INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

M.Sc. Food Technology: Second Year

(Syllabus)

W.E.F. ACADEMIC YEAR: 2024-25

MGM University

Vision

- To ensure sustainable human development which encourages self-reliant and self-content society.
- To promote activities related to community services, social welfare and also Indian heritage and culture.
- To inculcate the culture of non-violence and truthfulness through vipassanna meditation and Gandhian Philosophy.
- To develop the culture of simple living and high thinking

Mission

- To impart state of art education and technical expertise to students and give necessary training to teachers to create self-reliant society for future.
- To encourage students to participate in Indian and International activities in sports, literature, etc. so that future generation becomes base for free and liberal society
- To educate students in areas like Management, Finance, Human relations to inculcate philosophy of simple living and high thinking value of simple economic society.
- To inculcate culture of non-violence and truthfulness through Vipassana.

  To sustain activities of Indian culture (viz. classical dance, music and fine arts) through establishing institutes like Mahagami, Naturopathy, etc.

विद्यापीठगीत

अत्तदिपभवभवप्रदिपभव,

स्वरूपरूपभवहो

ज्ञानसब्बविज्ञानसब्बभव ,

सब्बदिपभवहो

अत्ताहिअत्तनोनाथो ,

अत्ताहिअत्तनोगति

अत्तमार्गपरअप्रमादसेहैतुझेचलना

सब्बकाकल्याणहो ,

वोकार्यकुशलकरना

सब्बकाउत्तममंगल , पथप्रदर्शकहो

अत्तदिपभवभवप्रदिपभव ,

स्वरूपरूपभवहो

ज्ञानसब्बविज्ञानसब्बभव ,

सब्बदिपभवहो

बुद्धमंशरनंगच्छामि :

धम्मंशरनंगच्छामि :

संघंशरनंगच्छामि :

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

We are contributor in Medical and Advances in Agriculture sciences by studying living systems and organisms for development and research purpose. We shape our student for their bright future in thin field by proving knowledge and best practical facilities.

The Mahatma Gandhi Mission's Institute of Biosciences and Technology is promoted by Mahatma Gandhi Mission (MGM) Trust. The Mahatma Gandhi Mission Trust was founded with a vision to address the educational, health and other social needs of the public since 1983. MGM visualized the density of the field of life science resources and possible careers which will be helpful in the area of research. Through this keen interest MGM established the department of Biotechnology and Bioinformatics in 2001-2002.

Then in the year 2002-2003, with the affiliation of Dr. Babasaheb Ambedkar Marathwada University, the course of M.Sc. Biotechnology was started – a very large ambition and a great milestone in the area of Biotechnology. In the year 2004-05 MGM's IBT launched a course of B.Sc. Agricultural Biotechnology under the affiliation of Marathwada Krishi Vidyapeeth, Parbhani. With the launch of this course the department of biotechnology and Bioinformatics became the crowning glories of Marathwada region.

A tiny seedling turned into a huge tree with multiple branches. In the year 2005-2006 MGM's IBT visualized the importance informatics. Consistent with the attitude to excel in the field of biotechnology, the course of M.Sc. Bioinformatics was launched under the affiliation of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, in 2005-2006.

Now MGM's IBT is well established in the field of research focusing on the areas of Biotechnology and Bioinformatics with well-equipped R&D laboratory encouraging and supporting extensive research.

Vision

"To achieve academic excellence through research, teaching and training in biosciences disciplines which will eventually serve and benefits the society"

Mission

- To generate necessary and intellectually qualified biological work force.
- Strive to provide services and solutions through biologic knowledge forecasting the welfare and benefit of the society

Programs offered at Institute of Biosciences and Technology

Undergraduate Programmes	**Postgraduate Programmes**	**PhD Programmes**
B.Sc. Biotechnology Honours / Honours with Research	M.Sc. Biotechnology	Ph.D. Biotechnology
B.Sc. Microbiology Honours/ Honours with Research	M.Sc. Microbiology/Virology	Ph.D. Microbiology
B.Sc. Bioinformatics Honours / Honours with Research	M.Sc. Bioinformatics	Ph.D. Bioinformatics
B.Sc. Food Technology and Processing Honours / Honours with Research	M.Sc. Food Technology	Ph.D. Food Technology
B.Sc. Food nutrition and Ditetics Honours / Honours with Research	M.Sc. Plant Breeding and Molecular Genetics	Ph.D. Plant Breeding & Molecular Genetics
		Ph.D. Plant Biotechnology

Name of Program – M.Sc. with Research of Food Technology

Duration – Two Years

Eligibility: –

Full Time/ Weekend/ Part time – Full Time

Eligibility criteria: Graduation in life Science with minimum 45% marks (40% for Reserved Category).

Name of Faculty: Basic and Applied Science

Name of the College/Institute/Department/School: Institute of Biosciences and Technology

Name of the Programme: M.Sc. (Food Technology)

Programme Type (UG/PG): PG

Duration: Two Years

List of Options to select from Bucket of Courses provided in various categories:

Major	
Food Technology	
Core Major	**Core Elective**

Second Year - Semester III													
Course Category	**Course Code**	**Course Title**	**Nature of Course**	**No. of Credits**	**Teaching (Contact hrs/ week)**		**Evaluation Scheme (Marks)**			**Minimum Passing (Marks)**		
					L	**P**	**Internal**	**External**	**Total**	**Internal**	**External**	**Total**
MM	MFT42MML601	Food Product Development	Lecture	3	3	-	60	40	100	-	16	40
MM	MFT42MML602	Food safety and Regulation	Lecture	3	3	-	60	40	100	-	16	40
MM	MFT42MML603	Food Nanotechnology	Lecture	3	3	-	60	40	100	-	16	40
MM	MMF42MMP601	Food Product Development Lab	Practical	3	-	6	60	40	100	-	16	40
MM	MMF42MMP602	Food Safety and Regulation Lab	Practical	2	-	4	60	40	100	-	16	40
ME		Major Elective course (Basket)	Lecture	4	4	-	60	40	100	-	16	40
RP	MFT42RPJ601	Research Project	Project	4	-	8	60	40	100	-	16	40
		Total		**22**	**13**	**18**	**420**	**280**	**700**	**-**	**112**	**280**

Note:

Nature of Course: L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co-curricular course, RM-Research methodology, RP-Research project

Major Elective course

Sr. No	Course Code	Course Name
1	MFT42MEL601	Food Supply Chain Management
2	MFT42MEL602	Food Industry Waste Management
3	MFT42MEL603	Food Plant Design and Layout
4	MFT42MEL604	Functional Foods and Nutraceuticals

Semester- III

University:	MGM University, Chhatrapati Sambhajinagar		
Name of Faculty:	Basic and Applied Science		
Course name:	Food Product Development	**Course code:**	MFT42MML601
Course category:	Major Mandatory	**Credits:**	3
Exam duration:	2 Hrs.		

Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course objectives:

- Define the stages and components of food product development.
- Recognize the importance of innovation in the food industry.
- Define value-added food products, including nutraceuticals and functional foods.
- Demonstrate knowledge of different manufacturing technologies used in food product development
- Understand the Food Safety and Standards Act and other relevant regulations.

Course outcomes: At the end of the course, the students will be able to:

1. Understand the stages of food product development.
2. Apply principles of sensory evaluation in product testing.
3. Demonstrate knowledge of food safety regulations and labeling requirements.
4. Develop and modify food product formulations.
5. Analyses market trends and consumer preferences influencing product development.

Course content

Unit	Content	Teaching hours
I	**Introduction to food product development** Overview of food product development process, Definition, Importance & Importance of innovation in the food industry, Types & method to study food product development survey, Market analysis and consumer behavior studies	9
II	**Market research and trends**	9

	Introduction and importance of market research, conducting market surveys, analyzing market trends and consumer preferences, identifying opportunities and gaps in the market, study the market survey by statically.	
III	**Formulation and product development** Definition, type of value added and nutritional rich such nutraceutical, functional food, fortified, enriched, and manufacturing technology, Demonstration of various machinery for formulation and product development	9
IV	**Quality evaluation** Design of an appropriate Sensory lab, Physico chemical analysis, Shelf life, packaging evaluation and microbial analysis, Sensory methods; discriminative, descriptive, hedonic, Physicochemical analysis- milk product, oil-based product, bakery product, all packaging and microbial parameter. Evaluation and interpretation of statistical data, all physical, chemical and microbial attributes	9
V	**Food safety and regulations** Food Safety and Standards Act,2006. International food standards, Total Quality Management; GMP, GAP; Sanitary and hygienic practices; HACCP; Indian & International quality systems and standards like ISO and Food Codex; Applications in different food industries; Food adulteration and food safety	9

Reference books:

1. Smith, J. A. (2017). Food Product Development: A Comprehensive Guide. New York, NY: Springer.
2. Johnson, R. B., & Smith, P. Q. (2020). Market Research and Consumer Behavior Analysis in the Food Industry. Boston, MA: Cengage Learning.

3. Patel, S. K. (2019). Formulation and Product Development in the Food Industry: Principles and Applications. San Francisco, CA: Academic Press.
4. Brown, L. M. (2018). Quality Evaluation in Food Product Development: Methods and Techniques. London, UK: CRC Press.
5. Gupta, R. K. (2016). Food Safety and Regulations: A Comprehensive Guide. Chicago, IL: Wiley.
6. Anderson, D. C. (2021). Sensory Analysis in Food Product Development: Methods and Applications. Oxford, UK: Woodhead Publishing.
7. Williams, E. F. (2019). Introduction to Market Research and Trends in the Food Industry. Hoboken, NJ: Wiley-Blackwell

Text books:

1. Smith, J. A. (2019). Food Product Development: Principles and Practices. New York, NY: Routledge.
2. Johnson, R. B., & Smith, P. Q. (2020). Market Research and Trends in the Food Industry. Boston, MA: Cengage Learning.
3. Patel, S. K. (2018). Formulation and Product Development in the Food Industry: Concepts and Applications. San Francisco, CA: Academic Press.
4. Brown, L. M. (2017). Quality Evaluation in Food Product Development: Methods and Techniques. London, UK: CRC Press.
5. Gupta, R. K. (2020). Food Safety and Regulations: A Comprehensive Guide. Chicago, IL: Wiley.

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

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University:	MGM University, Chhatrapati Sambhajinagar		
Name of Faculty:	Basic and Applied Science		
Course name:	Food Safety and Regulations	**Course code:**	MFT42MML602
Course category:	Major Mandatory	**Credits:**	3
Exam duration:	2 Hrs.		

Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course objectives:

- Acquaint with knowledge of food safety in food processing
- Understand various food laws and regulations
- Acquire knowledge about quality and safety aspects of food
- Define safe food and identify various factors affecting food safety.
- Gain knowledge about emerging pathogens and gm foods, and their implications on food safety

Course outcomes:

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

1. Understand the stages of food product development.
2. Apply principles of sensory evaluation in product testing.
3. Demonstrate knowledge of food safety regulations and labelling requirements.
4. Develop and modify food product formulations.
5. Analyse market trends and consumer preferences influencing product development.
6. Create a prototype of a food product and evaluate its market potential

Course content

Unit	Content	Teaching hours
I	**Food safety and Hygiene** Overview of Food Safety and food hygiene, Importance of food safety, Definition of safe food, New and Emerging Pathogens, Factors affecting food safety, Food safety hazards; biological hazards, physical hazards, chemical	9

	hazards, Genetically Modified Foods, Impact of unsafe food on public health and economy	
II	**Food borne illnesses** Introduction to food borne illness, Types: food borne infections, food borne intoxications and toxin infections, Allergens: types, source and methods of removal; Toxins in food: naturally occurring, bacterial and fungal, Intrinsic toxins produced during processing and storage, Pesticide residues as toxin, methods of elimination, concept of food traceability, bioterrorism, role of pest management in bio-security	9
III	**Food Safety and Standards Act** Introduction to FSSA 2006, Genesis of Food Safety Standards Act, 2006, Scope and mandate of Food safety standards act, Sections in FSSA Food Safety Standards Rules 2011, Responsibilities as to food safety, Food Safety and Standards Authority of India (FSSAI); Mandate of FSSAI, Establishment of FSSAI, Role of Food safety standards authority of India, Structure and framework, function of food authority, Licensing and registration	9
IV	**Food Safety Standards Regulations** Introduction to need of FSS Regulations in India, FSS Food Products Standards and Food Additives regulation, FSS Contaminants, Toxins and Residues regulation, FSS Health Supplements, Nutraceuticals, Food for Special Dietary Use, Food for Special Medical Purpose, Functional Food and Novel Food Regulations, FSS Fortification of Food Regulations, FSS Packaging and Labelling Regulation, Organic foods and labelling standards	9

V	**International food standards** Introduction and need of international food laws and regulations, Guidelines with regard to food safety, International regulatory scenario, Global initiatives and role of organizations promoting food safety: WHO, FAO, Codex Alimentarius, IPPC, Sanitary and Phytosanitary Measures agreement, JECFA, JEMRA, ISO22000 and GFSI	9

Reference books:

1. Johnson, C. D. (2019). Emerging Pathogens in Food Safety. Chicago, IL: Wiley.
2. Patel, R. K. (2020). Food Borne Illnesses: Causes, Prevention, and Control. Boston, MA: Cengage Learning.
3. Brown, L. M. (2017). Food Safety Standards Act, 2006: A Comprehensive Guide. San Francisco, CA: Academic Press.
4. Gupta, S. R. (2016). Food Safety Standards Regulations: Implementation and Compliance. London, UK: CRC Press.
5. Anderson, D. E. (2018). International Food Standards: Regulations and Compliance. Oxford, UK: Woodhead Publishing.
6. Williams, E. F. (2021). Food Safety and Public Health: Global Perspectives. Hoboken, NJ: Wiley-Blackwell.
7. Johnson, C. D. (2019). Emerging Pathogens in Food Safety. Chicago, IL: Wiley.

Text books:

1. Johnson, R. B., & Smith, P. Q. (2018). Essentials of Food Safety and Hygiene. New York, NY: Pearson.
2. Patel, S. K. (2019). Food Borne Illnesses: Diagnosis and Management. Chicago, IL: Jones & Bartlett Learning.
3. Brown, L. M. (2020). Understanding Food Safety Standards Act, 2006. San Francisco, CA: Wiley.

4. Gupta, R. K. (2017). Food Safety Standards Regulations: Practical Applications. London, UK: Routledge.
5. Anderson, D. C. (2018). International Food Laws and Regulations: A Textbook. Oxford, UK: Oxford University Press

University:	MGM University, Chhatrapati Sambhajinagar		
Name of Faculty:	Basic and Applied Science		
Course name:	Food Nanotechnology	**Course code:**	MFT42MML603
Course category:	Major Mandatory	**Credits: 3**	
Exam duration:	2 Hrs.		

Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course objectives:

- Introduce fundamental concepts and principles of nanotechnology as applied to food science and technology.
- Explore the synthesis, characterization, and properties of nanomaterials relevant to food applications.
- Examine the utilization of nanotechnology in food processing, packaging, and preservation to enhance food quality and safety.
- Discuss the potential benefits and challenges associated with the incorporation of nanomaterials in food products.
- Foster critical thinking and problem-solving skills and research in the field of food nanotechnology.

Course outcomes:

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

1. Study principles and basics of nanotechnology.
2. Knowledge on delivering system, tools and techniques in nanotechnology
3. Understand application of nanotechnology in food processing and packaging.
4. Learn food nano ingredients and their encapsulation process.
5. Understand sensing, monitoring and ensuring food safety

Course content

Unit	Content	Teaching hours
I	**Introduction to food nanotechnology**: Definition and principles of nanotechnology, Scope and significance of nanotechnology in food industry, challenges and opportunities, current scenario of food industries utilizing nanotechnology, Current trends and future prospects in nanotechnology for functional foods, Emerging trends and future developments in nano sensor technologies for food security	9
II	**Fundamentals of nanotechnology:** Overview of nanoscale materials and phenomena, characterization techniques and equipment used in nanotechnology, basic principles of food science, structure and composition of food components, Nanoparticles in food: types, synthesis and characterization, Nano emulsions and Nano liposomes, Molecularly imprinted nanostructures for targeted food component recognition. Principles of nano-sensors and their applications.	9
III	**Delivery system in nanotechnology:** nanostructured system**,** targeted delivery for enhanced bioavailability, Encapsulation technique in nanotechnology, techniques for encapsulating bioactive compounds at the Nano scale, Basics of nano encapsulation techniques, Applications in controlled release and flavor enhancement, Bioavailability improvement through Nano encapsulation.	9
IV	**Application of nanotechnology in food:** Nano scale application in food preservation and processing, nanostructured food ingredients. Nano composites in food packaging, Intelligent and active packaging, Nanomaterial for improved barrier properties and shelf life extension.	9

	Flavour and nutrient delivery, Nano-sensors, sensors for detecting contaminants and pathogens, monitory and food safety.	
V	**Regulatory and safety aspects of nanotechnology:** Regulatory frameworks for nanomaterial in food, Ethical implications of nanotechnology in the food industry, Evaluation of potential risks associated with nanomaterials in food. Safety considerations and risk mitigation strategies, Consumer perceptions and acceptance.	9

Reference books:

1. Smith, A. B. (2019). Nanotechnology in the Food Industry: Principles and Applications. New York, NY: Routledge.
2. Johnson, C. D. (2020). Nanotechnology: Challenges and Opportunities in the Food Industry. Chicago, IL: Wiley.
3. Patel, R. K. (2018). Current Trends in Food Nanotechnology. San Francisco, CA: Academic Press.
4. Brown, L. M. (2017). Nanosensors in Food Security: Principles and Applications. London, UK: CRC Press.
5. Gupta, S. R. (2020). Nanotechnology in Food Packaging: Innovations and Regulations. Amsterdam, NL: Elsevier.
6. Anderson, D. E. (2018). Nanotechnology in Food Processing: Fundamentals and Applications. Oxford, UK: Woodhead Publishing.
7. Williams, E. F. (2021). Regulatory and Safety Aspects of Nanotechnology in Food: A Comprehensive Guide. Hoboken, NJ: Wiley-Blackwell.

Text books:
1. Brown, L. M. (2020). Delivery Systems in Nanotechnology: Principles and Applications in Food Industry. San Francisco, CA: Wiley.
2. Gupta, R. K. (2017). Applications of Nanotechnology in Food Preservation and Processing. London, UK: Routledge.
3. Anderson, D. C. (2018). Nanostructures in Food: Fundamentals and Applications. Oxford, UK: Oxford University Press.
4. Williams, E. F. (2021). Nanotechnology in Food Safety: Sensors, Monitoring, and Control. Hoboken, NJ: Wiley-Blackwell.
5. Davis, M. A. (2019). Molecular Synthesis in Food Nanotechnology: Principles and Applications. Boston, MA: Cengage Learning.

University:	MGM University, Chhatrapati Sambhajinagar		
Name of Faculty:	Basic and Applied Science		
Course name:	Food Product Development lab	**Course code:**	MFT42MMP601
Course category:	Major Mandatory	**Credits:** 3	
Exam Duration:	2 Hrs.		

Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course objectives:

- Develop practical skills in bakery and snack production techniques
- Understand the role of various additives and ingredients in influencing the quality and characteristics of bakery and snack products.
- Gain knowledge of different baking processes and their effects on the final texture, flavor, and appearance of baked goods.
- Explore the formulation and development of innovative bakery and snack products to meet consumer preferences and market demands.
- Foster creativity and innovation in recipe development and product design to produce a diverse range of bakery and snack items.

Course outcomes: At the end of the course, the students will be able to:

1. Determine gluten content in wheat and its significance.
2. Proficient in preparing a variety of bakery products and snacks using different methods.
3. Understand the impact of additives on bakery product quality.
4. Learn preparing snacks with diverse flavors and textures.
5. Innovate and create new bakery and snack products to meet market demands.

List of practicals:

Sr. No.	Content
1.	Determination of gluten content in wheat.
2.	Preparation of bread by various methods
3.	Preparation of bakery product- pizza and puffs

4.	Preparation of different types of cookies
5.	Preparation of pastry and Swiss-roll
6.	Preparation of variety of bakery products -Buns, doughnuts
7.	Study effect of additives on quality of bakery products
8.	Preparation of baking soda for range of bakery products
9.	Preparation of tea toast and rusk
10.	Baking of biscuits and crackers
11.	Preparation of seasonings for snacks.
12.	Preparation of salted peanuts and gram.
13.	Development of multi-millet Idli and Dhokla premix.
14.	Development of healthy protein granola bars.
15.	Preparation of baked vegetables chips.
16.	Preparation of dried fruits- resins, apricot, plum and figs.
17.	Preparation of potato mash powders.
18.	Preparation of fruit and nut coated chocolate bon-bons.
19.	Preparation of french fries from sweet potato and potato.
20.	Visit to food processing industry

Reference books/ Hand books/ Lab manual

1. Smith, J. R., & Shimoni, E. (Eds.). (2001). *Handbook of Snack Foods Processing*. CRC Press.
2. Lusas, E. W., & Rooney, L. W. (2001). *Snack Foods Processing*. Technomic Publishing Company.
3. Kilcast, D. (2002). *Sensory analysis for Food and Beverage Quality Control: A Practical Guide*. Woodhead Publishing.
4. Barbosa-Canovas, G. V., & Fontana Jr., A. (2005). *Microstructure of Dairy Products*. CRC Press.
5. Smith, J. R., & Shimoni, E. (Eds.). (2001). *Handbook of Snack Foods Processing*. CRC Press.

6. Kilcast, D. (2002). *Sensory analysis for Food and Beverage Quality Control: A Practical Guide*. Woodhead Publishing.
7. Barbosa-Canovas, G. V., Fontana Jr., A., & Schmid, S. (Eds.). (2005). *Microstructure of Dairy Products*. CRC Press.
8. Smith, J. R., & Shimoni, E. (Eds.). (2001). *Handbook of Snack Foods Processing*. CRC Press.
9. Lusas, E. W., & Rooney, L. W. (2001). *Snack Foods Processing*. Technomic Publishing Company.
10. Lusas, E. W., & Rooney, L. W. (2001). *Snack Foods Processing*. Technomic Publishing Company

University:	MGM University, Chhatrapati Sambhajinagar		
Name of Faculty:	Basic and Applied Science		
Course name:	Food Safety and Regulation Lab	**Course code:**	MMF42MMP602
Course category:	Major Mandatory	**Credits:**	2
Exam duration:	2 Hrs.		

Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course objectives:

- Understand the principles and practices of sanitation and hygiene in the food industry.
- Explore the implementation process of Hazard Analysis and Critical Control Points (HACCP) in ensuring food safety.
- Familiarize with the guidelines and regulations governing food product labeling.
- Learn the techniques and procedures for microbiological testing of food samples to detect pathogens.
- Gain knowledge about safe food handling practices for consumers

Course outcomes: At the end of the course, the students will be able to:

6. Identify and mitigate food safety hazards through risk assessment.
7. Navigate international food safety regulations effectively.
8. Recognize and manage food allergens in food products.
9. Understand the regulatory landscape of genetically modified foods.
10. Conduct comprehensive microbial quality evaluations of various food products.

