



**GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY, HISAR**  
 (Established by State Legislature Act 17 of 1995)  
 'A+' Grade, NAAC Accredited State Govt. University

Acad./AC-III/BOS&R-1/2026/ 3574  
 Dated: 11/6/26

To

The Controller of Examinations  
 GJUS&T, Hisar.

**Sub. Approval of the scheme of examinations and syllabi of M.Sc. Food Technology (3<sup>rd</sup> and 4<sup>th</sup> semester) under NEP-2020 w.e.f. academic session 2025-26 (Batch: 2025-26) being run in University Teaching Department.**

Sir,

I am directed to inform you that the Vice-Chancellor, on the recommendations of Dean, Faculty of Environmental and Bio Sciences & Technology on dated 04.06.2026, is pleased to approve the scheme of examinations and syllabi of M.Sc. Food Technology (3<sup>rd</sup> and 4<sup>th</sup> semester) under NEP-2020 w.e.f. academic session 2025-26 (Batch: 2025-26) being run in University Teaching Department, under Section 11(5) of the University Act, 1995 in anticipation of approval of the Academic Council.

A copy of the scheme of examinations and syllabi of above said programme is enclosed herewith. You are therefore, requested to take further necessary action accordingly.

Yours faithfully

DA: As above

*Anshu*  
11/6/26  
 Assistant Registrar (Academic)  
 for Dean Academic Affairs

Endst. No. Acad./AC-III/BOS&R-1/2026/ 3575-78 Dated: 11/6/26

A copy of the above is forwarded to the following for information and necessary action:-

1. Dean, Faculty of Environmental and Bio Sciences & Technology, GJUST, Hisar.
2. ✓ Chairperson, Department of Food Technology, GJUST, Hisar. She is requested to get upload the scheme of examinations and syllabi of above said programme being run in University Teaching Department on the website of the University on the priority basis.
3. OSD to Vice-Chancellor (for kind information of the Vice-Chancellor), GJUST, Hisar.
4. P.A. to Registrar (for kind information of the Registrar), GJUST, Hisar.

*Anshu*  
11/6/26  
 Assistant Registrar (Academic)

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Final.  
24/06/26

**Scheme  
For  
M.Sc. in Food Technology (Semester System)  
As per NEP 2020**

**To be implemented w.e.f. Academic Session 2025-26**



**Department of Food Technology  
Guru Jambheshwar University of Science and Technology  
Hisar-125001**

27/05/2026  
Anshul

### **Vision**

- To emerge as a nationally and internationally recognized department for excellence in education, research and innovation in food science and technology.
- To establish a cutting-edge centre for food analysis and quality assurance, offering expert guidance to the food industry on physical, chemical, sensory and microbiological aspects of food products.

### **Mission**

- To foster sustainable growth of the food industry by providing innovative technological solutions and expert technical services.
- To add value to regional and national agro-resources through focused R&D initiatives and industry collaboration.
- To nurture competent and ethically responsible professionals equipped to meet the evolving needs of the food sector.

### **Programme Educational Objectives (PEOs)**

1. To develop students into knowledgeable, skilled, and ethical professionals for careers in food and allied industries.
2. To empower students to become entrepreneurs and leaders capable of initiating successful start-ups in the food sector.
3. To inspire and prepare students for higher studies and research in food engineering food science, and related interdisciplinary domains.

### **Programme Outcomes (POs)**

At the end of a postgraduate program, students will be able to:

- PO1. Demonstrate the ability to conduct independent and collaborative research with scientific integrity and critical thinking.
- PO2. Effectively communicate scientific knowledge, findings, and ideas through written, oral, and digital means.
- PO3. Apply advanced knowledge and skills in the area of specialization to solve real-world and theoretical problems.
- PO4. Utilize appropriate tools, techniques, and methodologies to analyze data and interpret results in the chosen field.
- PO5. Integrate interdisciplinary perspectives to approach complex issues holistically and innovatively.
- PO6. Practice professional ethics and contribute to achieving the Sustainable Development Goals.



### Programme Specific Outcomes (PSOs)

PSO1. Analyze food components, their behavior, and changes during processing using advanced scientific techniques.

PSO2. Apply technological, engineering, and microbiological principles to food product development, safety, and quality.

PSO3. Design and improve food systems that align with health, nutrition, safety, sustainability, and consumer needs.

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### SEMESTER-III

Type of Course	Course Code	Nomenclature of Paper/ Course	Credits	Contact Hours	Internal Marks	External Marks	Total Marks	Duration of Exam (Hr)
Discipline-Specific Course (DSC)	U25MFT301T	Instrumental Analysis of Foods	4	4	30	70	100	3 Hr.
	U25MFT302T	Food Storage and Packaging	4	4	30	70	100	3Hr.
	U25MFT303T	Food Safety and Quality Assurance	2	2	15	35	50	2Hr.
	U25MFT304T	Technology of Snack Foods	2	2	15	35	50	2Hr.
Discipline Elective Course (DEC)	U25MFT311T OR	Food Additives, Contaminants & Toxicants	4	4	30	70	100	3Hr.
	U25MFT312T OR	Novel Technologies in Food Processing						
	U25MFT313T	Technology of Spices and Herbs						
Practicum (PC I)	U25MFT305P	Scientific Communication and Research Methodology Lab	3	6	25	50	75	6 Hr.
Practicum (PC II)	U25MFT314P OR	Food Additives, Contaminants & Toxicants Lab	3	6	25	50	75	6 Hr.
	U25MFT315P OR	Novel Technologies in Food Processing Lab						
	U25MFT316P	Technology of Spices and Herbs Lab						
*Open Elective Course (OEC)	U25OEC316T	Introduction to Food Technology	2	2	15	35	50	2Hr.
Total Credits			22					

\*To be opted by the students of other departments,\*\* The students of Food Tech. Dept. are required to opt for only one OEC out of this pool. (Annexure-II)

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## SEMESTER-IV

Type of Course	Course Code	Nomenclature of Paper/ Course	Credits	Contact Hours	Internal Marks	External Marks	Total Marks	Duration of Exam (Hr)
<b>A. Dissertation on Campus</b>								
Discipline-Specific Course (DSC)	U25MFT401 T	Food Business Management	4	4	30	70	100	3 Hr.
Discipline Elective Course (DEC)	U25MFT411 T OR U25MFT412 T OR U25MFT413 T	Technology of Frozen Foods OR Food Biotechnology OR Industrial Microbiology	4	4	30	70	100	3 Hr.
*Vocational Course (VOC)	U25VOC416 T	Baked & Extruded Food Products	2	2	15	35	50	2Hr.
*Skill Enhancement Course (SEC)	U25SEC416T	Value Added Fruits and Vegetables-Based Products	2	2	15	35	50	2Hr.
*Employability and Entrepreneurship Skills Course (EEC)	U25EEC416T	Value Added Dairy-Based Products	2	2	15	35	50	2Hr.
**	U25MFT401 R	**Research Thesis	12				300	
		<b>Total Credits</b>	<b>22</b>					

**Student is required to opt for one course out of SEC/EEC/VOC.**

\* Students are required to select one VOC/SEC/EEC offered by other departments of the University (To be selected from the Central Pool available on University Website)

OR

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B. Dissertation outside Campus								
	Course Code	Nomenclature of Paper/ Course	Credits	Contact Hours	Internal Marks	External Marks	Total Marks	Duration of Exam (Hr)
	U25MFT402R	Industrial Project	20				500	
*Vocational Course (VOC)	U25VOC416T	Baked & Extruded Food Products	2	2	15	35	50	2Hr.
*Skill Enhancement Course (SEC)	U25SEC416T	Value -Added Fruits and Vegetables- Based Products	2	2	15	35	50	2Hr.
*Employability and Entrepreneurship Skills Course (EEC)	U25EEC416T	Value- Added Dairy-Based Products	2	2	15	35	50	2Hr.
		<b>Total Credits</b>	<b>22</b>					

**\*The student is required to opt for one course out of SEC/EEC/VOC**

\* Students are required to select one VOC/SEC/EEC offered by other departments of the University ((To be selected from the Central Pool available on University Website)

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**Important Notes:**

1. The students of the Department of Food Technology are required to opt for only one Value-Added Course (VAC) out of the list during semester I. (Annexure -I)
2. Internship of 4 credits (120 contact hours) over & above a 4-6 weeks duration after the 2<sup>nd</sup> Semester.

**Internship rules**

- The student will submit a copy of the report to the concerned supervisor within 15 days of completion of training.
  - Evaluation of Internship shall be done by a committee consisting of 2 senior professors appointed by the Chairperson of the department.
  - Mark will be awarded by the committee out of 100 marks on the basis of the report and viva voce examination.
  - Internship will be governed by the prevailing rules of the university from time to time.
3. **Exit Option:** After Successful completion of Semester II: Post-Graduate Diploma in Food Technology with 48 credits.
  4. The students are required to opt for only one Open Elective Course (OEC) during semester III out of the list (To be selected from the Central Pool available on University Website)
  5. During semester IV, Skill Enhancement Course (SEC), Employability and Entrepreneurship Skills Course (EEC), and Vocational Course (VOC) will be offered. The student is required to choose one course from SEC/EEC/VOC.
  6. Every M.Sc. Supervisor will be allotted 0.5 credit/student/week for M.Sc. dissertation in final semester
  7. In semester IV, students will have to opt for one option out of two options (A or B)

**A. Dissertation on Campus:**

By the end of the 3<sup>rd</sup> semester, the student may opt for a research project of 12 Credits (Course Code: U25MFT401R) on campus along with courses offered by the department. The synopsis presentation must be delivered by the end of the first month of semester IV.

