

Fruit, Vegetable, and Milk process technology			
Course Code	1MFDT 201	Scheme	2026
Type of Course	PCC	Semester	02
Teaching Hours/Week (L:T:P)	3:1 : 0	CIE Marks	50
Total Hours of Pedagogy L /T/P/SL&TW:	42: 28 : 0 : 50	SEE Marks	50
Credits	4	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3
Course Outcomes At the end of the course, the student will be able to: 1. Learn the importance of fruits, vegetable and milk processing in India. 2. Learn different processing and preservation methods for fruits, vegetable and milk. 3. Learn advanced methods of fruits, vegetable and milk processing. 4. Apply acquired knowledge to evaluate different processing methods. 5. Apply acquired knowledge to select appropriate method for processing of fruits and vegetables			
Module-1			
POST-HARVEST HANDLING Production of Fruits and vegetables in India, Composition of major fruits and vegetables produced in the country, Post-harvest handling, transport and storage practices of fresh fruits and vegetables, Factors effecting for post-harvest losses. Production of milk in India, Composition of milk produced in the country, Post-harvest handling, transport and storage practices of milk, Factors effecting for post-harvest losses in milk during handling, transport and storage Number of Hours:10			
Module-2			
FRUITS AND VEGETABLES PROCESSING Canning: Preparation of fruits and vegetables for canning – Washing, peeling, grating, slicing dicing, deseeding, blanching; Common machinery for operations, Juice and pulp extraction – extractors, Hydraulic Press, Hot and Cold Break process, Clarification, Clarification centrifuges, Decanters and desludgers; Fruit juice concentrates-methods of concentration, types of evaporators; Fruit Powders - Preparation of Fruit material for powder production, Process operations Number of Hours:10			
Module-3			
MILK AND MILK PRODUCT PROCESSING: Filtration, milk storage, bulk cooling, stirring and mixing, standardization, pasteurization, sterilization, centrifugation, homogenization, evaporation and condensation. Manufacturing of milk products and principles of processing of cheese, ice- cream, butter, milk powder, casein, whey, curd, butter milk etc. Number of Hours:10			
Module-4			
ASPETIC AND OTHER PROCESSING METHODS Aseptic processing- Aseptic heat exchangers / homogenizers, Aseptic fillers. Filling systems- Tetra pack for small quantities, Dole system and Scholle system for bulk filling; Hurdle technology with reference to Vegetable, Fruit and Milk processing Number of Hours:10			
Module-5			
NOVEL PROCESSING METHODS UV, High pressure processing, Ultrasound, Membrane, High intensity pulsed electric field, ozone, Irradiation, Minimal processing, Storage in Modified Atmosphere, Active Packaging, Freeze			

concentration, Vacuum frying, Edible coatings, Ohmic heating, Microwavedielectric heating technology.

Number of Hours:10

Textbooks:

1. Hand book of vegetables and vegetable processing. N.K.Sinha, Y. H. Hui, E. O.Evrantz, M. Siddiq, J. Ahmed, Wiley-Blackwell, 1st edition, 2011
2. Hand Book of Vegetable Preservation and Processing. Y. H. Hui, E. ÖzgülEvrantz, CRC Press, 2nd Edition, 2015
3. Fruit and Vegetable Preservation; Principles and Practices. R.P. Srivastava and Sanjeev Kumar, CBS; 3rd Edition, 2014
4. Technological Interventions In The Processing Of Fruits And Vegetables. RachnaSehrawat, Khursheed A. Khan, Megh R.Goyal, Apple Academic Press Inc. 2018

Reference books / Manuals:

1. Outlines of Dairy Technology. Sukumar De, Oxford University Press, 5th Edition, 2005
Dairy Plant System and Layout. Tufail Ahmed, Kitab Mahal, New Delhi, 1996
Milk processing and quality management. A.Y.Tamime, Wiley- Blackwell, West Sussex, UK, 2009
2. Dairy Technology: Principles of Milk Properties and Processes. P. Walstra, T.J. Geurts, A. Noomen, A. Jellema, M.A.J.S. vanBoekel, 1st Edition, Marcel Dekker, New York, 1999
3. Dairy science and technology hand book- Principles and properties. Y.H. Hui, Wiley-VCH, New York, 1993

Assessment Structure (both CIE and SEE)

The weightage assigned to Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) shall be **50% each**. A student shall secure a minimum of 50% of the maximum marks prescribed for CIE and a minimum of **40%** of the maximum marks prescribed for SEE to be eligible for passing.

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to a subject/course only if he/she secures not less than **50% of the aggregate marks** obtained in CIE and SEE taken together.

Continuous Internal Evaluation:

Continuous Comprehensive Assessments (CCA)+ Internal Assessment Test (IA) = Continuous Internal EvaluationCIE [25+25=50 marks]

A minimum of **two Internal Assessment Tests (IA)** shall be conducted. Each test shall be conducted for a maximum of **25 marks**. The average of the two test marks shall be the marks secured by a student in IA.

In addition, **Continuous Comprehensive Assessment (CCA)** shall be conducted for a total of **25 marks**.

