

M.Sc. Food Technology (Hons.) Syllabus for 2023-24 (I<sup>st</sup> & II<sup>nd</sup> Sem)

# Mata Gujri College

An Autonomous College, Fatehgarh Sahib

Affiliated to Punjabi University Patiala

**M.Sc. Food Technology (Hons.) - First Year**  
(I<sup>st</sup> & II<sup>nd</sup> Semester)

## SYLLABUS OF COURSES TO BE OFFERED

Core, Open Elective and General Elective



**Academic Session 2023-2024**

**M.Sc. Food Technology (Hons.) Syllabus for 2023-24 (I<sup>st</sup> & II<sup>nd</sup> Sem)**

**Semester-I**

Paper code	Paper No.	Name of paper	Period/ week	External Marks	Internal Marks*	Total Marks	Credits
MSFT-101 (C-1)	Paper I	Food Biochemistry and Nutrition	4	70	30	100	4
MSMB-302 (C-2)	Paper II	Food Microbiology	4	70	30	100	4
MSFT-102 (C-3)	Paper III	Principles of Food Processing	4	70	30	100	4
MSFT-103 (GE-1)	Paper IV a	Nutraceutical and Functional Foods	2	35	15	50	2
	Paper IV b	Fermentation Technology					
MSMB-103 (C-4)	Paper V	Research Methodology	2	35	15	50	2
MSFT-104	LC-101	Food Biochemistry and Nutrition Lab	4			50	2
MSMB-302	LC-102	Lab course pertaining to Food Microbiology	4			50	2
MSFT-105	LC-103	Principles of Food Processing Lab	4			50	2
MSFT-406	Dissertation ( <b>Synopsis submission</b> )					50	2
<b>Total</b>						<b>600</b>	<b>24</b>

\*Internal assessment (30%): Seminar and Assignments (25% of total IA) MST (50% of total IA), Attendance (25% of total IA)

**Semester – II**

Paper code	Paper No.	Name of paper	Period/ Week	External Marks	Internal Marks*	Total Marks	Credits
MSFT-201 (C-5)	Paper VI	Food Additives	4	70	30	100	4
MSMB-402 (C-6)	Paper VII	Industrial Microbiology	4	70	30	100	4
MSFT-202 (C-7)	Paper VIII	Milk and Milk Processing Technology	4	70	30	100	4
MSFT-203 (C-8)	Paper IX	Food Quality Regulations and IPR	2	35	15	50	2
MSMAT001 (OE-1)	Paper X	Biostatistics	4	70	30	100	4
MSFT-204	LC-201	Food Additives Lab	4			50	2
MSMB-404	LC-202	Lab course pertaining to Industrial Microbiology	4			50	2
MSFT-205	LC-203	Milk and Milk Processing Technology Lab	4			50	2
MSFT-406	Dissertation ( <b>Experimental Work</b> )					50	2
<b>Total</b>						<b>650</b>	<b>26</b>

\*Internal assessment (30%): Seminar and Assignments (25% of total IA) MST (50% of total IA), Attendance (25% of total IA)

**M.Sc. Food Technology (Hons.) Syllabus for 2023-24**

**Semester III**

Paper code	Paper No.	Name of paper	Period/ week	External Marks	Internal Marks*	Total Marks	Credits
MSFT-301 (C-9)	Paper XI	Egg, Meat and Fish Technology	2	35	15	50	2
MSFT-302 (C-10)	Paper XII	Food Engineering	4	70	30	100	4
MSFT-303 (C-11)	Paper XIII	Fruits and Vegetable Technology	2	35	15	50	2
MSFT-304 (C-12)	Paper XIV	Bakery and Confectionary Technology	2	35	15	50	2
MSFT-305 (GE-2)	Paper XV	Beverage Technology	2	35	15	50	2
		Enzymes in Food Industry	2	35	15	50	
MSFT-306	LC-301	Egg, Meat and Fish Technology Lab	4			50	2
MSFT-307	LC-302	Food Engineering Lab	4			50	2
MSFT-308	LC-303	Fruits and Vegetable Technology Lab	4			50	2
MSFT-309	LC-304	Bakery and Confectionary Technology Lab	4			50	2
MSFT-310	Industrial Training		<b>Non-Credit</b>				
MSFT-406	Dissertation ( <b>Experimental work</b> )					150	6
<b>Total</b>						<b>700</b>	<b>26</b>

\*Internal assessment (30%): Seminar and Assignments (25% of total IA) MST (50% of total IA), Attendance (25% of total IA)