**B. Dissertation Off Campus:**

During the 4<sup>th</sup> semester, students may opt for the Industrial Project/Research Institute/Organization (U25MFT402R) for 22 Credits, without course credit, offered by the department. For this, they may obtain prior approval through the proper channel to complete the research work in an approved industry under the guidance of an approved industry mentor, in coordination with an institutional mentor. Students will be required to submit an offer letter to the department at least 15 days before the commencement of the 4<sup>th</sup> semester. Upon successful completion, the project will be evaluated by a committee comprising an external expert, a supervisor, and the department's Chairperson.


### SEMESTER-III

<b>SEMESTER-III</b> <b>Course Type:</b> Discipline Specific Course (DSC) <b>Course Code:</b> U25MFT301T <b>Course Title:</b> Instrumental Analysis of Foods <b>Category:</b> Theory <b>Mode:</b> Lectures (L) <b>Hours/week:</b> 04 <b>Credits:</b> 04 <b>Examination Duration:</b> 3 Hours	<b>Course Assessment Methods:</b> <b>Note for Paper Setters:</b> <b>Max. Marks: 100 (Internal: 30; External: 70)</b>  <i>Note for Paper Setters:</i>  Max. Marks: 100 (Internal: 30; External: 70) Two mid-term exams, each of 15 marks, will be conducted for the internal assessment, and the marks of the best one will be considered. Weightage for assignment and class participation will be 10 and 05 marks, respectively.  <b>Note:</b> The end semester examination will be of 70 marks. The examiner is required to set nine questions in all. The first question will be compulsory, consisting of seven short questions covering the entire syllabus, carrying 2 marks each. In addition to that, eight more questions will be set, two questions from each unit. The students shall be required to attempt five questions in all, selecting one question from each unit in addition to compulsory Question No. 01. All questions shall carry equal marks, i.e., 14 marks.
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**Course Objectives:** To develop a comprehensive understanding of various advanced analytical techniques used in food analysis and research.

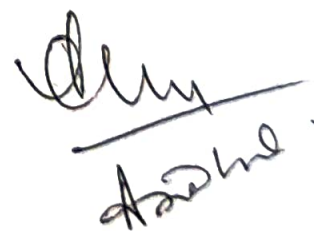
#### UNIT-I

Chromatographic Techniques; Introduction of chromatography, High-Performance Liquid Chromatography (HPLC) and Ultra-Performance Liquid Chromatography (UPLC); working principles, instrumentation, types of HPLC, column types, detectors. and their application in food analysis.

#### UNIT-II

Thermo-Analytical and Spectroscopic Techniques; Differential Scanning Calorimetry (DSC) instrumentation, working mechanism, thermal transition, and their applications. Fourier Transform Infrared spectroscopy (FTIR) basic principles, components, and applications.

#### UNIT-III



Mass Spectrometric Techniques: Gas Chromatography-Mass Spectrometry (GC-MS), Liquid Chromatography-Mass Spectrometry (LC-MS), Inductively Coupled Plasma Mass Spectrometry (ICP-MS); principles, working mechanism, instrumentation, and application in food analysis.

#### UNIT-IV

Microscopy Techniques: Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM), and Atomic Force Microscopy (AFM): principles, working mechanism, sample preparation, and application in structural analysis. Introduction, principles and application of PCR and ELISA.

#### Recommended Readings:

1. Gunzler, H. and Williams, A. (2001), Handbook of Analytical techniques. Wiley.
2. Nielsen, S.S. (2017) Food Analysis, Springer.
3. Pare, J. R. J. and Bélanger, J. M. R. (2015). Instrumental Methods of Food Analysis. Elsevier
4. Pomeranz, Y. and Meloan, C. E. (1996). Food Analysis: Theory and Practice (3 ed.): CBS Publications, New Delhi.
5. Skoog D., Holler, F.J and Crouch, S. R. (2018). Principles of instrumental analysis, 7th edition, Cengage learning.
6. Sun, D. W (2018). Modern techniques for food authentication. Academic Press

RBT Level	Course Outcomes: After the completion of the course, the students will be able to
L2	CO1: <b>Describe</b> the fundamental principles, instrumentation, and working mechanisms of advanced analytical techniques.
L3	CO2: <b>Apply</b> suitable analytical techniques for the evaluation of food samples.
L4	CO3: <b>Examine</b> and interpret data obtained from various instrumental methods to assess the structural and chemical properties of food materials.
L5	CO4: <b>Evaluate</b> and integrate suitable analytical approaches for solving complex problems in food analysis.
L6	CO5: <b>Construct</b> the new methods for the analysis of different food products.

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<p><b>SEMESTER-III</b></p> <p><b>Course Type: Discipline Specific Course (DSC)</b></p> <p><b>Course Code: U25MFT302T</b></p> <p><b>Course Title: Food Storage and Packaging</b></p> <p><b>Category: Theory</b></p> <p><b>Mode: Lectures (L)</b></p> <p><b>Hours/wcek: 04</b></p> <p><b>Credits: 04</b></p> <p><b>Examination Duration: 03 hrs.</b></p>	<p><b>Course Assessment Methods:</b></p> <p><b>Note for Paper Setters:</b></p> <p><b>Max. Marks: 100 (Internal: 30; External: 70)</b></p> <p><i>Note for Paper Setters:</i></p> <p>Two mid-term exams each of 15 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for assignment and class participation will be 10 and 05 marks, respectively.</p> <p>Note: The end semester examination will be of 70 marks. The examiner is required to set nine questions in all. The first question will be compulsory consisting of 7 short questions covering the entire syllabus consisting of 2 marks each. In addition to that 8 more questions will be set, with 2 questions from each unit. The students shall be required to attempt 5 questions in all, selecting one question from each unit carrying 14 marks each, in addition to compulsory Question No. 01.</p>
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**Course Objective:** The course aims to acquaint the students about food storage techniques and designing of the packaging system of food products.

#### UNIT-I

Introduction to Food Storage: Importance of food storage. Food grain spoilage, causes of spoilage- microbial, enzymatic, chemical. Types of Food Storage: Traditional and modern storage techniques. Design of silos. Refrigerated storage and frozen storage. Storage Conditions: Temperature, humidity, light, air control, storage time, FIFO (First In, First Out) principle. Food Safety Regulations: HACCP in food storage, storage guidelines for raw and cooked foods.

#### UNIT-II

Introduction to Food Packaging: Functions: protection, preservation, communication, convenience. Types of Packaging Materials: Glass, plastic, metal, paper/cardboard, biodegradable materials, active and intelligent packaging.

#### UNIT-III

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Designing of packaging system for given dry food products based on principles of mass transfer (gas/moisture). Active and interactive packaging. Principle of TTI (time-temperature integrator) and its application.

#### UNIT-IV

Labeling and Regulations: Mandatory and clean labeling requirements Food labeling laws and standards (FSSAI, FDA). Sustainability and Innovation: Environmental impact of packaging waste, recycling and biodegradable packaging, innovations in eco-friendly packaging.

#### Recommended Readings

1. Fellows, P. J. (2009). Food processing technology: Principles and practice (3rd ed.). Woodhead Publishing.
2. Robertson, G. L. (2012). Food packaging: Principles and practice (3rd ed.). CRC Press.
3. Kadoya, T. (1990). Food packaging. Academic Press.
4. Sinha, N. K., & Hui, Y. H. (Eds.). (2007). Handbook of fruits and fruit processing. Blackwell Publishing.
5. Verma, L. R., & Joshi, V. K. (2000). Postharvest technology of fruits and vegetables: General concepts and principles. Indus Publishing Company.
6. Sharma, H. (n.d.). Food packaging technology. AgriMoon. Retrieved from <https://agrimoon.com>
7. ICAR e-Courses. (n.d.). Food technology modules. Indian Council of Agricultural Research. Retrieved from <https://ecourses.icar.gov.in>

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

RBT Level	Course Outcomes
L2	CO1: Describe the comprehensive understanding of the principles and practices involved in safe and effective food storage and packaging
L3	CO2: Apply scientific and technological knowledge to select appropriate storage and packaging solutions for various food products.
L4	CO3: Analyze and interpret food safety regulations and labeling standards to ensure compliance in food storage and packaging.
L5	CO4: environmental impacts of different packaging materials and propose sustainable and innovative packaging alternatives.
L6	CO5: Develop critical thinking and problem-solving skills to address challenges in food preservation, spoilage control, and packaging system design.

Semester-III Course Type: Discipline-	Course Assessment Methods:
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<p>Specific Course (DSC)  <b>Course Code:</b>  U25MFT303T  <b>Course Title:</b> Food Safety and Quality Assurance  <b>Category:</b> Theory  <b>Mode:</b> Lectures (L)  <b>Hours/week:</b> 02  <b>Credits:</b> 02  <b>Examination Duration:</b> 2 hrs</p>	<p><b>Note for Paper Setters:</b></p> <p><b>Max. Marks:</b> 50 (Internal: 15; External: 35)</p> <p>Two mid-term exams each of 10 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for class participation will be 05 marks.</p> <p><b>Note:</b> The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set, with two questions from each unit. The students shall be required to attempt three questions in all, selecting one question from each unit carrying 10 marks each, in addition to compulsory Question No. 01 carrying 15 marks.</p>
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**Course objective:** Understand the fundamentals of food safety hazards and learn various quality assurance systems, management tools, national and international regulations.

#### UNIT-I

Food safety and quality: definition and terminology, Quality control & quality assurance. Objective, functions and importance. Current challenges to food safety. Food Hazards types, Risk management, Management Philosophies: 5S, Six sigma, Lean manufacturing, Plant/food industry sanitation. HACCP: Introduction, history, principles, application, implementation steps and benefits of HACCP.