FOOD LAWS, REGULATIONS AND CERTIFICATIONS			
Course Code	1 MFDT202	Scheme	2026
Type of Course	PCC	Semester	2
Teaching Hours/Week (L:T:P)	3:0 : 0	CIE Marks	50
Total Hours of Pedagogy L /T/P/SL&TW:	42: 0 : 0 : 48 :	SEE Marks	50
Credits	3	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3
Course Outcomes At the end of the course, the student will be able to: 1. Understand the implications of food adulteration and the food safety management system 2. Understand various laws for smooth running of food industries 3. Understand and apply FSSAI in food industries 4. Understand about other Indian food regulatory bodies 5. Apply various international laws and practices for smooth running of food industries			
Module-1			
FOOD ADULTERATION AND FOOD SAFETY MANAGEMENT Food Adulteration, Food Safety Management System, Mandatory and voluntary food laws. Number of Hours:8			
Module-2			
DIFFERENT FOOD LAWS Various food laws for food processing, Essential Commodity Act, Prevention of Food Adulteration Act (PFA), Fruit Products Order (FPO) and Meat Food Products Order (MFPO), FSSAI - Introduction Number of Hours:8			
Module-3			
FSSAI Food Safety and Standards Authority of India (FSSAI), Structure and Function, Food Safety and Standards Act Number of Hours:8			
Module-4			
OTHER RELEVANT NATIONAL BODIES Bureau of Indian Standards (BIS), Agricultural and Processed Food Products Export Development Authority (APEDA), Marine Products Export Development Authority (MPEDA), Spice Board India and Agricultural Marketing and Grading Standards (AGMARK). Number of Hours:8			
Module-5			
INTERNATIONAL FOOD LAWS AND PRACTICES Food Codex laws, Food and Drug Administration (FDA), International Organization for Standardization (ISO), Good Manufacturing Practices (GMP), Good Agricultural Practices (GAP), Hazard Analysis and Critical Control Point (HACCP). Number of Hours:8			
Textbooks: 1. A Practical Guide to Food Laws and Regulations. Kiron Prabhakar, Bloomsbury Professional India, 1st Edition, 2016 2. International Food Law and Policy. Gabriela Steier and Kiran Patel, Springer International Publishing, 1st Edition, 2016 3. Food Regulation: Law, Science, Policy and Practice, N.D. Fortin, Wiley Publication, 2nd Edition, 2016 Reference books / Manuals: 1. Food Safety and Standards Act and Regulations, Food Safety and Standards Authority			

of India, Ministry of Health and Family Welfare, Government of India, 2006

2. **International Food Law and Policy. Gabriela Steier & Kiran K. Patel (Eds.) Springer Nature; 1st Edition. 2016**

Assessment Structure (both CIE and SEE)

The weightage assigned to Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) shall be **50% each**. A student shall secure a minimum of 50% of the maximum marks prescribed for CIE and a minimum of **40%** of the maximum marks prescribed for SEE to be eligible for passing.

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Continuous Internal Evaluation:

Continuous Comprehensive Assessments (CCA)+ Internal Assessment Test (IA) = Continuous Internal Evaluation CIE [25+25=50 marks]

A minimum of **two Internal Assessment Tests (IA)** shall be conducted. Each test shall be conducted for a maximum of **25 marks**. The average of the two test marks shall be the marks secured by a student in IA.

In addition, **Continuous Comprehensive Assessment (CCA)** shall be conducted for a total of **25 marks**.

Process Control and Instrumentation in Food Industry			
Course Code	1MFDT203	Scheme	2026
Type of Course	PCC	Semester	2
Teaching Hours/Week (L:T:P)	3:0 : 0	CIE Marks	50
Total Hours of Pedagogy L /T/P/SL&TW:	42: 0 : 0 : 48 :	SEE Marks	50
Credits	3	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3
Course Outcomes At the end of the course, the student will be able to: 1. Apply pressure and humidity related equipments for food related measurements 2. Apply and analyze gravimetric methods for food related measurements 3. Apply chromatographic and MS methods for food analysis 4. Evaluate different spectroscopic methods for food analysis 5. Evaluate different analytical, electron microscopic methods and sensors for food analysis			
Module-1			
INTRODUCTION Instruments for temperature, pressure, humidity measurements - types, calibration. Pressure gauge, basic concept of pneumatic pressure transmitter, pressure current and pressure resistance transducers.. Number of Hours:8			
Module-2			
PROPERTIES AND PROCESS CONTROL Positive displacement meter, Weight measurement- mechanical scale, electronic tank scale, conveyor scale, measurement of specific gravity, measurement of humidity, measurement of viscosity, measurement of density, automatic valves. Definition of process control, simple system analysis, dynamic behavior of simple process, Laplace transform Number of Hours:8			
Module-3			
INSTRUMENTATION AND ANALYTICAL METHODS Ionization techniques, scanning technique, application of GC/MS, LC/MS and Linked scan techniques. Basic principles of chromatography. Paper chromatography, thin layer chromatography, HPLC (High performance liquid chromatography), Gas chromatography, Application in food analysis Number of Hours:8			
Module-4			
SPECTROSCOPY AND SPECTRAL ANALYTICAL METHODS Introduction and principles of Spectrophotometry and Atomic absorption spectroscopy. Electromagnetic spectrum – The NMR Phenomenon – Types of information provided by NMR spectra, application of NMR to Food analysis Number of Hours:8			
Module-5			
INSTRUMENTAL ANALYSIS OF FOOD QUALITY analyzer, e-sensors, biosensors, Nitrogen analyzers. Number of Hours:8			

Textbooks:

1. Introduction to Analytical Chemistry: Instrumental methods of chemical analysis. B.K Sharma, Goel Publishing House, 23rd Edition, 2004
2. Process System Analysis and Control. Donald R Coughanowr and Steven E. LeBlanc, Mc-Graw Hill's, 3rd Edition, 2009
3. Cocoa production and processing technology. Afoakwa EO. Taylor and Francis group, 2014
4. Principles of Industrial Instrumentation. D. Patranabis, Tata Mc-Graw Hill, 1976

Reference books / Manuals:

1. Transducers and Instrumentation. D.V.S. Murty, Prentice Hall India, 2nd Edition, 2008
2. Food Processing Handbook. James G. Brennan and Alistair S. Grandison, Wiley-VCH Verlag GmbH & Co. KGaA, 2011

Assessment Structure (both CIE and SEE)

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Continuous Internal Evaluation:

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A minimum of **two Internal Assessment Tests (IA)** shall be conducted. Each test shall be conducted for a maximum of **25 marks**. The average of the two test marks shall be the marks secured by a student in IA.