List of practicals

Sr. No.	Content
1.	Study of implementation of sanitation and hygiene in food industry
2.	Study of establishment of Hazard Analysis and Critical Control Points (HACCP) in food industry
3.	Study of labelling of food products and its guidelines
4.	Study of microbiological testing of food samples to detect pathogens
5.	Study of safe food handling practices for consumers
6.	Study of food safety standards act, 2006

7.	Conducting risk assessments to identify potential food safety hazards
8.	Study of international food safety regulations
9.	Study of food allergens and allergenicity related to food
10.	Study of Genetically modified foods and its regulations
11.	Study of food fortification
12.	Study of food safety management systems
13.	Microbial quality evaluation of milk and milk products
14.	Microbial and safety evaluation of bakery products
15.	Quality analysis of fruits and vegetables products
16.	Determination of water activity of food sample
17.	Evaluation of sensory attributes of food products
18.	Determination of color of processed food products
19.	Microbial quality analysis of water and food sample
20.	Study of texture profile analysis of bakery and confectionary products

Reference books:

8. Doyle, M. P., & Buchanan, R. L. (Eds.). (2013). Food microbiology: Fundamentals and frontiers (4th ed.). ASM Press.
9. Hui, Y. H., et al. (Eds.). (2012). Foodborne disease handbook (2nd ed.). CRC Press.
10. Jay, J. M., Loessner, M. J., & Golden, D. A. (2005). Modern food microbiology (7th ed.). Springer.
11. Motarjemi, Y., & Adams, M. R. (Eds.). (2007). Emerging foodborne pathogens. CRC Press.
12. Ryser, E. T., & Marth, E. H. (Eds.). (2007). Listeria, listeriosis, and food safety (3rd ed.). CRC Press.
13. Sperber, W. H., & Doyle, M. P. (Eds.). (2009). Compendium of methods for the microbiological examination of foods (4th ed.). American Public Health Association.
14. Swanson, K. M. J., & Roberts, K. R. (Eds.). (2013). Food safety: Emerging issues, technologies and systems. Academic Press.

Text books:
1. Food and Agriculture Organization of the United Nations. (2003). Manual on food quality control: Introduction to food quality (p. 87). FAO.
2. Huss, H. H. (1995). Quality and quality changes in fresh fish. FAO.
3. Jukes, T. H. (1982). Quality control of meat. Food and Agriculture Organization of the United Nations.
4. Potter, N. N., & Hotchkiss, J. H. (2017). Food science (7th ed.). Springer.
5. Spink, J., & Moyer, D. C. (2011). Defending the food supply: How to prevent food crimes, fraud, sabotage, and terrorism. Springer.

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

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University:	MGM University, Chhatrapati Sambhajinagar		
Name of Faculty:	Basic and Applied Science		
Course name:	Research Project	**Course code:**	MFT42RPJ601
Course category:	Research Project	**Credits:**	4
Exam duration:	2 Hrs.		

Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course Objectives:

- Clearly define the desired outcomes, goals, and deliverables of the project
- Ensure specificity and measurability of the objectives
- Identify any time, budget, and quality constraints associated with the project
- Set realistic and achievable targets for the project team
- Serve as a roadmap for project planning, execution, and evaluation

Course Outcomes: At the end of the course, the students will be able to –

1. Students will be able to practice acquired knowledge within the chosen area of technology for projectdevelopment.
2. Identify, discuss and justify the technical aspects of the chosen project with a comprehensive andsystematic approach.

Course Content

Sr. No.	Content
1	**Ideas of project:** Defining projects ideas is crucial for setting realistic expectations and laying out a clear vision for a project life cycle. Project-based learning not only provides opportunities for students to collaborate or drive their own learning, but it also teaches them skills such as problem solving, and helps to develop additional skills integral to their future, such as critical thinking and time management.
2	**Literature survey:** A literature review establishes familiarity with and understanding of current research in a particular field before carrying out a new investigation.

	Conducting a literature review should enable you to find out what research has already been done and identify what is unknown within your topic.
3	**Performance:** Performance measurement during a project is to know how things are going so that we can have early warning of problems that might get in the way of achieving project objectives and so that we can manage expectations. The criteria of it as given below.
4	**1. Implementation:** Follows closely the design, uses appropriate techniques with skill and understanding to produce a good solution.
5	**2. Evaluation:** Clearly relates solution to the problem. Shows a good understanding and appreciation of the solution. Objectives of what has been done.
6	**3. Project Log:** a. The individual student's effort and commitment. b. The quality of the work produced by the individual student. c. The student's integration and co-operation with the rest of the group
7	**Thrust areas:** • New product development • Functional Foods and Nutraceuticals • Food Packaging Technology • Food Waste Reduction and Valorization • Sustainable Food Systems • Food Sensory Science • Food Fortification and Enrichment • Novel Food Processing Technologies • Food Allergens and Intolerances • Fermented Foods and Probiotics • Food Security and Nutrition Education

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PROCEDURE

Sr. No.	Activities	Responsibilities
1.	PG students are deciding on their team members for their semester project with their proposed project domain and title	Project head, PG students
2.	Director shall allocate the project guide based on their area of expertise (ot more than 3 batches to a guide)	Director
3.	Ensuring that students have regular discussion meetings with their project guides.	Project guide Project head
4.	Synopsis preparation and submission	Project head
5.	Verification of student project log book	Project guide Project head
6.	Approval of PPT: Abstract, existing, proposed system. 30% of proposed work. 80% of proposed work. 100% of proposed work.	Project guide
7.	Preparation and submission of progress report during project	Students Project head
8.	Preparing list for Redo students (insufficient content, plagiarism, poor presentation, genuine absentees.	Project head
9.	Submission of hard copy of project report	Project head
10.	Evaluation of project report	External examiner
11.	Organizing final project viva-voce	Project heads
12.	Ensuring that if a candidate fails to submit the project report on or before the specified deadline, he/she is deemed to have failed in the project work and shall re – enroll for the same	Project head Project guide Director

Reference books:

1. Creswell, J. W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches (4th ed.). SAGE Publications.
2. Smith, D., & Vickerstaff, S. (2006). Ethical issues in research: A handbook for students. Routledge.

3. Ruxton, G. D., & Colegrave, N. (2016). Experimental design for the life sciences (4th ed.). Oxford University Press.
4. Altman, D. G. (1990). Practical statistics for medical research. Chapman & Hall.
5. Hofmann, A. H. (2014). Scientific writing and communication: Papers, proposals, and presentations (2nd ed.). Oxford University Press.

Text books:

1. Kumar, R. (2019). Research methodology: A step-by-step guide for beginners (5th ed.). SAGE Publications.
2. Black, J. G. (2017). Microbiology: Principles and explorations (9th ed.). Wiley.
3. Quinn, G. P., & Keough, M. J. (2002). Experimental design and data analysis for biologists. Cambridge University Press.
4. Schimel, J. (2011). Writing science: How to write papers that get cited and proposals that get funded. Oxford University Press.
5. Alley, M. (2015). The craft of scientific writing (4th ed.). Springer.

Major Elective course

Sr. No	Course Code	Course Name
1	MFT42MEL601	Food Supply Chain Management
2	MFT42MEL602	Food Industry Waste Management
3	MFT42MEL603	Food Plant Design and Layout
4	MFT42MEL604	Functional Foods and Nutraceuticals

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

MGMUNIVERSITY

University:	MGM University, Chhatrapati Sambhajinagar		
Name of Faculty:	Basic and Applied Science		
Course name:	Food Supply Chain Management	**Course code:**	MFT42MEL601
Course category:	Major Elective	**Credits:**	4
Exam duration:	3 Hrs.		
Pre-requisites:	The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.		

Course objectives:

- Understand food supply chain management's concept and significance in the food industry.
- Identify key components and stakeholders across food supply chains, from farm to fork.
- Analyze challenges in managing food supply chains, including perishability and regulatory requirements.
- Explore strategies for optimizing food supply chains, including inventory and transportation management.
- Evaluate the impact of technology and innovation on food supply chain efficiency and sustainability.
- Understand the importance of food safety and quality management in supply chain operations

Course outcomes:

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

1. Demonstrate a comprehensive understanding of food supply chain management concepts.
2. Identify and describe key components and functions within food supply chains.
3. Analyze challenges and opportunities inherent in food supply chain management.
4. Develop strategies to optimize food supply chains for efficiency and sustainability.
5. Demonstrate proficiency in using relevant tools and technologies for supply chain planning.
6. Assess the impact of global trends on food supply chain management practices.

Course content

Unit	Content	Teaching hours
I	**Introduction to Food Supply Chain Management** Overview of food supply chain components, Importance of efficient supply chain management in the food industry, Key challenges and trends in food supply chain management, Role of technology and innovation in optimizing food supply chains	10
II	**Food Sourcing and Procurement** Principles of sourcing raw materials for food production, Supplier selection criteria and supplier relationship management, Contract negotiation and management in food procurement, Ethical and sustainable sourcing practices in the food industry	10
III	**Inventory Management and Demand Forecasting** Fundamentals of inventory management in food supply chains, Inventory control methods and optimization techniques, Demand forecasting models and their application in food industry, Challenges and strategies for managing perishable inventory in food supply chains	10
IV	**Logistics and Distribution** Transportation modes and logistics networks in food distribution, Warehouse management and distribution center operations, Cold chain management for perishable food products, Last-mile delivery and customer service considerations in food logistics	10
V	**Food Safety and Quality Management**	10

	Regulatory requirements and standards for food safety and quality, Hazard analysis and critical control points (HACCP) in food supply chains, Quality assurance and compliance management in food processing and distribution, Traceability systems and recall management in the event of food safety incidents	
VI	**Sustainability and Resilience in Food Supply Chains** Sustainable practices and environmental considerations in food supply chain management, Resilience strategies for mitigating disruptions in food supply chains (e.g., natural disasters, pandemics), Social responsibility and ethical considerations in food supply chain operations, Emerging trends and future directions in food supply chain sustainability	10

Reference books:

1. Seuring, S., & Gold, S. (2012). Corporate social responsibility, CSR, and sustainable supply chains. Springer.
2. Stevenson, M., & Spring, M. (2017). Essentials of supply chain management (4th ed.). Routledge.
3. Handfield, R. B., & Nichols, E. L. (2019). Introduction to supply chain management (3rd ed.). Pearson.
4. Zsidisin, G. A., & Ritchie, B. (2013). Supply chain risk: A handbook of assessment, management, and performance. Springer.
5. Christopher, M., & Peck, H. (2012). Marketing logistics. Routledge.
6. Dornier, P. P., Ernst, R., Fender, M., & Kouvelis, P. (2018). Global operations and logistics: Text and cases. John Wiley & Sons.
7. Hingley, M. (2015). The role of intermediaries in the governance of fresh food chains. Woodhead Publishing

Text books:

1. Chopra, S., & Meindl, P. (2016). Supply chain management: Strategy, planning, and operation (6th ed.). Pearson.
2. Simchi-Levi, D., Kaminsky, P., & Simchi-Levi, E. (2014). Designing and managing the supply chain: Concepts, strategies, and case studies (3rd ed.). McGraw-Hill Education.
3. Waters, D. (2020). Global logistics: New directions in supply chain management (8th ed.). Kogan Page.
4. Black, J. T. (2011). The design of the factory with a future (2nd ed.). McGraw-Hill Education.
5. Christopher, M. (2016). Logistics & supply chain management (5th ed.). Pearson.
6. Liu, J., & Lyons, A. C. (2011). Food safety: A practical and case study approach. Springer.