#### UNIT-II

PRP's for food safety. FSSA, 2006. ISO 22000: Introduction, History, benefits. FSSC 22000, GFSI, SQF, FDA, CAC. Total Quality Management: Objectives, principles, implementation; Benefits of TQM. Quality Tools, Quality Circle. Auditing and Surveillance: Introduction, Definition, Objectives of auditing, Types of Audit, Principles of Auditing, Audit Program Procedures, Audit Activities, Audit Competencies, Lead Auditor, Surveillance.

#### Recommended readings:

1. Mathur, Pulkit (2018). Food Safety and Quality Control. The Orient Blackswan. ISBN 13: 978-9352873791



2. Vasconcellos, J.A. (2003). Quality Assurance for Food Industry – A Practical Approach, CRC Press, Boca Raton
3. Clute, M. (2008). Food Industry Quality Control Systems, CRC Press, Boca Raton
4. Early, R. (2006) Guide to Quality Management Systems for the Food Industry, Blackie, Academic and professional, London.
5. Gould, W.A and Gould, R.W. (2005) Total Quality Assurance for the Food Industries, CTI Publications Inc. Baltimore.

RBT Level	Course Outcomes: After the completion of the course, the students will be able to:
L1	<b>CO1: Describe</b> concept of laws, standards and systems related to food quality and safety.
L2	<b>CO2: Explain</b> principles and mechanism related to food safety and quality management systems.
L3	<b>CO3: Deploy</b> various safety systems as per the requirement of dynamic food sector.
L5	<b>CO4: Appraise</b> various factors that affect food quality and safety for good quality and safe foods.
L6	<b>CO5: Design</b> and implement a food safety management system based on HACCP principles.

<b>SEMESTER-III</b>  <b>Course Type:</b> Discipline Specific Course (DSC) <b>Course Code:</b> U25MFT304T <b>Course Title:</b> Technology of	<b>Course Assessment Methods:</b>  <i>Note for Paper Setters:</i>
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<p>Snack Foods</p> <p><b>Category:</b> Theory  <b>Mode:</b> Lectures (L)  <b>Hours/week:</b> 02  <b>Credits:</b> 02  <b>Examination Duration:</b> 2 hrs</p>	<p><b>Max. Marks:</b> 50 (Internal: 15; External: 35)</p> <p>Two mid-term exams each of 10 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for class participation will be 05 marks.</p> <p><b>Note:</b> The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set, with two questions from each unit. The students shall be required to attempt three questions in all, selecting one question from each unit carrying 10 marks each, in addition to compulsory Question No. 01 carrying 15 marks</p>
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**Course Objective:** To provide postgraduate students with advanced knowledge of extrusion technologies and snack food processing. The course aims to develop skills in applying modern techniques for manufacturing, quality assessment, and equipment handling in the snack food industry.

#### UNIT-I

Snack food: Introduction, definition, classification and importance. Indian snack food industry: market and globalization. Snack food processing: traditional and modern. Extrusion: working principle, processing and applications. Post-extrusion processes: coloring, flavoring & packaging of extruded snack foods. Texturized vegetable protein. Direct expanded (DX) and third generation (3G) snacks. Chemical and nutritional changes in food during extrusion. Breakfast cereals: Introduction and classification (flaked cereals, oven puffed cereals, gun puffed cereals, shredded products). Breakfast cereal-manufacturing processes (traditional and modern methods).

#### UNIT-II

Technology for whole grain-based snacks: roasted, toasted, puffed, popped, and flaked. Technology of Coated grains: salted, spiced, and sweetened. Technology of batter-based and dough-based products: bhujia, boondi, wafers, cookies, muffins, doughnuts. Technology of formulated products: chips, papads, instant premixes. Technology for fruit

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and vegetable-based snacks: chips, wafers; Technology for coated nuts- salted, spiced, and sweetened chikkies. Nutritional and quality assessment: chips, wafers, papads, cookies, muffins, extrudates, instant premixes. Machinery and Equipment: frying, baking, drying, toasting, roasting, flaking, popping, blending, coating, and chipping.

**Recommended Readings:**

1. Booth, R. G. (1997). Snack Food: CBS, New Delhi.
2. Raymond, W. L. & Rooney, L. W. (2001). Snack Foods Processing: CRC. London
3. Lusas, E. W. & Rooney, L. W. (2015). Snack Foods Processing: CRC. London.
4. Guy, R. (2001). Extrusion Cooking: Technologies and Applications: Woodhead, USA.
5. Riaz, M. N. (2000). Extruders in Food Applications. CRC Press.

RBT Level	Course Outcomes: After the completion of the course, the students will be able to
L1	CO1: <b>Understand</b> the working principles, types and operations of extruders used in the food industry.
L2	CO2: <b>Analyze</b> pre- and post-extrusion processing parameters and assess nutritional and chemical changes in snacks.
L3	CO3: <b>Demonstrate</b> processing of breakfast cereals, DX and 3G snacks, and evaluate health impacts.
L4	CO4: <b>Compare</b> the technologies for whole grain, coated, and formulated snack products.
L5& L6	CO5: <b>Evaluate</b> the quality of snack products and assess the correct use and maintenance of food processing machinery.

<p><b>SEMESTER-III</b></p> <p><b>Course Type:</b> Discipline Elective Course (DEC)</p> <p><b>Course Code:</b> U25MFT311T</p>	<p><b>Course Assessment Methods:</b></p> <p><b>Note for Paper Setters:</b></p> <p><b>Max. Marks: 100 (Internal: 30; External: 70)</b></p> <p><b>Note for Paper Setters:</b></p>
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<p><b>Course Title:</b> Food Additives, Contaminants &amp; Toxicants  <b>Category:</b> Theory  <b>Mode:</b> Lectures (L)  <b>Hours/week:</b> 04  <b>Credits:</b> 04  <b>Examination Duration:</b> 3 Hours</p>	<p>Max. Marks: 100 (Internal: 30; External: 70) Two mid-term exams, each of 15 marks, will be conducted for the internal assessment, and the marks of the best one will be considered. Weightage for assignment and class participation will be 10 and 05 marks, respectively.</p> <p><b>Note:</b> The end semester examination will be of 70 marks. The examiner is required to set nine questions in all. The first question will be compulsory, consisting of seven short questions covering the entire syllabus, carrying 2 marks each. In addition to that, eight more questions will be set, two questions from each unit. The students shall be required to attempt five questions in all, selecting one question from each unit in addition to compulsory Question No. 01. All questions shall carry equal marks, i.e., 14 marks.</p>
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**Course Objectives:** To develop a scientific understanding of food additives, contaminants, toxicants interaction with food components and their effect on sensory characteristics, stability, nutrition, quality and safety.

#### UNIT-I

Food additives: general classification, applications, functions, legal aspects, risks, and benefits. Preservatives- antimicrobial agents (types, mode of action, and their application). Antioxidants (types and mechanism of oxidation inhibition). Anti-browning agents (types, functions, and mode of action). Acidulants and pH control agents: types, uses and mode of action.

#### UNIT-II

Coloring Agents: synthetic food colorants, color chemistry, application and levels of use, natural colorants, sources of natural color (plant, microbial, animal and insects), misbranded products, color extraction techniques. Emulsifiers: types, selection of emulsifiers, emulsion stability, functions, and mechanism of emulsifiers. Chelating agents and sequestrants: types, uses, and mechanisms

#### UNIT-III.

Flavoring agents: sweeteners (nutritive and non-nutritive), flavors (natural and synthetic flavors), off-flavor in foods, flavor enhancers: types, chemistry and uses, flavor stabilization, flavor encapsulation: terminologies, techniques & applications. Stabilizers & thickening agents: types, uses and functions. Nutritional additives: types and uses. Food contaminants: Drug residues in food, heavy metals, use of veterinary drugs.

*Dr. Anshu*

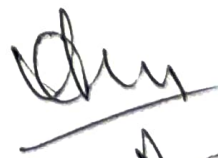
#### UNIT-IV

Introduction to Food Toxicology: Natural toxins in food: food-toxins of plant and animal origin, microbial toxins, their toxicity and significance. Food allergens: Natural sources of food allergens, Food allergens as Ingredients, Handling of food allergen in industry. Toxicants produced during Processing: Polycyclic aromatic hydrocarbons, N – nitrosamines, Acrylamide.

#### Recommended Readings:

1. Bagchi & Swaroop, (2016). Food Toxicology, CRC Press.
2. Liangli (Lucy) Yu, Shuo Wang, Bao-Guo Sun, (2015). Food Safety Chemistry Toxicant Occurrence, Analysis and Mitigation, CRC Press.
3. Jonathan, B.M. ( 2000). Food Allergies and Food Intolerance: The Complete Guide to Their Identification and Treatment, Healing Arts Press.
4. Millstone, E. (2003). A. Larry Branen, P. Michael Davidson, Seppe Salminen and John, H. Thorngate III (editors). Food Additives, New York and Basel: Marcel Dekker Inc. 2001.
5. Emerton, V.& Choi, E. (2008). Essential Guide to Food Additives (3<sup>rd</sup>ed.): RSCP, UK.
6. Ashurst, P.R. (1995). Food Flavorings (2<sup>nd</sup>ed.): Chapman and Hall, Glasgow.