In addition, **Continuous Comprehensive Assessment (CCA)** shall be conducted for a total of **25 marks**.

FOOD ALLERGIES AND ALLERGENS			
Course Code	1MFDT204	Scheme	2026
Type of Course	PCC	Semester	2
Teaching Hours/Week (L:T:P)	3: 0 : 0	CIE Marks	50
Total Hours of Pedagogy L /T/P/SL&TW:	42: 0 : 0 : 48	SEE Marks	50
Credits	3	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3
Course Outcomes At the end of the course, the student will be able to: 1.Understand food allergies and allergens 2.Understand Factors affecting food allergenicity 3.Analyze Characteristics of food allergenictiy 4.Manage food allergenicity 5. Evaluate Preventive measures for food allergies and Regulatory and labelling procedures			
Module-1			
INTRODUCTION Introduction to food allergies and allergens: Overview of food allergies, allergens, immune system, antigen antibody interactions; sign & symptoms of food allergy; global prevalence of food allergies; classification of hypersensitivity reactions, use of bioinformatics in understanding and identification of potential cross allergens Number of Hours:8			
Module-2			
Factors: food allergies and allergens Factors affecting food allergenicity, issues related to food additives and ingredients, genetic inheritance of food allergy, Immunological response, Oral allergy syndrome, GM foods and risk of allergy. Number of Hours:8			
Module-3			
Characteristics of food allergenicity Natural sources and chemistry of food allergens, handling of food allergies; Detection & Diagnostic techniques for allergy, limitationsof food allergy diagnostic techniques; Characterization of allergens, food sensitivities (anaphylactic reactions, metabolic food disorders and idiosyncratic reactions). Number of Hours:8			
Module-4			
Management of food allergenicity Principles of management of food allergens including detailed knowledge of avoidance measures; Application of Genetic modification to reduce allergenicity; Methods used in safety evaluation-risk assessments Number of Hours:8			
Module-5			
Preventive measures for food allergies and Regulatory and labelling procedures: Prevention of allergic disease by primary, secondary and tertiary methods including aspects of epidemiology, hygiene and allergic march hypotheses; Case studies of reported food allergies and related food recalls. Hypoallergenic foods and dietary management of allergy, effect of processing treatments on food allergenicity; Regulatory procedures for food allergens at national and international level; Labelling guidelines. Number of Hours:8			

Textbooks:

1. Judy Owen, Jenni Punt, Sharon Stranford. (2013). Immunology by Kuby. 7th edition
2. S Flanagan. (2014). Handbook of Food Allergen Detection and Control, Simon Flanagan. 1st edition Woodhead publishing .
3. Scott H. Sicherer. (2013). Food Allergy: Practical Diagnosis and Management. 1st edition CRC Press.

Reference books / Manuals:

1. Ebisawa M. Sagamihara, Ballmer-Weber B.K. Zurich, Vieths S. Langen and Wood.
2. R.A. Baltimore, Md. (2015). Food Allergy: Molecular Basis and Clinical Practice. Karger Publishing.

Assessment Structure (both CIE and SEE)

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Continuous Internal Evaluation:

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A minimum of **two Internal Assessment Tests (IA)** shall be conducted. Each test shall be conducted for a maximum of **25 marks**. The average of the two test marks shall be the marks secured by a student in IA.

In addition, **Continuous Comprehensive Assessment (CCA)** shall be conducted for a total of **25 marks**.

PLANTATION PRODUCTS AND SPICES TECHNOLOGY			
Course Code	1 MFD T 205A	Scheme	2026
Type of Course	PEC	Semester	2
Teaching Hours/Week (L:T:P)	3:0:0	CIE Marks	50
Total Hours of Pedagogy L /T/P/SL&TW:	42:0:0:48	SEE Marks	50
Credits	3	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3
Course outcome (Course Skill Set) At the end of the course the student will be able to: 1. Understand different types of spices and their importance 2. Understand the methods of processing of different spices & dry fruits 3. Understand and create strategies for processing of tea leaves to obtain different kinds of tea 4. Understand the processing of coffee to obtain different kinds of coffee 5. Understand and create strategies for processing of cocoa bean to obtain different products of cocoa			
Module-1			
INTRODUCTION Classification, composition, structure and characteristics. Production status of spices in India: major spice producing area in India and worldwide, export potential of processed and raw spice product Number of Hours: 8			
Module-2			
SPICE AND DRY FRUIT PROCESSING: Processing of major and minor spices: Preservation and processing of major and minor spices of India; Processing of whole spice, spice powder, paste and extracts; production and processing of spice mixtures; spice oils and oleoresins, functional role of spices, quality specification for spices Composition, Structure, characteristics & processing of cashew nut and other dry fruits. Number of Hours: 8			
Module-3			
TEA PROCESSING: Composition and production of tea leaves; processing of tea leaves; CTC tea, black tea, green tea and Oolong tea, grading and packaging; processing of instant tea, Iced Tea Number of Hours: 8			
Module-4			
COFFEE PROCESSING: Production and processing of coffee cherries by wet and dry method; processing technology for coffee; preparation of brew; processing technology for instant coffee and decaffeinated coffee; Nitrous coffee; Specialty coffee, Introduction to coffee cupping/tasting. Number of Hours: 8			
Module-5			
COCOA PROCESSING: Cocoa bean-introduction, history and composition; processing of cocoa bean; processed products of cocoa such as cocoa powder. Number of Hours: 8			
Textbooks: 1. The complete book on cultivation and manufacture of tea. Panda H, 2nd revised edition, Asia Pacific Business Press Inc., NIIR 2. Coffee-growing, processing, sustainable production. Wintgens J.N., Wiley- VCH, 2004. 3. Cocoa production and processing technology. Afoakwa EO. Taylor and Francis group, 2014 4. Handbook on Spices and Condiments (Cultivation, Processing and Extraction), Panda H. Asia Pacific Business Press Inc., NIIR, 2010.			
Reference books / Manuals: 1. Small-scale cashew nut processing. Azam-Ali S.H. and Judge E.C. FAO, 2001			