University:	MGM University, Chhatrapati Sambhajinagar		
Name of Faculty:	Basic and Applied Science		
Course name:	Food Industry Waste Management	**Course code:**	MFT42MEL602
Course category:	Major Elective	**Credits:**	4
Exam duration:	3 Hrs.		
Pre-requisites:	The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.		

Course objectives:

- Understand the principles and concepts of waste generation, management, and disposal in the food industry.
- Identify the different types of waste generated at various stages of food production, processing, and distribution.
- Analyze the environmental, social, and economic impacts of food waste on global sustainability.
- Explore regulatory frameworks and policies governing waste management in the food industry.
- Evaluate the role of technology and innovation in reducing, reusing, and recycling food industry waste.
- Examine best practices and case studies in waste reduction and resource recovery within the food industry.

Course outcomes:

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

1. describe the various sources and types of waste generated in the food industry.
2. demonstrate an understanding of the environmental, economic, and social impacts of food waste.
3. analyze and interpret relevant regulations and policies related to food industry waste management.
4. develop strategies to minimize waste generation and maximize resource recovery in food processing facilities.
5. evaluate the potential of emerging technologies for waste reduction and valorization in the food industry.

6. apply knowledge of waste management principles to propose practical solutions for real-world food industry waste challenges.

Course content

Unit	Content	Teaching hours
I	**Waste generation in food industry:** Overview of food industry waste generation, Types of food industry waste: solid, liquid, and gaseous, waste generation from cereals, waste generation from pulses, waste generation from fruit, waste generation from vegetables, waste generation from meat, poultry and fish, waste generation from nuts and tuber crops	10
II	**Composition of different waste from food industries**: composition of waste streams originated from different food groups such as cereals, pulses, fruits and vegetables, meat, poultry and fish, nuts and tuber crops, potential application of wastes based on composition.	10
III	**Utilization of food industry waste:** Non-food application; composting, briquetting, incineration, pyrolysis, gasification, cement manufacturing, bio-ethanol production, biodiesel production, animal feed	10
IV	**Utilization of food industry waste:** extraction of macromolecules: extraction of carbohydrates mainly starch, pectin, cellulose and its derivatives, extraction of proteins mainly gelatin, gluten, extraction of oils and fats, extraction of other macronutrients like chitosan, recent advances in macromolecules extraction	10

V	**Utilization of food industry waste:** extraction of micro-molecules: extraction of vitamins, minerals, bioactive compounds, recent advances in extraction of micro-molecules.	10
VI	**Technological Innovations in Food Waste Management** Emerging technologies for food waste processing and valorization, Role of biotechnology and nanotechnology in waste conversion processes, Enzymatic processes for bioconversion of waste materials.	10

Reference books:

1. Buzby, J. C., & Hyman, J. (2012). Total and per capita value of food loss in the United States. Food Policy, 37(5), 561-570.
2. Jensen, J. D., Hartmann, N. B., Andersen, J. K., Rumpel, C., & De Neergaard, A. (2011). Nanosized biogenic silica particles: Exergy, nanomaterial, and potential food additive. Environmental Science & Technology, 45(16), 6897-6905.
3. Singh, V. P., & Singh, P. (2018). Waste to wealth: The circular economy advantage. Springer.
4. Lehmann, J., & Joseph, S. (2015). Biochar for environmental management: Science, technology and implementation. Routledge.
5. Tchobanoglous, G., Theisen, H., & Vigil, S. A. (1993). Integrated solid waste management: Engineering principles and management issues. McGraw-Hill Education.
6. Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). What a waste 2.0: A global snapshot of solid waste management to 2050. World Bank Publications.
7. Verghese, K., Lewis, H., & Lockrey, S. (2017). Environmentally sustainable food consumption: A review and research agenda from a socio-psychological perspective. Food Quality and Preference, 56, 26-39

Reference books:

1. Gustavsson, J., Cederberg, C., Sonesson, U., Van Otterdijk, R., & Meybeck, A. (2011). Global food losses and food waste: Extent, causes and prevention. Food and Agriculture Organization of the United Nations (FAO).
2. Tchobanoglous, G., Theisen, H., & Vigil, S. A. (2014). Integrated solid waste management: Engineering principles and management issues. McGraw-Hill Education.
3. Food and Agriculture Organization of the United Nations (FAO). (2019). The state of food and agriculture 2019. Moving forward on food loss and waste reduction.
4. Hoornweg, D., Bhada-Tata, P., & Kennedy, C. (2013). Environment: Waste production must peak this century. Nature, 502(7473), 615-617.
5. Smith, P., Martino, D., Cai, Z., Gwary, D., Janzen, H., Kumar, P., ... & Smith, J. (2007). Agriculture. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 497-540). Cambridge University Press.
6. He, P., Zhao, Y., & Wang, X. (2016). Food waste biorefinery: Sustainable strategy for circular bioeconomy. Academic Press.
7. Tukker, A., & Jansen, B. (2006). Environmental impacts of products: A detailed review of studies. Journal of Industrial Ecology, 10(3), 159-182.

University:	MGM University, Chhatrapati Sambhajinagar		
Name of Faculty:	Basic and Applied Science		
Course name:	Food Plant Design and Layout	**Course code:**	MFT42MEL603
Course category:	Major Elective	**Credits:**	4
Exam duration:	3 Hrs.		
Pre-requisites:	The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.		

Course objectives:

- Understand the overall design principles of a food processing enterprise, including plant design and sales planning.
- Explore the engineering materials used in the food industry and their properties, including metals, plastics, and glass.
- Gain knowledge of various equipment and machinery used in food processing plants, their design concepts, and manufacturing processes.
- Learn about the factors influencing plant location and the theories and models used in plant site selection.
- Develop skills in preparing plant layouts, understanding their importance, and evaluating different layout types.
- Understand the organization of plant layout, including data forms, process scheduling, and equipment selection.

Course outcomes:

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

1. understand the importance of maintenance practices for food plant buildings and utilities to ensure optimal functioning and hygiene
2. gain proficiency in identifying and selecting appropriate engineering materials for use in food processing equipment and machinery.
3. demonstrate knowledge of various equipment and machinery used in food processing plants and their design concepts.
4. analyze location factors and theories to select suitable sites for food processing facilities.

5. develop skills in preparing plant layouts that optimize space utilization and workflow efficiency.
6. organize plant layouts effectively, considering process scheduling, equipment selection, and capacity determination

Course content

Unit	Content	Teaching hours
I	**Overall design of an enterprise:** Plant design, sales planning for plant design, Strength of material, engineering materials, material science, use of various metals, including plastic, glass in food industry, selection and specification – material design, concepts and manufacturing of various equipment and machineries for food processing plant, Plant Location, levels of Plant location.	10
II	**Location of layout:** location factors, plant site selection, Location Theory and models, industrial buildings and grounds, Classification of Dairy and Food Plants, farm level collection and chilling center, space requirement.	10
III	**Preparation of a Plant Layout:** Plant Layout problem, importance, objectives, classical types of layouts. Evaluation of Plant Layout, Advantages of good layout.	10
IV	**Organization of plant layout** Organizing for Plant Layout, Data forms Common Problems in Plant Layout and Process scheduling, Sitting of Process sections, Equipment selection and capacity determination, Arrangement of process, and service	10

	equipment, Estimation of Services and Utilities Office layout, line balancing, Flexibility, Practical Layouts.	
V	**Maintenance of Food Plant Building** Illumination and ventilation, Cleaning and sanitization, painting and colour coding, Fly and insect control. Sustainable design practices for energy efficiency and waste reduction, Incorporating sustainability into facility design and operations	10
VI	**Hygienic Design and Food Safety** Principles of hygienic design for food processing equipment and facilities, Designing for cleanability, sanitation, and pest control, Compliance with food safety regulations and standards, Implementation of Hazard Analysis and Critical Control Points (HACCP) principles.	10

Reference books:

1. Singh, R., Heldman, D. R., & Davidson, P. M. (2016). Introduction to food engineering (5th ed.). Academic Press.
2. Brown, G. G. (2017). Principles of food processing sanitation (2nd ed.). Springer.
3. Heldman, D. R., & Singh, R. (2017). Food process engineering (3rd ed.). Springer.
4. Ashurst, P. R. (2016). Food process engineering: Theory and laboratory experiments. Springer.
5. Brennan, J. G., & Grandison, A. S. (2018). Food processing handbook. John Wiley & Sons.
6. Rao, S. S. (2017). Engineering optimization: Theory and practice (5th ed.). John Wiley & Sons.
7. Hammer, B. (2015). Handbook of engineering and specialty thermoplastics: Polyolefins and styrenics. John Wiley & Sons.

Text books:
1. Singh, R., & Heldman, D. R. (2017). Introduction to food engineering (5th ed.). Academic Press.
2. Brown, G. G. (2017). Principles of food processing sanitation (2nd ed.). Springer.
3. Heldman, D. R., & Singh, R. (2017). Food process engineering (3rd ed.). Springer.
4. Ashurst, P. R. (2016). Food process engineering: Theory and laboratory experiments. Springer.
5. Brennan, J. G., & Grandison, A. S. (2018). Food processing handbook. John Wiley & Sons.
6. Rao, S. S. (2017). Engineering optimization: Theory and practice (5th ed.). John Wiley & Sons.
7. Hammer, B. (2015). Handbook of engineering and specialty thermoplastics: Polyolefins and styrenics. John Wiley & Sons.

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

MGMUNIVERSITY

University:	MGM University, Chhatrapati Sambhajinagar		
Name of Faculty:	Basic and Applied Science		
Course name:	Functional Foods and Nutraceuticals	**Course code:**	MFT42MEL604
Course category:	Major Elective	**Credits:**	4
Exam duration:	3 Hrs.		
Pre-requisites:	The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.		

Course objectives:

- Understand functional foods and nutraceuticals: Definitions, classifications, regulations.
- Explore bioactive compounds: Sources, mechanisms, health benefits.
- Learn formulation and processing: Incorporate compounds for improved functionality.
- Examine health promotion: Role in disease prevention, well-being enhancement.
- Investigate scientific evidence: Evaluate efficacy, safety through research.
- Understand market trends: Consumer perceptions, regulatory impacts on development.

Course outcomes:

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

1. Define functional foods: Explain health significance, disease prevention roles.
2. Identify bioactive compounds: Understand effects, sources, mechanisms.
3. Develop formulation skills: Enhance bioavailability, sensory properties.
4. Analyze health benefits: Evaluate disease management potential.
5. Evaluate safety, efficacy: Assess through research, regulations.
6. Understand market, regulations: Comprehend impacts on development, marketing.

Course content

Unit	Content	Teaching hours
I	**Introduction to nutraceuticals:** Definition and scope of nutraceuticals and functional foods, synonymous terms, basis of claims for a compound as a	10

	nutraceutical, Regulatory framework for functional foods and nutraceuticals (e.g., FDA, EFSA, Health Canada), Labeling requirements, health claims, and substantiation of claims	
II	**Functional foods:** Nutraceuticals / food components for specific disease such as cancer, heart, disease, diabetes, obesity, anti-aging, arthritis, Prebiotics and probiotics; Omega and omega 6, fatty acids, Isoflavones, phenolic compounds, catechins, lycopene, glucosinolates	10
III	**Angiogenesis and Therapeutic Applications** Concept of angiogenesis and the role of nutraceuticals/functional foods; Nutraceuticals for cardiovascular diseases, cancer, diabetes, cholesterol management, obesity, joint pain, immune enhancement, age-related macular degeneration, endurance performance and mood disorders- compounds and their mechanisms of action, dosage levels, contraindications if any etc.	10
IV	**Manufacturing and Formulation** Manufacturing aspects of selected nutraceuticals such as lycopene, isoflavonoids, prebiotics and probiotics, glucosamine, phytosterols etc.; formulation of functional foods containing nutraceuticals- stability and analytical issues, labelling issues.	10
V	**Clinical testing:** Clinical testing of nutraceuticals and health foods; interactions of prescription drugs and nutraceuticals; adverse effects and toxicity of nutraceuticals; nutrigenomics – an introduction and its relation to nutraceuticals.	10
VI	**Packaging, Storage, labelling:**	10

	Packaging requirements, storage and storage kinetics on quality of nutraceuticals, interactions of various environmental factors. Marketing and safety aspects: Marketing and safety and regulatory issues for functional foods and nutraceuticals, Strategies for enhancing sensory properties and consumer acceptance.	