**Semester – IV**

Paper code	Paper No.	Name of paper	Period/ Week	External Marks	Internal Marks*	Total Marks	Credits
MSFT-401 (C-13)	Paper XVI	Cereal, Pulses and Legume Technology	4	70	30	100	4
MSFT-402 (C-14)	Paper XVII	Food Packaging and Marketing	4	70	30	100	4
MSFT-403 (C-15)	Paper XVIII	Spices and Flavor Technology	2	35	15	50	2
MSFT-404	LC-401	Cereal, Pulses and Legume Technology Lab	4			50	2
MSFT-405	LC-402	Food Packaging and Marketing Lab	4			50	2
MSFT-406	Dissertation ( <b>Submission and Seminar</b> )					250	10
<b>Total</b>						<b>600</b>	<b>24</b>

\*Internal assessment (30%): Seminar and Assignments (25% of total IA) MST (50% of total IA), Attendance (25% of total IA)

**Assessment Parameters for Dissertation**

**Weightage (%)**

- |                               |    |
|-------------------------------|----|
| 1. Quality of Dissertation    | 40 |
| 2. Quantitative data analysis | 20 |
| 3. Significance of work       | 20 |
| 4. Presentation and defense   | 20 |

**M.Sc. (Hons.) Food Technology (Semester-I)**  
**MSFT-101 (C-1) – Food Biochemistry and Nutrition**

Exam Time: 3 Hours  
Lectures to be delivered: 60 (Credits-4)  
Internal assessment: 30  
Pass Percentage: 40%

Max Marks: 100  
Theory Marks: 70

**Course Objective:** To understand the chemical aspect, interaction of different food bio-molecules and their impact on human health. Also reveal the way to select functional food component in human diet.

**INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES**

The question paper will consist of three sections. Section A and B will have four questions each from respective units. Candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 12 marks. Section C will consist of 11 short answer type questions covering entire syllabus and are compulsory to attempt. Each question in section C will carry 2 marks.

**Unit-I**

**Introduction to Food Biochemistry and Water:** Application and scope. Water, and its properties

**Carbohydrates:** Carbohydrate classification (mono, oligo and polysaccharides), structures, nutritional value and properties (physical and chemical).

**Proteins:** Sources, amino acids, peptides, protein classification, structure and their properties, protein denaturation, malnutrition and malnourishment.

**Lipids:** Classification and uses of lipids in food, physical and chemical properties, Sources, classification of lipids, Fatty acids (Saturated, Unsaturated and essential fatty acids) ALA, EPA & DHA (omega fatty acids), Rancidity in fats, Functions of oils and fats in food, Refining of oils

**Unit-II**

**Vitamins and Minerals:** Classification, Sources, functions and deficiency symptoms

**Dietary Fibre:** Complex carbohydrates as functional food ingredient. Soluble and insoluble dietary fibre, sources, Functions and benefits

**Plant Pigments:** Structure, Function of plant pigments (Chlorophyll, Carotenoids and Anthocyanins) and processing effects

**Enzymes:** Introduction, Nomenclature and classification, Factors affecting the rate of enzyme catalysed reactions, Enzyme immobilization, Enzymes in food processing, Enzymatic browning

**Course Outcomes:**

- ✚ Present course values in-depth knowledge for nutritional values of food molecules in human diet.
- ✚ Enhance capability to formulate healthy foods with much emphasis on functional food concept

**Books Recommended:**

- ❖ Chopra, H. K Anupama P and Panesar S. P. (2013) *Bio-organic Chemistry*. Alpha International.
- ❖ Fennema OR. Food Chemistry. (2014). Marcel Dekker. (5<sup>th</sup> Edition)
- ❖ Singh, Kumar and Kumar (2022). An objective Food Science Compendium. Brillion Publishers

**M.Sc. (Hons.) Food Technology Semester-I**  
**Food Microbiology (MSMB-302)**

Lectures to be delivered: 60 (Credit-4)

Max. Marks: 70

Pass Marks: 40%

**Course Objective:** Course objectives are to introduce students with microorganisms associated with food, importance of microbes in food and their applications in food industries along with HACCP and FSSAI standards.

**Course outcome:** Student will be able to identify the microorganisms associated with food spoilage along with important physico-chemical methods to control these microorganisms. Along with this, students will also be able to utilize the microorganisms in different fermentation and production processes.

**INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES**

The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective units of the syllabus and carry 12 marks each. Section - C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B. Section-C is compulsory.