RBT Level	Course Outcomes: After the completion of the course, the students will be able to
L1	CO1: <b>Describe</b> the chemistry and functionality of different food additives, contaminants and toxicants.
L2	CO2: <b>Explain</b> the significance of food additives in the food industry.
L3	CO3: <b>Illustrate</b> the effect of adulterants, contaminants and food additives on food quality and safety.
L4	CO4: <b>Compare</b> the functionality of various additives in food products.
L5	CO5: <b>Select</b> the maximum permissible limit for food additive, contaminants and toxins doses as per National and International standards.

  
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<p><b>SEMESTER-III</b></p> <p><b>Course Type</b> Discipline Elective Course (DEC)</p> <p><b>Course Code:</b> U25MFT312T</p> <p><b>Course Title:</b> Novel Technologies in Food Processing</p> <p><b>Category:</b> Theory</p> <p><b>Mode:</b> Lectures (L)</p> <p><b>Hours/week:</b> 04</p> <p><b>Credits:</b> 04</p> <p><b>Examination Duration:</b> 3 hrs</p>	<p><b>Course Assessment Methods:</b></p> <p><b>Note for Paper Setters:</b></p> <p><b>Max. Marks: 100 (Internal: 30; External: 70)</b></p> <p>Two mid-term exams each of 20 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for assignment and class participation will be 6 and 4 marks, respectively.</p> <p><b>Note:</b> The end semester examination will be of 70 marks. The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to that eight more questions will be set, two questions from each unit. The students shall be required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 01. All questions shall carry equal marks i.e. 14 marks.</p>
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**Course objectives:** This course aims to provide a comprehensive understanding of various food preservation methods, thermal processing design, and emerging thermal and non-thermal technologies, along with recent advancements in food processing.

#### UNIT I

**Membrane Technology:** Principles and classification of pressure-driven membrane processes: Microfiltration (MF), Ultrafiltration (UF), Nano filtration (NF), Reverse Osmosis (RO) Membrane distillation and applications in food industries. **Supercritical Fluid Extraction (SCFE):** Concepts and characteristics of supercritical fluids, commonly used supercritical fluids, SCFE process and equipment, Applications in extraction of food components. **Ultrasonic Processing:** Properties of ultrasonic waves, generation, and equipment, Mechanism of action and applications.

#### UNIT II

**Microwave and Radio Frequency Processing:** Fundamentals of microwave and radio frequency heating, Dielectric properties of food, Applications: microwave blanching, sterilization, drying. **High Pressure Processing (HPP):** Principle and mechanism of microbial and enzyme inactivation, Equipment design and working, Impact on food quality and nutrients, Commercial applications. **Emerging Thermal Techniques:** Ohmic heating, inductive heating, infrared heating, Principles, equipment, and applications.

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### UNIT III

Hurdle Technology: Concept and principles, Types of hurdles: temperature, water activity, pH, preservatives, Synergistic effects in preservation. Cold Plasma: Fundamentals and mechanism of microbial inactivation, Design of cold plasma systems, Applications in decontamination and shelf-life extension. Ozonization: Properties of ozone, equipment, safety concerns, Applications in food disinfection, preservation, and storage.

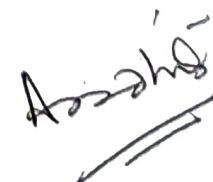
### UNIT IV

Novel Drying Techniques: Freeze drying, vacuum drying, spray drying, Microwave-assisted drying, infrared drying, fluidized bed drying, Impact on nutritional and functional properties of food. Kinetic modeling of quality degradation, Accelerated shelf-life testing (ASLT), mathematical modeling. Nanotechnology in Food Processing: Introduction to nanotechnology in food, Nanosensors, nanoemulsions, nanocapsules, Food packaging using nanomaterials.

#### Recommended Books

1. Gould GW, 2000. *New Methods of Food Preservation*, CRC Press.
2. Barbosa-Canovas, 2002. *Novel Food Processing Technologies*, CRC Press.
3. Dutta AK & Anantheswaran RC. 1999. *Hand Book of Microwave Technology for Food Applications*, CRC Press.
4. Sun DW, 2015. *Emerging Technologies for Food Processing*, Elsevier Ltd.
5. Kudra T and Mujumbar AS, 2009. *Advanced Drying Technologies*, CRC Press.
6. Nema PK, Kaur BP and Mujumdar AS, 2018. *Drying Technologies for Foods: Fundamentals and Applications*, CRC Press
7. R.P. Singh Introduction to Food Engineering

RBT Level	Course Outcomes: After the completion of the course, the students will be able to
L1	CO1: <b>Demonstrate</b> and apply the concepts of non-thermal food processing methods
L2	CO2: <b>Analyze</b> different design aspects of thermal processing applied to food.
L2	CO3: <b>Solve</b> issues related to membrane and hurdle technology in food processing
L3	CO4: <b>Develop</b> and analyze the efficacies of high-pressure processing in food applications
L4	CO5: <b>Infer</b> about recent developments in advanced thermal and non-thermal techniques of food processing.



<p><b>SEMESTER-III</b></p> <p><b>Course Type:</b> Discipline Elective Course (DEC)</p> <p><b>Course Code:</b> U25MFT313T</p> <p><b>Course Title:</b> Technology of Spices and Herbs</p> <p><b>Category:</b> Theory</p> <p><b>Mode:</b> Lectures (L)</p> <p><b>Hours/week:</b> 04</p> <p><b>Credits:</b> 04</p> <p><b>Examination Duration:</b> 3 hrs</p>	<p><b>Course Assessment Methods:</b></p> <p><b>Note for Paper Setters:</b></p> <p><b>Max. Marks:</b> 100 (Internal: 30; External: 70)</p> <p>Two mid-term exams each of 15 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for assignment and class participation will be 10 and 05 marks, respectively.</p> <p><b>Note:</b> The end semester examination will be of 70 marks. The examiner is required to set nine questions in all. The first question will be compulsory consisting of 7 short questions covering the entire syllabus consisting of 2 marks each. In addition to that 8 more questions will be set, with 2 questions from each unit. The students shall be required to attempt 4 questions in all, selecting one question from each unit carrying 14 marks each, in addition to compulsory Question No. 01.</p>
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**Course objectives:** To impart knowledge on the importance, functional, and industrial significance of spices and herbs.

#### UNIT-I

Current status/scope of spices and herbs processing industries in India and across the globe. Definition, importance and role of herbs and spices in diet. Classification and types of herbs and spices. Composition/ properties and active ingredients of major and minor herbs and spices.

#### UNIT-II

Qualities, specifications, physiological effects, antimicrobial and antioxidant properties of spices and herbs (Turmeric, ginger, cardamom, cinnamon, pepper, chili, clove, mint, curry leaves, basil etc). Postharvest handling/preprocessing operations of herbs and spices.

#### UNIT-III

Processing, manufacturing, processing equipments for common spices and herbs (Pepper, cinnamon, cardamom, nutmeg, saffron, turmeric, ginger, cloves, leafy spices, bay,

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oregano, and other seed spices) in India. Different unit operations in processing of herbs and spices. Encapsulation techniques, encapsulated spices and herbs products, manufacturing of encapsulated spices and herbs products.

#### UNIT-IV

Packaging of herbs and spices, type of packaging, labelling. Quality standards, regulatory compliance and export potential. Adulteration detection and testing protocols. Spice blends and extractives, manufacturing steps, essential oils, salad dressings, seasonings, oleoresins. Scope of spice and herb processing in India and globe, overview of Indian Spice Board and National Medicinal Plant Board (NMPB).

#### Recommended Readings

- Peter, K.V. (2012). Handbook of Herbs and Spices. Woodhead Publishing Series.
- Farrell K. T. (1985) Spices, condiments and seasonings. The AVI Publications.
- Purseglove J. W., Brown E. G., Green C. L. & Robbins S. R. J. (1981) Spices, Longman Publications.
- Hirasaka & Takemasa M. (1998) Spice Science and Technology, Marcel Dekker Inc.
- Pruthi J. S. (1996) Quality assurance in spices and spice products (Modern methods of analysis), Allied Publishers Limited.

RBT Level	Course Outcomes: After the completion of the course, the students will be able to
L1	CO1: Describe the current scope, significance, and classification of herbs and spices at national and international levels. <b>(Remember)</b>
L2	CO2: Identify and explain the physiological, antimicrobial, and antioxidant properties of major spices and herbs along with their quality attributes and postharvest handling practices. <b>(Understand)</b>
L3	CO3. Demonstrate knowledge of processing methods, manufacturing techniques, and equipment used in spice and herb industries, including encapsulation technologies. <b>(Apply)</b>
L4	CO4. Evaluate various packaging methods, labelling standards, quality control measures, and regulatory guidelines related to spice and herb products. <b>(Analyze &amp; Evaluate)</b>
L5	CO5. Design or propose spice-based value-added products such as blends, essential oils, oleoresins, and assess their market/export potential with awareness of relevant national bodies. <b>(Create)</b>

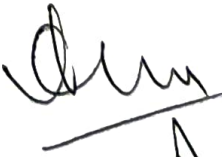

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<p><b>SEMESTER-III</b></p> <p><b>Course Type:</b> Practicum (PCI)</p> <p><b>Course Code:</b> U25MFT305P</p> <p><b>Course Title:</b> Scientific Communication and Research Methodology Lab</p> <p><b>Category:</b> Practical</p> <p><b>Mode:</b> Lab Practical (P) and Assignments</p> <p><b>Hours/week:</b> 06</p> <p><b>Credits:</b> 03</p> <p><b>Examination Duration:</b> 6 Hours</p>	<p><b>Course Assessment Methods:</b></p> <p><b>Max. Marks: 75 (Internal: 25; External: 50)</b></p> <p><i>Note for Paper Setters:</i></p> <p>The internal assessment will be based on mid-term exam (10 Marks), assignment/quiz/class test etc. (10 Marks) and class participation of 05 marks. External evaluation will be based on submission of practical records (10 Marks), viva-voce (10Marks) and written exam with lab performance (30 Marks).</p> <p>The internal examination will be conducted by the course coordinator. The external examination will be conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.</p>
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**Course Objectives:** To provide students with practical experience in applying statistical concepts and methods through hands-on activities using statistical software.