2. Vanilla-post harvest operations. InPho-Post harvest compendium. Javier De La Cruz Medina , Guadalupe C. Rodriguez Jiménez, and Hugo S. García. FAO, 2009

Assessment Structure (both CIE and SEE)

The weightage assigned to Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) shall be **50% each**. A student shall secure a minimum of 50% of the maximum marks prescribed for CIE and a minimum of **40%** of the maximum marks prescribed for SEE to be eligible for passing.

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to a subject/course only if he/she secures not less than **50% of the aggregate marks** obtained in CIE and SEE taken together.

Continuous Internal Evaluation:

Continuous Comprehensive Assessments (CCA)+ Internal Assessment Test (IA) = Continuous Internal Evaluation CIE [25+25=50 marks]

A minimum of **two Internal Assessment Tests (IA)** shall be conducted. Each test shall be conducted for a maximum of **25 marks**. The average of the two test marks shall be the marks secured by a student in IA.

In addition, **Continuous Comprehensive Assessment (CCA)** shall be conducted for a total of **25 marks**.

NANOTECHNOLOGY IN FOOD INDUSTRY			
Course Code	1 MFDT 205B	Scheme	2026
Type of Course	PEC	Semester	2
Teaching Hours/Week (L:T:P)	3:0:0	CIE Marks	50
Total Hours of Pedagogy L /T/P/SL&TW:	42:0:0:48	SEE Marks	50
Credits	3	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3
Course outcome (Course Skill Set) At the end of the course the student will be able to: 1. Understand nanotechnology for improving food quality and detection of contaminants 2. Understand nano ingredients and additives 3. Apply Nanotechnology in Agriculture and Food Technology fields 4. Apply Nano technology in packaging 5. Evaluate the risks associated with nanotechnology			
Module-1			
INTRODUCTION: Definition of nanotechnology, development, application of nanoscale materials, AFM, natural food nano substances and nanostructure – carbohydrate, protein, emulsion. Nanotechnology fo improving food quality, detection of contaminants Number of Hours: 8			
Module-2			
NANO INGREDIENTS AND ADDITIVES: Nano Ingredients and additives Nano materials for food applications- metal oxides, functionalized nanomaterials, nano additives, relation to digestion Number of Hours: 8			
Module-3			
NANOTECHNOLOGY IN AGRICULTURE AND FOOD TECHNOLOGY: Nanotechnology in Agriculture and Food Technology Nanotechnology in Agriculture - Precision farming, Smart delivery system Nanofertilizers: Nanourea and mixed fertilizers, Nanofertigation Nanopesticides, Nanoseed Science. Nanotechnology in Food industry Nanopackaging for enhanced shelf life - Smart/Intelligent packaging - Food processing and food safety and bio-security – Electrochemical sensors for food analysis and contaminant detection. Number of Hours: 8			
Module-4			
NANO TECHNOLOGY IN PACKAGING: Nano technology in packaging, Nano technology in food packaging, nano composites, nano coatings. Role in active packaging, intelligent packaging. Nano sensor. Nano membrane Potential Benefits and hazards. Industrial benefits, consumer benefits, Detection and characterization of nanoparticles in food, exposure, potential hazards Number of Hours: 8			
Module-5			
RISKS ASSOCIATED WITH NANOTECHNOLOGY: Risks associated ENP, health risks- toxins, metabolism action etc. Risk governance- principle Regulations. General regulations, safety aspects in different regions, Regulation aspects of nano scale food ingredients, additives, FCMS. Number of Hours: 8			

Textbooks:

1. P. Brown and K. Stevens, Nanofibers and Nanotechnology in Textiles, Woodhead publication, London, 2006.
2. J. Altmann, Routledge, Military Nanotechnology: Potential Applications and Preventive Arms Control, Taylor and Francis Group, 2006.
3. Introduction to nanotechnology - Charles P. Poole; Frank J. Owens – 2008 – Wiley.
4. Nanotechnologies in Food – Qasim Chaudhary, Laurence Castle, Richard Watkins - 2010- RSC Publishing
5. P. J. Brown and K. Stevens, Nanofibers and Nanotechnology in Textiles, Woodhead Publishing Limited, Cambridge, (2007).

Reference books / Manuals:

1. Q. Huang -Nanotechnology in the Food, Beverage and Nutraceutical Industries. Woodhead Publishing 2. Limited - 2010
2. Lestie prey, “Nanotech in food products”, Wiley publications 2010.
3. Pandua W., “Nanotech research methods for foods and bioproducts”, Wiley publications 2012.