**Unit-I**

**Introduction to food microbiology:** Food as substrate for microorganisms, microorganisms in food (moulds, yeast and bacteria) and their importance, factors influencing microbial growth in food, extrinsic and intrinsic factors 5

**Food spoilage and preservation:** Detection of spoilage and characterization of spoilage organisms, spoilage of cereals, vegetables, fruits, milk and milk products, fish and sea foods, poultry, sugar products and canned food, Principles of food preservation, aseptic control of microorganisms (physical methods, TDT curves, chemical preservatives and modified environments 12

**Food borne infection and intoxications:** Infection and intoxication caused by: *Clostridium*, *Staphylococcus*, *Salmonella*, *Shigella* and *Vibrio* 7

**Packaging Material:** Selection of packaging material and characteristics of packaging materials: paper (paper board, corrugated paper, fiber board), glass, metals, plastics, foils and laminates, retort pouches and package forms. Packaging techniques: vacuum packaging, modified atmosphere packaging (MAP) and Eco-friendly packaging 6

**Unit-II**

**Food Fermentations I:** Raw materials and fermentative process for production of fermented plant foods (Bread, soyabean), fermented vegetables (sauerkraut), Oriental fermented foods (soya sauce, meso, tempeh), Indian Fermented Foods (Dhokla, Wadas, Rabdi, Idli and Dosa, Bhature, Jalebi) 10

**Food Fermentations II:** Fermented meat products, Fermented milk and milk products: kefir, kumis, yogurt, Bulgarian milk, acidophilus milk and cheese 8

**Probiotics:** Definition, types, microorganisms and health benefits 4

**Food testing and quality control:** Collection and handling of food samples, food plant sanitation, overview of HACCP and FSSAI standards for potable water and milk 8

**Books Recommended**

Frazier WC et al (2013) Food Microbiology, 5th edition, McGraw Hill Education

Jay JM et al (2006) Modern Food Microbiology, 7th edition, Springer

Adams M R et al (2015) Food Microbiology, 4th edition, Royal Society of Chemistry

**M.Sc. (Hons.) Food Technology (Semester-I)**  
**MSFT-102 (C-3) – Principles of Food Processing**

Exam Time: 3 Hours  
Lectures to be delivered: 60 (Credit-4)

Max. Marks: 100  
Theory Marks: 70  
Internal assessment: 30  
Pass Percentage: 40%

**Course Objective:** To impart basic knowledge about different preservation process or combination of them to enhance the storage stability of food products.

**INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES**

The question paper will consist of three sections. Section A and B will have four questions each from respective units. Candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 12 marks. Section C will consist of 11 short answer type questions covering entire syllabus and are compulsory to attempt. Each question in section C will carry 2 marks.

**Unit-I**

**Introduction of Food Processing:** Status of Food processing sectors in India, Properties of foods.

**Ambient-Temperature Processing:** Raw material preparation, cooling crops and carcasses, cleaning, sorting, grading and peeling. Minimal food processing aspect

**Thermal Processing:** Introduction to thermal processing, Effect of heat on microorganisms, enzymes and nutritional quality of food. Theory and equipment used for heat processing using steam or water (Blanching, Pasteurization, and Heat sterilization)

**Drying Processes:** Dehydration effect in food, principle, process of drying and types of driers (Spray drier, Roller or Drum drier, Tunnel drier, Freeze drier, Radio Frequency Driers, Tray drier and Cabinet drier), Concept of osmotic dehydration

**Unit-II**

**Low Temperature Processing:** Chilling and Freezing: theory, Equipments, Applications and its effect on food and micro-organisms. Freeze concentration

**Non-Thermal Technologies:** Theory and effect on microorganisms (High-pressure processing, Ohmic heating, Pulse electric field, Irradiation and Microwave)

**Hurdle Technology:** Concept, application and Types (physical, chemical and microbiological).

**Membrane Processing:** Types (Micro filtration, Ultra filtration, Nano filtration, Reverse osmosis), Principle and application in food industry

**Course Outcomes:**

- ✚ Awareness about different food processing aspect, application in preservation of food by way of these unit operations
- ✚ Can do job in various food processing industries as the concept of preservation is studied

**Books Recommended:**

- ❖ Stewart, G. F. and Maynard A. A. (2012). *Introduction to food science and technology*. Elsevier.
- ❖ Montet, Didier, and Ramesh C. (2016). *Ray Fermented Foods, Part I: Biochem & Biotech*. CRC Press.
- ❖ Siddiq, M and Mark A. U *Handbook of vegetables and vegetable processing*. John Wiley & Sons, 2018.

**M.Sc. (Hons.) Food Technology (Semester-I)**  
**MSFT-103 a (GE-I) – Nutraceutical and Functional Food**

Exam Time: 1:30 Hours  
Lectures to be delivered: 30 (Credit-2)

Max. Marks: 50  
Theory Marks: 35  
Internal assessment: 15  
Pass Percentage: 40%

**Course Objective:** To enhance the learning and understanding potential of various functional foods that favors the human health. Comprehensive understanding of different nutraceutical and functional foods

**INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES**

The question paper will consist of three sections. Section A and B will have four questions each from respective units. Candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 6 marks. Section C will consist of 11 short answer type questions of 1 mark each, covering entire syllabus and are compulsory to attempt.