**List of Practicals:**

1. Identification of research problem: research domain and problem formulation, hypothesis and research gap.
2. Literature survey: Application of different scientific database for the literature survey.
3. Reference manager: Application of different reference manager softwares and citation styles.
4. Review writing: Review of literature, identify the gap and review writing.
5. Plagiarism check: Application of different plagiarism check tools
6. Data collection and management: entering and organizing the data in excel/ GraphPad prism/SPSS.
7. Descriptive Statistics; Mean, median, mode, standard deviation, standard error, critical difference.
8. Analysis of variance: one-way ANOVA and two-way ANOVA.
9. Data presentation: creating different types of graph (bar, line, scatter, histogram, box plot).
10. Correlations, regression and clustering analysis using different softwares.
11. Application of RSM in optimization of product formulation
12. Principal component analysis (PCA) in research



<p><b>SEMESTER-III</b></p> <p><b>Course Type:</b> Practicum Course (PCII)</p> <p><b>Course Code:</b> U25MFT314P</p> <p><b>Course Title:</b> Food Additives, Contaminants and Toxicants Lab</p> <p><b>Category:</b> Practicum</p> <p><b>Mode:</b> Practical (PC II)</p> <p><b>Hours/week:</b> 6</p> <p><b>Credits:</b> 3</p> <p><b>Examination Duration:</b> 6 Hours</p>	<p><b>Course Assessment Methods:</b> <b>Note for Paper Setters:</b></p> <p><b>Max. Marks: 75 (Internal:25; External: 50)</b></p> <p>The internal assessment will be based on mid-term exam (10 Marks), assignment/quiz/class test etc. (10 Marks) and class participation of 05 marks. External evaluation will be based on submission of practical records (10 Marks), viva-voce (10Marks) and written exam with lab performance (30 Marks).</p> <p>The internal examination will be conducted by the course coordinator. The external examination will be conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.</p>
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**Course Objective:** To acquaint the students about assessment, safety perspectives and legal aspects of food additives applications.

**List of Practicals:**

1. Familiarise students about various types of food additives
2. Qualitative and quantitative estimation of benzoic acid
3. Identification of gum bases in gum - based products
4. Extraction and identification of natural colorants (lycopene content)
5. Estimation of antioxidant activity of natural/synthetic additives
6. Estimation of total polyphenolic compounds
7. Estimation of artificial sweeteners (aspartame)
8. To estimate emulsifying properties of lecithin, mono or diglycerides
9. Application of organic acid in controlling pH
10. Estimation of pectin content.
11. Extraction of pectin and estimation of degree of methylation in extracted sample.
12. Estimation of MSG in food sample
13. Extraction of gums from fruits and vegetables products and their application as thickening agents

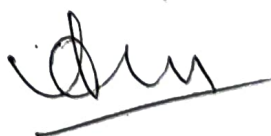

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14. Estimation of food adulterants (DART)
15. Estimation of food contaminants

**Recommended Readings:**

1. Joint FAO/WHO Expert Committee on Food Additives. (2021). Safety evaluation of certain food additives and contaminants: Prepared by the eighty-ninth meeting of the JECFA (WHO Food Additives Series, No. 80). World Health Organization.
2. Food Safety and Standards Authority of India. (2015). Food Additives. Manual of Methods of Analysis of Foods.
3. DART- Detect adulteration with rapid test. FASSAI, Imprinting Trust, assuring safe and nutritious food, Ministry of Health and Family Welfare, Government of India.
4. Smith, J. T. (2015). Preservatives in modern food production. In L. Zhang & M. C. Hall (Eds.), Handbook of food additives and safety (pp. 135–160). Academic Press.
5. World Health Organization. (1992). Compendium of food additive specifications (Vol. 1). Food and Agriculture Organization of the United Nations.

RBT Level	Course Outcomes: After the completion of the course, the students will be able to:
L1	CO1: <b>Identify</b> different types of food additives and their application.
L3	CO3: <b>Interpret</b> labelling regulations and safety limits of various additives, contaminants, allergens based on existing food regulations
L5	CO2: <b>Evaluate</b> chemical, functional properties and stability of food additives, contaminants.
L6	CO4: <b>Design</b> and conduct experiments to compare natural vs synthetic additives.

<p><b>Course Type:</b> Practicum Course (PCII)  <b>Course Code:</b> U25MFT315P</p> <p><b>Course Title:</b> Novel Technologies in Food Processing</p> <p><b>Category:</b> Practicum  <b>Mode:</b> Practical (PC II)  <b>Hours/week:</b> 6  <b>Credits:</b> 3  <b>Examination Duration:</b> 6 Hours</p>	<p><b>Course Assessment Methods:</b>  <b>Note for Paper Setters:</b></p> <p><b>Max. Marks: 75 (Internal:25; External: 50)</b></p> <p>The internal assessment will be based on mid-term exam (10 Marks), assignment/quiz/class test etc. (10 Marks) and class participation of 05 marks. External evaluation will be based on submission of practical records (10 Marks), viva-voce (10Marks) and written exam with lab performance (30 Marks).</p> <p>The internal examination will be conducted by the course coordinator. The external examination will be conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.</p>
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**Course Objective:** To equip students with knowledge and skills in novel technologies, enabling them to design and conduct experiments to optimize processing parameters ensuring safety and quality of food.

**List of Practicals:**

1. Measurement of TDS reduction in water using RO setup.
2. Extraction of essential oil (e.g., from cloves or turmeric) using SCFE system.
3. Determination of yield and analysis by GC or TLC.
4. Ultrasonic-assisted extraction of bioactive compounds.
5. Heating profile study of different food matrices using a microwave oven.
6. Microwave-assisted blanching or drying of vegetables.
7. Study of enzyme inactivation or microbial reduction by pressure treatment.
8. Design and testing of an ohmic heater.
9. Study of heating rate and effect on juice or liquid food conductivity.
10. Preservation of fruit juice using combinations of temperature, pH, and preservatives.
11. Microbial load comparison before and after treatment.
12. Ozonation of water or food and study of microbial reduction or shelf-life improvement.

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13. Demonstration of freeze-drying or spray-drying of fruit pulp or milk.
14. Measurement of moisture content and rehydration property.
15. Drying kinetics study of fruits or vegetables.
16. Study of effect of modified atmosphere packaging (MAP) or vacuum packaging.
17. Accelerated shelf-life testing using ASLT protocol.

RBT Level	Course Outcomes: After the completion of the course, the students will be able to:
L1	CO1: <b>Understand</b> novel processing technologies in food
L3	CO3: <b>Analyze</b> the effectiveness of different non-thermal technologies
L5	CO2: <b>Evaluate</b> the impact of various drying & preservation techniques on food quality
L6	CO4: <b>Demonstrate</b> skills in operating instruments like ohmic heaters, ultra-sonicator

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<p><b>Course Type:</b> Practicum Course(PCII)  <b>Course Code:</b> U25MFT316P  <b>Course Title:</b> Technology of Spices and Herbs Lab  <b>Category:</b> Practicum  <b>Mode:</b> Practical (PC II)  <b>Hours/week:</b> 6  <b>Credits:</b> 3  <b>Examination Duration:</b> 6 Hours</p>	<p><b>Course Assessment Methods:</b>  <b>Note for Paper Setters:</b></p> <p><b>Max. Marks: 75 (Internal:25; External: 50)</b></p> <p>The internal assessment will be based on mid-term exam (10 Marks), assignment/quiz/class test etc. (10 Marks) and class participation of 05 marks. External evaluation will be based on submission of practical records (10 Marks), viva-voccc (10Marks) and written exam with lab performance (30 Marks).</p> <p>The internal examination will be conducted by the course coordinator. The external examination will be conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.</p>
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**Course Objective:** To equip students with hands-on skills and scientific knowledge in the analysis, processing, and value addition of spices and herbs.

**List of practicals:**

1. Determination of moisture content in whole and ground spices.
2. Estimation of curcumin content in turmeric.
3. Extraction and estimation of essential oil in a given spice sample.
4. Preparation of spice paste from garlic, ginger, and green chili.
5. Preparation of spice-infused oils and formulation of salad dressing.
6. Evaluation of microbial load in raw and processed spices.
7. Determination of pungency level (Scoville Heat Units) in chili powder.
8. Preparation of herbal tea blend using tulsi, mint, and lemongrass.
9. Effect of drying methods (sun, hot air, freeze-drying) on quality of spices and herbs.
10. Formulation of value-added products: salad dressing, seasoning mix, spice oil and oleoresins.
11. GC-MS analysis/Demonstration of essential oils (e.g., cinnamon, clove)
12. HPLC analysis/Demonstration of bioactive compounds in spices.
13. Adulteration detection in turmeric, chili, black pepper.



14. Design, labelling and packaging of spice products as per FSSAI/Export standards

RBT Level	Course Outcomes: After the completion of the course, the students will be able to:
L1	CO1: <b>Demonstrate</b> technical skills in analyzing the quality parameters of spices and herbs.
L2	CO2: <b>Apply</b> appropriate techniques for the extraction, formulation, and processing of spice-based and herbal products.
L3	CO3: <b>Utilize</b> advanced analytical tools such as HPLC and GC-MS to detect bioactive compounds and essential oils in spices and herbs.
L4	CO4: <b>Detect</b> common adulterants in spices through simple analytical methods.
L5	CO5: <b>Design</b> , package, and label value-added spice and herb products in accordance with FSSAI and export standards.

