

**As Per NEP 2020**

**University of Mumbai**



**Title of the programme**

- |           |  |   |                 |
|-----------|--|---|-----------------|
| <b>A-</b> | P.G. Diploma in Home Science –<br>Food Processing and Preservation     | } | <b>2023- 24</b> |
| <b>B-</b> | M.Sc. (Home Science –<br>Food Processing and Preservation) (Two Years) |   |                 |
| <b>C-</b> | M.Sc. (Home Science –<br>Food Processing and Preservation) (One Year)  |   | <b>2027- 28</b> |

**Syllabus for**

**Semester – Sem. - III & IV**

**Ref: GR dated 16th May, 2023 for Credit Structure of PG**

**(With effect from the academic year 2024-25)**

# University of Mumbai



(As per NEP 2020)

Sr. No.	Heading	Particulars
1	Title of program O: _____ B	M.Sc. (Home Science – Food Processing and Preservation) (Two Years)
2	Scheme of Examination R: _____	NEP 50% Internal 50% External, Semester End Examination Individual Passing in Internal and External Examination
3	Standards of Passing R: _____	40%
4	Credit Structure R: _____	Attached herewith
5	Semesters	Sem. III & IV
6	Program Academic Level	6.5
7	Pattern	Semester
8	Status	New
9	To be implemented from Academic Year	2024-25

**Sign of the BOS**  
**Chairman**  
**Name of the**  
**Chairman**  
**BOS in**

**Sign of the**  
**Offg. Associate Dean**  
**Name of the**  
**Associate Dean**  
**Faculty of**

**Sign of the**  
**Offg. Associate**  
**Dean**  
**Name of the**  
**Associate Dean**  
**Faculty of**

**Sign of the**  
**Offg. Dean**  
**Name of the Dean**  
**Faculty of**

# Preamble

## 1) Introduction

The College of Home Science Nirmala Niketan had instituted a M.Sc. programme in Foods and Nutrition in the year 1972, which was later amended to M.Sc. in Foods, Nutrition and Dietetics – a programme that covered the diverse areas of Foods, Nutrition and Dietetics. This highly successful programme has produced many acclaimed nutritionists in the field who have been gainfully employed in the various streams of the foods, nutrition and dietetics industries.

The field of nutrition is an extremely dynamic one and has evolved greatly in the last many decades. Advancement has been especially in the area of food processing and preservation as the food industry exponentially increased its products and its consumer reach. Thus, there arose a need to look at a new specialization which could produce nutritionists specially trained in this niche area. With this purpose the M.Sc. programme in Food Processing and Preservation was started in the year 2010.

The M.Sc. programme in Food Processing and Preservation has been restructured with the guidelines and the goals of the National Education Policy 2020. This programme in Food Processing and Preservation provides an in-depth knowledge of both theoretical and practical components across the diverse areas of the subject. The coursework includes advanced concepts of core subjects required in designing food products for individuals at different stages of the life cycle. These core subjects include human nutrition, nutritional biochemistry and nutrition across the lifecycle. The programme enables advanced knowledge and skill development in the specialised areas of food processing and preservation such as food chemistry, food science, food processing and quality control, food preservation, packaging and food informatics, and food engineering with inputs on ethical and sustainable food production.

The elective courses have been designed in order to provide students with opportunities to obtain insights and skill development in newer areas of food production, food science and quality control using latest research and trends with emphasis on the use of technology and innovative ideas. In the current times of evolution of thought with respect to sustainable practices, this syllabus draws the students' attention to the UN Sustainable Development Goals (SDGs) related to health. Electives have been offered on ethics and sustainability in the food processing industry to ensure that future professionals qualified in the areas of food processing and quality control hold these values as a priority.

Focus has been given to areas of innovation, entrepreneurship and sustainability in the food health. Through this programme the student will get multiple opportunities to create and innovate with regards to food product development with inputs in Intellectual Property Rights (IPR) which they can continue ahead into their professional career.

The strong emphasis on research methods, descriptive and advanced statistics and research project strengthens the students' scientific temper and builds research expertise and applications. The courses in research methods and statistics will help the students to understand the techniques and methodologies used across the diverse branches of study in the field of Food Processing and Preservation.

The M.Sc. in Food Processing and Preservation will deliver a holistic education that is in line with the goals of the National Education Policy 2020. The theory and practical learnings will help the students establish a niche career for themselves. They will be able to provide specialized expertise in the field to ensure that safe and healthy food products reach the market, thus being a

significant contributor to the health and wellness of individuals, communities and the nation and participating in the creation of sustainable health.

## **2) Aims and Objectives**

- a) To prepare students to create a strong understanding of fundamental, advanced and applied concepts in the field of food processing and preservation.
- b) To equip students with knowledge, skills and research competencies for practical applications into the areas of food science and processing, and food quality and its control.
- c) To develop in students the ability to think critically, conduct innovative research projects in relation to food product development, processing, preservation and quality control, embrace new technologies, blend creativity with health and sustainable development goals to bring outcomes for improved individual and community well-being.
- d) To foster an entrepreneurial mindset in students in the food processing and preservation course, enabling them to identify and seize opportunities within the industry, develop innovative food products, and create sustainable ventures in the field.
- e) To create competent professionals who work with acknowledgement of the dynamism and evolution in the field and are capable of keeping up with the emerging trends and practices in the field and have a vision to contribute to national and global development.
- f) To develop skilled professionals who recognize the rapid rate of research and technological advancement in the food industry, possess the skills to adapt to new trends, and work with a perspective to contribute to both national and global health improvement.

### 3) Learning Outcomes

The programme encompasses a comprehensive range of skills and knowledge, enabling graduates to excel in the multifaceted field of Food Processing and Preservation. On successful completion of the programme, student will be able to be a competent and valuable member of the fraternity as outlined below:

<b>Programme Outcome (PO)</b>	<b>Definition</b>	<b>Graduate Attribute</b>
	To be able to...	
PO1	Demonstrate an in-depth knowledge and understanding of core fundamentals of concepts of food preservation, food processing and its production. This will enable them to professionally practice in the industry of food preservation and processing competently.	Disciplinary Knowledge
PO2	Effectively develop holistic nutritious and sustainable food products, and to explain complex nutritional concepts in simple and understandable terms by both orally and in written communication to fellow professionals as well as the community.	Communication Skills
PO3	Design innovative food products for health, using sustainable methods, efficient processing methods along with its analysis to better community health will be addressed.	Critical Thinking
PO4	Creatively construct dietary, nutritional and lifestyle based products which help to preserve health, manage diseases, address nutrition related health issues in the community; to support the industry as a knowledge partner in formulation of healthy food products; and to engage in entrepreneurial initiatives to solve individual and community health problems.	Problem Solving Innovation Entrepreneurial Skills
PO5	Competently evaluate both traditional and newer food processing practices in relation to research-based products and draw applicable conclusions, using a scientific and an open mind with the vision of bettering food preservation and processing.	Analytical and Scientific Reasoning
PO6	Proficiently explore the cause-and-effect relationships of lifestyles on health and through a research-based temper and statistical analysis, draw adequate conclusions for applications of research in the food preservation and processing industry and community either as an employee or entrepreneur.	Research related skills

PO7	Successfully work in teams; and cooperate and derive significant and valuable conclusions for consumers of processed food through an interdisciplinary and collaborative efforts in the food preservation industry, community, research and organizational set-ups.	Cooperation /Team work
PO8	Translate research, recent innovations and personal and professional experiences into applications to benefit food processing and packaging industry, community health; and entrepreneurial ventures with self-awareness and contemplation.	Reflective Thinking
PO9	Use technology for food preservation and processing its communication, consumer information, hospital administration, nutrition education as well as be aware of using digitation for entrepreneurial ventures.	Information/digital literacy
PO10	Work independently or in groups, identify appropriate resources for a project and manage a project to its fruitful completion.	Self – Directed Learning
PO11	Be adept with use of national and global multi-cultural aspects of foods and nutrition, thus being able to deliver food products and nutrition and lifestyle strategies for health in harmony with the existing cultural practices of the individual and the community.	Multi-cultural competence
PO12	Practice safe principles of food preservation, processing, and community health in the most sustainable and effective manner, placing consumer, patient, community and fraternity well-being at the centre of all operations and to refrain from unethical behaviour at workplace, the community and research.	Moral and Ethical awareness and reasoning
PO 13	To ensure that all aspects of the Intellectual Property Rights (IPR) are adhered to in the interest of the community.	Moral and Ethical values
PO14	Take on leadership positions in food product development its formulation its packaging and sharing an inspiring vision and the eagerness to bring productive and sustainable positive results for the professional group, the community and the food processing and packaging industry using organizational, entrepreneurial and managerial skills.	Leadership readiness/qualities
PO15	Continue lifelong training and be updated with cutting edge knowledge and practices in the field and the understanding that ongoing learning has to be the personal and professional way of life; thus, being continuously involved in evolving, up scaling, reinventing and reskilling to the requirements of the times.	Lifelong learning

**4) Any other point (if any)**

**5) Credit Structure of the Program (Sem III & IV)**  
**(Table as per Parishisht 1 with sign of HOD and Dean)**

R\_\_\_\_\_

Post Graduate Programs in University:

- **PG Diploma in Home Science – Food Processing and Preservation**
- **M.Sc. (Home Science – Food Processing and Preservation) (Two Years)**

Parishishta - 1

**Exit option: PG Diploma (44 Credits) after Three Year UG Degree**

II	6.5	Sem III	<p><b>Course 1:</b> Nutrition and Biochemistry Theory (4 Cr) <b>Credits 4</b></p> <p><b>Course 2:</b> Advances in Food Processing Technology Theory (2 Cr) Advances in Food Analysis and Microbiology Practical (2 Cr) <b>Credits 4</b></p> <p><b>Course 3:</b> Advanced Study of Food Safety and Quality Assurance Theory (4 Cr) <b>Credits 4</b></p> <p><b>Course 4:</b> Entrepreneurship and Innovation Theory (2 Cr) <b>Credits 2</b></p>	<p><b>Credits 4</b></p> <p><b>Course 1:</b> Therapeutic Foods for Health and Disease Theory (2 Cr)</p> <p><b>Course 2:</b> Therapeutic Food Product Development and Shelf-life Studies Practical (2 Cr)</p> <p><b>OR</b></p> <p><b>Course 2:</b> Food Auditing Theory (2 Cr)</p> <p><b>Course 3:</b> Food Auditing Practical (2 Cr)</p>			<p>Research Project (4cr) <b>Credits 4</b></p>	22	<b>PG Degree After 3-YrUG</b>
----	-----	---------	---	---	--	--	--	----	-------------------------------



	<b>Sem IV</b>	<b>Course 1:</b> Advances in Human Nutrition Theory (4 Cr) <b>Credits 4</b>  <b>Course 2:</b> Food Biotechnology Theory (4 Cr) <b>Credits 4</b>  <b>Course 3:</b> Food Packaging Technology Theory (2 Cr)  Case Study Applications of Food Engineering in the Food Industry Practical (2cr) <b>Credits 4</b>	<b>Credits 4</b>  <b>Course 1:</b> Digital Technologies, Artificial Intelligence and Robotics in Food Processing Theory (2 Cr)  Food Psychology and Consumer Behaviour Practical (2 Cr)  <b>OR</b> <b>Course 2:</b> Niche Markets in Food Production Theory (2 Cr)  Niche Food Product Development Practical (2 Cr)			Research Project (6 Cr) <b>Credits 6</b>	22
	<b>Cum. Cr. for 1 Yr PG Degree</b>	<b>26</b>	<b>8</b>			<b>10</b>	<b>44</b>
	<b>Cum. Cr. for 2 Yr PG Degree</b>	<b>54</b>	<b>16</b>	<b>4</b>	<b>4</b>	<b>10</b>	<b>88</b>

Note: \* The number of courses can vary for totaling 14 Credits for Major Mandatory Courses in a semester as illustrated.

**Sem. - III**

**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - III)**

Course Code	Course Title	Th/Pr	Credits
FPP03C1	Nutrition and Biochemistry	Theory	4

**Course Objectives:**

To help, guide and support students to:

1. Recall the fundamental concepts of nutrition and biochemistry, such as macronutrients, micronutrients, metabolic pathways, and biochemical reactions.
2. Interpret the relationship between structure and function of biomolecules.
3. Apply biochemical principles in the study of metabolic pathways of human body.
4. Develop illustrative content on biochemical pathways and molecular reactions.

**Course Outcomes (CO):**

On successful completion of the course, the student will be able to:

CO No.	Course Outcomes
CO1	Recall the key terms and dietary guidelines recommended for different nutrients, as well as the structures of major biomolecules.
CO2	Interpret biochemical pathways involved in digestion, absorption, metabolism, and energy production.
CO3	Apply knowledge of biochemistry to explain the molecular mechanisms behind dietary recommendations and interventions.
CO4	Critically assess biochemical reactions and their outcomes
CO5	Evaluate the impact of different dietary patterns on biochemical markers and overall health outcomes.
CO6	Develop biochemical models or diagrams to illustrate metabolic pathways or molecular interactions.