**Unit-I**

**Functional Foods and Nutraceutical:** Introduction (Defining the concept), Classification, Significance of nutraceutical and functional foods in management of disease and disorder

**Therapeutic Role and Food Sources:** Soya, olive oil, tea, grape wine, garlic, dietary fibre, other fruits and its effect on metabolic disorders (Diabetes and Obesity).

**Animal Source:** CLA (Conjugated Linoleic Acid), Omega fatty acids in special reference to Omega-3 ( $\omega$ -3), Meat, Milk and other dairy products

**Unit-II**

**Herbs as Nutraceutical:** Ashwgandha, Triphala powder of plants as remedies and its effect on chronic diseases (CVD/CHD and Cancer).

**Microflora as Functional Food:** Benefits associated with *Latobacillus* and *Streptococcus* as Gut cum GI Tract (Gastrointestinal) microflora

**Development of Nutraceutical and Functional Food:** Enrichment, Fortification and Supplementation, Composite Foods, Infant formula, Gluten Free concept in food preparation

**Course Outcomes:**

- ✚ Acquire knowledge on various bioactive compounds showing health benefits
- ✚ Understand various physiological and biochemical aspects of chronic diseases and its remedies by food
- ✚ Application of studied concept for new products development with nutraceutical potential

**Books Recommended:**

- ❖ Robert easy Wildman. (2001). Handbook of Nutraceuticals and Functional Foods.
- ❖ Campbell JE & Summers JL. (2004) Dietary Supplement Labeling Compliance.
- ❖ Israel Goldberg. (2011). Functional foods, Pharma foods, Nutraceuticals.
- ❖ Singh, Kumar and Kumar (2022). An objective Food Science Compendium. Brillion Publishers

**M.Sc. (Hons.) Food Technology (Semester-I)**  
**MSFT-103 b (GE-I) – Fermentation Technology**

Exam Time: 1:30 Hours  
Lectures to be delivered: 30 (Credit-2)

Max. Marks: 50  
Theory Marks: 35  
Internal assessment: 15  
Pass Percentage: 40%

**Course Objective:** This course covers the needs of students to learn the chemistry of aerobic and anaerobic process by the way of various microflora impacts on to the products and co-products for the sake of human benefit

**INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES**

The question paper will consist of three sections. Section A and B will have four questions each from respective units. Candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 6 marks. Section C will consist of 11 short answer type questions of 1 mark each, covering entire syllabus and are compulsory to attempt.

**Unit-I**

**Introduction:** Origin, scope and developments of fermented food and beverage industry

**Raw Materials for Microbial Production:** Conventional and non-conventional medium, Storage, Transportation and homogenization of medium

**Fermentation Types:** Batch, Fed batch, and Continuous. Submerged, Surface, Solid substrate fermentation, design of fermenter / bioreactors and its parts

**Unit-II**

**Inoculum Development:** Techniques for the development of inoculum for bacteria, Fungus and yeast in industrial fermentation process

**Fermented Beverages:** Fermentative production and quality analysis of undistilled (red and white Wine, Beer (Ale and Lager) / Distilled (Whiskey and Rum) liquors

**Microbial Biomass for Food and Feed:** Single cell protein, Industrial scale fermentative production and characterization of Algal, Bacterial, Fungal and yeast biomass as single cell protein

**Course Outcomes:**

- ✚ To develop learning credentials for production of biomass and operational technique for fermenter
- ✚ Hands on efficiency in operational methods for development of various alcoholic drinks
- ✚ Development of food and feed synthesized by means of microbial resources

**Books Recommended:**

- ❖ Ojha and Tiwari. (2016) Novel Food Fermentation Technologies. Springer Press.
- ❖ Arindam Kula and Vinay Sharma. (2018). Principles and Applications of Fermentation Technology. Wiley Press
- ❖ Prescott S. C and Cecil G. D. (2009) "Industrial microbiology." *Industrial microbiology*.
- ❖ Stanbury P. F, Allan W and Stephen J. H.(2013). *Principles of fermentation technology*. Elsevier
- ❖ Stanbury, Peter F., Allan Whitaker, and Stephen J. Hall. (2013). *Principles of fermentation technology*. Elsevier.



**M.Sc. (Hons.) Food Technology (Semester-I)**  
**Research Methodology (MSMB-103)**

Lectures to be delivered: 30 (Credit-2/Week)

Max. Marks: 35

Pass Marks: 40%

**Course Objectives:** Student will learn the meaning of research, to find the research problem, to create the research objectives etc. They will also find suitable methods for finding the solution for their research problem. This course will through light on various aspects of thesis writing and judicial ways of paper publishing.