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<p><b>SEMESTER-III</b></p> <p><b>Course Type:</b> Open Elective Course (OEC)</p> <p><b>Course Code:</b> U25OEC316T</p> <p><b>Course Title:</b> Introduction to Food Technology</p> <p><b>Category:</b> Theory</p> <p><b>Mode:</b> Lectures (L)</p> <p><b>Hours/week:</b> 02</p> <p><b>Credits:</b> 02</p> <p><b>Examination Duration:</b> 02 hrs</p>	<p><b>Course Assessment Methods:</b></p> <p><b>Note for Paper Setters:</b></p> <p><b>Max. Marks: 50 (Internal: 15; External: 35)</b></p> <p>Two mid-term exams each of 10 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for class participation will be 5 marks,</p> <p><b>Note:</b> The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set, with two questions from each unit. The students shall be required to attempt three questions in all, selecting one question from each unit carrying 10 marks each, in addition to compulsory Question No. 01 carrying 15 marks.</p>
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**Course Objective:** The course aims to provide students with fundamental insights into food science, focusing on the basic concepts of food composition, processing, spoilage, quality assurance, and new product development.

#### UNIT-I

Introduction to food science: definition and scope, basic food groups and their classification, Food composition: carbohydrates, proteins, fats, vitamins and minerals, Importance of water and water activity in food. Food Processing principles and preservation techniques (thermal, chemical and biological).

#### UNIT-II

Types of food spoilage (chemical, biological and physical), Food quality assurance: standards and regulations, Food packaging (definition, types and materials, functions), New product development (definition, process and importance).

#### Recommended Readings:

1. Norman, N.P. and Joseph, H.H.(1997) Food Science 5<sup>th</sup> edition, CBS Publication, New Delhi.
2. ShankuntalaManay N. (2022) Food Facts and Principles 5<sup>th</sup> edition, New Age International Publisher, New Delhi.

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3. Gordon W. Fuller (2011) New Food Product Development 3th edition, CRC Press, Taylor and Francis Groups, New York.

RBT Level	Course Outcomes: After the completion of the course, the students will be able to
L2	CO1: <b>Explain</b> the fundamental concepts of food science and its scope.
L3	CO2: <b>Identify</b> basic food components and their role in nutrition.
L4	CO3: <b>Understand</b> food processing principles and preservation techniques
L5	CO4: <b>Describe</b> the types and causes of food spoilage and methods to ensure food safety and quality.
L6	CO5: <b>Explain and design</b> the process and significance of new product development in the food industry.

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## SEMESTER-IV

<b>SEMESTER-IV</b>  <b>Course Type:</b> Discipline Specific Course (DSC) <b>Course Code:</b> U25MFT401 <b>Course Title:</b> Food Business Management <b>Category:</b> Theory <b>Mode:</b> Lectures (L) <b>Hours/week:</b> 4 <b>Credits:</b> 4 <b>Examination Duration:</b> 3 Hours	<b>Course Assessment Methods:</b> <b>Note for Paper Setters:</b> <b>Max. Marks:</b> 100 (Internal: 30; External: 70) Two mid-term exams each of 15 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for assignment and class participation will be 10 and 05 marks, respectively.  <b>Note:</b> The end-semester examination will be worth 70 marks. The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus carrying of 2 marks each. In addition to that eight more questions will be set, two questions from each unit. The students shall be required to attempt five questions in all, selecting one question from each unit in addition to compulsory Question No. 01. All questions shall carry equal marks i.e. 14 marks.
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**Course objective:** To equip students with comprehensive knowledge and skills in managing food businesses, encompassing economics, operations, marketing, and regulatory aspects, to foster entrepreneurship and effective management in the food industry.

### UNIT-I

Introduction to Food Business Management: An overview of the food industry and its economic significance. Food policy, new product development, value analysis, and quality control. Process selection and forecasting: new business, cost, and product forecasting. Food commodity trading. Types of food businesses: manufacturing, retail, and services. Business environment analysis: PESTLE and SWOT frameworks.

### UNIT-II

Entrepreneurship Development Programs (EDP): introduction, importance, characteristics, and functions of an entrepreneur. Entrepreneurship in the food sector. Government schemes and incentives for the promotion of entrepreneurship. on small and medium enterprises (SMEs)/small-scale industries (SSIs). Business plan development and feasibility analysis. Funding sources and financial planning for food ventures. Financing and risk management in the food business. Business startup, mentorship and case study.

### UNIT-III

Marketing and supply chain management, Principles of marketing in the food industry. Market research for food business.; type of marketing management in food business

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production, management, retail and supply chain management, inventory management (introduction, functions, attributes, needs), market segmentation. Characteristics of Indian food processing industry. Social responsibility of food processing business.

#### UNIT-IV

Intellectual property rights and branding in food businesses. World trade agreements related with food business, export and prospects of food products in India. Regulatory and Quality Assurance. Govt. institutions: APEDA, MOFPI, Tea Board, Spice Board, etc. World Food Day. Consumer behavior towards food consumption, consumer surveys by various institutes and agencies.

#### Recommended Readings:

1. Acharya, S.S., & Agarwal, N.L. (2011). Agricultural Marketing in India. Oxford & IBH.
2. Kotler, P., & Keller, K. (2015). Marketing Management. Pearson Education.
3. Kuratko, D.F. (2016). Entrepreneurship: Theory, Process, Practice. Cengage Learning.
4. Government of India Reports – MOFPI, APEDA, FSSAI, etc.
5. Ramaswamy, V.S., & Namakumari, S. (2018). Marketing Management: Global Perspective Indian Context. McGraw Hill.
6. Jordan, L. (2015). Food Industry: Food Processing and Management. Callisto Reference; Illustrated edition.
7. Jeffrey, D. H. (2014). Economics and Management of the Food Industry. Taylor & Francis Ltd.

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

RBT Level	CO Code	Course Outcomes
L2	CO1	Explain the structure and economic significance of the food industry, policies, and business environment frameworks.
L3	CO2	Apply marketing and supply chain principles in food processing and consumer behavior.
L4	CO3	Analyze entrepreneurship opportunities, government schemes, and financial planning for food ventures.
L5	CO4	Evaluate IP rights, branding, and regulatory bodies' roles in food businesses, including global trade prospects.
L6	CO5	Design and propose a business plan for a food venture considering SWOT/PESTLE, forecasting, and feasibility analysis

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<b>Semester-IV</b> <b>Course Type:</b> Discipline Elective Course <b>Course Code:</b> U2MFT411T <b>Course Title:</b> Technology of Frozen Foods <b>Category:</b> Theory <b>Mode:</b> Lectures (L) <b>Hours/week:</b> 4 <b>Credits:</b> 4 <b>Examination Duration:</b> 3 Hours	<table border="0"> <tr> <td style="text-align: center;"><b>Course</b></td> <td style="text-align: center;"><b>Assessment</b></td> <td style="text-align: center;"><b>Methods:</b></td> </tr> <tr> <td style="text-align: center;">Note</td> <td style="text-align: center;">for</td> <td style="text-align: center;">Setters:</td> </tr> <tr> <td></td> <td style="text-align: center;">Paper</td> <td></td> </tr> </table> <p><b>Max. Marks: 100 (Internal: 30; External: 70)</b></p> <p>Two mid-term exams each of 15 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for assignment and class participation will be 10 and 05 marks, respectively.</p> <p><b>Note:</b> The end semester examination will be of 70 marks. The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to that eight more questions will be set, two questions from each unit. The students shall be required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 01. All questions shall carry equal marks i.e. 14 marks.</p>	<b>Course</b>	<b>Assessment</b>	<b>Methods:</b>	Note	for	Setters:		Paper	
<b>Course</b>	<b>Assessment</b>	<b>Methods:</b>								
Note	for	Setters:								
	Paper									

**Course Objective** – To impart knowledge and practical understanding of freezing technologies, packaging methods, quality and safety aspects, and cold chain management for the development and preservation of value-added frozen foods in India.

#### UNIT – I

Current status of frozen food industry in India, freezing process: mechanism of freezing, freezing curve, factors affecting freezing rate, glass transition temperature, thermo-physical properties of frozen foods, freezing load, freezing time calculations and state diagrams

#### UNIT – II

Freezing methods and equipment, convective (air freezing, brine freezing, cryogenic freezing) and conductive processes (contact and scraped freezers) of freezing, Individual Quick Freezing (IQF), Innovation in freezing process: freeze concentration, dehydro freezing, freeze drying, cryogenic freezing, changes during frozen storage, thawing techniques and microbial quality of thawed foods.

#### UNIT – III

Quality and safety of frozen foods: changes during freezing, quality and safety of frozen meat, fish, poultry and their products, quality and safety of frozen vegetables, fruits, dairy



products, ready to eat meals, bakery products, eggs and eggs products; sensory analysis and shelf-life evaluation of frozen foods.

#### UNIT – IV

Packaging of frozen foods: Introduction to frozen food packaging, different materials used for packaging, packaging machinery, cold store design, transportation of frozen foods, retail display equipment, household refrigerators and freezers, monitoring and control of cold chain.