Assessment Structure (both CIE and SEE)

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Continuous Internal Evaluation:

Continuous Comprehensive Assessments (CCA)+ Internal Assessment Test (IA) = Continuous Internal Evaluation CIE [25+25=50 marks]

A minimum of **two Internal Assessment Tests (IA)** shall be conducted. Each test shall be conducted for a maximum of **25 marks**. The average of the two test marks shall be the marks secured by a student in IA.

In addition, **Continuous Comprehensive Assessment (CCA)** shall be conducted for a total of **25 marks**.

BIOCHEMISTRY AND HUMAN NUTRITION			
Course Code	1 MFDT 205C	Scheme	2026
Type of Course	PEC	Semester	2
Teaching Hours/Week (L:T:P)	3:0:0	CIE Marks	50
Total Hours of Pedagogy L /T/P/SL&TW:	42:0:0:48	SEE Marks	50
Credits	3	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3
Course outcome (Course Skill Set) At the end of the course the student will be able to: 1. Evaluate nutritional requirements of individuals 2. Understand enzyme kinetics 3. Understand metabolism of carbohydrates, lipids and proteins 4. Evaluate and correlate the ill-effects of deficiency of different micro nutrients 5. Analyze and learn how to restore deficient nutrients by fortification and supplementation			
Module-1			
INTRODUCTION TO NUTRITION: Nutrition, malnutrition, functions of food, basic food groups, nutritional needs, requirements and recommended allowances of foods. Number of Hours: 8			
Module-2			
ENZYMOLGY: Mechanism of enzyme action, coenzymes, enzyme kinetics, Derivation of Michaelis-Menten Equation. Number of Hours: 8			
Module-3			
METABOLISM: Sources, functions, digestion, absorption, assimilation and transport of carbohydrates, proteins and fats in human beings. Metabolism of carbohydrates: Respiration, Metabolism of lipids, Metabolism of proteins. Number of Hours: 8			
Module-4			
MINERALS, VITAMINS AND HORMONES: Functions, sources, factors affecting absorption of minerals, absorption promoters and inhibitors, effect of deficiency of Calcium, phosphorus, iron, zinc, iodine, fluorine and copper. Vitamins and hormones. Number of Hours: 8			
Module-5			
NUTRITIONAL DEFICIENCY AND FOOD PROCESSING: Classification, functions, sources, effects of deficiency. Changes during food processing operations, restoration, enrichment, fortification and supplementation of foods. Number of Hours: 8			
Textbooks: 6. Textbook of Nutrition and Dietetics. Kumud Khanna, Sharda Gupta, Santosh Jain Passi, Rama Seth, Ranjana Mahna and Seema Puri, Elite Publishing House Pvt. Ltd., 2nd Edition, 2016 7. Principles of Biochemistry, A.L. Lehninger, D.L. Nelson and M.M. Cox, W. H. Freeman, 4th Edition, 1993 8. Textbook of Biochemistry. E. S. West, W. R. Todd, H. S. Mason, and J. T. Van Bruggen, MacMillan, 4th Edition, 1966 9. Nutrition and Dietetics. Shubhangini A. Joshi, Tata Mc Grow- Hill publishing Company Ltd, 1992			
Reference books / Manuals: 1. Biochemistry of Foods. N.A.M Eskin, Academic Press, 1st Edition, 1971 2. Food Chemistry. O.R. Fennema, Marcel Dekkar Inc, 3rd Edition, 1996			

3. Essentials of Food and Nutrition. M. S. Swaminathan, Ganesh and Co, 1st Edition, 1974
4. Outlines of Biochemistry. Eric E. Conn and P.K. Stumpf, John Wiley and Sons, 3rd Edition, 1972

Assessment Structure (both CIE and SEE)

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Continuous Internal Evaluation:

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In addition, **Continuous Comprehensive Assessment (CCA)** shall be conducted for a total of **25 marks**.

FOOD BUSINESS MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT			
Course Code	1 MFDT 205D	Scheme	2026
Type of Course	PEC	Semester	2
Teaching Hours/Week (L:T:P)	3:0:0	CIE Marks	50
Total Hours of Pedagogy L /T/P/SL&TW:	42:0:0:48	SEE Marks	50
Credits	3	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3
Course outcome (Course Skill Set) At the end of the course the student will be able to: 1. Understand fundamentals of project management and entrepreneurship development 2. Understand project formulation and market survey techniques 3. Create network and project schedules 4. Evaluate project costs 5. Learn launching and organizing of an enterprise			
Module-1			
INTRODUCTION: Introduction and definitions related with project management and entrepreneurship; Fundamentals of project management and entrepreneurship development. Number of Hours: 8			
Module-2			
PROJECT FORMULATION: Market survey techniques, project identification, project selection, project proposal, work breakdown structure Number of Hours: 8			
Module-3			
Network scheduling: Activity, networks, use of CPM, PERT in project scheduling. Resource planning, resource allocation, project scheduling with limited resources Number of Hours: 8			
Module-4			
BUSINESS: Estimation of project costs, earned value analysis, project techno-economic viability, break-even analysis. Identification of business opportunity in food processing sector. Government policies for promotion of entrepreneurship in food processing Number of Hours: 8			
Module-5			
ENTERPRISE: Launching and organizing an enterprise, enterprise selection, market assessment, feasibility study, SWOT analysis, resource mobilization. Financial institution in promoting entrepreneurship; Supply chain management Number of Hours: 8			
Textbooks: 1. An Introduction to Business (v.1). Collins K. creativecommons.org, 2012 2. Economics and Management of the Food Industry. Jeffrey H. Dorfman, Routledge, 1st Edition, 2013 3. Food and Beverage Management. Partho Pratim Seal, Oxford University Press; 1st Edition, 2017 4. Food Industry: Food Processing and Management. Lisa Jordan, Callisto Reference, 2015			
Reference books / Manuals: 5. Fundamentals of Entrepreneurship. Nandan H., Prentice Hall India Learning Private Limited; 3rd Edition, 2013			