Unit No.	Course Content	No. of Hours
I.	<p><b>A. Cell biochemistry:</b></p> <p>(i) Cell membrane and cellular communication: Cellular transport- Principles of mechanisms of passive, facilitated diffusion and active transport.</p> <p>(ii) Overview of Na- K ATPase, GLUT proteins and SGLT</p> <p>(iii) Overview of cell signalling and gap junctions in extracellular communication</p> <p><b>B. Carbohydrate biochemistry:</b></p> <p>(i) Classification of carbohydrates: Monosaccharides, oligosaccharides, polysaccharides, sugar alcohols, glycosides</p> <p>(ii) Carbohydrate metabolism: Overview of EMP Pathway, TCA cycle, glycogen metabolism and gluconeogenesis, HMP shunt, galactose metabolism</p> <p>(iii) Phosphorylation reactions (ATP synthesis), energy rich compounds, overview of ETC</p>	15

	(iv) Overview of metabolism of carbohydrate in fed, fasting and starvation states, in hyperglycemia and hypoglycemia	
<b>II.</b>	<p><b>A. Protein biochemistry:</b></p> <p>(i) Essential and non-essential amino acids, chemical structure of amino acids</p> <p>(ii) Formation of specialized products from amino acids and overview of their functions- glutathione, creatine &amp; creatinine, biogenic amines (dopamine, norepinephrine, tyramine, serotonin, GABA, histamine).</p> <p>(iii) Four levels of protein structure</p> <p>(iv) Functions of Insulin, Haemoglobin, Carboxypeptidase, Keratin</p> <p>(v) Overview of amino acid metabolism: Transamination, deamination, ammonia formation, detoxification, urea cycle, decarboxylation</p> <p>(vi) Metabolism of aromatic amino acids, BCAA, methionine and trans-methylation reactions. Inborn errors of amino acid metabolism</p> <p>(vii) Reactions of one carbon metabolism.</p> <p><b>B. Enzymes chemistry:</b></p> <p>(i) Enzyme classification, structure, factors affecting enzyme activity and enzyme inhibition</p> <p>(ii) Units to measure enzyme activity, significance of Km</p> <p>(iii) Overview of enzymes in digestion of carbohydrate, protein and fats</p>	<b>15</b>
<b>III</b>	<p><b>A. Lipids:</b></p> <p>(i) Classification: compound lipids, fatty acids, MCT's, cholesterol, prostanoids</p> <p>(ii) Lipid metabolism – Knoop's Beta oxidation, fatty acid biosynthesis, cholesterol biosynthesis, ketogenesis</p> <p>(iii) Lipoprotein metabolism</p> <p>(iv) Overview of composition of various edible oils</p> <p><b>B. Chemistry and Metabolism of Nucleic Acids:</b></p> <p>(i) Structure, properties and functions of DNA replication, RNA transcription and translation</p> <p>(ii) Overview of structure of gene and its organization, gene regulation and operon model</p> <p>(iii) Mutation – types, physical, chemical and biological agents causing mutations</p> <p>(iv) DNA repair mechanism</p> <p>(v) Epigenetics: Definition and mechanisms</p>	<b>15</b>
<b>IV</b>	<p><b>A. Overview of Endocrinology</b></p> <p>(i) Overview of classification of hormones, mechanism of action, synthesis of hormones– pituitary hormones, thyroxine, adrenal hormones, pancreatic hormones, gastro-intestinal hormones, male and female sex hormones, adipose tissues hormones</p> <p>(ii) Functions and hyper – hypo states of thyroid, insulin, glucagon, adrenal, medullary and cortical hormones</p> <p><b>B. Acid- base balance: Fluid and Electrolyte Balance</b></p> <p>(i) Fluid balance, role of water in human nutrition</p> <p>(ii) Dehydration; commercial rehydration solutions</p>	<b>15</b>
	<b>Total Contact Hours</b>	<b>60</b>

### References:

- Nelson D.L. and Cox M.M. (2004) *Lehninger Principles of Biochemistry*. 4<sup>th</sup> Edition, W. H. Freeman & Company, New York, U.S.A.
- Rastogi S.C. (2019). *Biochemistry*. Tata Mac Graw Hill Publishing Co. Ltd.
- Whitney, E. N. and Rolfes, S. R. (2018) *Understanding Nutrition*. 15<sup>th</sup> Edition. West publishing Company, St. Paul, U.S.A.

Berg, J. M., Tynocrko, J. L. et al. (2006). *Biochemistry* (6th ed.) New York W.H. Freeman and Co .  
 Brody Tom. (2004). *Nutritional Biochemistry* 2nd ed. New Delhi Elsevier/Reed Elsevier India Pvt. Ltd.  
 Chatterjee M.N. Shinde and Rana. (2012). *Textbook of Medical Biochemistry* 8th ed. New Delhi Jaypee Brothers Medical Publishers.  
 Puri Dinesh. (2002). *Textbook of Biochemistry. A Clinically oriented Approach* New Delhi B.I. Churchill Livingstone Pvt. Ltd.  
 Satyanarayan U. and Chakrapani U. (2013). *Biochemistry* 4<sup>th</sup> ed. Elsevier.  
 Satyanarayan U. and Chakrapani U. (2019). *Essentials of Biochemistry* 3<sup>rd</sup> ed. Books and Allied (p) Ltd.

**Evaluation:**

4 credits 100 marks

<b>CONTINUOUS INTERNAL EVALUATION:</b>	<b>Marks</b>
Written and oral presentations on assigned topic / Literature review with class discussion	20
Class participation, Class test/ Quiz/ Group Discussion	20
Creating learning resources (videos or posters or brochures)	10
<b>Total</b>	<b>50</b>
<b>SEMESTER-END EXAMINATION</b>	<b>Marks</b>
All questions are compulsory with internal choice.	
Question 1 from Unit 1	10
Question 2 from Unit 2	10
Question 3 from Unit 3	10
Question 4 from Unit 4	10
Question 5 from multiple units	10
<b>Total</b>	<b>50</b>

**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - III)**

Course Code	Course Title	Th/Pr	Credits
FPP03C2A	Advances in Food Processing Technology	Theory	2

**Course Objectives:**

To mentor and uphold students to:

1. Memorize key methods and techniques used in modern food processing.
2. Apply knowledge of advanced food processing technologies to optimize food preservation, shelf-life extension, and sensory attributes.
3. Develop ideas for integrating advanced food processing technologies into food production systems.

**Course Outcomes:**

On successful completion of the course, the student will be able to:

CO No.	Course Outcome
CO1	Recall and describe the basic principles and concepts of food processing technology.
CO2	Explain the principles behind advanced food processing technologies, such as high-pressure processing, membrane technology, and novel thermal processing methods.
CO3	Apply knowledge of food processing technologies to select appropriate methods for specific food products.
CO4	Analyze the impact of advanced food processing technologies on food composition, structure, and sensory properties.
CO5	Evaluate the sustainability and environmental impact of advanced food processing technologies.
CO6	Design innovative food processing strategies or modifications to existing techniques to enhance food quality or safety.

Unit No.	Course Content	No. of Hours
I.	<p><b>A. Cereals, Millets and Pseudo-Cereals</b></p> <p>(i) Recent advances in milling of rice, wheat and millets</p> <p>(ii) Specialty corn for value addition</p> <p>(iii) Malting technology- an overview</p> <p>(iv) Technology used in production of breakfast cereals</p> <p><b>B. Pulses and Legumes</b></p> <p>(i) Recent advances in milling and processing of pulses</p> <p>(ii) Current trends in plant-based protein consumption, e.g. pea protein, nut protein</p> <p>(iii) Cereal-Pulse combinations to enhance nutritive value</p> <p><b>C. Fruits and Vegetables</b></p>	15

	<p>(i) Overview of methods used in fruit and vegetable processing: freezing, canning, sun-drying dehydration</p> <p>(ii) Overview of advanced technology used in fruit and vegetable processing: Ohmic processing, extrusion technology, high pressure processing, ozonation, gamma radiation</p> <p>(iii) Packaging requirements and methods of packaging minimally processed fruits and vegetables</p> <p>(iv) Overview of value-added products made from fruits and vegetables: jams / jellies/ marmalades/ fruit leather, etc.</p> <p><b>D. Nuts and Oilseeds:</b></p> <p>(i) Technology and equipment used in oil/ fat processing: pressing, extraction, refining and hydrogenation</p> <p>(ii) Blending of oils</p> <p>(iii) Overview of processing of value-added products (margarine, vanaspati, ghee, mayonnaise, nut butters, nut milk, coconut products)</p> <p><b>E. Plant-based Beverages:</b></p> <p>Overview of process through flow-charts:</p> <p>(i) Tea</p> <p>(ii) Coffee</p> <p>(iii) Cocoa processing</p> <p>F. Fortification of plant based foods</p>	
<p><b>II.</b></p>	<p><b>A. Meat</b></p> <p>(i) Meat plant design</p> <p>(ii) Technology and machinery used in meat processing: freezing, smoking, curing</p> <p>(iii) By-products from meat industries and their utilization</p> <p><b>B. Poultry:</b></p> <p>(i) Technology used in processing of value-added poultry products (frozen chicken, dehydrated powders, salami, sausages)</p> <p>(ii) By-products from poultry industries and their utilization</p> <p><b>C. Eggs</b></p> <p>(i) Technology used in processing of value-added egg products (frozen eggs, canned egg whites/yolks, pasteurized egg products, dried eggs, pickled eggs)</p> <p><b>D. Seafood</b></p> <p>(i) Technology used in processing and preservation of fish: canning, freezing, drying, smoking and curing.</p> <p>(ii) Manufacture of fish flour and fish oils</p>	<p><b>15</b></p>

(ii) Overview of value added products from sea-weed and marine algae	
<b>E. Milk and Milk Products</b>	
(i) Introduction to processed products: fermented and unfermented products from milk	
(ii) Processing and utilization of milk processing by-products: casein, caseinates, lactose, whey protein concentrates and isolates,	
(iii) Substitutes for milk and milk products	
(iv) Overview of technology of baby foods	
(v) Emergence and production of probiotic milk products and lactose-free milk products	
<b>Total hours</b>	<b>30</b>

### References:

- Khetarpaul N (2010) *Emerging Trends in Post Harvest Processing and Utilization of Plant Foods*. ATPA
- P J Fellows (2009) *Food Processing Technology: Principles and Practice*. Woodhead Publishing Series in Food Science, Technology and Nutrition
- Amalendu Chakraverty and Arun S. Mujumdar. (2003) *Handbook of Postharvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices*.
- Scottsmith and Hui Y.H (Editors) (2004) *Food Processing – Principles and Applications*. London Blackwell Publishing.
- Subbulakshmi, G and Udipi, S. A. (2021). *Foods Processing and Preservation* (2nd ed). New Delhi: New Age International (P) Ltd. Publishing.
- Srilakshmi, B (2018). *Food Science* (7th ed). New Delhi: New Age International Publishers
- Rathore, NS et al. (2008). *Fundamentals of Dairy Technology- Theory & Practices*. Himanshu Publications.

### Evaluation:

2 Credits                      50 marks

<b>CONTINUOUS INTERNAL EVALUATION (50%):</b>	<b>Marks</b>
Preparation of any one value added product from fruit/ vegetable and conducting its sensory evaluation through a formal set-up	15
Class participation, Class test/ Quiz	10
<b>Total</b>	<b>25</b>
<b>SEMESTER-END EXAMINATION (50%):</b>	<b>Marks</b>
<b>All questions are compulsory with internal choice</b>	
Question 1 from Unit 1	10
Question 2 from Unit 2	10
Question 3 from multiple units	5
<b>Total</b>	<b>25</b>



**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - III)**

Course Code	Course Title	Th/Pr	Credits
FPP03C2BP	Advances in Food Analysis and Microbiology	Practical	2

**Course Objectives:**

To equip, train and enable students to:

1. Recall the basic principles and terminology related to food analysis and microbiology.
2. Explain the principles behind advanced techniques in food analysis.
3. Apply knowledge of advanced food analysis techniques to identify and quantify components in food samples.
4. Critically evaluate the reliability and accuracy of food analysis results and microbial testing methods.
5. Design experiments to investigate specific food analysis.

**Course Outcomes:**

On successful completion of the course, the student will be able to:

CO No.	Course Outcome
CO1	Memorize safety protocols and regulations relevant to handling and testing food samples.
CO2	Summarize the importance of accurate food analysis in ensuring food quality, safety, and regulatory compliance.
CO3	Apply knowledge of food analysis techniques to perform qualitative and quantitative analysis of food samples.
CO4	Compare and contrast the microbiological profiles of different food products and their implications for consumer health.
CO5	Assess the reliability and validity of food analysis results in relation to regulatory standards and consumer protection.
CO6	Design protocols for conducting comprehensive food safety assessments using integrated approaches in microbiology and food analysis.