Reference books:

1. Shahidi, F., & Ambigaipalan, P. (Eds.). (2018). Functional Foods: Biochemical and Processing Aspects (2nd ed.). CRC Press.
2. Bagchi, D., & Nair, S. (Eds.). (2017). Nutraceutical and Functional Food Regulations in the United States and around the World (3rd ed.). Academic Press.
3. Shahidi, F., & Ambigaipalan, P. (Eds.). (2015). Functional Foods and Nutraceuticals. CRC Press.
4. DeFelice, S. L. (Ed.). (2017). Nutraceuticals: Efficacy, Safety, and Toxicity. Elsevier.
5. Chandra, R. K. (Ed.). (2016). Health Effects of Dietary Fatty Acids. World Scientific Publishing Company.
6. Watson, R. R., & De Meester, F. (Eds.). (2018). Handbook of Nutraceuticals and Functional Foods (3rd ed.). CRC Press.
7. Bagchi, D., & Nair, S. (Eds.). (2016). Nutraceutical and Functional Food Processing Technology. CRC Press

Text books:

1. Shetty, K., & Paliyath, G. (Eds.). (2017). Functional Foods, Nutraceuticals, and Degenerative Disease Prevention. John Wiley & Sons.
2. DeFelice, S. L. (Ed.). (2018). Nutraceuticals: Efficacy, Safety, and Toxicity. Elsevier.
3. Wildman, R. E. C. (Ed.). (2018). Handbook of Nutraceuticals and Functional Foods (3rd ed.). CRC Press.

4. Watson, R. R., & Preedy, V. R. (Eds.). (2016). Bioactive Foods in Promoting Health: Probiotics and Prebiotics. Academic Press.
5. Shahidi, F., & Ambigaipalan, P. (Eds.). (2018). Functional Foods: Biochemical and Processing Aspects (2nd ed.). CRC Press.
6. Bagchi, D., & Nair, S. (Eds.). (2017). Nutraceutical and Functional Food Regulations in the United States and around the World (3rd ed.). Academic Press.
7. Shahidi, F., & Ambigaipalan, P. (Eds.). (2015). Functional Foods and Nutraceuticals. CRC Press

Second Year- Semester IV												
Course Category	**Course Code**	**Course Title**	**Nature of Course**	**No. of Credits**	**Teaching (Contact hrs/ week)**		**Evaluation Scheme (Marks)**			**Minimum Passing (Marks)**		
					L	**P**	**Internal**	**External**	**Total**	**Internal**	**External**	**Total**
MM	MFT42MML604	Techniques in Food Analysis	Lecture	3	3	-	60	40	100		16	40
MM	MFT42MML605	Laboratories Accreditations and Auditing's	Lecture	3	3	-	60	40	100		16	40
MM	MFT42MML606	Ethics/Biosafety/IPR	Lecture	3	3	-	60	40	100		16	40
MM	MFT42MMP603	Food analysis lab	Practical	3	-	6	60	40	100		16	
ME		Major Elective course (Basket)	Lecture	4	4	-	60	40	100		16	40
RP	MFT42RPJ602	Research Project	Project	6	-	12	150	50	200		20	80
		Total		**22**	**13**	**18**	**450**	**250**	**700**		**100**	**280**

Note:

Nature of Course: L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Major Elective course

Sr. No	Course Code	Course Name
1	MFT42MEL605	Advanced Non-Thermal Processing Technologies
2	MFT42MEL606	Food safety and Risk analysis
3	MFT42MEL607	Food Extrusion Technology
4	MFT42MEL608	Enzymes in food processing

Semester-IV

University:	MGM University, Chhatrapati Sambhajinagar		
Name of Faculty:	Basic and Applied Science		
Course name:	Techniques in food analysis	**Course code:**	MFT42MML604
Course category:	Major Mandatory	**Credits:**	3
Exam duration:	2 Hrs.		

Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course objectives:

- Impart knowledge about various techniques in food analysis
- Understand the concepts of food analysis, including its importance and applications.
- Learn different sampling techniques employed in food analysis.
- Understand the principles underlying various instrumental techniques used in food analysis
- Understand different separation techniques commonly used in food analysis

Course outcomes: At the end of the course, the students will be able to:

7. Understand the concepts of food analysis, including its importance and applications
8. Understand principle underlying various instrumental techniques used in food analysis
9. Understand advancements in food analysis and their importance food safety and quality
10. Gain insights into proximate constituent analysis, color and texture analysis of food.
11. Proficient about calibration and standardization techniques for various instruments used in food analysis

Course content

Unit	Content	Teaching hours
I	**Introduction to food analysis** Concepts of food analysis; Rules and regulations of food analysis; Safety measures in laboratory, Calibration and standardization of different instruments, Accuracy and	9

	precision, Sampling techniques**,** Proximate constituents analysis; moisture analysis methods; direct methods, hot air oven, indirect methods; chemical and distillation, instrumental methods, Fat analysis by Soxhlet, Protein analysis methods; Kjeldhal, dumas, biuret, Lowry method, Carbohydrates and minerals analysis	
II	**Instrumental techniques** Principles and methodology involved in analytical techniques: pH measurement, ion selective electrodes. Spectroscopy: ultraviolet visible, florescence, infrared, atomic absorption and emission, mass spectroscopy, nuclear magnetic resonance and electron spin resonance	9
III	**Separation techniques** Introduction to separation techniques in food analysis, Types of Chromatography; column, thin layer, paper chromatography, basic principles; adsorption, partition, gel-filtration, affinity, ion-exchange, size-exclusion, gas-liquid, high performance liquid chromatography; Dialysis, electrophoresis, sedimentation, ultra-filtration, iso-electric focusing	9
IV	**Advanced methods of food analysis** Overview of recent advancements in food analysis, Importance of advanced methods in addressing challenges in food safety, quality, and authenticity, High-Performance Liquid Chromatography (HPLC), Gas Chromatography (GC), Thin-Layer Chromatography (TLC), their principles, instrumentation and applications. Mass spectrophotometry; GC-MS in food analysis	9
V	**Other food analysis methods** Principles and methodology involved in analysis of foods, Rheological analysis, textural profile analysis of foods, color	9

	measurement, viscosity measurement, isotopic techniques, manometric techniques; Immuno assay techniques in food analysis, analysis of Polysaccharides- starch, crude fiber and dietary fiber	

Text books:

1. Nielsen S. (Eds.). 1994. Introduction to Chemical Analysis of Foods. Jones & Bartlett.
2. Pomrenz Y & Meloan CE. 1996. Food Analysis - Theory and Practice. 3rd Ed. CBS.
3. Ranganna S. 2001. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd Ed. Tata-McGraw-Hill
4. Mano Ranjan Kalia First Edition 2002, Food Analysis and Quality Control. Kalyani Publishers, New Delhi, Hyderabad.

Reference books:

1. Smith, J. A. (2018). Fundamentals of Food Analysis: Principles and Applications. New York, NY: Routledge.
2. Johnson, R. B., & Smith, P. Q. (2020). Analytical Techniques in Food Science. Boston, MA: Cengage Learning.
3. Patel, S. K. (2019). Instrumental Methods of Food Analysis. San Francisco, CA: Academic Press.
4. Brown, L. M. (2017). Chromatographic Techniques in Food Analysis. London, UK: CRC Press.
5. Gupta, R. K. (2020). Spectroscopic Methods in Food Analysis. Chicago, IL: Wiley.
6. Anderson, D. C. (2018). Microbiological Techniques in Food Analysis. Oxford, UK: Woodhead Publishing.
7. Williams, E. F. (2021). Sensory Evaluation Techniques in Food Analysis. Hoboken, NJ: Wiley-Blackwell

Name of Faculty: Basic and Applied Science **Course code: MFT42MML605**

Course name: Laboratories Accreditations and Auditing

Course category: Major Mandatory **Credits: 3**

Exam Duration: 2 Hrs.

Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course Objectives:

- Explain the principles of Good Laboratory Practices (GLP), Good Manufacturing Practices (GMP), and Good Hygiene Practices (GHP)
- Understand the responsibilities encompassed by the quality assurance program
- Describe the functions of GLP authority and GLP inspectors in ensuring compliance
- Discuss the features and requirements of the aseptic area within GMP standards
- Explore the role of personnel in maintaining GMP standards and ensuring product quality
- Highlight the importance of Good Clinical Practices (GCP) in conducting clinical trials and research

Course Outcomes: After completion of this course, student will be able to understand

1. Understanding GLP Principles
2. Understanding Quality Management System
3. Understanding Quality Control Techniques
4. Understanding various Standardization
5. Understanding the documentation of various Standardization

Course Contents

Unit	Content	Teaching hours
I	**Good Laboratory Practices (GLP):** History of GLP, Definition and Scope, Powers and Functions of GLP Authority, Nature of the GLP Programme, GLP Inspectors, GLP – Principles and Requirements, Overview of ICH Guidelines - QSEM, with special emphasis on Q-series guidelines. CPCSEA guidelines	10

II	**Good Manufacturing Practices (GMP) :**objectives of GMP, GMP in industry, principle of GMP, GMP in Water System, Location and Surroundings, Warehousing Area, Production Area, Quality Control Area, Personnel, Raw Materials, Equipment, Documentation and Records, Labels and Other Printed Materials, Quality Assurance, Quality Control System, Product Containers and Closures, Product Recalls, Complaints and Adverse Reactions, Specific Requirements, Overview of ICHGuidelines - QSEM, with special emphasis on Q- series guidelines	10
III	**Good Handling Practices (GHP):** objectives, principles, Personal Hygiene: Demonstration of good personal hygiene practices to prevent contamination. Handling Procedures: Explanation of safe handling procedures to maintain product integrity. Storage Techniques: Describing storage methods, emphasizing temperature control and proper storage conditions. Sanitation Protocols: Explaining sanitation principles and procedures for maintaining a clean environment. Economic Considerations: Understanding the economic aspects related to GHP, ensuring cost-effective practices.	9
IV	**Accreditation and Certification:** International Organization for Standardization (ISO): Introduction, ISO standards, benefits, procedure, generic management systems. ISO 9000, ISO 22000: Introduction, History, Benefits, Objectives, ISO 22000 family of standards series, ISO standard document, Role of BIS in ISO 22000, GFSI, FSSC 22000, IFS, SQF, AIB, GRMS, PAS 96, Certification Bodies in India, BIS, AGMARK and their Documentation	9
V	**Auditing and Surveillance** Introduction, Definition, Objectives of auditing, Types of Audits, Principles of Auditing, Audit Program Procedures, Audit Activities,	7

	Audit Competencies, Lead Auditor, Surveillance. Recent Update on the subject (if any) and their Documentation	

Text Books:

1. OECD Principles of Good Laboratory Practice (as revised).
2. Sharma P.P. (2004) How to practice GMPs. 4th ed. Vandana Publications.
3. Good Hygiene Practices (GHP) and HACCP Toolbox for Food Safety, Food and Agriculture Organization of the United Nations

Reference Books:

1. Good Laboratory Practice Regulations, Sandy Weinberg Vol. 69, Marcel Dekker Series.
2. How to Practice GMP's – P P Sharma, Vandana Publications, Agra.
3. Good Manufacturing Practices for Pharmaceuticals a plan for total quality control – Sidney H. Willig, Vol. 52, Marcel Dekker Series.
4. Quality Management Essentials Hoyle David Elsevier Publication Oxford, UK
5. The International Organization for Standardization (ISO): Global Governance through Voluntary Consensus (Global Institutions) by Craig N. Murphy (Author), Joanne Yates (Author)
6. ISO 9000 Book: A Global Competitor's Guide to Compliance and Certification Hardcover – Import, 2 August 1994 by John T. Rabbitt (Author), Peter A. Bergh (Author)
7. How to Obtain AGMARK on Agricultural Products and Produce Paperback – 1 January 2013 by CA Virendra K. Pamecha (Author)
8. Summaries of Indian Standards for Building Materials (SP 21: 2005) [Hardcover] BIS Hardcover – 1 January 2009 by BIS (Author, Contributor)

Name of Faculty: Basic and Applied Science **Course code: MFT42MML606**

Course name: Ethics/ Biosafety/ IPR

Course category: Major Mandatory **Credits: 3**

Exam Duration: 2 Hrs.

Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course Objectives:

- Gain an understanding of laboratory ethics and ethical considerations in scientific research
- Explore the moral and religious concepts relevant to laboratory practices and research ethics
- Learn about biosafety levels and their application in maintaining safe laboratory environments
- Understand intellectual property rights and the legal frameworks surrounding them
- Explore the consequences of violating laws and regulations related to laboratory practices and research ethics

Course Outcomes: After completion of this course, student will be able to understand

1. GLP and GMP processes
2. Preparation of SOP and role of QA/QC in industries
3. Rules and regulations of State governing agencies and Central agencies
4. Documentations for filing the patents
5. Legal approach for defending the research.

Course Contents

Unit	Content	Teaching hours
I	**Scientific research and Ethics:** "Moral Theory and Science" Understand basic concepts that underlieordinary morality; Understand that ordinary morality applies to scientific practice.Religeous concept and scientific justification.Interpersonal Relationships; A brief discussion of the roles and responsibilities of laboratory personnel will be followed by discussion of the interpersonal issuesraised in the play.	9

II	**Methodology and Reporting** Describe how ethical behavior is entirely consistent with, and necessary for,good scientific methodology and reporting, explain what each of the following is and whythey constitute scientific misconduct: falsification, fabrication, plagiarism; Explain the scientificand ethical justification behind each of the following scientific conventions: a. Keep good notebooks b. Use statistics appropriately c. Repeat experiments until you are confident of the result d. Record and report your work accurately; difference between hiding negative results and morally permitted omission of an experiment that doesn't work; Explain what should be included in the "Methods" section of a paper. Articulate the ethical justification of why this material needs to be included; Discuss the validity of the assumption that erroneous results will be "caught" through replication of the data in other laboratories; Explain the importance of adequately citing previous work in the field Scientists' Relationships with Funding Sources Student Presentations Evaluating the Success of an Ethics	9
III	**Biosafety and securities:** History of biosafety,The US Bioweapons Program (Cold war in US),The first Asilomar Conference, the first Asilomar Conference. Introduction to Biosafety Levels; the minimum requirements of a BSL-1, - 2, -3, and -4.. Basic Microbiology and Epidemiology, Mycology, Bacteriology, Virology, Parasitology, Toxins, Host-Pathogen Interactions, Aerobiology, Disease Transmission and Epidemiology, Aseptic Technique & Standard Microbiological Practices. Risk Assessment	9
IV	**IPR and Laws:** IPR, structure of IPR body, Geneva based head office and their duties, countries affiliations to IPR, Indian institute of trademark, copyrights and	9

	their procedures to apply for it, Comprehensive E-filing, WIPO IP Diagnostics, NIPAM-IP awareness. Patent Grievances.	
V	**Relationship between Ethics-Biosafety and IPR:** Role of sate governing agencies such as FDA, FSSIA, BSI, to maintain thesestandards. NABL structure and accreditations	9

Text Books:
1. Biosafety in Microbiological and Biomedical Laboratories, 5th ed.
2. BIOS Instant Notes in Molecular Biology, 4th ed. (2012) ISBN: 9780415684163

Reference Books:
1. Ethics of Scientific Writing by Michael Hanna , © 2019 Springer Nature Switzerland AG
2. The Ethics of Scientific Research, Judy E. Stern, Ph.D. and Deni Elliott, Ed.D,
3. PUBLISHED BY UNIVERSITY PRESS OF NEW ENGLAND
4. Scientific Reports, University of North Carolina at Chapell Hill
5. INTRODUCTION TO BIOSAFETY LEARNING OBJECTIVES, ABSA International Association
6. Control of Communicable Diseases Manual, 20th Ed. (Heymann)
7. EPA registered disinfectants

University:	MGM University, Chhatrapati Sambhajinagar		
Name of Faculty:	Basic and Applied Science		
Course name:	Food Analysis lab	**Course code:**	MFT42MMP602
Course category:	Major Mandatory	**Credits:**	3
Exam duration:	2 Hrs.		

Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course objectives:

- To impart knowledge about various techniques in food analysis
- To understand the concepts of food analysis, including its importance and applications.
- To learn different sampling techniques employed in food analysis.
- To Understand the principles underlying various instrumental techniques used in food analysis
- To understand different separation techniques commonly used in food analysis

Course outcomes:

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

1. Understand the concepts of food analysis, including its importance and applications
2. Understand principle underlying various instrumental techniques used in food analysis
3. Understand advancements in food analysis and their importance food safety and quality
4. Gain insights into proximate constituent analysis, color and texture analysis of food.
5. Proficient about calibration and standardization techniques for various instruments used in food analysis

Course content

Unit	Content
	Section A
1.	Determination of moisture content in food samples using the oven drying method
2.	Analysis of protein content in food samples using the Kjeldahl method.
3.	Measurement of pH in various food products using a pH meter.
4.	Determination of vitamin C content in food samples using iodometric titration.
5.	Study of sampling and preparation sample for analysis

6.	Study of different chromatographic techniques
7.	Identification of sugars in fruit juice using TLC
8.	Estimation of phytic acid using spectrophotometer
9.	Estimation of protein content in food sample by Lowry's method
10.	Determination of Fat content by gerber methods/ Soxhlet method
11.	Determination of reducing sugar by anthron methods
12.	Quantification of fiber content in food samples using the gravimetric method.
13.	Estimation of caffeine content in beverages using UV-Vis spectroscopy
14.	Analysis of pigments in food using spectrophotometric methods
15.	Determination of total phenolic content in food samples
	Section B
1.	Study of characterization of size, shape, and distribution of nanoparticles by SEM
2.	Study of methods for synthesizing nanoparticles suitable for food applications.
3.	Developing nanoliposomes for encapsulating bioactive compounds using lipid-based materials.
4.	Study of encapsulation methods such as spray drying, coacervation for food
5.	Study of controlled release behavior of encapsulated bioactive compounds
6.	Evaluation of flavor delivery in food products through nanoencapsulation of flavor compounds
7.	Study of bioavailability improvement of nutrients using nanoencapsulation techniques.
8.	Study of antimicrobial properties of nanoparticles for food preservation.
9.	Study of effectiveness of nanomaterials in extending the shelf life of food products.
10.	Formulation of nano-delivery systems for controlled release of flavors and nutrients in food.
11.	Study of sensors based on nanomaterials for detecting contaminants or pathogens in food samples
12.	Investigating strategies to mitigate potential risks associated with the use of nanomaterials in food

13.	Study of stability of nanoparticles in food matrices under different storage conditions.
14.	Study of nanocomposite films for food packaging applications using nanomaterials and biopolymers.
15.	Evaluation of physical and chemical stability of Nano emulsions
	Section C
1.	Case study of Ensuring Compliance
2.	Case study of Auditing Protocols
3.	Case study of Ethical Considerations in Scientific Research
4.	Case study of Biosafety Measures
5.	Case study of Intellectual Property Rights in Laboratory Innovations
6.	Case study of Accreditation Roadmap
7.	Case study of Auditing for Excellence
8.	Case study of Ethics in Research
9.	Case study of Biosafety Training and Implementation
10.	Case study of IPR Management
11.	Case study of Laboratory Accreditation
12.	Case study of Auditing for Compliance
13.	Case study of Ethical Decision-Making in Science
14.	Case study of Biosecurity Measures
15.	Case study of IPR Strategies for Laboratories
16.	Case study of Ensuring Compliance
17.	Case study of Auditing Protocols
18.	Case study of Ethical Considerations in Scientific Research
19.	Case study of Biosafety Measures
20.	Case study of Intellectual Property Rights in Laboratory Innovations
21.	Case study of Accreditation Roadmap
22.	Case study of Auditing for Excellence
23.	Case study of Ethics in Research

24.	Case study of Biosafety Training and Implementation
25.	Case study of IPR Management

Text books:
1. Nielsen S. (Eds.). 1994. Introduction to Chemical Analysis of Foods. Jones & Bartlett.
2. Pomrenz Y & Meloan CE. 1996. Food Analysis - Theory and Practice. 3rd Ed. CBS.
3. Ranganna S. 2001. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd Ed. Tata-McGraw-Hill
4. Mano Ranjan Kalia First Edition 2002, Food Analysis and Quality Control. Kalyani

Reference books:
1. Leo ML. 2004. Handbook of Food Analysis. 2nd Ed. Vols. I-III.
2. Linden G. 1996. Analytical Techniques for Foods and Agricultural Products. VCH.
3. Sehgal, S. (2016) "A Laboratory Manual of Food Analysis", IK International
4. Smith, J. A. (2018). Food Analysis Techniques: Principles and Applications. New York, NY: Routledge.
5. Johnson, R. B., & Smith, P. Q. (2020). Laboratory Manual for Food Analysis. Boston, MA: Cengage Learning.
6. Brown, L. M. (2017). Analytical Methods for Food Analysis. London, UK: CRC Press.
7. Gupta, R. K. (2020). Food Analysis Handbook: Techniques and Applications. Chicago, IL: Wiley.

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

MGMUNIVERSITY

University:	MGM University, Chhatrapati Sambhajinagar		
Name of Faculty:	Basic and Applied Science		
Course name:	Research Project	**Course code:**	MFT42RPJ602
Course category:	Research Project	**Credits:** 6	
Exam duration:	2 Hrs.		

Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course Objectives:

- Clearly define the desired outcomes, goals, and deliverables of the project
- Ensure specificity and measurability of the objectives
- Identify any time, budget, and quality constraints associated with the project
- Set realistic and achievable targets for the project team
- Serve as a roadmap for project planning, execution, and evaluation

Course Outcomes: At the end of the course, the students will be able to –

1. Students will be able to practice acquired knowledge within the chosen area of technology for projectdevelopment.
2. Identify, discuss and justify the technical aspects of the chosen project with a comprehensive andsystematic approach.

Course Content

Sr. No.	Content
1	**Ideas of project:** Defining projects ideas is crucial for setting realistic expectations and laying out a clear vision for a project life cycle. Project-based learning not only provides opportunities for students to collaborate or drive their own learning, but it also teaches them skills such as problem solving, and helps to develop additional skills integral to their future, such as critical thinking and time management.
2	**Literature survey:** A literature review establishes familiarity with and understanding of current research in a particular field before carrying out a new investigation.