#### Recommended Readings:

1. Sun, D. W. (2016). Handbook of frozen food processing and packaging. CRC press.
2. Hui Y. H., Legarretta I. G., Lim M. H., Murrell K.D. & Nip W. (2004) Handbook of Frozen Foods, CRC Press.
3. Erickson, M. C., & Hung, Y. C. (2012). Quality in frozen food. Springer Science & Business Media.
4. Evans J. A. (2011) Frozen Food Science and Technology, Wiley-Blackwell.
5. Branco, P. A. B. (2018). Frozen food technology. Arcler Education Inc.

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

RBT Level	Course Outcomes
L2	<b>CO1:</b> Recognize the freezing mechanism of foods and types of freezing methods.
L3	<b>CO2:</b> Interpret properties of frozen food and calculation of freezing time.
L4	<b>CO3:</b> Examine sensory and shelf-life characteristics of frozen foods.
L5	<b>CO4:</b> Identify various packaging materials and machine for manufacturing of frozen products
L6	<b>CO5:</b> Generate ideas regarding improved technologies for development of value-added frozen foods and management of suitable cold chain facilities in India.

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<b>Semester-IV</b> <b>Course Type:</b> Elective <b>Course Code:</b> U2MFT412T <b>Course Title:</b> Food Biotechnology <b>Category:</b> Theory <b>Mode:</b> Lectures (L) <b>Hours/week:</b> 4 <b>Credits:</b> 4 <b>Examination Duration:</b> 3 Hours	<table border="0"> <tr> <td style="text-align: center;"><b>Course Note</b></td> <td style="text-align: center;"><b>Assessment for Paper</b></td> <td style="text-align: center;"><b>Methods: Setters:</b></td> </tr> <tr> <td colspan="3"><b>Max. Marks: 100 (Internal: 30; External: 70)</b></td> </tr> <tr> <td colspan="3">Two mid-term exams each of 15 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for assignment and class participation will be 10 and 05 marks, respectively.</td> </tr> <tr> <td colspan="3"><b>Note:</b> The end semester examination will be of 70 marks. The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to that eight more questions will be set, two questions from each unit. The students shall be required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 01. All questions shall carry equal marks i.e. 14 marks.</td> </tr> </table>	<b>Course Note</b>	<b>Assessment for Paper</b>	<b>Methods: Setters:</b>	<b>Max. Marks: 100 (Internal: 30; External: 70)</b>			Two mid-term exams each of 15 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for assignment and class participation will be 10 and 05 marks, respectively.			<b>Note:</b> The end semester examination will be of 70 marks. The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to that eight more questions will be set, two questions from each unit. The students shall be required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 01. All questions shall carry equal marks i.e. 14 marks.		
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**Course Objective-**To provide students with advanced knowledge and practical skills in applying biotechnology techniques to improve food quality, safety, and production.

#### UNIT – I

Introduction to food biotechnology, bacteriophages, plasmids, basic principles of gene cloning, methods of gene cloning, advantages & disadvantages of methods, food safety and biotechnology. Polymerase Chain Reaction.

#### UNIT – II

Transgenic plants: current status, methods, prospects, risks and regulation. Application of transgenic plants in food industry, enhanced oil production, controlling oil quality through transgenesis.

#### UNIT – III

Transgenic Animals: current status, methods, prospects, risks and regulation. Application of transgenic animals in food industry- enhanced wool production, milk production.

#### UNIT – IV

Natural control of micro-organisms– bacteriocins of lactic acid bacteria, applications of bacteriocins in food systems. Aflatoxins– production, control and reduction using

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molecular strategies. Bioflavours and biocolors. Biosensors- principle, types and applications in food processing.

### Recommended Readings

1. Sinosh S. & Abhilash M (2022). Introduction to Food Biotechnology. CBS Publishers.
2. Yaradoddi, J. S., Meti, B. S., Mudgulkar, S. B., & Agsar, D. (Eds.). (2024). *Frontiers in food biotechnology*. Springer Nature.
3. Joshi, V. K., & Singh, R. S. (Eds.). (2012). *Food Biotechnology: Principles and Practices*. IK International Pvt Ltd.
4. Lee, B. H. (2014). *Fundamentals of food biotechnology*. John Wiley & Sons.
5. Gutierrez, G. F. & Barbosa-Canovas, G. V. (2003). *Food Science and Food Biotechnology*: CRC Press.
6. Chawla, H. S. (2000). *Introduction to Plant Biotechnology*: Oxford & IBH, New Delhi.

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

RBT Level	Course Outcomes
L2	CO1: <b>Explain</b> the fundamental concepts of food biotechnology including gene cloning and food safety.
L3	CO2: <b>Apply</b> DNA-based techniques such as PCR in food quality and safety assessments.
L4	CO3: <b>Analyze</b> the development, applications, and ethical implications of transgenic plants and animals..
L5	CO4: <b>Evaluate</b> molecular strategies such as bacteriocins, aflatoxin reduction, and protein engineering in food safety.
L6	CO5: <b>Design and develop</b> bio-based ingredients and sensors for use in food processing industries.

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<p><b>SEMESTER-IV</b></p> <p><b>Course Type:</b> Discipline Specific Course (DEC)</p> <p><b>Course Code:</b> U25MFT413T</p> <p><b>Course Title:</b> Industrial Microbiology</p> <p><b>Category:</b> Theory</p> <p><b>Mode:</b> Lectures (L)</p> <p><b>Hours/week:</b> 4</p> <p><b>Credits:</b> 4</p> <p><b>Examination Duration:</b> 3 Hours</p>	<p><b>Course Assessment Methods:</b></p> <p><b>Note for Paper Setters:</b></p> <p><b>Max. Marks: 100 (Internal: 30; External: 70)</b></p> <p><i>Note for Paper Setters:</i> Max. Marks: 100 (Internal: 30; External: 70) Two mid-term exams, each of 15 marks, will be conducted for the internal assessment, and the marks of the best one will be considered. Weightage for assignment and class participation will be 10 and 05 marks, respectively.</p> <p><b>Note:</b> The end semester examination will be of 70 marks. The examiner is required to set nine questions in all. The first question will be compulsory, consisting of seven short questions covering the entire syllabus, carrying 2 marks each. In addition to that, eight more questions will be set, two questions from each unit. The students shall be required to attempt five questions in all, selecting one question from each unit in addition to compulsory Question No. 01. All questions shall carry equal marks, i.e., 14 marks.</p>
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**Course Objective:** The objectives of this course are to educate students about the fundamental concepts of industrial microbiology and its related applications, thus preparing them to meet the challenges of the new and emerging areas of fermentation industry.

### UNIT I

Introduction to Fermentation Technology: Fermentation- Overview, Introduction to fermentation processes, industrially important Microorganisms-Isolation, screening, and preservation of industrially important microorganisms, Strain improvement for increased yield and other desirable characteristics; Fermentation Systems: Batch and Continuous system, Fed batch culture, multistage systems, Feedback systems, Solid substrate fermentation. Growth and non-growth associated product formation, product formation kinetics.

### UNIT II

Fermenter Design: Bioreactor configuration, design features, Criteria in Fermenter design, Requirement for aeration and mixing, Energy Transfer. Other fermenter designs- Tube reactors, packed bed reactors, fluidized bed reactors, cyclone reactors, trickle flow reactors. Production and Recovery of Primary and Secondary Metabolites: Industrial Alcohol, Beer, Wine, Citric Acid, Acetic acid, Baker's Yeast, Single Cell Protein, Industrial enzymes- Proteases, Antibiotics- Penicillin.

### UNIT III

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Downstream Processing: Separation of insoluble products - filtration, centrifugation, sedimentation, flocculation; Cell disruption; separation of soluble products: Liquid-liquid extractions, precipitation, chromatographic techniques, reverse osmosis, ultra and micro filtration, electrophoresis; final purification: drying; crystallization; storage and packaging.

#### UNIT IV

Waste Treatment: Waste Treatment systems, Aerobic and anaerobic waste treatment systems for waste treatment in fermentation industry, Treatment of sewage (primary, secondary and tertiary treatments), treatment of industrial effluents (distillery, textile, pulp and paper), methods to detect various pollutants (metals, sediments, toxin and organic matters). Solid waste types, composting, landfill development, incineration methods, composting and sustainable agriculture, biogas production, plastic degrading microorganisms as a tool for bioremediation, challenges in waste management.

#### Recommended Readings:

1. Stanbury, P.F., Hall, S., Whitaker, A., Principles of Fermentation Technology (3rd Ed.). Butterworth Heinemann Ltd., Elsevier. 2016.
  2. Ward, O.P., Fermentation Biotechnology - Principles, Process and Products. Prentice Hall Publishing, New Jersey. 1999.
  3. Prescott, S.C. & Dunn, G.C., Prescott and Dunn's Industrial Microbiology (4th Ed.). CBS Publication, New Delhi. 1992
  4. Cruger, W. & Kruger, A., Biotechnology -A Textbook of Industrial Microbiology (2nd Ed.). Panima Publishing Corporation, New Delhi. 2002. 8. Clarke, W., Industrial Microbiology. CBS Publisher and Distributors PVT. LTD New Delhi. 2016.
- Course Outcomes:** After the completion of the course, the students will be able to

RBT Level	Course Outcomes
L2	<b>Will have</b> gained insight on industrially important microbes, recent developments in fermentation processes and various optimization strategies at the fermenter level.
L3	<b>Attain</b> knowledge about designing of industrial strains and various media optimization strategies
L4	<b>Learn</b> about the design, types of fermenters and various critical components of bioreactors
L5	<b>Acquire</b> knowledge about various industrially relevant microbial products and their production process

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<p><b>Semester-IV</b>  <b>Course Type:</b> VOC  <b>Course Code:</b>  U25VOC416T  <b>Course Title:</b> Baked and Extruded Food Products  <b>Category:</b> Theory  <b>Mode:</b> Lectures (L)  <b>Hours/week:</b>2  <b>Credits:</b> 2  <b>Examination Duration:</b> 2 Hours</p>	<p><b>Course Assessment Methods:</b></p> <p><i>Note for Paper Setters:</i></p> <p><b>Max. Marks:</b> 50 (Internal: 15; External: 35)  Two mid-term exams each of 10 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for class participation will be 05 marks.</p> <p><b>Note:</b> The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set, with two questions from each unit. The students shall be required to attempt three questions in all, selecting one question from each unit carrying 10 marks each, in addition to compulsory Question No. 01 carrying 15 marks.</p>
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**Course Objective:** To equip students with the skills and knowledge required to produce a variety of baked and extruded products.