Unit No.	Course Content	No. of Hours
I.	<p><b>Chemical Analysis of Foods</b></p> <p>(i) Estimation of proteins using microkjehldahl method</p> <p>(ii) Study of soxhlet apparatus for fat estimation</p> <p>(iii) Mohr titration of salt in butter (AOAC method 960.29)</p> <p>(iv) Study of factors affected by food spoilage:</p> <ul style="list-style-type: none"> <li>• Study of changes in pH of food with increasing spoilage, using pH meter, pH pen, pH paper and universal indicator solution</li> <li>• Study of changes in titratable acidity of foods with ripening/ storage</li> <li>• Study of changes in sugar content in food with increasing spoilage, using refractrometer</li> </ul>	30

	<p>(v) Comparative analysis of water from at least five different sources:</p> <ul style="list-style-type: none"> <li>• pH of water samples using universal indicator solution</li> <li>• Sensory test for odour and taste of the water samples</li> <li>• Hardness of the water samples</li> </ul> <p>(vi) Analysis of nature and quality of oils/fat:</p> <ul style="list-style-type: none"> <li>• Estimation of peroxide value</li> <li>• Estimation of acid value</li> <li>• Estimation of iodine value</li> <li>• Estimation of saponification value</li> </ul> <p>(vii) Study of antioxidant profile of food sample using UV- spectrophotometer</p>	
<b>II.</b>	<p><b>Microbiological Analysis of Foods</b></p> <p>(i) Testing of water quality for presence of coliforms using MPN method</p> <p>(ii) Conventional methods for enumeration (and wherever applicable, confirmation) of:</p> <ul style="list-style-type: none"> <li>• Yeast and moulds</li> <li>• Coliforms</li> <li>• Bacillus cereus</li> <li>• Staphylococcus aureus</li> <li>• Salmonella</li> </ul> <p>(iii) Study of rapid test kits available for detection of food-borne pathogens</p>	<b>30</b>
	<b>Total hours</b>	<b>60</b>

**References:**

A.O.A.C. (2023). *Official Methods of Analysis* (23rd ed.). Association of official analytical chemists, Washington, D.C.

Nielsen, S. Suzanne (ed). (2002). *Introduction to the Chemical Analysis of Foods*. CBS Publishers and Distributors, New Delhi

Bureau of Indian standards: *specifications and standard methods* volume I to XII

Glazer AN and Nikaïdo H. (2007). *Microbial Biotechnology* (2nd ed). Cambridge University Press

Glick BR, Pasternak JJ and Patten CL.(2010). *Molecular Biotechnology* (4<sup>th</sup> ed). ASM Press

Mahindru, S.N. (2000). *Food safety - a techno legal analysis*. Tata McGraw Hill Publishing Co. Ltd New Delhi

Nielson, S.S. (1994). *Introduction to the chemical analysis of foods*. Jones and Bartlet Publishers Boston

**Evaluation:**

2 Credits

50 marks

<b>CONTINUOUS INTERNAL EVALUATION (50%):</b>	<b>Marks</b>
Class participation, Journal	5
Involvement in, and adherence to, laboratory protocols	5
Performance of microbial quality control test for any one food sample using total plate count and yeast and mold count	15
<b>Total</b>	<b>25</b>

<b>SEMESTER-END EXAMINATION (50%):</b>	<b>Marks</b>
Performance of practical from Unit 1	10
Performance of practical from Unit 2	10
Viva voce	5
<b>Total</b>	<b>25</b>

**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - III)**

Course Code	Course Title	Th/Pr	Credits
FPP03C3	Advanced Study of Food Safety and Quality Assurance	Theory	4

**Course Objectives:**

**To uphold and enable students to:**

1. Memorize key regulations, standards, and guidelines governing food safety and quality assurance.
2. Interpret the relationship between food safety practices, quality control measures, and consumer protection.
3. Evaluate the effectiveness of food safety and quality assurance programs in preventing foodborne illnesses.
4. Design protocols or procedures for conducting food safety assessments as professionals.

**Course Outcomes:**

On successful completion of the course, the student will be able to:

CO No.	Course Outcome
CO1	Recall fundamental principles and terminology related to food safety and quality assurance, including hazard analysis, critical control points (HACCP), and food quality parameters.
CO2	Explain the principles and concepts underlying food safety management systems, such as ISO standards and Good Manufacturing Practices (GMP).
CO3	Apply knowledge of advanced food safety and quality assurance principles to develop and implement effective food safety plans and quality management systems.
CO4	Analyze case studies or scenarios involving food safety incidents or quality issues to identify root causes and propose corrective actions.
CO5	Assess the economic impact of food safety incidents and quality failures on businesses and stakeholders.
CO6	Develop comprehensive food safety and quality assurance strategies for specific food products or processing facilities.

Unit No.	Course Content	No. of Hours
I.	<p><b>A. Management Systems in Food Quality Control</b></p> <p>(i) Detailed study of national and international food standards – ISI, BIS, AGMARK, Codex Alimentarius, ISO, BRC Global Standards, SQF</p> <p>(ii) Systems in laboratory accreditation</p> <p><b>B. Management Systems in Food Quality Control</b></p> <p>Detailed study of :</p> <p>(i) TQM and Kaizen</p> <p>(ii) Lean manufacturing, six sigma</p> <p>(iii) Schedule 2 of FSSAI (Licensing and Registration of Food Businesses)</p> <p>(iv) Schedule 4 of FSSAI (Food Audits)</p>	15

<p><b>II.</b></p>	<p>Food Safety Management Systems</p> <p>(i) Concept of food safety management systems (FSMS)</p> <p>(ii) Implementation of FSMS in various sectors:</p> <ul style="list-style-type: none"> <li>• Manufacturing</li> <li>• Re-packing/ Re-labeling</li> <li>• Catering</li> <li>• Distribution</li> <li>• Import</li> <li>• Retail</li> </ul> <p>(iii) Drafting of FSMS plans</p> <p>Food Safety in Supply Chain Management</p> <p>(i) Supplier management and auditing</p> <p>(ii) Traceability and recall procedures</p> <p>(iii) Supply chain risk assessment</p>	<p><b>15</b></p>
<p><b>III.</b></p>	<p>Standard Operating Procedures (SOPs)</p> <p>(i) Format of an SOP in food business operation</p> <p>(ii) Guidelines for drafting of scope, policy and quality objectives of a food business operator</p> <p>(ii) SOP for purchasing raw materials, receiving raw materials, storage, cleaning, holding, cooling, freezing, thawing, reheating, personal hygiene, facility and equipment</p> <p><b>Pre-requisite Programmes</b></p> <p>(i) Good manufacturing practices</p> <p>(ii) Good hygiene practices</p> <p>(iii) Occupational health and safety specification</p> <p>(iv) Construction and maintenance of food processing plant</p>	<p><b>15</b></p>
<p><b>IV.</b></p>	<p>Emerging Issues in Food Safety</p> <p>(i) Food fraud and authenticity</p> <p>(ii) Food defense and bioterrorism</p> <p>(iii) Novel foods and their safety assessment</p> <p><b>Introduction to logistics and supply chain management in food business</b></p> <p>Professional Development and Industry Trends</p> <p>(i) Career opportunities in food safety and quality assurance</p> <p>(ii) Professional certifications for career upgrade</p> <p>(iii) Industry trends and future directions</p>	<p><b>15</b></p>
<b>Total hours</b>		<p><b>60</b></p>

**References:**

- Srilakshmi, B (2018). *Food Science* (7th ed). New Delhi: New Age International Publishers
- Manay, N.S. and Shadaksharaswamy, M. (2021). *Food Facts and Principles* (5th ed) New Age International Publishers. New Delhi.
- Shearshet, A. (2020). *Food Safety For Food Processors + Quality Assurance in Manufacturing* (2nd ed.). NutriNiche

System LLC.

Weaver, C.M., Daniel, J.R. (2003). *The Food Chemistry Laboratory: A Manual for Experimental Foods, Dietetics, and Food Scientists* (2nd ed.). CRC Press. London

Alli, I. (2003). *Food Quality Assurance* (1st ed.). CRC Press.

Knechtges, P. (2011). *Food Safety: Theory and Practice* (1st ed.). Jones & Bartlett Learning

Andres, V. J. (2005). *Quality Assurance for the Food Industry - a Practical Approach*. CRC press.

Mortimore, S. and Wallace, C. (2013). *HACCP - a Practical Approach* (3rd ed.). Chapman and Hall, London.

Regulations and schedules under Food Safety and Standards Authority of India (FSSAI)

**Evaluation:**

4 Credits

100 marks

<b>CONTINUOUS INTERNAL EVALUATION (50%):</b>	<b>Marks</b>
Quiz/ class test	10
Presentation of case study on food frauds/ bioterrorism	10
Draft a HACCP plan for any food business operation	20
Class participation	10
<b>Total</b>	<b>50</b>
<b>SEMESTER-END EXAMINATION (50%):</b>	<b>Marks</b>
<b>All questions are compulsory with internal choice</b>	
Question 1 from Unit 1	10
Question 2 from Unit 2	10
Question 3 from Unit 3	10
Question 4 from Unit 4	10
Question 5 from multiple units	10
<b>Total</b>	<b>50</b>

**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - III)**

Course Code	Course Title	Th/Pr	Credits
FPP03C4	Entrepreneurship and Innovation	Theory	2

**Course Objectives:**

**To enable students to:**

1. Memorize key principles of entrepreneurial success and innovation processes.
2. Utilize creativity and problem-solving skills to generate innovative business ideas and solutions.
3. Assess the scalability and sustainability of innovative business ideas and ventures.
4. Develop strategies to foster an entrepreneurial mindset and culture within organizations or communities.

**Course Outcomes:**

On successful completion of the course, the student will be able to:

CO No.	Course Outcome
CO1	Recall fundamental concepts and terminology related to entrepreneurship and innovation, such as business models, market analysis, and intellectual property.
CO2	Interpret the role of innovation in driving business growth and competitive advantage.
CO3	Apply entrepreneurial concepts and frameworks to analyze market opportunities, assess feasibility, and develop business plans.
CO4	Critically evaluate business models, market strategies, and innovation processes in real-world contexts.
CO5	Evaluate the potential impact of new technologies, trends, and disruptions on entrepreneurial ventures and industries.
CO6	Develop a skills for formulating a comprehensive business plan for a new venture, incorporating elements of innovation, market analysis, financial projections, and risk management.

Unit No.	Course Content	No. of Hours

<p><b>I.</b></p>	<p>Entrepreneurship in Food Processing</p> <p>(i) Definition and meaning of entrepreneurship</p> <p>(ii) Types, classification and trends of entrepreneurial ventures in foods and nutrition</p> <p>(iii) Qualities and skills of an entrepreneur</p> <p>(iv) Resources required for a business</p> <p>(v) Project formulation, evaluation and feasibility analysis</p> <p>(vi) Idea generation</p> <p>(vii) Market research</p> <p>(viii) Project selection</p> <p>(ix) Project evaluation using appropriate industry standards</p> <p>(x) Business planning</p> <p>(xi) Importance, purpose and efficiency of a plan</p> <p>(i) Business acquisition, franchising and outsourcing</p> <p>(ii) Legal, ethical and environmental considerations of the entrepreneurial venture</p> <p>(iii) Overview of business regulation by the government</p> <p>(iv) Inspection, licensing</p> <p>(xvi) Patent, trademark and intellectual property rights registration and accreditations</p>	<p><b>15</b></p>
<p><b>II.</b></p>	<p><b>Marketing and Marketing Management</b></p> <p>(i) Concepts of marketing</p> <p>(ii) Channels of distribution</p> <p>(iii) Market Research and Marketing strategies</p> <p>(iv) Market segmentation, targeting and positioning</p> <p>(v) Novel and innovative product /service development</p> <p>(vi) Brand development and promotion</p> <p><b>Financial Considerations of Entrepreneurship</b></p> <p>(i) Funding for the business proposal</p> <p>(ii) Government and non-government opportunities for funds and resources</p> <p>(iii) Franchising opportunities</p> <p>(iv) Product pricing and profit generation</p> <p>(v) Tools of analysis of costing, cost control and budgeting</p> <p>(vi) Accounting procedures and financial statements</p> <p>(vii) Investing resources into the business</p> <p>(viii) Corporate social responsibility</p>	<p><b>15</b></p>
	<p><b>Total hours</b></p>	<p><b>60</b></p>

**References:**

Kotler, P. (2003). *Marketing Management* 11th ed. Pearson Education (Singapore) Pte. Ltd. Delhi.

Agarwal, T. (2007) *Strategic Human Resource Management*. Oxford University Press – New Delhi

Aswathappa, K. (2005). *Human Resource and Personnel Management – Text and Cases*. Tata McGraw – Hill Publishing Co. Ltd. New Delhi

Boyd, H.W., Walker, O.C. and Larreche, J. (1995) *Marketing Management – A Strategic Approach with a Global Orientation*. 2nd ed. Irwin Chicago

Cartwright, R., Collins, M., Green, G. and Candy, A. (2001). *The Handbook for Managing Resources and Information*. Infinity books, New Delhi

Ivancevich, J.M., Donnelly, J.H. and Gibson, J.L. (1996). *Management – Principles and Functions*. (4th ed.) All India Traveller Bookseller. Delhi

Kale, N.G. (2003) *Principles and Practice of Marketing*. Vipul prakashan – Mumbai

Rao, V.S.P. (2005) *Human Resource Management – Text and Cases*. (2nd ed.) Excel Books. New Delhi



Shookla, M.S. (2004). *A Handbook of Human Relations (with Structured Experiences and Instruments)*. Macmillan India Ltd. Delhi  
 Singh, P.N. (1998). *Developing and Managing Human Resources*. (3rd ed.) Suchandra Publications. Mumbai.