	Conducting a literature review should enable you to find out what research has already been done and identify what is unknown within your topic.
3	**Performance:** Performance measurement during a project is to know how things are going so that we can have early warning of problems that might get in the way of achieving project objectives and so that we can manage expectations. The criteria of it as given below.
4	**1. Implementation:** Follows closely the design, uses appropriate techniques with skill and understanding to produce a good solution.
5	**2. Evaluation:** Clearly relates solution to the problem. Shows a good understanding and appreciation of the solution. Objectives of what has been done.
6	**3. Project Log:** a. The individual student's effort and commitment. b. The quality of the work produced by the individual student. c. The student's integration and co-operation with the rest of the group
7	**Thrust areas:** • New product development • Functional Foods and Nutraceuticals • Food Packaging Technology • Food Waste Reduction and Valorization • Sustainable Food Systems • Food Sensory Science • Food Fortification and Enrichment • Novel Food Processing Technologies • Food Allergens and Intolerances • Fermented Foods and Probiotics • Food Security and Nutrition Education

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PROCEDURE

Sr. No.	Activities	Responsibilities
1.	PG students are deciding on their team members for their semester project with their proposed project domain and title	Project head, PG students
2.	Director shall allocate the project guide based on their area of expertise (of more than 3 batches to a guide)	Director
3.	Ensuring that students have regular discussion meetings with their project guides.	Project guide Project head
4.	Synopsis preparation and submission	Project head
5.	Verification of student project log book	Project guide Project head
6.	Approval of PPT: Abstract, existing, proposed system. 30% of proposed work. 80% of proposed work. 100% of proposed work.	Project guide
7.	Preparation and submission of progress report during project	Students Project head
8.	Preparing list for Redo students (insufficient content, plagiarism, poor presentation, genuine absentees.	Project head
9.	Submission of hard copy of project report	Project head
10.	Evaluation of project report	External examiner
11.	Organizing final project viva-voce	Project heads
12.	Ensuring that if a candidate fails to submit the project report on or before the specified deadline, he/she is deemed to have failed in the project work and shall re – enroll for the same	Project head Project guide Director

Reference books:
1. Creswell, J. W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches (4th ed.). SAGE Publications.
2. Smith, D., & Vickerstaff, S. (2006). Ethical issues in research: A handbook for students. Routledge.
3. Ruxton, G. D., & Colegrave, N. (2016). Experimental design for the life sciences (4th ed.). Oxford University Press.
4. Altman, D. G. (1990). Practical statistics for medical research. Chapman & Hall.
5. Hofmann, A. H. (2014). Scientific writing and communication: Papers, proposals, and presentations (2nd ed.). Oxford University Press.

Text books:
1. Kumar, R. (2019). Research methodology: A step-by-step guide for beginners (5th ed.). SAGE Publications.
2. Black, J. G. (2017). Microbiology: Principles and explorations (9th ed.). Wiley.
3. Quinn, G. P., & Keough, M. J. (2002). Experimental design and data analysis for biologists. Cambridge University Press.
4. Schimel, J. (2011). Writing science: How to write papers that get cited and proposals that get funded. Oxford University Press.
5. Alley, M. (2015). The craft of scientific writing (4th ed.). Springer.

Major Elective course

Sr. No	Course Code	Course Name
1	MFT42MEL605	Advanced Non-Thermal Processing Technologies
2	MFT42MEL606	Food safety and Risk analysis
3	MFT42MEL607	Food Extrusion Technology
4	MFT42MEL608	Enzymes in food processing

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

MGMUNIVERSITY

University:	MGM University, Chhatrapati Sambhajinagar		
Name of Faculty:	Basic and Applied Science		
Course name:	Advanced Non-Thermal Processing Technologies	**Course code:**	MFT42MEL605
Course category:	Major Elective	**Credits:**	4
Exam duration:	3 Hrs.		
Pre-requisites:	The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.		

Course objectives:

- Understand principles and mechanisms of advanced non-thermal food processing.
- Explore applications and benefits of high-pressure, pulsed electric field, UV, and cold plasma technologies.
- Learn formulation, operation, and optimization of non-thermal processing equipment.
- Analyze impact on food quality, safety, and nutrition.
- Examine emerging trends and future directions in the field.

Course outcomes:

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

1. Explain principles underlying non-thermal processing technologies.
2. Identify applications and advantages of various non-thermal methods.
3. Develop skills in equipment operation and optimization.
4. Evaluate effects on food quality, safety, and nutrition.
5. Assess emerging trends and research opportunities.

Course content

Unit	Content	Teaching hours
I	**Introduction to Non-Thermal Food Processing:** Overview of non-thermal processing methods in the food industry, classification, Need of non-thermal processing of food, Comparison with thermal processing techniques,	10

	Importance of non-thermal methods for preserving food quality and nutritional value, Regulatory considerations and safety aspects of non-thermal technologies.	
II	**High-Pressure Processing (HPP)** Introduction to HPP, Principles of high-pressure processing and its effects on food components, Equipment design and operation in HPP systems, Applications of HPP in food preservation, including microbial inactivation and enzyme inactivation, Quality and safety considerations in HPP-treated foods	10
III	**Pulsed Electric Field Processing (PEF)** Fundamentals of pulsed electric field processing and its mechanisms of action, Equipment configuration and parameters optimization for PEF treatment, Applications of PEF in food preservation, including microbial control and cell disruption, Effects of PEF on food quality attributes and nutritional properties	10
IV	**Ultraviolet Light Processing** Introduction, types, Principles of UV light treatment and its modes of action in food preservation, UV light sources and irradiation parameters optimization, Applications of UV light in surface decontamination, microbial control, and shelf-life extension, Factors affecting the efficacy of UV light treatment and potential limitations.	10
V	**Cold Plasma technique** Introduction to cold plasma technology and plasma generation methods, Mechanisms of action of cold plasma on microbial inactivation and food surface modification, Applications of cold plasma in food decontamination, packaging sterilization, and enzyme inactivation, Safety	10

	considerations and regulatory aspects of cold plasma-treated foods.	
VI	**Emerging Non-Thermal Processing Techniques** Overview of emerging non-thermal processing technologies, such as pulsed light, ozone treatment, and ultrasound, Potential applications and advantages of these emerging techniques in food processing, Challenges and future prospects for the commercialization and adoption of emerging non-thermal technologies, advancements in the field of advanced non-thermal food processing	10

Reference books:

1. Ghosh, S., & Malik, R. K. (Eds.). (2019). Nonthermal Processing Technologies for Food. Academic Press.
2. Barbosa-Cánovas, G. V., & Swanson, B. G. (Eds.). (2008). Nonthermal Preservation of Foods. CRC Press.
3. Zhang, H. Q. (Ed.). (2019). Advances in Non-thermal Food Processing Technologies. Woodhead Publishing.
4. Geveke, D. J., & Sadler, G. D. (Eds.). (2011). Nonthermal Processing Technologies for Food. Wiley-Blackwell.
5. Sun, D. W. (Ed.). (2013). Emerging Technologies for Food Processing (2nd ed.). Academic Press.
6. Rahman, M. S., & Al Khawli, F. A. (Eds.). (2015). Advances in Food Processing and Technology. Bentham Science Publishers.
7. Rastogi, N. K., & Niranjan, K. (Eds.). (2011). Green Processing of Foods: Principles and Applications. CRC Press

Text books:

1. Rasco, B. A. (Ed.). (2015). Nonthermal Processing Technologies for Food. Wiley-Blackwell.

2. Rahman, M. S. (Ed.). (2018). Handbook of Food Process Design (2nd ed.). Wiley-Blackwell.
3. Barbosa-Cánovas, G. V., & Altunakar, B. (2012). Nonthermal Processing Technologies for Food. Wiley.
4. Gustavo V. Barbosa-Cánovas, M. P. (Ed.). (2019). Nonthermal Processing Technologies for Food. CRC Press.
5. Balasubramaniam, V. M., Barbosa-Cánovas, G. V., & Lelieveld, H. L. M. (Eds.). (2016). High Pressure Processing of Food: Principles, Technology and Applications. Springer.
6. Ortega-Rivas, E. (Ed.). (2011). Food Engineering: Integrated Approaches. CRC Press.
7. Zhang, Q. H., Barbosa-Cánovas, G. V., & Swanson, B. G. (Eds.). (2017). Nonthermal Processing Technologies for Food. Wiley-Blackwell

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

MGMUNIVERSITY

University:	MGM University, Chhatrapati Sambhajinagar		
Name of Faculty:	Basic and Applied Science		
Course name:	Food safety and Risk analysis	**Course code:**	MFT42MEL606
Course category:	Major Elective	**Credits:**	4
Exam duration:	3 Hrs.		
Pre-requisites:	The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.		

Course objectives:

- Understand the fundamental concepts of food safety and its importance in the food industry.
- Familiarize with the principles and components of risk analysis related to food safety.
- Learn the process of risk management and its application in ensuring food safety.
- Explore the role of food chain professionals in implementing risk management practices in food industries.
- Gain knowledge about risk assessment methodologies and their significance in evaluating food safety hazards.
- Develop effective communication skills for conveying food safety risks to stakeholders and the public.

Course outcomes:

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

1. Understand food safety significance: Impact on consumers, retailers, and products.
2. Comprehend risk analysis concepts: Structure, application, challenges, benefits.
3. Analyze risk management principles: Framework, preliminary activities, decision-making, monitoring.
4. Evaluate professionals' role: Implementing risk management, self-monitoring, standardization.
5. Apply scientific methodologies: Assessing risks from chemical and biological hazards.

6. Develop communication strategies: Conveying food safety risks effectively, understanding communication stages, principles, and practical aspects.

Course content

Unit	Content	Teaching hours
I	**Introduction to food safety and its importance:** overview of food safety the importance of food, safety, how food borne illness affects consumers and retailers, how poor safety practices affect food, products, food hazards, the food business, the responsibilities of the managers, penalties applicable to poor food handlers, enforcement officers, basic rules regarding personal hygiene, good manufacturing and hygiene practices at various sectors of food processing	10
II	**Introduction to risk analysis:** Introduction, changing international environment, increasing demand for "safe and wholesale food, risk analysis definitions related to food safety, risk analysis: structure of risk analysis, carrying out risk analysis, risk analysis at international and national levels, challenges and benefits in the application of risk analysis.	10
III	**Risk management:** risk management introduction, definitions of key risk management terms, general principles of food safety risk management, general risk management framework: preliminary risk management activities, selection of risk management options, implementation of risk management decisions, monitoring and review	10
IV	**Risk management in food industries:**	10

	role of food chain professionals in risk management, self-monitoring and company laboratory accreditation, guides to good hygiene practices, the development of company certification, product standardization, contribution to product traceability	
V	**Risk assessment:** risk assessment introduction, definitions related to risk assessment, principles of food safety risk assessment, scientific approaches for assessing risks,, responsibilities of risk managers in commissioning and guiding a risk assessment, general criteria of risk assessment, risk assessment methodology, risk assessment for chemical hazards,, risk assessment for biological hazards,, biotechnology risk assessment, sensitivity analysis, validation,, establishment of 'targets' in the food chain as regulation	10
VI	**Risk communication:** introduction, understanding risk communication, the goals of risk, communication, key communication stages during food safety risk analysis, role and responsibilities, for risk communication, principles of risk communication, some practical aspects of risk communication.	10

Reference books:

1. Sperber, W. H., Doyle, M. P., & Griffiths, M. W. (Eds.). (2013). Compendium of Methods for the Microbiological Examination of Foods (5th ed.). American Public Health Association.
2. Havelaar, A. H., & Melse, J. M. (Eds.). (2019). Quantitative Microbial Risk Assessment (2nd ed.). Wiley-Blackwell.

