Ayurvedic system.

UNIT II: Processing and preservation of traditional Indian foods 15 Hours

Unit Description: The unit will provide knowledge on the processing and preservation of traditional Indian foods

Subtopics:

- Ancient practices of food preservation: Dehydration, osmotic drying techniques
- Other Processing techniques used in preparation of traditional Indian foods

Practical
Credit : 2, Hours: 60

Unit I: Practicals based on literature survey of the traditional Indian foods including the ingredients used, processing and health benefits.

1. Students will make presentations on vedic foods of India
2. Presentation on regional/state wise traditional Indian foods

Unit II: Practicals based on processing and preservation techniques used in Traditional Indian foods

1. Preparation of regional traditional foods: Regional cuisine preparation
2. Functional traditional foods: Fermented foods (grain based/drinks), adjuncts (papad/chutney/pickle).
3. Ayurvedic food preparations: Fruits and vegetable based/milk and milk product-based (ghee/buttermilk) processing of traditional foods
4. Processing of a traditional Indian foods by osmotic dehydration/drying

Essential Readings

- Achaya, K.T. (1994). Indian Food: A Historical Companion. Oxford University Press.
- Sarkar, P., Dh, L. K., Dhumal, C., Panigrahi, S. S., & Choudhary, R. (2015). Traditional and ayurvedic foods of Indian origin. Journal of Ethnic Foods, 2(3), 97-109.
- Raghunathsuri. (2012). Bhojanakutuhalam (Translated from original by Scholar of I-AIM, Institute of Ayurveda and Integrative Medicine, Bangalore).
- Suri, R. Balakrishna, A. (2013). Bhojanakutuhalam, first ed. Divya Prakashan, Haridwar, pp.1-373.

Suggested Readings

- Singh, A., & Singh, R. K. (2007). Cultural significance and diversities of ethnic foods of Northeast India.
- Subbulakshmi, G and Subhadra, M. (2020). Nutrition in Traditional Therapeutic Nutrition. Daya Publishing House Vol. 1 and 2