**Evaluation:**

4 Credits                      100 marks

<b>CONTINUOUS INTERNAL EVALUATION (50%):</b>	<b>Marks</b>
Presentation of case study on Indian food-preneurs	20
Presentation of case study on marketing strategies of Indian food brands	20
Class participation	10
<b>Total</b>	<b>50</b>

<b>SEMESTER-END EXAMINATION (50%):</b>	<b>Marks</b>
<b>All questions are compulsory with internal choice</b>	
Question 1 from Unit 1	10
Question 2 from Unit 2	10
Question 3 from Unit 3	10
Question 4 from Unit 4	10
Question 5 from multiple units	10
<b>Total</b>	<b>50</b>

**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - III)**

Course Code	Title of the Course	Th/Pr	Credits
FPP03C5E1A	Therapeutic Foods for Health and Disease	Theory	2

**Course Objectives:**

To enable students:

1. Recall fundamental concepts and terminology related to therapeutic foods, including their definition, types, and classifications based on health benefits.
2. Utilize dietary guidelines and nutritional recommendations to optimize the use of therapeutic foods in clinical and preventive healthcare settings.
3. Develop strategies to integrate therapeutic food recommendations into clinical practice and public health initiatives.

**Course Outcomes:**

On successful completion of the course, the student will be able to:

CO No.	Course Outcome
CO1	Memorize key nutrients and bioactive compounds in foods that contribute to therapeutic effects in various health conditions.
CO2	Explain the biochemical and physiological mechanisms through which therapeutic foods exert their effects on health and disease prevention.
CO3	Apply knowledge of therapeutic foods to design personalized dietary plans for individuals with specific health conditions, such as diabetes, cardiovascular diseases, or inflammatory disorders.
CO4	Analyze scientific literature and research studies on the efficacy and safety of therapeutic foods in disease management.
CO5	Evaluate the impact of dietary patterns and food choices on health outcomes, considering cultural, socioeconomic, and individual factors.
CO6	Design educational materials or resources to promote the role of therapeutic foods in disease prevention and management.

Unit No.	Course Content	No. of Hours
I.	<p><b>A. Introduction to Therapeutic Foods</b></p> <p>(i) Definition and scope of therapeutic foods</p> <p>(ii) Importance of food science in addressing nutritional challenges</p> <p><b>B. Bioactive Compounds and Functional Foods</b></p> <p>(i) Overview of bioactive compounds and their health benefits</p> <p>(ii) Exploration of vitamins, minerals, phytochemicals, and their roles in health</p> <p>(iii) Functional foods and their impact on disease prevention and management</p> <p>(iv) Importance of probiotics, prebiotics</p>	15

	<b>C. Food Preservation Techniques for Nutrient Retention</b> (i) Preservation methods: drying, freezing, fermentation (ii) Minimizing nutrient loss during food processing	
<b>II.</b>	<b>A. Sensory Evaluation and Safety of Therapeutic Foods</b> (i) Sensory attributes and consumer acceptance of therapeutic foods (ii) Ensuring food safety and quality in therapeutic food production <b>B. Ethical and Regulatory Considerations</b> (i) Ethical challenges in marketing and labeling therapeutic foods (ii) Regulatory frameworks and guidelines for therapeutic food development <b>C. Future Trends in Therapeutic Food Science</b> (i) Emerging technologies in food science and their potential impact (ii) Innovations in personalized nutrition and its application in therapeutic foods	<b>15</b>
	<b>Total hours</b>	<b>30</b>

**References:**

- Amerine, Pangborn & Roessler (1965). *Principles of Sensory Evaluation of food*, Academic Press, London.  
deMan J. (2007). *Principles of Food Chemistry*, 3rd ed., Springer.  
Jameson K. (1998). *Food Science – A Laboratory Manual*, New Jersey:Prentice Hall Inc. Lawless, H. and Heymann, H. (1998).  
McWilliam, M. (2001). *Foods – Experimental Perspectives* (4th Ed.), New Jersey: Prentice Hall Inc.USA: CRC Press Inc.  
Meilgard (1999). *Sensory Evaluation Techniques*, 3rd ed. CRC Press LLC, 1999.  
Pomeranz Y and Meloan CE (2002). *Food Analysis – Theory and Practice*, CBS Publishers and Distributors, New Delhi.  
Rao E. S. (2013). *Food Quality Evaluation*. Variety Books.  
*Sensory Evaluation of Food – Principles and Practices*, Kluwer Academic/Plemer Publishers.  
Weaver, C. (1996), *Food Chemistry Laboratory – A manual for Experimental Foods*.

**Evaluation:**

**2 credits (Total marks 50)**

<b>CONTINUOUS INTERNAL EVALUATION:</b>	<b>Marks</b>
Class participation, PowerPoint Presentation/ Literature review with class discussion	15
Critical analysis/ Literature review/Preparation of learning resources (videos/ posters/ brochures) for nursing or dietetic student/ Group discussion/ Quiz/ Class Test	10
<b>Total Marks for Internal Assessment</b>	<b>25</b>
<b>SEMESTER-END EXAMINATION:</b>	<b>Marks</b>
All questions are compulsory with internal choice.	
Question 1 from Unit 1	10
Question 2 from Unit 2	10
Question 3 from multiple units	10
<b>Total Marks for Semester End Examination</b>	<b>25</b>

**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - III)**

Course Code	Title of the Course	Th/Pr	Credits
FPP03C5E1BP	Therapeutic Food Product Development and Shelf-life Studies	Practical	2

**Course Objectives:**

To uphold and guide students to:

1. Recollect the fundamental concepts and terminology related to therapeutic food product development.
2. Interpret the factors affecting the stability and quality of therapeutic foods over time.
3. Utilize techniques for shelf-life testing to evaluate the effectiveness of preservation methods and packaging materials.
4. Design and formulate novel therapeutic food products tailored to specific nutritional needs and health conditions.

**Course Outcomes:**

On successful completion of the course, the student will be able to:

CO No.	Course Outcome
CO1	Recall key factors influencing the shelf-life of therapeutic foods, such as packaging, storage conditions, and microbial stability
CO2	Explain the principles and considerations involved in the formulation of therapeutic food products, including nutrient fortification, bioavailability, and sensory attributes
CO3	Apply knowledge of food science and technology to develop formulations for therapeutic foods targeting specific health conditions.
CO4	Analyze the nutritional content and bioactive components of therapeutic food ingredients and their impact on product efficacy.
CO5	Assess the economic feasibility and scalability of producing therapeutic foods for targeted populations and healthcare settings.
CO6	Develop strategies to optimize product shelf-life, including packaging innovations and storage recommendations, to ensure product quality and safety.
CO7	Analyze the impact of processing methods on the preservation of bioactive compounds.
CO8	Design innovative therapeutic food products that cater to specific health goals.

Unit No.	Course Content	No. of Hours
I.	A. Sensory evaluation of foods	30

	<ul style="list-style-type: none"> <li>i Threshold concentrations of primary tastes</li> <li>ii Effect of Temperature on taste</li> <li>iii Identification of samples through Difference, Descriptive and Affective testing</li> <li>iv Describing sensory attributes requiring modification in various clinical conditions</li> </ul> <p><b>B. Generation of idea and evaluation of sensory quality</b></p> <ul style="list-style-type: none"> <li>i Concept development and testing based on market research</li> <li>ii Product development</li> <li>iii Determination of sensory evaluation methods for evaluating quality</li> <li>iv Developing scorecard as an evaluation tool</li> </ul>	
<b>II.</b>	<p><b>A. Food Product Formulation addressing health concern</b></p> <p>Enhancement of nutritive value, waste utilization, cost effectiveness, value addition of anyone of the product categories – Yoghurt, Beverage, Salad dressing, Low fat/low calorie/high fibre products, Desserts using artificial/low calorie sweeteners, Low sodium, low fat and high fibre products containing functional foods OR any other relevant product</p> <p><b>B. Identifying suitable packaging material and designing nutrition labels</b></p>	<b>30</b>
	<b>Total hours</b>	<b>60</b>

### References:

- Amerine, Pangborn & Roessler (1965). *Principles of Sensory Evaluation of food*, Academic Press, London.
- deMan J. (2007). *Principles of Food Chemistry*, 3rd ed., Springer.
- Jameson K. (1998). *Food Science – A Laboratory Manual*, New Jersey: Prentice Hall Inc. Lawless, H. and Heymann, H. (1998).
- McWilliam, M. (2001). *Foods – Experimental Perspectives* (4th Ed.), New Jersey: Prentice Hall Inc. USA: CRC Press Inc.
- Meilgard (1999). *Sensory Evaluation Techniques*, 3rd ed. CRC Press LLC, 1999.
- Pomeranz Y and Meloan CE (2002). *Food Analysis – Theory and Practice*, CBS Publishers and Distributors, New Delhi.
- Rao E. S. (2013). *Food Quality Evaluation*. Variety Books.
- Sensory Evaluation of Food – Principles and Practices*, Kluwer Academic/Plemer Publishers.
- Weaver, C. (1996), *Food Chemistry Laboratory – A manual for Experimental Foods*.

### Evaluation:

#### 2 credits (Total marks 50)

CONTINUOUS INTERNAL EVALUATION:	Marks
Class participation, Journal	5
Development of a new food product in groups (Writing the research proposal for development new product, standardization, packaging, labeling, marketing and sales)	20
<b>Total Marks for Internal Assessment</b>	<b>25</b>

SEMESTER-END EXAMINATION:	Marks
All questions are compulsory with internal choice.	

Question 1 Applications of food science from Unit 1	10
Question 2 Plan an experiment from Unit 2	10
Question 3: Viva-voce examination	5
<b>Total Marks for Semester End Examination</b>	<b>25</b>

**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - III)**

Course Code	Title of the Course	Th/Pr	Credits
FPP03C5E2A	Food Auditing	Theory	2

**Course Objectives:**

To enable students to:

1. Memorize key regulatory requirements and industry guidelines applicable to food safety and quality audits.
2. Interpret the roles and responsibilities of auditors, auditees, and stakeholders in the food supply chain during audit processes.
3. Develop strategies to implement continuous improvement initiatives based on audit findings and performance metrics to enhance food safety and quality assurance practice.

**Course Outcomes:**

On successful completion of the course, the student will be able to:

CO No.	Course Outcome
CO1	Recall fundamental principles and terminology related to food auditing, including audit types, standards (e.g., FSSAI hygiene audit, ISO 22000, GMP), and audit process phases.
CO2	Explain the purpose and importance of food auditing in ensuring compliance with food safety regulations, quality standards, and industry best practices.
CO3	Apply knowledge of audit principles and standards to plan and conduct food safety and quality audits in food processing facilities, distribution centers, and retail establishments.
CO4	Critically evaluate audit reports and recommendations for corrective actions to mitigate risks and enhance food safety outcomes.
CO5	Assess the impact of audit outcomes on organizational performance, consumer trust, and brand reputation in the food industry.
CO6	Design audit protocols, procedures, and tools tailored to specific food safety standards, regulatory requirements, and industry sector.

Unit No.	Course Content	No. of Hours
I.	<p><b>Basics of Food Auditing</b></p> <p>(i) Concept of food safety and hygiene</p> <p>(ii) Introduction to food safety audit, purpose and benefits</p> <p>(iii) Types (internal vs. external, first party vs. second party vs. third party, compliance vs. program audit vs. management system audit)</p> <p>(iv) Role and responsibilities of a food hygiene and food safety auditor, and lead auditor</p> <p>(v) Participants of a food audit</p> <p>(vi) Steps in a food safety audit</p> <p>(vii) Useful tools in food safety auditing</p> <p>(viii) Overview of food safety management system (FSMS) plans</p>	15

	(ix) Third-party food safety audit providers (x) Training/ certifications needed for a food safety auditor and agencies providing the same (xi) Ethical, legal and professional issues	
<b>II</b>	<b>General and Industry-Specific Food Safety/ Hygiene Audit</b>  (i) Key areas of a food audit  (ii) Formulation and components of a food safety checklist  (iii) Inspectional requirements for food business operators  (iv) Overview of inspection checklists for special establishments: bakery units, meat processing units, milk processing units, food warehouse, retail establishments  (v) Overview of gap analysis, root cause analysis (RCA), corrective actions and preventive actions (CAPA), VACCP and TACCP  (vi) Analysis of audit reports  (vii) Follow-up and completion protocol	<b>15</b>
	<b>Total hours</b>	<b>30</b>

## References

- The Training Manual for Food Safety Regulators*. (2011) Vol.III, Food Safety regulations and food safety management. Food Safety and Standards Authority of India. New Delhi.
- Chesworth, N. *Food Hygiene Auditing*. Springer-Verlag New York Inc.
- Wilson, S. (2021). *The ASQ Certified Food Safety and Quality Auditor Handbook*. ASQExcellence, Milwaukee, WI, Canada**
- Foreign Trade Policy (27th August 2009 to 31st March 2014)*, Department of Commerce, Ministry of Commerce and Industry, Government of India**
- Kotsanopoulos, K. V., & Arvanitoyannis, I. S. (2017). The role of auditing, food safety, and food quality standards in the food industry: A review. *Comprehensive reviews in food science and food safety*, 16(5), 760-775.