#### UNIT-I

Baked Products: Introduction to baking, Types of baked products (bread, cakes, pastries, cookies), Role of ingredients and their functions. Baking techniques and processes. Technology of Bread, Cookies, and Cakes.

#### UNIT-II

Extrusion: Introduction, Types of extruded products (snacks, breakfast cereals, pet foods), Role of ingredients and their functions. Extrusion process and equipment. Factors affecting extruded product quality. Technology of extruded snacks, breakfast cereal production (e.g., corn flakes, rice flakes).

#### Recommended Readings:

1. Kurien, V. (Ed.). (2004). Traditional Foods of India. ICAR.
2. Riar, C. S., & Saxena, D. C. (2014). Traditional Indian Foods: A Comprehensive Review. Springer.
3. Rahman, M. S. (Ed.). (2020). Handbook of food preservation. CRC press.
4. Madison, D. (2007). Preserving food without freezing or canning: Traditional techniques using salt, oil, sugar, alcohol, vinegar, drying, cold storage, and lactic fermentation. Chelsea Green Publishing.

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

RBT Level	Course Outcomes
L1	CO1: <b>Understand</b> the baking and extrusion process
L2	CO2: <b>Evaluate</b> the role of ingredients in baked and extruded products
L3	CO3: <b>Analyze</b> the role of process parameters in product quality
L4	CO4: <b>Assess</b> the quality and safety practices in baking and extrusion
L5	CO5: <b>Develop</b> innovative baked & extruded products

Dr  
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<p><b>Semester-IV</b>  <b>Course Type:</b> Skill Enhancement Course (SEC)  <b>Course Code:</b> U25SEC416T  <b>Course Title:</b> Value added Fruits and Vegetables Based Products  <b>Category:</b> Theory  <b>Mode:</b> Lectures (L)  <b>Hours/week:</b> 2  <b>Credits:</b> 2  <b>Examination Duration:</b> 2 Hours</p>	<p><b>Course Assessment Methods:</b></p> <p><i>Note for Paper Setters:</i></p> <p><b>Max. Marks:</b> 50 (Internal: 15; External: 35)</p> <p>Two mid-term exams each of 10 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for class participation will be 05 marks.</p> <p><b>Note:</b> The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set, with two questions from each unit. The students shall be required to attempt three questions in all, selecting one question from each unit carrying 10 marks each, in addition to compulsory Question No. 01 carrying 15 marks.</p>
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**Course objective:** To gain practical knowledge on the processing and preservation of fruits and vegetables and apply different packaging and quality evaluation techniques on developed products.

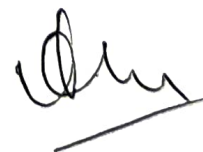
#### UNIT-I

Preparation of Jam, Jelly, leather, squash, nectar, cordial, preserve, syrup, candy, dried fruit, blanching, preparation of tomato products (juice, puree, paste, sauce), pickle, vegetable-based spread, gummies, dried vegetable, fermented products (sauerkraut, Kanji).

#### UNIT-II

Estimation of TSS, moisture, total solids, titratable acidity, ascorbic acid, total and reducing sugars, non-enzymatic browning, pectin, total polyphenolic compounds, Extraction (enzymatic, extractor) and clarification of fruit pulp/juice, thermal processing of fruits/fruit products.

**Recommended readings:**



1. Manual of methods of analysis of foods: Fruit and vegetables products, FSSAI, 2016
2. Jongen, W. (2002). Fruit and vegetable processing: Improving Quality: Woodhead Publishing, Boca raton.
3. Zeuthen, P. & Bogh- Sprensen, L. (2003). Food Preservation Techniques: CRC Press, Boca raton.
4. Vonloesecka, H. W. (1998). Drying and Dehydration of Foods: Allied, Bikaner.

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

RBT Level	Course Outcomes
L2	<b>CO1: Understand</b> food safety, hygiene, and standard practices during processing.
L3	<b>CO2: Use</b> principles of food preservation for new product development
L4	<b>CO3: Appraise</b> various processing techniques and equipment for product development
L5	<b>CO4: Evaluate</b> quality parameters of processed products
L6	<b>CO5: Develop</b> value added fruit & vegetable based new products

*Dr. Anshu*

SEMESTER-IV	Course Note	Assessment for Paper	Methods: Setters:
<b>Course Type:</b> Employability and Entrepreneurship Skill Course (EEC) <b>Course Code:</b> U2SEEC416T <b>Course Title:</b> Value Added Dairy-Based Products <b>Category:</b> Theory <b>Mode:</b> Lectures (L) <b>Hours/week:</b> 2 <b>Credits:</b> 2 <b>Examination Duration:</b> 2hrs	<b>Max. Marks:</b> 50 (Internal: 15; External: 35)  Two mid-term exams each of 10 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for class participation will be 05 marks.  <i>Note:</i> The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory, consisting of five short question covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set with two questions from each unit. The students shall be required to attempt three questions in all, selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1, consisting of 15 marks.		

**Course Objective:** To provide knowledge on the classification, processing, innovation, and commercialization of indigenous traditional dairy products with emphasis on modern techniques and value addition.

#### UNIT-I

Present status of indigenous traditional milk products. Classification of traditional dairy products: Heat desiccated, Heat concentrated, Heat and acid coagulated, Fermented and frozen. Process improvement of traditional milk products. Processing and process improvement of milk sweets.

#### UNIT-II

Innovative dairy products based on fruits, vegetables, cereals, etc. Advances in the manufacture of ghee. Concept of convenience traditional dairy products. New packaging systems for traditional dairy foods. Establishment of a commercial dairy plant.

#### Recommended Readings:

1. Aneja, R.P., Mathur, B.N., Chandan, R.C. and Banerjee, A.K. (2002). Technology of Indian Milk Products. Dairy India Yearbook.
2. Sukumar De. (2014). Outlines of Dairy Technology. Oxford University Press.

3. Walstra, P., Wouters, J.T.M. and Geurts, T.J. (2006). Dairy Science and Technology. CRC Press.
4. Singh, S. (2020). Traditional Dairy Products: Quality and Processing. New India Publishing Agency.

RBT Level	Course Outcomes: After the completion of the course, the students will be able to
L1	CO1: Describe traditional and modern classification systems of dairy-based value-added products.
L2	CO2: Explain the improved processes for manufacturing traditional milk-based sweets and desserts.
L3	CO3: Evaluate technological advances in the manufacturing of ghee and convenience dairy foods.
L4	CO4: Analyze packaging systems suitable for traditional dairy products.
L5	CO5: Design a basic layout and plan for a commercial dairy plant.

*Dr. Anand*

**A. Project/Dissertation (On campus)**

**Course Objective:** The course aims to acquaint the students with working on the project specified by the industry, meeting consumer demands, and reporting the work.

<p><b>SEMESTER IV</b>  <b>Course Type:</b>  <b>Course Code:</b> U25MFT401R  <b>Course Title:</b> Research Thesis  <b>Category:</b> Practical  <b>Mode:</b> Practical (P)</p>	<p><b>Course Assessment Methods:</b>                  The evaluation will be conducted in two components:                  Report-200 marks; Open viva -Voce examination-100 marks</p> <p><b>Max. Marks:</b> 300</p> <p><b>Note:</b> At the end of the project (during the 4th semester), the evaluation will be conducted by a committee comprising an external expert, the supervisor, and the department chairperson.</p>
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OR

**B. Industrial Project/Dissertation outside campus**

**Course Objective:** The course aims to acquaint the students about the research project preparation, execution and thesis submission.

<p><b>SEMESTER IV</b>  <b>Course Type:</b>  <b>Course Code:</b> U25MFT402R  <b>Course Title:</b> Industrial Project/Dissertation  <b>Category:</b> Practical  <b>Mode:</b> Practical (P)</p>	<p><b>Course Assessment Methods:</b> Evaluation will be conducted in 3 components- 200 marks (Report) + 100 marks (Viva) by an external expert                  100 marks – Supervisor +100 marks – Industry Mentor</p> <p><b>Max. Marks:</b> 500</p> <p><b>Note:</b> At the end of the project (during the 4th semester), the evaluation will be conducted by a committee comprising an external expert, the supervisor, and the department chairperson.</p>
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**Course Outcomes:** After the completion of the course, the students will be able to:

RBT Level	Course Outcomes	
L4: Analyse	CO1	<b>Identification</b> of areas of research project and planning of research problems in the food domain.
L4: Analyse	CO2	<b>Identify</b> the relevant methodology and preparation of the synopsis.
L5: Evaluate	CO3	<b>Evaluate</b> Design and conduct of experiments to achieve stated

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		objectives of the research problem.
L6: Create	CO4	<b>Generate</b> logical conclusions based on analysis and validation of research data.
L6: Create	CO5	<b>Organize</b> research findings in the form of thesis/ dissertation and its publication for the benefit of society.

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