**Course Outcome:** The student will have the detailed knowledge about research problems, their types and their solutions as well. They will also be able to define the sampling methods, paper writing and tools of research.

**INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES**

The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective units of the syllabus and carry 6 marks each. Section - C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 11 marks in all. Candidates are required to attempt two questions each from sections A and B. Section-C is compulsory.

**Unit-I**

**Foundations of Research:** Definition, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory, Characteristics of scientific method, Understanding the language of research and Concept

**Problem Identification and Formulation:** Research Question, Investigation Question, measurement Issues: formation of Hypothesis

**Research Design:** Concept and Importance in Research, Features of a good research design, Exploratory Research Design. Descriptive Research Designs and Experimental Design: Concept of Independent and Dependent variables

**Qualitative and Quantitative Research:** Qualitative research, Quantitative research, Concept of measurement, causality, generalization, replication, merging the two approaches

**Unit-II**

**Sampling:** Introduction to Sample types, sampling frame, Sample error, determining size of the sample, Practical considerations in sampling

**Interpretation of Data and Paper Writing:** Layout of a Research Paper, Search for Journals, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, plagiarism and self plagiarism, plagiarism detection (Urkund, Plagtracker)

**Use of tools /techniques for Research:** Patents and IPR, Methods to search required information effectively, Software for paper formatting (MS Office), statistical tools (SPSS)

**Books Recommended**

Kothari CR (2004) Research Methodology: Methods and Techniques, 2<sup>nd</sup> Ed., New Age International publishers

Marder MP (2011) Research Methodology for Science, First Ed. Cambridge University Press

Kumar R (2011) Research Methodology: a step by step guide for beginners, 3<sup>rd</sup> Ed., SAGE Publications Ltd

**M.Sc. (Hons.) Food Technology (Semester-I)**  
**MSFT-104 (LC-101) – Food Biochemistry and Nutrition Lab**

Exam Time: 4 Hours  
Period/Week-4

Practical Marks: 50 (Credit-2)  
Pass Percentage: 40%

**INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES**

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C comprises of practical note book evaluation and Viva-Voce exam (13 Marks).

**Practicals:**

1. Preparation and standardization of solution
2. To estimate moisture content and total solids in given food sample (Milk and Flour)
3. Qualitative and quantitative tests for sugars
4. Quantitative tests for protein estimation
5. To perform various Quantitative/Qualitative tests for lipids
6. Paper chromatography of pigments
7. Estimation of vitamin C in citrus fruits
8. To determine crude fibre content in given food sample
9. Proximate calculation for different flour

**M.Sc. (Hons.) Food Technology (Semester-I)**  
**MSMB-302: Lab course pertaining to Food Microbiology**

Practical Time: 4 Hours/week (Credit -2)

Max. Marks: 50

Pass Marks: 40%

**Course objective:** Students will be introduced with physical and chemical preservatives, along with quality check of different foods and food products.

**Course outcome:** After completion, student will have thorough knowledge of physical and chemical preservatives along with their importance in food industry. Students will also be able to perform various quality tests of these products.

**INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES**

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (13 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (12 Marks).

- 1 To study the impact of physical and chemical preservatives on shelf life of given food sample
- 2 Microbiological analysis of fresh food samples
- 3 To perform standard plate count for food sample and characterization of microorganisms
- 4 Isolation and characterization of milk microflora associated with raw and processed milk
- 5 Isolation of *Salmonella* from given food samples
- 6 Study the microbial succession in sauerkraut production
- 7 To check the quality of milk sample using MBRT test
- 8 Determination of TDT for given microorganism
- 9 Determination of Iodine number of given fat sample
- 10 To determine fat, SNF and TSS of given milk sample
- 11 To determine acidity of food sample

**Books Recommended**

Neelima Garg, K.L. Garg, K.G. Mukerji (2010), Laboratory Manual of Food Microbiology, I.K. International Publishing House Pvt. Ltd, New Delhi

Ahmed E. Yousef, Carolyn Carlstrom (2003), Food Microbiology: A Laboratory Manual

**M.Sc. (Hons.) Food Technology (Semester-I)**  
**MSFT-105 (LC-103) – Principles of Food Processing Lab**

Exam Time: 4 Hours  
(Credit-2) Period/Week-4

Practical Marks: 50  
Pass Percentage: 40%

**INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES**

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C comprises of practical note book evaluation and Viva-Voce exam (13 Marks).