## Evaluation

2 Credits

50 marks

<b>CONTINUOUS INTERNAL EVALUATION:</b>	<b>Marks</b>
Class participation	10
Presentation of case study on food establishments in India violating food safety norms, consequences and resolution	15
<b>Total Marks for Internal Assessment</b>	<b>25</b>
<b>SEMESTER-END EXAMINATION:</b>	<b>Marks</b>
All questions are compulsory with internal choice.	
Question 1 from Unit 1	10
Question 2 from Unit 2	10
Question 3 from multiple units	5
<b>Total Marks for Semester End Examination</b>	<b>25</b>



**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - III)**

Course Code	Title of the Course	Th/Pr	Credits
FPP03C5E2A	Food Auditing	Practical	2

**Course Objectives:**

To enable students to:

1. Recall and identify the key principles, standards, and regulations governing food safety and quality.
2. Conduct mock audits or simulations in controlled environments to practice audit techniques, including interviewing personnel, inspecting facilities, and observing processes.
3. Develop strategies to communicate audit results effectively to stakeholders, including management, regulatory authorities, and food safety teams.

**Course Outcomes:**

On successful completion of the course, the student will be able to:

CO No.	Course Outcome
CO1	Memorize audit terminology, audit types (e.g., internal, external), and phases of the audit process (e.g., planning, execution, reporting).
CO2	Explain the importance and objectives of food auditing in ensuring compliance with regulatory requirements, industry standards, and best practices.
CO3	Apply audit planning techniques to develop audit schedules, checklists, and documentation review protocols tailored to specific food safety and quality standards.
CO4	Critically assess audit reports and recommend corrective actions based on identified risks and root causes observed during practical audit exercises.
CO5	Evaluate the effectiveness of audit techniques and methodologies in detecting food safety hazards, quality deviations, and regulatory violations.
CO6	Design comprehensive audit reports summarizing findings, conclusions, and recommendations for corrective and preventive actions (CAPAs) based on practical audit exercises.

Unit No.	Course Content	No. of Hours
I.	<p><b>Planning and Execution of Food Audit</b></p> <p>(i) Study of schedule 4 of FSSAI, HACCP, BRC, ISO 22000 and other related standards</p> <p>(ii) Drafting an audit checklist for the following for any 1 food business operation:</p> <ul style="list-style-type: none"> <li>• GMP</li> <li>• GHP</li> <li>• Based on HACCP</li> <li>• Based on FSSAI Schedule 4</li> <li>• Based on ISO 22000 (for any 1 food business operation)</li> </ul> <p>(iii) Planning a mock audit for any food business establishment</p> <p>(iv) Conducting a mock audit based on generated plan</p>	30

<b>II</b>	<b>Food Safety Management System</b> (i) Developing FSMS plan for any 1 food business operation  <b>Post-audit Activities</b> (i) Writing of non-conformance (NC) report (ii) Drafting of corrective action plan for all NCs (ii) Preparing a report covering the strength and gaps of the food business establishment	<b>30</b>
	<b>Total hours</b>	<b>60</b>

### References

- The Training Manual for Food Safety Regulators*. (2011) Vol.III, Food Safety regulations and food safety management. Food Safety and Standards Authority of India. New Delhi.
- Chesworth, N. *Food Hygiene Auditing*. Springer-Verlag New York Inc.
- Wilson, S. (2021). *The ASQ Certified Food Safety and Quality Auditor Handbook*. ASQExcellence, Milwaukee, WI, Canada**
- Foreign Trade Policy (27th August 2009 to 31st March 2014)*, Department of Commerce, Ministry of Commerce and Industry, Government of India**
- Kotsanopoulos, K. V., & Arvanitoyannis, I. S. (2017). The role of auditing, food safety, and food quality standards in the food industry: A review. *Comprehensive reviews in food science and food safety*, 16(5), 760-775.

### Evaluation

2 Credits

50 marks

<b>CONTINUOUS INTERNAL EVALUATION:</b>	<b>Marks</b>
Class participation, Journal	10
Preparation of matrix to show correspondence of various food safety audit standards/ agencies	15
<b>Total Marks for Internal Assessment</b>	<b>25</b>

<b>SEMESTER-END EXAMINATION:</b>	<b>Marks</b>
All questions are compulsory with internal choice.	
Question 1 Plan an experiment from Unit 1	10
Question 2 Plan an experiment from Unit 2	10
Question 3: Viva-voce examination	5
<b>Total Marks for Semester End Examination</b>	<b>25</b>

**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - III)**

Course Code	Title	Th/Pr	Credits	Hours
FPP 03 C6	Research Project	Practical	4	180

**COURSE OBJECTIVES:**

1. To provide students with an opportunity to conduct independent research under supervision in Food Processing and Preservation, and allied areas.
2. To encourage students to work in conjunction with relevant food manufacturing units, food service units, food testing laboratories, food safety consultancy, entrepreneurs and other relevant agencies.
3. To assist students in developing general research skills as well as research skills specific to their specialization.
4. To encourage students to adopt best practices in research.
5. To facilitate students in accomplishing the beginning steps of the research process, formulate and defend a research proposal, begin data collection, and write the first four chapters of the dissertation (Introduction, Review of Literature, Aims and Objectives and Method)

**COURSE OUTCOMES (CO):**

On successful completion of this course, students will be able to:

<b>CO1</b>	Demonstrate the ability to design and conduct independent research projects in the field of Food Processing and Preservation and related disciplines, under the guidance of faculty mentors.
<b>CO2</b>	Establish effective partnerships and collaborations with relevant food manufacturing units, food service units, food testing laboratories, food safety consultancy, entrepreneurs, and other stakeholders to enrich research endeavors and enhance practical applications of research findings.
<b>CO3</b>	Develop and apply advanced research methodologies, techniques, and tools specific to their area of specialization, while also honing general research skills such as critical thinking, problem-solving, and data analysis.
<b>CO4</b>	Adhere to ethical standards and best practices in research, including the responsible conduct of research, proper citation and referencing, and maintaining integrity in data collection, analysis, and reporting
<b>CO5</b>	Successfully complete key milestones in the research process, including formulating and defending a well-structured research proposal, initiating data collection procedures, and drafting the initial chapters of the dissertation (Introduction and Review of Literature; Methodology) with clarity, coherence, and scholarly rigor.

Unit No.	Course Content	No. of Hours
<b>I.</b>	<b>Understanding tools for review of literature</b> <ul style="list-style-type: none"> <li>• Metanalysis and Literature review- differences</li> <li>• PubMed, Cochrane Databases, Research Gate, Google Scholar</li> <li>• RefWorks, Citethisforme,</li> <li>• Understanding various referencing styles AMA, Vancouver, APA (6<sup>th</sup> Ed)</li> <li>• Plagiarism Check Softwares</li> </ul>	
<b>II</b>	<b>Review of Literature</b> <ul style="list-style-type: none"> <li>• Explore and finalize the area of interest for research with guidance from experts for feasibility, relevance and significance.</li> <li>• Refer national and international journals and other relevant literature like dissertations, thesis, books.</li> </ul>	

	<ul style="list-style-type: none"> <li>• Contacting and communicating with experts (locally, nationally, and internationally) initially and periodically throughout the research process</li> <li>• Identifying possible focus areas with regard to one topic; specifying one such focus area (using relevant reading and communication with experts); writing research objectives/ questions/ hypotheses; conducting a thorough literature review; presenting a clear and convincing argument in support of the study; writing the first chapter of the dissertation, namely, the <i>Introduction and Review of Literature</i>, with due acknowledgement of source of ideas.</li> </ul>	
<b>III</b>	<b>Proposed Methodology</b> <ul style="list-style-type: none"> <li>• Specifying variables; defining variables (citing relevant literature)</li> <li>• Selecting an appropriate research design</li> <li>• Writing the second chapter of the dissertation, namely, the <i>Method</i>, with due acknowledgement of source of ideas; orally defending a research proposal; integrating feedback.</li> <li>• Obtaining consent from participants and relevant agencies/authorities; starting data collection; integrating changes if any; scheduling remaining data collection; starting data entry; revising the first two chapters of the dissertation.</li> </ul>	
<b>IV</b>	<b>Beginning Data Collection</b> <ul style="list-style-type: none"> <li>• Obtaining consent from participants and relevant agencies/authorities;</li> <li>• At least starting data collection;</li> <li>• Integrating changes if any;</li> <li>• Scheduling remaining data collection;</li> <li>• Starting data entry;</li> <li>• Revising the first two chapters of the dissertation.</li> </ul>	
	<b>Total hours</b>	<b>60</b>

#### References:

Dissertations in the College Library

Relevant Research Literature as per selected topic from scientific journals, dissertations, theses, books, literature on the internet.

#### Evaluation (Total Marks 100):

Continuous Internal Evaluation	Marks
<b>Research Guide's Evaluation for Examining the Student's expertise with regard to Research:</b> Proactive / Initiative / Responsibility / Flexibility/ Receptivity to feedback/ Thoroughness/ Meeting deadlines / Regularity in meeting/ Ethics / Absence of Plagiarism/ Networking, collaboration/ contacting experts.	25
<b>Research Guide's Evaluation for Examining the Quality of Chapters 1 and 2 of the M.Sc. Dissertation:</b> Chapter 1: Literature Review; Research Purpose (Objectives/Hypotheses/Questions); Chapter 2: Tools/Measurement	25
<b>Total</b>	<b>50</b>

Semester-end Examination	Marks
<b>External Examiner's Evaluation of the Submitted Document:</b> Relevance of research topic; Accuracy/Thoroughness of Literature Review; Clarity & Appropriateness of the Research Purpose; Accuracy & quality of methodology-related decisions; Quality & appropriateness (including ethics) of measurement/tools	25
<b>External Examiner's Evaluation through Viva Voce, of Student's expertise with regard to Research:</b> Clarity/Soundness/Accuracy with regard to selection of topic; Ability to clarify and contextualize Non-Indian vs Indian Literature; Clarity/Soundness/Accuracy with regard to the review of literature , research design & sampling, measurement/tools & plan of analysis, the	25

beginning steps of the research process; student's emerging research expertise	
<b>Total</b>	<b>50</b>

**Sem. - IV**

**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - IV)**

Course Code	Course Title	Th/Pr	Credits
FPP04C1	Advances in Human Nutrition	Theory	4

**Course Objectives:**

To enable students to understand:

1. Get an insight into the role of nutrition in growth and development.
2. Understand the importance of nutrition in maintaining optimum body composition
3. Understand the need for special nutritional considerations in altered climatic conditions.
4. Issues in the field of human nutrition and contributions of research towards addressing the same.
5. Complementary nutrition strategies for achieving and maintaining health.

**Course Outcomes (CO):**

On successful completion of the course, the student will be able to:

CO No.	Course Outcomes
CO1	Remember the key terms and dietary guidelines recommended for different nutrients, as well as the structures of major biomolecules.
CO2	Explain the process of digestion and absorption of nutrients, and the pathways involved in their metabolism
CO3	Develop personalized dietary plans for individuals at different life stages, considering specific nutritional needs and health conditions
CO4	Analyze case studies to identify and address nutritional issues in diverse populations.
CO5	Assess the impact of various factors affecting nutritional choices and health outcomes.
CO6	Design educational materials or interventions to promote healthy nutrition practices in specific life stages or population groups.