6. Management in Engineering: Principles and Practice. Gail Freeman-Bell and James Balkwill, Prentice Hall, 1993
7. Operations Research: An Introduction. Hamdy A. Taha, Pearson Publication, 9th Edition, 2010
8. Project Management. K. Nagarajan, New Age International Pvt Ltd; 8th Edition, 2017

Assessment Structure (both CIE and SEE)

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In addition, **Continuous Comprehensive Assessment (CCA)** shall be conducted for a total of **25 marks**.

LIVESTOCK, FISH AND MARINE PRODUCTS PROCESSING			
Course Code	1MFDT206A	Scheme	2026
Type of Course	PEC	Semester	I
Teaching Hours/Week (L:T:P)	3:0:0	CIE Marks	50
Total Hours of Pedagogy L /T/P/SL&TW:	42:0:0:48	SEE Marks	50
Credits	3	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3
Course outcome (Course Skill Set) At the end of the course the student will be able to: 1. Evaluate different methods of meat preservation 2. Evaluate quality of meat 3. Analyze abattoir design and evaluate poultry processing methods 4. Evaluate unit operations for poultry and fish products 5. Evaluate different methods of processing of marine products			
Module-1			
INTRODUCTION: Production, Economics, and processing scenario of meat, fish and poultry. Preservation of meat- dehydration, freezing, pickling, curing, cooking and smoking; preservation of meat using ionizing radiation; preservation of meats using- antibiotics and chemical preservatives.			
			Number of Hours: 8
Module-2			
QUALITY OF THE PROCUCT: Eating quality of meat and discoloration; water-holding capacity and juiciness in cooked and uncooked meat; texture and tenderness- definition and measurement, factors affecting texture and tenderness, artificial tenderizing			
			Number of Hours: 8
Module-3			
PROCESSING: Abattoir design and layout, meat plant sanitation and safety, by-products utilization. Processing and preservation of eggs, production of egg yolk and egg yellow powder. Poultry processing.			
			Number of Hours: 8
Module-4			
UNIT OPERATIONS: Unit operations for various poultry products; Fish processing: Unit operations for various fish products.			
			Number of Hours: 8
Module-5			
ADVANCED PROCESSING: Different Sea food resources and their postharvest quality changes; bulk handling and chilling; quick freezing; cook-chill processing; modified-atmosphere packaging; retort pouch packaging.			
			Number of Hours: 8

Textbooks:

1. Lawrie's Meat Science. Fidel Toldra, Woodhead Publishing, 8th Edition, 2007
2. Egg Science and Technology. W.J. Stadelmen and O.J. Cotterill, CRC Press, 4th Edition, 1995
3. Handbook of Meat Processing. Ed. Fidel Toldrá, Blackwell Publishing, 1st Edition, 2010
4. Marine and Freshwater Products Handbook, Roy E. Martin, Emily Paine Carter, George J. Flick, Jr., Lynn M. Davis, CRC Press, 1st Edition, 2000

Reference books / Manuals:

1. Meat Handbook. A. Lavie, AVI, Westport, 4th Edition, 1980
2. Food Science. Norman N. Potter and Joseph H. Hotchkiss, S. Chand Publication, 5th Edition, 2007
3. Meat Products Handbook. G Feiner, Woodhead Publishing, 1st Edition, 2006
4. Muscle as Food. P.J. Bechtel, Academic Press, 1st Edition, 1986

Assessment Structure (both CIE and SEE)

The weightage assigned to Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) shall be **50% each**. A student shall secure a minimum of 50% of the maximum marks prescribed for CIE and a minimum of **40%** of the maximum marks prescribed for SEE to be eligible for passing.

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to a subject/course only if he/she secures not less than **50% of the aggregate marks** obtained in CIE and SEE taken together.

Continuous Internal Evaluation:

Continuous Comprehensive Assessments (CCA)+ Internal Assessment Test (IA) = Continuous Internal Evaluation CIE [25+25=50 marks]

A minimum of **two Internal Assessment Tests (IA)** shall be conducted. Each test shall be conducted for a maximum of **25 marks**. The average of the two test marks shall be the marks secured by a student in IA.

In addition, **Continuous Comprehensive Assessment (CCA)** shall be conducted for a total of **25 marks**.