**Practicals:**

1. Moisture determination by hot air oven method (Wet and Dry basis)
2. Evaluate the effect of chilling injury on perishable products
3. Estimate the effect of pasteurization on liquid food
4. To study the effect of sterilization on food quality
5. Estimate the effect of thermization on food quality
6. Calculate the drying kinetics of food and its effect on food quality
7. Preparation of syrup and brine and determination of its strength
8. To estimate water activity ( $a_w$ ) of foods using saturated salt solution
9. To study osmotic dehydration of fruits
10. Visit to food processing industry

**M.Sc. (Hons.) Food Technology (Semester-II)**  
**MSFT-201 (C-5) – Food Additives**

Exam Time: 3 Hours  
Lectures to be delivered: 60 (Credit-4)

Max. Marks: 100  
Theory Marks: 70  
Internal assessment: 30  
Pass Percentage: 40%

**Course Objective:** To impart knowledge of international (European Union) and national (FDA) legislation of food additives. Also help to get classification and mechanism of action of food additives, advantages and risks associated with them.

**INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES**

The question paper will consist of three sections. Section A and B will have four questions each from respective units. Candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 12 marks. Section C will consist of 11 short answer type questions of 2 marks each, covering entire syllabus and are compulsory to attempt.

**Unit I**

**Introduction:** Additives in food processing and preservation, Functions, safety and quality evaluation of additives.

**Additives-I:** Types, properties and application of chemical preservatives (potassium meta bi-sulphite, sodium benzoate, parabens and sorbate), Sequestrants and Humectants

**Additives-II:** Types, properties and application of Colours, Acidulants, Anticaking agents, Thickeners, Flour bleaching agents, Bread improvers

**Unit-II**

**Emulsifier and Stabilizer:** Types of emulsifier and stabilizer, their role in food formulation. Emulsion stabilization.

**Flavors and Sweeteners:** Types of liquid and dry flavor, description of food flavors. Flavor enhancer. Sweeteners (Natural and Artificial) and its health benefit

**Antioxidants and Natural Pigments:** Natural & synthetic antioxidants and its uses in food Lycopene, Curcumin and Anthocyanin.

**Course Outcomes:**

- ✚ Gain awareness about different type of additives to increase the shelf life of food product
- ✚ Theoretical knowledge of preservation aspect as per FSSAI labeling to develop food and feed
- ✚ Develop application capacity for home scale flavored drinks and foods

**Books Recommended:**

- ❖ Branen, A. Larry, P. Michael D, Seppo S. and John T. (2001) *Food additives*. CRC Press.
- ❖ Pomeranz, Y. \*(2012) *Functional properties of food components*. Academic Press.
- ❖ Saltmarsh, M. and Mike S. *Essential guide to food additives*. (2013) Royal Society of Chemistry
- ❖ Saltmarsh, Michael, and Mike Saltmarsh. (2013) *Essential guide to food additives*. Royal Society of Chemistry, .
- ❖ Lindsay, Robert C. (2017) *Fennema's food chemistry*, pp. 803-864. CRC Press.

**M.Sc. (Hons.) Food Technology, Semester-II**  
**Industrial Microbiology (MSMB-402)**

Lectures to be delivered: 60 (Credit – 4/week)

Max. Marks: 70

Pass Marks: 40%

**Course Objectives:** Course objectives are to inculcate a better understanding of the microbes in industries and to introduce students with various industrial enzymes, antibiotics, alcoholic beverages, organic acids along with different immobilization techniques.

**Course Outcome:** Student will be able to exploit the microorganisms in different industries and associated fermentation productions like beverages, antibiotics, enzymes, organic acids.

**INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES**

The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective units of the syllabus and carry 12 marks each. Section - C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B. Section-C is compulsory.

**Unit-I**

**Introduction to Industrial Microbiology:** Importance of industrial microbiology, industrially important microorganisms, inoculum development, strain improvement, selection of raw materials, medium optimization and formulation

**Microbial fermentation processes:** Types of fermentations (batch, continuous and fed-batch), open and closed systems, media sterilization: batch and continuous sterilization, concept of heat and mass transfer, Digital control and automation in fermentation process

**Fermenter design:** Basic components of a fermenter, fermenter construction materials, types of fermenter, impellers, baffle and spargers, sampler design, foam controller

**Upstream and Downstream Processing:** Inoculum preparation, scale up, Batch filtration, centrifugation, cell disruption, liquid-liquid extraction, solvent recovery, chromatography techniques in product recovery, ultra-filtration and reverse osmosis, drying (lyophilization and spray drying), crystallization

**Unit-II**

**Important industrial products:** Bio-ethanol, single cell protein, Baker's yeast production, organic acids (acetic acid and citric acid), lactam antibiotics (Penicillin and streptomycin).

**Alcoholic beverages:** Non-distilled (beer and wine) and distilled alcoholic beverages (Whisky, rum, brandy).

**Industrial enzymes and amino acids:** Production and applications of industrial enzymes (amylases, proteases, cellulose, lipase); amino acid (glutamic acid and lysine).