Unit No.	Course Content	No. of Hours
<b>I.</b>	<p><b>Nutrition for Growth and Development</b></p> <p>A. General Aspects of Growth:</p> <ul style="list-style-type: none"> <li>(i) Cellular and physical growth</li> <li>(ii) Critical periods of growth and development</li> <li>(iii) Epigenetic influence of nutrients on physical and mental growth and development</li> </ul> <p>B. Human Body Composition:</p> <ul style="list-style-type: none"> <li>(i) Changes in body composition through life cycle and factors influencing the same</li> <li>(ii) Concept of dietary nutrient recommendations: EAR, RDAs, DRI, TUL etc.</li> </ul> <p>C. Energy</p> <ul style="list-style-type: none"> <li>(i) Units of energy</li> <li>(ii) Energy imbalances-excess &amp; deficiency</li> <li>(iii) Physiological adaptations to over and under nutrition</li> </ul>	<b>15</b>
<b>II.</b>	<p><b>Macronutrients in Human Nutrition</b></p> <p>A. Carbohydrates</p> <ul style="list-style-type: none"> <li>(i) Digestion, absorption and metabolism</li> <li>(ii) Recent advances in carbohydrate recommendations</li> <li>(iii) Glycemic index, glycemic load and their applications</li> <li>(iv) Dietary fiber and resistant starch- types and health benefits</li> </ul> <p>B. Fats and Fatty acids</p> <ul style="list-style-type: none"> <li>(i) Digestion, absorption and metabolism</li> <li>(ii) Recent advances in RDAs of total dietary fat and fatty acid consumption, and fatty acid ratios</li> <li>(iii) Role of total fat intake, SFA, MUFA &amp; PUFAs in health &amp; disease</li> <li>(iv) Overview of oil blends</li> </ul> <p>C. Proteins and Amino acids:</p> <ul style="list-style-type: none"> <li>(i) Digestion, absorption and metabolism</li> <li>(ii) Recent advances in RDAs of proteins and essential amino acids</li> <li>(iii) Amino acid imbalances</li> </ul>	<b>15</b>



<b>III</b>	<p><b>Micronutrients in Human Nutrition</b></p> <p>A. Micronutrients- Vitamins</p> <p>(i) General process for digestion, absorption, metabolism and transportation of fat-soluble vitamins</p> <p>(ii) General process for digestion, absorption, metabolism and transportation of water-soluble vitamins</p> <p>(iii) Vitamin-vitamin interactions</p> <p>(iv) Inter-relationship between vitamins and macronutrients</p> <p>B. Micronutrients- Minerals</p> <p>(i) General process for digestion, absorption, metabolism and transportation</p> <p>(ii) Mineral-mineral interactions</p> <p>(iii) Interrelationship between vitamins &amp; minerals</p> <p>(iv) Interrelationship between minerals and macronutrients</p>	<b>15</b>
<b>IV</b>	<p><b>Nutritional Requirements for Special Conditions</b></p> <p>A. Extreme Climatic Conditions (overview and highlights)</p> <p>(i) High altitude</p> <p>(ii) Space</p> <p>(iii) Natural calamities</p> <p>B. Complementary Nutrition</p> <p>(i) Classification and health benefits</p> <p>(ii) Types, sources, health benefits and (if applicable) regulations for:</p> <ul style="list-style-type: none"> <li>• Prebiotics, probiotics and synbiotics</li> <li>• Functional foods</li> <li>• Phytochemicals</li> </ul> <p>(iii) Meal replacers:</p> <ul style="list-style-type: none"> <li>• Context and overview of mechanism</li> <li>• Classification</li> <li>• Health benefits</li> <li>• Recommendations &amp; concerns</li> </ul>	<b>15</b>
	<b>Total Contact Hours</b>	<b>60</b>

**References:**

Grodd, J.L. and Gropper, S.S. (1999). *Advanced Nutrition and Human Metabolism*. Belmont CA Wodworth/ Thomson learning.

Brown, J.E. (1998). *Nutrition Now*. West/wadsworth International Thomson Pub. Co.

Williams, Cand Devlin, T.J. (1992). *Foods Nutrition and Sports Performance* E and N Sposs I Ed.

Goodhart R.S.S and Shils, M.E. (1998) *Modern Nutrition in Health and Disease*. Philadelphia Lea and Febiger.

Shils, M.E., Olson, J., Shike, M. and Roos, C. (2003). *Modern Nutrition in Health and Disease*. 9<sup>th</sup> edition Williams and Williams. A Beverly Co. London.

Stipanuk Martha H. (2006) *Biochemical, Physiological, Molecular Aspects of Human Nutrition* – Saunders ELSEVIER.

Paul, I, Turner, E.R., Ross, Don. (2006). *Discovering Nutrition*. 2<sup>nd</sup> ed. Jones and Bartlett Publishers – Canada.

Geissler, C., Powers, H. (2005). *Human Nutrition*. 11<sup>th</sup> ed. Elsevier Churchill Livinstone

Zegler, E.E and Filer, L.J. (1996). *Present Knowledge in Nutrition*. Washington D.C. International Life Sciences Institute.

**Evaluation:**

4 credits      100 marks

<b>CONTINUOUS INTERNAL EVALUATION:</b>	<b>Marks</b>
Written and oral presentations on assigned topic / Literature review with class discussion	20
Class participation, Class test/ Quiz/ Group Discussion	20
Creating learning resources (videos or posters or brochures)	10
<b>Total</b>	<b>50</b>

<b>SEMESTER-END EXAMINATION</b>	<b>Marks</b>
All questions are compulsory with internal choice.	
Question 1 from Unit 1	10
Question 2 from Unit 2	10
Question 3 from Unit 3	10
Question 4 from Unit 4	10
Question 5 from multiple units	10
<b>Total</b>	<b>50</b>

**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - IV)**

Course Code	Course Title	Th/Pr	Credits
FPP04C2	Food Biotechnology	Theory	4

**Course Objectives:**

To enable students to:

1. Understand the role of biotechnology in food processing and preservation
2. Provide knowledge about techniques used in plant, animal and microbial biotechnology
3. Introduce students to new developments in the field of food biotechnology

**Course Outcomes:**

On successful completion of the course, the student will be able to:

CO No.	Course Outcome
CO1	Understand the fundamentals involved in the processing of various food groups.
CO2	Describe the steps and instruments involved in milling of cereals, and decortication and germination of pulses.
CO3	Evaluate the conventional and modern techniques and devices in place for processing and packaging of fruits, vegetables, milk and milk products.
CO4	Compare the properties of minimally processed and fully refined products made from cereals, nuts and oilseeds.
CO5	Critique the basic manufacturing practices involved in meat, poultry, eggs and seafood industry.
CO6	Design flowcharts for quick understanding of process flow in food processing industries.

Unit No.	Course Content	No. of Hours
I.	<p><b>Introduction to Biotechnology</b></p> <p>A. Recombinant DNA technology</p> <p>(i) Definition</p> <p>(ii) Components</p> <p>(iii) Process</p> <p>(iv) Applications in agriculture and food</p> <p>B. Plant Biotechnology</p> <p>(i) Terminologies: haploidy, diploidy, totipotency</p>	15

	<p>(ii) Overview of plant breeding techniques: wide hybridization, embryo culture, protoplast fusion, haploid generation, somaclonal variation, micropropagation, synthetic seeds</p> <p>(iii) Plant tissue culture: concept, requirements, media used, process, applications in agriculture and food industry</p> <p>C. Animal Biotechnology</p> <p>(i) Terminologies: cloning, transgenic animals, cryopreservation</p> <p>(ii) Animal cell culture: concept, requirements, media used, process, applications in agriculture and food industry</p>	
<b>II.</b>	<p><b>Microbial Biotechnology &amp; Fermentations</b></p> <p>(i) Genetically modified microorganisms</p> <p>(ii) Use of CRISPR in improvement of fermenting microbial strains</p> <p>(iii) Overview of types of industrial fermentations: batch, continuous, fed-batch, anaerobic, aerobic, surface, submerged, solid substrate/ state</p> <p>(iv) Improvement of microbial strains used in following processes:</p> <ul style="list-style-type: none"> <li>• Beer</li> <li>• Wine</li> <li>• Bread</li> <li>• Yogurt</li> <li>• Acetic acid</li> <li>• Lactic acid</li> <li>• Citric acid</li> <li>• Vitamins</li> <li>• Pigments</li> <li>• Amino acids</li> <li>• Flavors</li> <li>• Sweeteners</li> </ul>	<b>15</b>
<b>III.</b>	<p>A. Enzyme Technology</p> <p>Biotechnological production and food-based applications of:</p> <p>(i) Amylases</p> <p>(ii) Proteases</p> <p>(iii) Lipases</p> <p>(iv) Cellulases</p> <p>(v) Pectinases</p> <p>B. Applications of biotechnology in food waste management</p> <p>C. Applications of biotechnology in development of value added products</p>	<b>15</b>

<b>IV.</b>	A. Nanobiotechnology	<b>15</b>
	(i) Terminologies: nanoparticles, nanomaterial, nano-composites, nanocrystals (ii) Use of nanoparticles for delivery of bioactive constituents (iii) Nanoencapsulation of active constituents in food formulations (iv) Nanopackaging in food processing (v) Nanosensors for detection of pesticides & pathogens (vi) Overview of nutrigenomics and applications in the food industry	
	B. Ethical Concerns, Safety and Regulatory Issues of biotechnological products	
	<b>Total hours</b>	<b>60</b>

**References:**

Pometto, A. (2005). *Food Biotechnology*, 2nd Edition. CRC Press  
 Lee, H.B. (2014). *Fundamentals of Food Biotechnology*. 2<sup>nd</sup> ed. Wiley- Blackwell  
 Bhatia, S.C. (2017). *Food Biotechnology*. (1<sup>st</sup> ed.) WPI Publishing  
 McClements, D.J. (2022). *Food Nanotechnology*. De Gruyter

**Evaluation:**

4 Credits                      100 marks

<b>CONTINUOUS INTERNAL EVALUATION (50%):</b>	<b>Marks</b>
Preparation of a home-based traditionally fermented food product, presenting it using process flowchart and identifying the steps where biotechnological improvement can be applied	25
Class test	15
Class participation	10
<b>Total</b>	<b>50</b>

<b>SEMESTER-END EXAMINATION</b>	<b>Marks</b>
All questions are compulsory with internal choice.	
Question 1 from Unit 1	10
Question 2 from Unit 2	10
Question 3 from Unit 3	10
Question 4 from Unit 4	10
Question 5 from multiple units	10
<b>Total</b>	<b>50</b>
<b>SEMESTER-END EXAMINATION (50%):</b>	<b>Marks</b>

**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - IV)**

Course Code	Course Title	Th/Pr	Credits
FPP04C3A	Food Packaging Technology	Theory	2

**Course Objectives:**

To equip, train and enable students to:

1. Understand the application of chemical and microbiological analysis in quality control of foods.
2. Compare the estimated values with the recommended values and thereby assess the quality of foods.
3. Be adept with the steps involved in detection, enumeration and confirmation of food-borne pathogens.

**Course Outcomes:**

On successful completion of the course, the student will be able to:

CO No.	Course Outcome
CO1	Understand the techniques used in qualitative and quantitative chemical and microbial analysis of foods.
CO2	Explain the tests required for detecting the presence of adulterants in various foods.
CO3	Apply the principles of food chemistry in estimation of nutritional parameters in any given food sample.
CO4	Comparatively analyse the factors affecting food spoilage and the microbial load of different food commodities, based on regulations.
CO5	Justify the use of specific protocols and techniques in food analysis.
CO6	Develop complete understanding of basic tests carried out in food analysis laboratories as per prescribed standards.

Unit No.	Course Content	No. of Hours
I.	<p><b>Understanding the Role of Packaging for Foods</b></p> <p>Introduction to Food Packaging</p> <p>(i) Definitions: packaging, package, packing</p> <p>(ii) Levels of packaging: primary, secondary, tertiary</p> <p>Functions of packaging</p> <p>Containment, protection, convenience, communication</p> <p>(iii) Environment grid to check efficacy</p> <p>Material used for food packaging (properties, forms, types, overview of making process):</p> <p>Polymers</p> <p>Paper</p> <p>Glass</p> <p>Metal</p> <p>Shelf-life Studies</p> <p>Influence of packaging on shelf-life</p> <p>Overview of accelerated shelf-life testing: principles, procedure and examples</p>	15
II.	<p><b>Recent Advances in Food Packaging</b></p> <p>Edible, Bio-based and Bio-degradable Packaging</p> <p>Overview of classification: category 1, category 2, category 3 and category 4</p>	15

<ul style="list-style-type: none"> <li>Properties</li> <li>Commercialization and applications</li> <li>Limitations and methods to improve functionality</li> <li>Aseptic Packaging</li> <li>Overview of: <ul style="list-style-type: none"> <li>(i) Carton systems</li> <li>(ii) Can systems</li> <li>(iii) Bottle systems</li> <li>(iv) Sachet and pouch systems</li> <li>(v) Cup systems</li> </ul> </li> <li>C. Active and Intelligent Packaging</li> <li>Definitions</li> <li>Materials used in active packaging</li> <li>Overview of active packaging systems: self-heating and self-cooling, gas-permeability changers, widgets</li> <li>Intelligent packaging for indicating product quality</li> <li>Intelligent packaging for providing convenience and protection</li> </ul>	<b>Total hours</b>	<b>30</b>
--	--------------------	-----------

**4.**

**References:**

Robertson, G.L. (2012). *Food Packaging Principles and Practice*. (3rd ed.). CRC Press, Florida.  
Ahvenainen, R. (2005). *Novel Food Packaging Techniques*. Woodhead Publishing, England.  
Food Packaging Technology Hand book. (3rd ed.). NIIR project consultancy services, New Delhi.

**Evaluation:** 2 Credits                      50 marks

<b>CONTINUOUS INTERNAL EVALUATION (50%):</b>	<b>Marks</b>
Class participation	5
Presentation of case study on novel packaging solutions adopted by food business operators	20
<b>Total</b>	<b>25</b>

<b>SEMESTER-END EXAMINATION (50%):</b>	<b>Marks</b>
Question 1 from Unit 1	10
Question 2 from Unit 2	10
Question 3 multiple units	5
<b>Total</b>	<b>25</b>



**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - IV)**

Course Code	Course Title	Th/Pr	Credits
FPP04C3BP	Case Study Applications of Food Engineering in the Food Industry	Practical	2

**Course Objectives:**

To encourage and aid students to:

1. Recall fundamental principles of food engineering.
2. Describe the impact of food engineering on food product development and innovation.
3. Analyze case studies of food engineering applications in different food sectors.
4. Formulate a strategic plan for integrating advanced technologies (e.g., IoT, AI) into food processing operations.