FOOD INDUSTRY BYPRODUCT AND WASTE MANAGEMENT			
Course Code	1MFDT206B	Scheme	2026
Type of Course	PEC	Semester	2
Teaching Hours/Week (L:T:P)	3:0:0	CIE Marks	50
Total Hours of Pedagogy L /T /P/SL&TW:	42:0:0:48	SEE Marks	50
Credits	3	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3
Course outcome (Course Skill Set) At the end of the course the student will be able to: 1. Evaluate the uses of by-products of dairy, fruit and vegetables related processing industries 2. Evaluate the uses of by-products of meat and fish processing units and agro based industries 3. Analyze various laws and regulations of waste management and apply them for food processing industries. 4. Evaluate different waste treatment methods for food processing industries 5. Create strategies for the zero-discharge and zero-emission of waste			
Module-1			
BYPRODUCTS I: Various by-products from Food Processing Industry: By-products of cereals, legumes, oil seeds, dairy, fruit and vegetables processing industries and their uses. Number of Hours: 8			
Module-2			
BYPRODUCTS II: By-products of meat and fish processing units and their uses. Uses of by-products of agro based industries in various sectors. Number of Hours: 8			
Module-3			
LAWS AND REGULATIONS: Various laws and regulations for waste management in food processing industries. Number of Hours: 8			
Module-4			
WASTE TREATMENT METHODS: Food industry wastes, Waste treatment methods for Cereals, Fruits, vegetables, Meat, Fish, Dairy processing and Brewery Industries. Number of Hours: 8			
Module-5			
WASTE WATER TREATMENT: Preliminary treatment, primary, secondary, advanced and final treatment; zero-discharge and zero-emission system. Number of Hours: 8			
Textbooks: 5. Handbook of Waste Management and Co-Product Recovery in Food Processing. K. Waldron, Woodhead Publishing Limited, 1st Edition, 2007 6. Waste Management for the Food Industries. I.S. Arvanitoyannis, Academic Press, 2008 7. Utilization of By-Products and Treatment of Waste in the Food Industry. Vasso Oreopoulou and Winfried Russ, Springer US, 1st Edition, 2007 Reference books / Manuals: 1. Food Science. Norman N. Potter and Joseph H. Hotchkiss, S. Chand Publication, 5th Edition, 2007 2. Food Processing By-Products and their Utilization, Ed. Anil K Anal, Willey Publication, 1st Edition, 2017			

Assessment Structure (both CIE and SEE)

The weightage assigned to Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) shall be **50% each**. A student shall secure a minimum of 50% of the maximum marks prescribed for CIE and a minimum of **40%** of the maximum marks prescribed for SEE to be eligible for passing.

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to a subject/course only if he/she secures not less than **50% of the aggregate marks** obtained in CIE and SEE taken together.

Continuous Internal Evaluation:

Continuous Comprehensive Assessments (CCA)+ Internal Assessment Test (IA) = Continuous Internal Evaluation CIE [25+25=50 marks]

A minimum of **two Internal Assessment Tests (IA)** shall be conducted. Each test shall be conducted for a maximum of **25 marks**. The average of the two test marks shall be the marks secured by a student in IA.

In addition, **Continuous Comprehensive Assessment (CCA)** shall be conducted for a total of **25 marks**.

FOOD SEPARATION ENGINEERING			
Course Code	1MFDT206C	Scheme	2026
Type of Course	PEC	Semester	2
Teaching Hours/Week (L:T:P)	3:0:0	CIE Marks	50
Total Hours of Pedagogy L /T/P/SL&TW:	42:0:0:48	SEE Marks	50
Credits	3	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3
Course outcome (Course Skill Set) At the end of the course the student will be able to: 1. Understand various separation processes 2. Apply concepts of phase equilibrium in food processing 3. Analyze various laws and regulations of waste management and apply them for food processing industries. 4. Evaluate different waste treatment methods for food processing industries 5. Create strategies for the zero-discharge and zero-emission of waste			
Module-1			
INTRODUCTION: Introduction to various separation processes; Gas-Liquid, Gas-Solid, Liquid-Liquid, Liquid-Solid separation Number of Hours: 8			
Module-2			
PHASE EQUILIBRIUM: Concept of phase equilibrium; Impingement separator; Electrostatic precipitation; Distillation-Application of distillation in food processing. Number of Hours: 8			
Module-3			
MEMBRANE SEPARATION TECHNOLOGY: Introduction to microfiltration, ultra-filtration, nano-filtration, reverse osmosis, electro dialysis; Physical characteristics of membrane separation; Factor affecting reverse osmosis process; Concentration of polarization; Design of reverse osmosis and ultra-filtration system; Operation layout of the modules; Electrodialysis; Pervaporization; Fabrication of membrane; Application of membrane technology in food industry. Number of Hours: 8			
Module-4			
POWDER TECHNOLOGY: Classification of powder; Separation of powder; Sieving; Air classification; Factor affecting air classification; Cyclone application; Air separation; Particle size distribution. Number of Hours: 8			
Module-5			
SUPER CRITICAL FLUID (SCF) EXTRACTION: Introduction; Properties of SCF; Food application of SCF; Application of SCFE during analysis and pharmaceutical applications. Number of Hours: 8			

Textbooks:

1. Mechanical Operations for Chemical Engineers (Incorporating Computer Aided Analysis). C.M. Narayanan and B.C. Bhattacharya, Khanna Publishers, 3rd Edition, 1990
2. Membrane Technology and Applications. Richard W. Baker, John Wiley & Sons, 2nd Edition, 2004
3. Membranes and Membrane Separation Processes, 1. Principles. Heinrich Strathmann, Wiley VCH Verlag GmbH & Co. KGaA., 2011

Reference books / Manuals:

1. Powder Technology Handbook. Hiroaki Masuda, Ko Higashitani and Hideto Yoshida, CRC Press Taylor and Francis, 3rd Edition, 2006
2. Transport Processes and Separation Process. Chistie John Geankoplis, Pearson Education India; 4th Edition, 2015

Assessment Structure (both CIE and SEE)

The weightage assigned to Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) shall be **50% each**. A student shall secure a minimum of 50% of the maximum marks prescribed for CIE and a minimum of **40%** of the maximum marks prescribed for SEE to be eligible for passing.