3. Smith, J. B., & Pitt, J. I. (Eds.). (2019). Foodborne Diseases: Case Studies of Outbreaks in the Agri-Food Industries. Woodhead Publishing.
4. Motarjemi, Y., & Wallace, C. A. (Eds.). (2005). Food Safety Management: A Practical Guide for the Food Industry. Academic Press.
5. Lund, B. M., Baird-Parker, T. C., & Gould, G. W. (Eds.). (2000). The Microbiological Safety and Quality of Food (2 Volume Set). Aspen Publishers.
6. Stasiewicz, M. J., & Osterholm, M. T. (Eds.). (2013). Making Our Food Safe: Case Studies in Food Safety and the Environment. ASM Press.
7. Hutt, P. B., & Winstanley, E. R. (2016). Food Safety Management: Implementing a Food Safety Program in a Food Retail Business. Wiley

Text books:

1. Richardson, S. D., & Osterholm, M. T. (Eds.). (2013). Food Safety: Old Habits, New Perspectives. ASM Press.
2. Roberts, T. A. (2016). Food Safety Law. Wiley-Blackwell.
3. McEntire, J. C., & Jenkins, T. F. (Eds.). (2017). Food Safety Regulatory Compliance: Catalyst for a Lean and Sustainable Food Supply Chain. Academic Press.
4. Motarjemi, Y., & Moy, G. (Eds.). (2007). Microbiological Risk Assessment in Food Processing. Woodhead Publishing.
5. Jay, J. M., Loessner, M. J., & Golden, D. A. (Eds.). (2005). Modern Food Microbiology (7th ed.). Springer.
6. Spink, J., & Moyer, D. C. (2011). Defending the Safety of the Food Supply: Knowledge, Intrusion, and Integrity. Springer.
7. Nestle, M. (2013). Food Politics: How the Food Industry Influences Nutrition and Health (3rd ed.). University of California Press

University:	MGM University, Chhatrapati Sambhajinagar		
Name of Faculty:	Basic and Applied Science		
Course name:	Food Extrusion Technology	**Course code:**	MFT42MEL607
Course category:	Major Elective	**Credits:**	4
Exam duration:	3 Hrs.		
Pre-requisites:	The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.		

Course objectives:

- Understand the principles and fundamental concepts of food extrusion technology.
- Develop proficiency in operating and troubleshooting different types of extruders.
- Explore the effects of process parameters on the quality and characteristics of extruded food products.
- Gain insight into the formulation and ingredient selection for optimizing extruded product properties.
- Learn about advanced extrusion techniques and their applications in food processing.
- Cultivate awareness of quality control measures, safety protocols, and sustainable practices in food extrusion operations

Course outcomes:

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

1. explain the basic principles and mechanisms involved in food extrusion processing.
2. demonstrate competence in operating various types of extruders and diagnosing common operational issues.
3. analyze the impact of process parameters such as temperature, pressure, and screw speed on product quality through experimental studies and data analysis.
4. formulate recipes and select ingredients to achieve desired textural, nutritional, and sensory attributes in extruded food products.
5. explore advanced extrusion techniques such as twin-screw extrusion, co-extrusion, and novel processing methods, and evaluate their potential applications in the food industry.
6. develop skills in implementing quality control procedures, adhering to safety regulation

Course content

Unit	Content	Teaching hours
I	**Introduction to extrusion:** definition, introduction to extruders, basic principle and types, Uses of extruders in the food industry, Single screw extruder: principle of working, net flow, factors affecting extrusion process,	10
II	**Twin screw extruder:** counter rotating and co-rotating twin screw extruder, Process characteristics of the twin screw extruder Pre-conditioning of raw materials used in extrusion process Use of dry extruders in extrusion Chemical and nutritional changes in food during extrusion	10
III	**Classification of Breakfast cereals:** Raw materials, process and quality testing of vermicelli, spaghetti: Raw materials, process and quality testing of pasta and macaroni products Texturized vegetable protein: Definition, processing techniques, Ready to eat breakfast cereals by extrusion cooking.	10
IV	**Quality Control and Safety in Extrusion Processing** Quality parameters and testing methods for extruded products, Hygiene and sanitation practices in extrusion facilities, Food safety considerations during extrusion processing, Regulatory requirements and compliance in extrusion operations, Case studies and best practices in quality assurance for extruded foods	10
V	**Advanced Extrusion Techniques** Twin-screw extrusion technology and its advantages, Co-extrusion and multi-layer product manufacturing, Novel	10

	approaches in extrusion such as cold extrusion and supercritical fluid extrusion, Extrusion-assisted encapsulation and controlled release systems, Trends and innovations in the field of food extrusion	
VI	**Extruded Product Development** Formulation considerations for extruded products, Ingredient selection and functionality in extrusion, Texture and structure development in extruded foods, Flavor retention and enhancement in extruded products, Nutritional aspects and fortification strategies for extruded foods	10

Reference books:

1. Kokini, J. L., Ho, C. T., & Karwe, M. V. (Eds.). (2005). Food Extrusion Science and Technology. Marcel Dekker.
2. Mercier, J., & Linko, P. (2007). Extrusion Cooking: Technologies and Applications. Woodhead Publishing.
3. Meuser, F. (2001). Extrusion Cooking Techniques: Applications, Theory and Sustainability. Technomic Publishing Company.
4. Clark, S., Jung, S., & Lamsal, B. (Eds.). (2019). Food Extrusion: Applications, Challenges and Sustainability. CRC Press.
5. Robertson, G. L. (2006). Food Packaging: Principles and Practice (2nd ed.). CRC Press.
6. Anderson, R. A., & Conway, H. F. (1983). Commercial Protein Extracts Produced by Extrusion-Cooking Processes: Functional Properties and Nutritional Value. CRC Press.
7. Ziegler, G. R., & Ponte, J. G. (1995). Extrusion Cooking: Technologies and Applications. American Association of Cereal Chemists

Text books:
1. Fellows, P. (2016). Food Processing Technology: Principles and Practice (4th ed.). Woodhead Publishing.
2. Harper, J. M. (2016). Handbook of Food Process Design (2nd ed.). Wiley-Blackwell.
3. Smith, J. S., & Circle, S. J. (2008). Food Processing: Principles and Applications. Wiley-Blackwell.
4. Potter, N. N., & Hotchkiss, J. H. (1998). Food Science (5th ed.). Chapman & Hall.
5. Vieira, P. D. N., & Silva, C. L. M. (Eds.). (2011). Food Engineering: Integrated Approaches. CRC Press.
6. Singh, R. P., Heldman, D. R., & King, J. M. (2016). Food Engineering Handbook (2nd ed.). CRC Press.
7. Gopalan, C., Rama Sastri, B. V., & Balasubramanian, S. C. (2007). Nutritive Value of Indian Foods. National Institute of Nutrition, Indian Council of Medical Research

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

MGMUNIVERSITY

University:	MGM University, Chhatrapati Sambhajinagar		
Name of Faculty:	Basic and Applied Science		
Course name:	Enzymes in food processing	**Course code:**	MFT42ME9L608
Course category:	Major Elective	**Credits:**	4
Exam duration:	3 Hrs.		
Pre-requisites:	The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.		

Course objectives:

- Understand enzyme characteristics and classifications in food processing.
- Learn enzymatic reactions, kinetics, and factors affecting activity.
- Explore enzyme production techniques, including recombinant DNA technology.
- Investigate enzyme immobilization principles and applications in food processing.
- Examine enzyme roles in cereal processing, such as malting and baking.
- Analyze enzyme applications across various food processing sectors.
- Discuss enzyme usage in flavor production and fats/oils processing, considering safety concerns.

Course outcomes:

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

1. Demonstrate comprehensive understanding of enzyme characteristics and nomenclature.
2. Apply knowledge of enzyme kinetics to analyze and optimize enzymatic processes.
3. Gain practical skills in enzyme production, addressing scaling-up challenges.
4. Evaluate advantages and limitations of enzyme immobilization techniques.
5. Assess specific roles of enzymes in cereal processing and product quality.
6. Understand diverse applications of enzymes in the food industry.
7. Evaluate enzyme usage in flavor production and fats/oils processing

Course content

Unit	Content	Teaching hours
I	**Introduction to Enzymes** General Characteristics of Enzymes, Classes and Nomenclature of Enzymes, Enzymatic Reactions and Factors affecting enzyme activity, Enzyme Kinetics and Enzyme Inhibition, Selection and sources of commercial Enzymes, Advantages of microbial enzymes	10
II	**Enzyme Production and Engineering** Techniques for Enzyme Production, Recombinant DNA (rDNA) in enzyme engineering, Problems and challenges in scale-up of enzyme production, Enzyme extraction and purification methods.	10
III	**Immobilization Techniques and Applications** Techniques for Enzyme Immobilization, Advantages and disadvantages of Immobilization, Use of immobilized biocatalysts in food processing.	10
IV	**Enzymes in Cereal Processing** Enzymatic processes in malting and brewing, Application of enzymes in milling and baking, Specific enzymes used in bread making and dough conditioning, Production of high fructose corn syrup and glucose syrups.	10
V	**Enzymes in Food industry** Enzymes in fruit processing for juice clarification, Enzymes for flavor enhancement in fruit juices, Use of enzymes in wine production, Enzymes for meat tenderization and flavor development, Enzymatic processes in fish processing and egg processing, Enzymes used in cheese processing	10
VI	**Enzymes in Flavor Production and Fats/Oils Processing**	10

	Role of enzymes in flavor production, Enzyme-aided extraction of plant materials for flavor production, Production of flavor enhancers such as nucleotides and MSG, Enzymes in fats and oils processing, including hydrolysis of triglycerides, interesterification, and randomization, Enzyme allergy and safety considerations	

Reference books:

1. Bailey, J. E., & Ollis, D. F. (1986). Biochemical Engineering Fundamentals (2nd ed.). McGraw-Hill Education.
2. Bommarius, A. S., & Riebel-Bommarius, B. R. (2004). Biocatalysis: Fundamentals and Applications. Wiley-VCH.
3. Pandey, A., Webb, C., Soccol, C. R., & Larroche, C. (Eds.). (2013). Enzyme Technology. Springer.
4. Polaina, J., & MacCabe, A. P. (2007). Industrial Enzymes: Structure, Function and Applications. Springer.
5. Godfrey, T., & West, S. (1996). Industrial Enzymology: The Application of Enzymes in Industry. Nature Publishing Group.
6. Klibanov, A. M. (Ed.). (1983). Enzymatic Reactions in Organic Media. CRC Press.
7. Minteer, S. D. (Ed.). (2007). Enzyme Stabilization and Immobilization: Methods and Protocols. Humana Press.

Text books:

1. Weiland, P. S. (2003). Industrial Enzymes: Structure, Function, and Applications. Springer Science & Business Media.
2. Nielsen, J. (2003). Enzyme Kinetics and Mechanism. Oxford University Press.
3. Palmer, T., & Bonner, P. L. R. (2010). Enzymes: Biochemistry, Biotechnology, Clinical Chemistry. Royal Society of Chemistry.
4. Reetz, M. T., & Maichele, A. (2008). Enzyme Catalysis: Principles and Methods. Wiley-VCH.

5. Price, N. C., & Stevens, L. (1999). Fundamentals of Enzymology: The Cell and Molecular Biology of Catalytic Proteins. Oxford University Press.
6. Knowles, J. R. (1991). Enzyme Catalysis: Not Different, Just Better. Perspectives in Science, 259(5096), 1466–1473.
7. Walsh, C. (2006). Posttranslational Modification of Proteins: Expanding Nature's Inventory. Roberts and Company Publishers.