**Course Outcomes:**

On successful completion of the course, the student will be able to:

CO No.	Course Outcome
CO1	Memorize key terminology and concepts used in food engineering case studies.
CO2	Summarize the importance of engineering design principles in ensuring food safety and quality.
CO3	Apply the use of published literature to understand how engineering principles are used to analyze and solve specific problems in food processing.
CO4	Compare and contrast engineering approaches to food processing in different categories of foods.
CO5	Assess the economic implications of adopting new technologies or processes in food engineering.
CO6	Develop a comprehensive proposal for improving food production efficiency through engineering innovations.

Unit No.	Course Content	No. of Hours
I.	<p><b>Case Study Analysis-I</b></p> <p>Understanding the applications of food engineering and preparing case study report (covering the background with objectives, justification/ relevance of the case study, important details of the case, analysis of case, major issues, recommendations or after-thoughts, conclusion and references) on any two processes as mentioned below, through real-time observation or literature study:</p> <p>(i) Pasteurization and sterilization in dairy industry</p> <p>(ii) High pressure processing (HPP) and pulsed electric fields (PEF)</p> <p>(iii) Fermentation of dairy products/ bread/ alcoholic beverages</p> <p>(iv) Mechanization of operations in hotel kitchens/ flight kitchens/ cloud kitchens</p>	30

	(v) Ingredient mixing and product development in bakery industry (vi) Snack food manufacturing using extrusion technology (vii) Reformulation of a product to create sugar-free/ reduced sugar variants (viii) Development of instant foods	
<b>II.</b>	<b>Case Study Analysis-II</b>  Understanding the applications of food engineering and preparing case study report (covering the background with objectives, justification/ relevance of the case study, important details of the case, analysis of case, major issues, recommendations or after-thoughts, conclusion and references) on any two processes as mentioned below, through real-time observation or literature study:  (i) Implementation of quality control systems in food processing (ii) Mechanization of sensory evaluation of foods (iii) Analysis of food and water quality (iv) Waste reduction/ waste management in food processing (v) Biodegradable/ recyclable packaging solutions for food and water (vi) Aseptic packaging of foods (vii) Engineering applications in food product traceability and recall <b>(viii) Accelerated shelf-life studies</b>	<b>30</b>
	<b>Total hours</b>	<b>60</b>

### References:

- Najim, K.. (1989). *Process Modeling and Control in Chemical Engineering* -CRC Press.
- Das, H. (2005). *Food Processing Operations Analysis*. Asian Books Private Limited.
- Ahmed, J. and Rahman, S. (2012). *Handbook of Food Process Design*. Wiley-Blackwell.
- Tijksens, L.M.M., Hertog, and Nicolai, B.M. (2001). *Food Process Modelling*. Woodhead Publishing.
- Bernd, H. (2017). *Measurement, Modeling and Automation in Advanced Food Processing*. Springer International Publishing.
- Moreira, R.G. (2001). *Automatic Control for Food Processing Systems*. Aspen publishers.
- Caldwell, D. G. (Ed.). (2012). *Robotics and automation in the food industry: Current and future technologies*. Elsevier.
- Sun, D. W. (Ed.). (2012). *Computer vision technology in the food and beverage industries*. Elsevier.
- Kress-Rogers, E., & Brimelow, C. J. (Eds.). (2001). *Instrumentation and sensors for the food industry*. Woodhead Publishing.

### Evaluation:

2 Credits                      100 marks

CONTINUOUS INTERNAL EVALUATION (50%):	Marks
Presentation of the four case studies	20
Class participation	5

<b>Total</b>	<b>25</b>
<b>SEMESTER-END EXAMINATION (50%):</b>	<b>Marks</b>
All questions are compulsory with internal choice	
Description of food engineering elements in a hypothetical food processing set-up	15
Submission of e-reports	10
<b>Total</b>	<b>25</b>

**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - IV)**

Course Code	Title of the Course	Th/Pr	Credits
FPP04C4E1A	Digital Technologies, Artificial Intelligence and Robotics in Food Processing	Theory	2

**Course Objectives:**

To enable students:

1. List examples of AI applications in food quality control and process optimization.
2. Describe the potential impacts of AI and robotics on workforce dynamics in the food industry.
3. Develop a proposal for implementing AI-driven strategies in a food manufacturing setting.

**Course Outcomes:**

On successful completion of the course, the student will be able to:

CO No.	Course Outcome
CO1	Recall basic concepts and terminology related to digital technologies, AI, and robotics in food processing.
CO2	Summarize the integration of IoT (Internet of Things) devices and sensors in food processing plants.
CO3	Utilize digital technologies to optimize food production processes, such as predictive maintenance or real-time monitoring.
CO4	Analyze case studies of successful implementations of AI and robotics in food processing plants.
CO5	Critique the ethical implications of AI and robotics adoption in food processing, including considerations of job displacement and safety.
CO6	Formulate a strategic plan for introducing robotic automation into a specific food processing operation to enhance productivity and safety.

Unit No.	Course Content	No. of Hours
I.	<p><b>A. Introduction to Concepts</b></p> <p>(i) Concept of automation and modeling</p> <p>(ii) Overview of PLC, DCS and SCADA systems in automation</p> <p>(iii) Overview of virtual instrumentation</p> <p>(iv) Concept of IoT and its applications in food processing</p> <p>(v) 3D printed foods</p> <p><b>B. Automation and AI in Different Unit Operations of Food Processing- I</b></p> <p>(i) Raw food material sorting, grading, size reduction</p> <p>(ii) Mixing and agitation</p>	15

	(iii) Thermal plant automation (iv) Freezing plant automation (v) Dehydration plant automation (vi) Packaging (vii) Transport and retail	
<b>II.</b>	<b>A. Automation and AI in Different Unit Operations of Food Processing- II</b> (i) Bottle washing machine automation (ii) Reverse osmosis plant automation (iii) Automation and AI applications in meat processing (iv) Automation and AI applications in poultry industry (v) Automation and AI applications in sea food processing (vi) Predictive maintenance of machinery and equipment  <b>B. Food Quality and Robotics in Food industry</b> (i) Automated evaluation of food quality (ii) Robotics in food industry (manufacturing, cloud kitchens, food service, etc.) (iii) Specifications of food sector robot  <b>Ethical implications of use of automation, AI and robotics in food processing</b>	<b>15</b>
	<b>Total hours</b>	<b>30</b>

**References:**

- Najim, K.. (1989). *Process Modeling and Control in Chemical Engineering* -CRC Press.  
 Das, H. (2005). *Food Processing Operations Analysis*. Asian Books Private Limited.  
 Ahmed, J. and Rahman, S. (2012). *Handbook of Food Process Design*. Wiley-Blackwell.  
 Tijsskens, L.M.M., Hertog, and Nicolai, B.M. (2001). *Food Process Modelling*. Woodhead Publishing.  
 Bernd, H. (2017). *Measurement, Modeling and Automation in Advanced Food Processing*. Springer International Publishing.  
 Moreira, R.G. (2001). *Automatic Control for Food Processing Systems*. Aspen publishers.  
 Caldwell, D. G. (Ed.). (2012). *Robotics and automation in the food industry: Current and future technologies*. Elsevier.  
 Sun, D. W. (Ed.). (2012). *Computer vision technology in the food and beverage industries*. Elsevier.  
 Kress-Rogers, E., & Brimelow, C. J. (Eds.). (2001). *Instrumentation and sensors for the food industry*. Woodhead Publishing.

**Evaluation:**

2 credits      50 marks

<b>CONTINUOUS INTERNAL EVALUATION:</b>	<b>Marks</b>
--	--------------

Class participation and conduct	10
Case study presentation of use of AI/ Robotics in food industry	15
<b>Total Marks for Internal Assessment</b>	<b>25</b>

<b>SEMESTER-END EXAMINATION:</b>	<b>Marks</b>
All questions are compulsory with internal choice.	
Question 1 from Unit 1	10
Question 2 from Unit 2	10
Question 3 from multiple units	10
<b>Total Marks for Semester End Examination</b>	<b>25</b>

**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - IV)**

Course Code	Title of the Course	Th/Pr	Credits
FPP04C4E1BP	Food Psychology and Consumer Behaviour	Practical	2

**Course Objectives:**

To help students:

1. Recall key terms and concepts in food psychology.
2. Describe the role of psychological factors (e.g., mood, stress, habit) in shaping eating behaviors.
3. Apply psychological theories to analyze consumer behavior in food-related contexts.
4. Design consumer-focused nutrition education content that incorporates insights from food psychology to promote healthy eating behaviors.

**Course Outcomes:**

On successful completion of the course, the student will be able to:

CO No.	Course Outcome
CO1	Recall and exist factors influencing consumer food choices.
CO2	Explain the psychological principles underlying food preferences and aversions.
CO3	Use psychological insights to develop strategies for promoting healthy eating habits or changing dietary behaviors.
CO4	Analyze case studies or scenarios illustrating how psychological factors influence food choices and consumption patterns.
CO5	Critique the ethical implications of food marketing practices targeted at vulnerable consumer groups.
CO6	Formulate a strategic plan for conducting research on emerging trends in food psychology and consumer behavior.

Unit No.	Course Content	No. of Hours
I.	<p><b>Understanding and Application of Food Psychology in the Food Market</b></p> <p>(i) Understanding of biological, social and psychological influences on food choice, eating behaviors in children and the impact of psychology in promoting healthy eating patterns, effect of stress on food choices and eating behavior</p> <p>(ii) Development of e-posters on influences on food choice: biological, social and psychological</p> <p>(iii) Development of videos on food psychology in children</p>	30

	(iv) Development of infograph on effect of stress on food choices (v) Creation of official social media page for uploading approved content to generate awareness	
<b>II.</b>	<b>A. Survey to Understand Consumer Behaviour</b>  (i) Formulation of a survey questionnaire to study: cues in consumer perception and acceptance of food product , factors affecting food purchase, food quality and consumer expectations, ethnic, religious and economic influences on food choice of the consumer, consumer perception of processed foods, supplements, organic and genetically modified foods, consumer attitudes to health and healthy food choices, ecological consciousness and sustainability with regard food consumption  (ii) Conducting online survey involving participants from any one age group (teenagers or adults), all genders and across the country  <b>B. Preparation of comprehensive report on the findings of the online survey</b>	<b>30</b>
	<b>Total hours</b>	<b>60</b>

### References:

- Booth D.A.(1994). *The Psychology of Nutrition*, Taylor and Francis, UK.
- Committee on Examination of the Adequacy of Food Resources and SNAP Allotments; Food and Nutrition Board; Committee on National Statistics; Institute of Medicine; National Research Council. Editors: Caswell J. and Yaktine a..(2013). *Supplemental Nutrition Assistance Program-Examining the Evidence to Define Benefit Adequacy*, National Academies Press (US); Washington (DC).
- Conner M and Armitage J.(2002).*The social psychology of food*, Open University Press, Mc –Graw Hill Education, UK.
- McGinnis M, Gootman J., and Kraak V. Editors. (2006). *Food Marketing to Children and Youth- Threat or Opportunity?* National Academic Press.DOI: <https://doi.org/10.17226/11514>. <https://www.nap.edu/read/11514>
- Layman B. (2012). *A Psychology of Food-More Than a Matter of Tastes*, Springer, Kindle Edition. Mayer E. (2016). *The Mind-Gut Connection: How the Hidden Conversation Within Our Bodies Impacts Our Mood, Our Choices, and Our Overall Health*, Harper Collins Publishers.
- Mendes R. and Dias E. (2011). *Health Protection, Health Promotion, and Disease Prevention at the Workplace*, Oxford University Press. DOI:10.1093/acprof:oso/9780195380002.003.0018
- Rankin S.H., Stallings K.D. and London F. (2005). *Patient Education in Health and Illness*, Lippincott Williams; Wilkins, Philadelphia.
- Shepherd R. and Raats M. (2010).*The Psychology of Food Choice*. The Centre for Agriculture and Bioscience International (CABI), Wallingford, England.

### Evaluation:

2 credits                      50 marks

<b>CONTINUOUS INTERNAL EVALUATION:</b>	<b>Marks</b>
Submission of e-poster/ video/ infographs	15
Submission of survey report	10
<b>Total Marks for Internal Assessment</b>	<b>25</b>

<b>SEMESTER-END EXAMINATION:</b>	<b>Marks</b>
All questions are compulsory with internal choice.	
Question 1: Planning of food product recipe based on factors affecting food choices/ pediatric products	20
Question 2: Viva-voce	5
<b>Total Marks for Semester End Examination</b>	<b>25</b>



**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - IV)**

Course Code	Title of the Course	Th/Pr	Credits
FPP04C4E2A	Niche Markets in Food Production	Theory	2

**Course Objectives:**

To enable students to:

1. Memorize examples of niche food products or brands that have successfully targeted specific consumer segments.
2. Explain the characteristics and requirements of niche markets compared to mainstream markets.
3. Apply market research techniques to identify and analyze potential niche market opportunities in the food industry.

**Course Outcomes:**

On successful completion of the course, the student will be able to:

CO No.	Course Outcome
CO1	Recall key definitions and concepts related to niche markets in food production (e.g., definition of niche markets, characteristics of niche food products).
CO2	Summarize the consumer behaviors and motivations driving demand in niche food segments.
CO3	Utilize knowledge of niche market dynamics to evaluate the feasibility of introducing specialty food products in specific geographic regions.
CO4	Analyze case studies of successful niche food products or brands, examining factors contributing to their market success
CO5	Assess the economic impact of niche market development on local economies and food producers.
CO6	Design a business plan for launching a new niche food startup.