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to a subject/course only if he/she secures not less than **50% of the aggregate marks** obtained in CIE and SEE taken together.

Continuous Internal Evaluation:

Continuous Comprehensive Assessments (CCA)+ Internal Assessment Test (IA) = Continuous Internal Evaluation CIE [25+25=50 marks]

A minimum of **two Internal Assessment Tests (IA)** shall be conducted. Each test shall be conducted for a maximum of **25 marks**. The average of the two test marks shall be the marks secured by a student in IA.

In addition, **Continuous Comprehensive Assessment (CCA)** shall be conducted for a total of **25 marks**.

AGRICULTURAL BIOINFORMATICS			
Course Code	1MFDT206D	Scheme	2026
Type of Course	PEC	Semester	2
Teaching Hours/Week (L:T:P)	3:0:0	CIE Marks	50
Total Hours of Pedagogy L /T/P/SL&TW:	42:0:0:48	SEE Marks	50
Credits	3	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3
Course outcome (Course Skill Set) At the end of the course the student will be able to: 1. Understand the fundamentals of bioinformatics and biological databases relevant to agriculture and food technology. 2. Apply sequence analysis, alignment, similarity searching, and phylogenetic approaches to agricultural and food-related biological data. 3. Analyse plant genomes, molecular markers, transcriptomic data, and genomic information for crop improvement. 4. Evaluate bioinformatics approaches for food quality, nutritional genomics, food safety, and microbial identification. 5. Apply emerging bioinformatics tools and computational approaches in agricultural biotechnology and food technology.			
Module-1			
FUNDAMENTALS OF AGRICULTURAL BIOINFORMATICS: Introduction to bioinformatics and agricultural bioinformatics, scope and applications in agriculture and food technology. Biological data types: DNA, RNA, protein, genome, transcriptome, and metabolome data. Biological databases: primary, secondary, and specialized databases. NCBI, EMBL-EBI, DDBJ, UniProt, PDB, and Ensembl Plants. Sequence formats and retrieval of biological data. Introduction to computational tools and online resources for agricultural and food biotechnology. Number of Hours: 8			
Module-2			
SEQUENCE ANALYSIS AND COMPARATIVE GENOMICS: DNA and protein sequence analysis, sequence similarity and homology. Pairwise and multiple sequence alignment. BLAST and its applications in crop and food-related research. Phylogenetic analysis and evolutionary relationships. Comparative genomics of food and crop plants. Genome annotation and gene prediction. Applications of sequence analysis in crop improvement and identification of genes of agricultural importance. Number of Hours: 8			
Module-3			
PLANT GENOMICS AND MOLECULAR BREEDING: Plant genome organization, structural and functional genomics. Transcriptomics and overview of RNA-seq data analysis. Molecular markers: SSR, SNP, AFLP, and RAPD. Marker-assisted selection and genomic selection. Quantitative Trait Loci (QTL) mapping and Genome-Wide Association Studies (GWAS). Bioinformatics approaches for crop improvement, disease resistance, abiotic stress tolerance, and nutritional quality. Number of Hours: 8			
Module-4			
BIOINFORMATICS FOR FOOD QUALITY, NUTRITION AND SAFETY: Bioinformatics approaches in food quality assessment. Identification and characterization of food-related genes and proteins. Plant secondary metabolites and metabolic pathway analysis. Metabolomics and systems biology approaches. Nutritional genomics and nutrigenomics. Molecular identification of food-borne microorganisms. Microbial genomics and pathogen genome analysis. Bioinformatics approaches for food allergens and food adulteration detection. Number of Hours: 8			
Module-5			

EMERGING APPLICATIONS OF AGRICULTURAL BIOINFORMATICS: Structural bioinformatics and protein structure prediction. Molecular docking and virtual screening in food and agricultural biotechnology. Systems biology and biological network analysis. Multi-omics approaches in agriculture and food science. Artificial intelligence and machine learning applications in agricultural bioinformatics. Precision agriculture and data-driven crop management. Bioinformatics approaches for sustainable agriculture, climate-resilient crops, functional foods, and food safety.

Number of Hours: 8

Textbooks:

1. Mount, D. W. (2004). Bioinformatics: Sequence and Genome Analysis. 2nd Edition, Cold Spring Harbor Laboratory Press.
2. Lesk, A. M. (2019). Introduction to Bioinformatics. 5th Edition, Oxford University Press.
3. Campbell, A. M. and Heyer, L. J. (2006). Discovering Genomics, Proteomics and Bioinformatics. 2nd Edition, Pearson Education.
4. Baxevanis, A. D. and Ouellette, B. F. F. (2005). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. 3rd Edition, Wiley-Interscience.
5. Brown, T. A. (2020). Genomes 4. Garland Science.

Reference books / Manuals:

1. Pevsner, J. (2015). Bioinformatics and Functional Genomics. 3rd Edition, Wiley-Blackwell.
2. Durbin, R., Eddy, S. R., Krogh, A. and Mitchison, G. (1998). Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids. Cambridge University Press.
3. Campbell, A. M. and Heyer, L. J. (2007). Genomics, Proteomics and Bioinformatics: A Practical Approach. Pearson.

Assessment Structure (both CIE and SEE)

The weightage assigned to Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) shall be **50% each**. A student shall secure a minimum of 50% of the maximum marks prescribed for CIE and a minimum of **40%** of the maximum marks prescribed for SEE to be eligible for passing.

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Continuous Internal Evaluation:

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In addition, **Continuous Comprehensive Assessment (CCA)** shall be conducted for a total of **25 marks**.