**Immobilization of enzymes:** Methods of enzyme immobilization (ionic bonding, adsorption, covalent bonding, microencapsulation and gel entrapment). Comparison of free and immobilized enzyme systems, Co-immobilization

**Book Recommended**

Prave P (2011) Fundamental of Biotechnology, VCH Publishers, New York Stanbury PF

Whitaker A and Hall SJ (2003) Principles of Fermentation Technology, 2nd Ed., Pergamon Press,

Oxford, UK Reed B (2005) Prescott and Dunn's Industrial microbiology, 4th edition Young MO

(2011) Comprehensive Biotechnology, 2nd edition, Elsevier

**M.Sc. (Hons.) Food Technology (Semester-II)**  
**MSFT-202 (C-7) – Milk and Milk Processing Technology**

Exam Time: 3 Hours

Lectures to be delivered: 60 (Credit-4)

Max. Marks: 100

Theory Marks: 70

Internal assessment: 30

Pass Percentage: 40%

**Course Objective:** Understanding the need and importance of dairy industry, handling and testing technologies cum processing aspects of milk into various products and by-products

**INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES**

The question paper will consist of three sections. Section A and B will have four questions each from respective units. Candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 12 marks. Section C will consist of 11 short answer type questions of 2 marks each, covering entire syllabus and are compulsory to attempt.

**Unit-I**

**Introduction:** Definition, Status of milk production and industries in India, milk composition, factors affecting composition. Cow (Indian and Exotic breeds), and Buffalo milk, Food and nutritive value, physicochemical properties of milk.

**Pre-processing:** Clean milk production, procurement and collection, platform tests for milk, cooling and transportation, receiving, judging and grading. Microbiology of milk

**Processing and Principles:** Preheating, filtration, clarification, cream separation and standardization (Pearson Square Method), pasteurization (LTLT/HTST/UHT); homogenization.

**Market Milk and Special Milk:** Sterilized milk, homogenized milk, soft curd milk, flavoured milk, vitaminized milk, standardized milk, full fat, toned, double toned, skim milk and humanized milk.

**Unit-II**

**Fermented Milk Products:** Buttermilk, acidophilus milk, bulgarian buttermilk, kumiss, kefir, yoghurt, dahi, lassi and probiotic dairy foods.

**Traditional Indian Dairy Products:** Khoa and khoa based sweets, channa based sweets, milk and cereal (composite) based foods; kheer and raabadi.

**Fat Rich Dairy Products:** Technology of preparation for Cream, Butter, and Ghee.

**Milk Powders:** Production of SMP and WMP, Infant food, Sodium caseinate and Whey powder.

**Course Outcomes:**

- ✚ To learn about the preservation cum processing techniques for milk with enhanced shelf life
- ✚ Developing skills about technological preparations of milk products at home scale aimed to shelf extension
- ✚ This course also helps to formulate lists of value added composite dairy foods

**Books Recommended:**

- ❖ Aneja, R. P., B. N. Mathur, R. C. Chandan, and A. K. Banerjee. (2002) Tech of indian milk products: hand book on process tech modernization for professionals, entrepreneurs & scientists. Dairy India Yearbook.
- ❖ De, Sukumar. (2008) Outlines of dairy technology. Oxford university press
- ❖ Rathore NS et al. (2008) Fundamentals of Dairy Technology-Theory and Practices.

**M.Sc. (Hons.) Food Technology (Semester-II)**  
**MSFT-203 (C-8) – Food Quality, Regulations and IPR**

Exam Time: 1:30 Hours  
Lectures to be delivered: 30 (Credit-2)

Max. Marks: 50  
Theory Marks: 35  
Internal assessment: 15  
Pass Percentage: 40%

**Course Objective:** Understanding the importance of food safety, food quality, food laws and food regulation amendments in food industry.

**INSTRUCTIONS FOR THE PAPER SETTERS / CANDIDATES**

The question paper will consist of three sections. Section A and B will have four questions each from respective units. Candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 6 marks. Section C will consist of 11 short answer type questions of 1 mark each, covering entire syllabus and are compulsory to attempt.

**Unit-I**

**ISO:** Introduction, ISO: 9000 (QMS: Quality Management System), ISO: 14000 (EMS: Environment Management System), ISO: 18000 (OHSAS: Occupational Health and Safety Assessment Series), ISO: 22000 (FSMS: Food Safety Management System), FSSC: 22000 and BRC, Features, Principles and Elements

**Total Quality Management:** Introduction and concept, Cost and economics of quality, Tools and techniques for analyzing the quality process, Six-sigma concept.