Unit No.	Course Content	No. of Hours
I.	<p><b>Basics of Niche Food Marketing</b></p> <p>(i) Concept of niche markets: synonyms and definition</p> <p>(ii) Principles of niche marketing</p> <p>(iii) Elements of niche marketing</p> <p>(iv) Characteristics of niche marketing</p> <p>(vi) Methods of market segmentation</p> <p>(vii) Benefits of focusing on niche markets in food sector</p> <p>(viii) Identifying profitable opportunities in niche markets</p>	15
II	<b>Niche Marketing in Food Industry</b>	15

	<p>(i) Concept of niche/ specialty food products</p> <p>(ii) Characteristics of niche food products</p> <p>(iii) Understanding existing/ potential niche foods as per different food groups:</p> <ul style="list-style-type: none"> <li>• Cereals (e.g. premixes/ breakfast cereals with millets and pseudocereals, etc.)</li> <li>• Pulses (e.g. sprouted pulses flour and specialty products made from the same)</li> <li>• Fruits (e.g. fruit and vegetable-based products for travelers, school-children, etc.)</li> <li>• Milk and milk products (e.g. artisanal ice cream, milk products targeted at chefs/ bakers/ professional cooks)</li> <li>• Non-dairy based products (e.g. nut-milk for lactose intolerant/ vegan populations)</li> <li>• Fats and oils (e.g. specialty ingredients meant for professional bakers/ cooks)</li> <li>• Meat, poultry and fish (e.g. specific cuts/ by-products aimed for purchase by other businesses)</li> <li>• Meat/ fish analogues (for vegans/ vegetarians)</li> <li>• Processed snacks (premium extruded snacks, beverages and confectionary for certain sections of consumers)</li> </ul> <p>(iv) Understanding existing/ potential niche foods as per health conditions and lifestyle requirements</p> <p>(v) Understanding existing/ potential niche foods as per lifespan and gender</p>	
	<b>Total hours</b>	<b>30</b>

### References

Kotler, P. *Marketing Management*. (2017). 15<sup>th</sup> ed.

Dalgic, T. (2008). *Handbook of Niche Marketing: Principles and Practice*. Jaico Publishing House.

Anderson, Chris. (2006). *The Long Tail: Why the Future of Business Is Selling Less of More*. New York: Hyperion.

### Evaluation

2 Credits

50 marks

<b>CONTINUOUS INTERNAL EVALUATION:</b>	<b>Marks</b>
Class participation	10
Presentation of case studies on successful niche food products and their marketing	15
<b>Total Marks for Internal Assessment</b>	<b>25</b>

<b>SEMESTER-END EXAMINATION:</b>	<b>Marks</b>
All questions are compulsory with internal choice.	
Question 1 from Unit 1	10
Question 2 from Unit 2	10
Question 3 from multiple units	5
<b>Total Marks for Semester End Examination</b>	<b>25</b>

**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - IV)**

Course Code	Title of the Course	Th/Pr	Credits
FPP04C4E2BP	Niche Food Product Development	Practical	2

**Course Objectives:**

To enable students to:

1. List examples of successful niche food products and their unique selling propositions.
2. Apply market research techniques to identify niche market opportunities and consumer needs.
3. Develop a marketing strategy and promotional campaign tailored to target niche consumer segments.

**Course Outcomes:**

On successful completion of the course, the student will be able to:

CO No.	Course Outcome
CO1	Recall key terminology and definitions related to niche food product development (e.g., niche market, artisanal foods, specialty ingredients).
CO2	Summarize the steps involved in the product development lifecycle for niche food products.
CO3	Develop prototypes or recipes for niche food products, considering flavor profiles, ingredient sourcing, and production feasibility.
CO4	Analyze consumer trends and market data to evaluate the potential demand for niche food products.
CO5	Critique the competitive landscape and positioning strategies of existing niche food products.
CO6	Design a comprehensive business plan for launching a new niche food product, including market analysis, product development timeline, and financial projections.

Unit No.	Course Content	No. of Hours
I.	<p><b>Niche Food Product Formulation Laboratory Trials</b></p> <p>(i) Product development/ value addition using niche foods- in any one category based on the classification learnt in theory</p> <p>(ii) Conducting survey to gauge market trends</p> <p>Development of the formula</p> <p>(iii) Preparing a flow chart indicative of the operational processes</p> <p>(iv) Sensory evaluation of the product</p> <p>(v) Identifying suitable packaging material</p> <p>(vi) Shelf life studies in various altered conditions</p>	30
II	<b>Marketing Exercise</b>	30

	(i) Understanding the concept of scale up (ii) Pricing and budgeting (iii) Business analysis and marketing strategy (iv) Launching of the product	
	<b>Total hours</b>	<b>60</b>

### References

Jameson K. (1998). *Food Science – A Laboratory Manual*. New Jersey: Prentice Hall Inc.  
 McWilliam, M. (2001). *Foods – Experimental Perspectives*. (4th Ed.). New Jersey: Prentice Hall Inc. USA: CRC Press Inc.  
 Meilgard (1999). *Sensory Evaluation Techniques*. (3rd ed.). CRC Press LLC.  
 Pomeranz Y and Meloan CE (2002). *Food Analysis – Theory and Practice*. CBS Publishers and Distributors, New Delhi.  
 Rao E. S. (2013). *Food Quality Evaluation*. Variety Books.

### Evaluation

2 Credits

50 marks

<b>CONTINUOUS INTERNAL EVALUATION:</b>	<b>Marks</b>
Class participation	5
Development of a new food product individually/ in pairs and submission of report (writing the proposal for development new product, standardization, packaging, labeling, marketing and sales)	20
<b>Total Marks for Internal Assessment</b>	<b>25</b>

<b>SEMESTER-END EXAMINATION:</b>	<b>Marks</b>
All questions are compulsory with internal choice.	
Planning a niche food product and drafting the proposal for its development, as per specified food group/ health requirement	20
Viva-voce examination	5
<b>Total Marks for Semester End Examination</b>	<b>25</b>

**Syllabus**  
**M.Sc. (Food Processing and Preservation)**  
**(Sem. - IV)**

Course Code	Title	Th/Pr	Credits	Hours
FPP 04 C5	Research Project	Practical	6	180

**COURSE OBJECTIVES:**

- To provide students with an opportunity to conduct independent research under supervision in Food Processing and Preservation and allied areas.
- To encourage students to work in conjunction with relevant food manufacturing units, food service units, food testing laboratories, food safety consultancy, entrepreneurs and other relevant agencies.
- To assist students in developing general research skills as well as research skills specific to their specialization.
- To encourage students to adopt best practices in research.
- To facilitate students in completing data collection/data entry/data analysis, and writing the remaining chapters of the dissertation (Results and Discussion, Summary and Conclusion and Limitations and Recommendations).
- To support students in: (a) completing and submitting the dissertation for the viva voce examination, (b) integrating feedback and submitting the final copy of the dissertation, and (c) writing a research paper using the findings of their research

**COURSE OUTCOMES (CO):**

On successful completion of this course, students will be able to:

<b>CO1</b>	Demonstrate the ability to design and conduct independent research projects in the field of Food Processing and Preservation and related disciplines, under the guidance of faculty mentors.
<b>CO2</b>	Establish effective partnerships and collaborations with relevant food manufacturing units, food service units, food testing laboratories, food safety consultancy, entrepreneurs and other other stakeholders to enrich research endeavors and enhance practical applications of research findings.
<b>CO3</b>	Develop and apply advanced research methodologies, techniques, and tools specific to their area of specialization, while also honing general research skills such as critical thinking, problem-solving, and data analysis.
<b>CO4</b>	Adhere to ethical standards and best practices in research, including the responsible conduct of research, proper citation and referencing, and maintaining integrity in data collection, analysis, and reporting.
<b>CO5</b>	Successfully complete key milestones in the research process, including formulating and defending a well-structured research proposal, initiating data collection procedures, and drafting all the chapters of the dissertation (especially, Results and Discussion Chapters) with clarity, coherence, and scholarly rigo.

**Course Content:**

Unit No.	Course Content	No. of Hours
<b>I.</b>	<b>Completing Laboratory Work/Product Development/ Data Collection</b> <b>Completing Data Entry and Preliminary Analyses</b> <ul style="list-style-type: none"> <li>Entering all data; checking for data entry errors; running preliminary analyses.</li> <li>Analyzing Data and Reporting Results</li> <li>Analyzing data; interpreting findings; reporting results in figures/tables and text using scientific protocol; writing the third chapter of the dissertation, namely, the Results, by research objectives/ questions/hypotheses; orally presenting the results and integrating feedback</li> </ul>	<b>30</b>
<b>II</b>	<b>Discussing Findings and Write Results and Discussions</b> <ul style="list-style-type: none"> <li>Corroborating own findings with those in previous research and theory</li> </ul>	<b>30</b>

	<ul style="list-style-type: none"> <li>Explaining findings using relevant literature and communication with experts</li> <li>Discussing implications of findings for practice/ industry/family/society</li> <li>Suggesting recommendations for future research; writing the fourth chapter of the dissertation, namely, the Discussion, using appropriate scientific protocol</li> </ul>	
<b>III</b>	<b>Discussing Findings and Write Results and Discussions</b> <ul style="list-style-type: none"> <li>Corroborating own findings with those in previous research and theory</li> <li>Explaining findings using relevant literature and communication with experts</li> <li>Discussing implications of findings for practice/ industry/family/society</li> <li>Suggesting recommendations for future research; writing the fourth chapter of the dissertation, namely, the Discussion, using appropriate scientific protocol</li> </ul>	<b>30</b>
<b>IV</b>	<b>Submission and Oral Defense; Writing of the Research Paper</b> <ul style="list-style-type: none"> <li>Orally defending the dissertation; integrating feedback into the final document; submitting the completed dissertation (hard copy and soft copy).</li> <li>Using the dissertation to write a research paper; submitting the research paper (hard copy and soft copy)/ Present the findings at Avishkar/Indian Science Congress or any other Conference</li> </ul>	<b>30</b>
	<b>Total hours</b>	<b>120</b>

#### References:

Dissertations in the College Library

Relevant Research Literature as per selected topic from scientific journals, dissertations, theses, books, literature on the internet.

#### Evaluation (Total Marks 100):

Continuous Internal Evaluation	Marks
<b>Research Guide's Evaluation for Examining the Student's expertise with regard to Research:</b> Proactive / Initiative / Responsibility / Flexibility/ Receptivity to feedback/ Thoroughness/ Meeting deadlines / Regularity in meeting/ Ethics / Absence of Plagiarism/ Networking, collaboration/ contacting experts.	25
<b>Research Guide's Evaluation for Examining the Quality of Chapters 1 and 2 of the M.Sc. Dissertation:</b> Less focus on Chapters 1 and 2; More focus on Chapters 3 (most) and 4.	25
<b>Total</b>	<b>50</b>

Semester-end Examination	Marks
<b>External Examiner's Evaluation of the Submitted Document:</b> <ul style="list-style-type: none"> <li>Chapter 2 (Method) – Sample Characteristics; Measurement and Plan of Analysis</li> <li>Chapter 3 (Results) – Relevance to research aim/objectives/hypotheses; Accuracy; Clarity; Organization</li> <li>Chapter 4 (Discussion) – Linkage to Indian and Non-Indian Literature</li> <li>Overall Quality of the Written Document</li> </ul>	25
<b>External Examiner's Evaluation through Viva Voce, of Student's expertise with regard to Research:</b> Clarity/Soundness/Accuracy with regard to Sample Characteristics; Measurement and Plan of Analysis; Ability to interpret, explain and communicate results of the study; Clarity/Soundness/Accuracy with regard to the discussion of findings; Originality/Insightfulness with regard to interpretation, explanation and discussion of findings; Overall rating of student's emerging research expertise	25
<b>Total</b>	<b>50</b>

**Letter Grades and Grade Points:**

<b>Semester GPA/ Programme CGPA Semester/ Programme</b>	<b>% of Marks</b>	<b>Alpha-Sign/ Letter Grade Result</b>
9.00 - 10.00	90.0 - 100	O (Outstanding)
8.00 - < 9.00	80.0 - < 90.0	A+ (Excellent)
7.00 - < 8.00	70.0 - < 80.0	A (Very Good)
6.00 - < 7.00	60.0 - < 70.0	B+ (Good)
5.50 - < 6.00	55.0 - < 60.0	B (Above Average)
5.00 - < 5.50	50.0 - < 55.0	C (Average)
4.00 - < 5.00	40.0 - < 50.0	P (Pass)
Below 4.00	Below 40.0	F (Fail)
Ab (Absent)	-	Absent

**Sign of the BOS  
Chairman  
Name of the  
Chairman  
BOS in**

**Sign of the  
Offg. Associate Dean  
Name of the  
Associate Dean  
Faculty of**

**Sign of the  
Offg. Associate  
Dean  
Name of the  
Associate Dean  
Faculty of**

**Sign of the  
Offg. Dean  
Name of the Dean  
Faculty of**