**HACCP:** Hazard analysis and critical control point types, HACCP principles, Good manufacturing practices (GMP) and Good handling practices (GHP).

**Unit-II**

**Food Safety and Standards Act (2006):** Introduction to FSSAI, FBO (Food Business Operator) registration and licensing.

**FSS Regulations:** Food product standards, Food contaminant and toxicants, Packaging and labelling regulations, Organic food, Nutraceutical and functional foods.

**Intellectual Property Rights (IPR):** Concept, Types and related Indian legislations, Patents: novelty, Inventiveness and industrial application; Filing of patent application, Patent infringement

**Course Outcomes:**

- ✚ After course completion, students will be able to get various areas of Food Safety & Quality Assurance.
- ✚ Grasp key concept about quality assessments of foods through Comprehend food quality management system
- ✚ Apprehend the Indian and International food laws

**Books Recommended:**

- ❖ Cornish, William, David Llewelyn, and T. Aplin. (2003) *Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights (6 th.* London, Sweet & Maxwell.
- ❖ Singh, K. K. (2014) *Biotechnology and Intellectual Property Rights: Legal and Social Implications.* Springer.
- ❖ Cornish WR. (2016) *Intellectual property: patents, trade mark and allied rights, universal law publishing, N Delhi.*
- ❖ Dudeja, Pujja, Rajul K. Gupta, and Amarjeet Singh Minhas, eds. (2016) *Food Safety in the 21st Century: Public Health Perspective.* Academic Press



**M.Sc. (Hons.) Food Technology (Semester-II)**  
**MSMAT001 (OE-1) – Biostatistics**

2023-2024

**M.Sc. (Hons.) Food Technology (Semester-II)**  
**MSFT-204 (LC-201) – Food Additives Lab**

Exam Time: 4 Hours  
(Credit-2) Period/Week-4

Practical Marks: 50  
Pass Percentage: 40%

**INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES**

The final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C comprises of practical note book evaluation and Viva-Voce exam (13 Marks).

**Practicals:**

1. Application of stabilizers in beverage formulation
2. Application of thickeners in soup preparation
3. Use of various chemical preservatives in food preservation
4. Application of emulsifiers in emulsion preparation and their stability
5. Application of various colorants in acceptability determination of beverages
6. Use of humectants in confectionary products
7. Effect of flour improver on dough quality
8. Preparation of flavored drink using synthetic flavor
9. Sensory evaluation practice for additive utilized food preparation in lieu of control sample
10. Development of fiber fortified milk beverage

**M.Sc. (Hons.) Food Technology (Semester-II)**  
**MSMB-404: Lab course pertaining to Industrial Microbiology Lab**

Practical Time: 4 Hours/week (Credit -2)

Max. Marks: 50  
Pass Marks: 40%

**INSTRUCTIONS FOR THE PAPER SETTERS / CANDIDATES**

The final practical paper will consist of three sections A, B and C. Section A will contain write up (13 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (12 Marks).

1. Construction and working of lab scale bioreactor
2. Production of alcoholic beverages
3. Estimation of alcohol content produced during wine production
4. Whole cell immobilization in calcium alginate gels
5. Enzyme immobilization by calcium alginate method
6. Isolation of lipase producing bacteria
7. To study amylase production and its estimation
8. To study protease production and its estimation
9. To study cellulase production and its estimation
10. Production and estimation of organic acid (citric acid)

**Books Recommended**

Sugitha Thankappan, P. Raja, R. Rajesh, Shiva kumar Uthandi (2020), Practical Manual cum Work book on industrial Microbiology. Tamil Nadu Agricultural University

Nupur Mathur and Anuradha Singh (2007), Industrial Microbiology: A Laboratory Manual, Aavishkar Publisher Distributors.

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**M.Sc. (Hons.) Food Technology (Semester-II)**  
**MSFT-205 (LC-203) – Milk and Milk Processing Technology Lab**

Time: 4 Hours  
(Credit-2) Period/Week-4

Practical Marks: 50  
Pass Percentage: 40%

**INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES**

The final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C comprises of practical note book evaluation and Viva-Voce exam (13 Marks).

**Practicals:**

1. To perform platform tests: temperature, % acidity, pH, COB and alcohol.
2. Determine of Fat, SNF and Total solids content in milk and juice sample.
3. Determination of specific gravity of given milk sample
4. To perform cream separation and standardization of milk
5. To check the efficiency of pasteurization by *Phosphatase* test
6. Preparation of value-added foods using millets and milk
7. Determination of moisture content, ash content and protein content in given milk sample
8. Preparation of butter and check fat, and moisture content of butter
9. Technology of preparation for curd and yoghurt and their sensory evaluation
10. Determination of homogenization efficiency in different layers of homogenized milk
11. Detection of various adulterants in given milk sample