

M.Sc Food Technology
Choice Based Credit System

1st Semester

Course Code	Course Name	Credits			Total
		L	T	P	
FT23101CR	Food Microbiology and Biotechnology	4	0	0	4
FT23102CR	Food Chemistry	4	0	0	4
FT23103CR	Food Processing Technology	4	0	0	4
FT23104CR	Food Packaging	3	0	1	4
FT23105DCE	Food Engineering	3	0	1	4
FT23106DCE	Experiments in Food Chemistry	0	0	2	2
FT23107DCE	Experiments in Microbiology	0	0	2	2
FT23001GE	Lipid Technology	2	0	0	2
FT23002OE	Elementary Food Processing	2	0	0	2

Semester I

FT23101CR

Food Microbiology and Biotechnology (4+0+0)

Unit I

- Brief history of Food Microbiology. Microbial Growth Curve.
- Factors affecting microbial growth: intrinsic and extrinsic factors.
- Types of microbes associated with foods & their characteristics: Bacteria, yeast, Fungi.
- Biochemical changes caused by microorganisms: Degradation of different food components.

Unit II

- Microorganisms associated with spoilage of milk, cereal, meat, fruit and vegetables & their products. Spoilage of canned products.
- Detection of Food spoilage using biosensors.
- Food borne diseases: Listeriosis, Salmonellosis, Shigellosis, Yersiniosis, Diseases caused by *Clostridium perfringens*, *Bacillus cereus*, *Escherichia coli*.
- Food intoxication: Staphylococcal intoxication, Botulism,
- Toxicants from molds: Aflatoxins, ochratoxins, patulin, Luteoskyrin, Pencillic acid.

Unit III

- Introduction to Genetic Engineering, Recombinant DNA Technology, Vectors, Ti Plasmid
- SCP: Sources, substrate requirement, Production,
- GM crops: Bt Corn, Bt Brinjal & Golden Rice.
- Antisense RNA & Gene silencing
- Genetic manipulation of industrially important yeast and Lactic Acid Bacteria.

Unit IV

- Fermentation- types of fermentation, Fermenters
- Waste utilization in industrial microbiology
- Biocolor: Technology of production, sources (Microbial & plant) and applications

- Bio-preservatives – types and applications
- Enzyme immobilization- methods and advantages. Industrial application of enzymes.

References:

1. Frazier, W.C. (2014). Food Microbiology. McGraw Hill Education (India) Private Ltd.
2. Jay, J. (2012). Modern Food Microbiology. Springer Science & Business Media.
3. George J. Banwart. (2012). Basic Food Microbiology. Springer Science & Business Media, 2012
4. Pommerville, J.C. Alcoms. (2021). Fundamentals of microbiology. Jones & Bartlett Learning
5. Stainier. (1979). Introduction to Microbiology. Prentice-Hall
6. Ray, B., & Bhunia, A. (2013). Fundamentals of Food microbiology. CRC Press, 2013
7. Pelczar, Smith & Chan. (2009). Microbiology. Tata McGraw-Hill Education
8. Joshi, V. K. and Sing., R.K. (2012). Food Biotechnology principles & Practices. I. K. International Publishing House Pvt. Ltd., New Delhi, Bangalore, India
9. Byong H. Lee. (2015). Fundamentals of Food Biotechnology. JohnWiley & Sons, Ltd
10. Buchanan, Jones, G. (2007). Biochemistry and molecular biology of plants. I.K. International Pvt. Ltd.
11. Adrian, S., Nigel W. S., Mark, R.F. (2008). Plant Biotechnology: The genetic manipulation of plants. Second Edition, Oxford University Press.

FT23102CR

Food Chemistry (4+0+0)

UNIT I

- Water- solute interactions.
- Carbohydrates- Classification, Structure and functional properties of mono, oligo & polysaccharides.
- Non- Enzymatic browning (NEB): Chemistry and factors affecting NEB.
- Polysaccharide solubility, viscosity and stability.
- Starch structure. Gelatinization and pasting properties.
- Industrially important polysaccharides like cellulose, pectic substances, Guar gum, locust bean gum, Xanthan gum, Carrageenans, & beta- glucan.

UNIT II

- Amino acid- Classification, structure and properties.
- Proteins: Classification, structure and forces involved in stability of protein structure.
- Protein denaturation, thermodynamics of denaturation and denaturing agents.
- Functional properties including hydration, solubility and interfacial properties.
- Nutritional properties of proteins: protein quality, digestibility, evaluation of protein nutritive value.

UNIT III

- Lipids: Classification, and nomenclature of saturated and unsaturated fatty acids.
- Physical properties of triacylglycerols - rheological, density, thermal and optical properties. Physicochemical transition of lipids – supercooling, nucleation, crystal growth, post crystallization events. Polymorphism in lipids.
- Isolation, purification and modification of lipids.
- Mechanism of oxidative rancidity and role of Prooxidants and antioxidants in lipid oxidation.
- Food lipids and health: Trans- fatty acids, omega fatty acids

UNIT IV

- Food Additives: Definition, classification and safety aspects.
- Commonly used food additives like antioxidants, antimicrobials, colorants and artificial sweeteners
- Food Flavors: Molecular mechanism of flavor perception. Taste substances and nonspecific saporous sensations: Sweet, bitter, sour, salty, astringency, Kokumi, pungency, and cooling.
- Flavoring substances associated with fruits and vegetables, milk, spices and processed products.
- Encapsulation, retention and controlled release of flavor and aroma compounds.

References:

1. Owen R. Fennema. (2007). Food Chemistry. CRC Press
2. Meyer. (1960). Food Chemistry. Reinhold Publishing Corporation.
3. Wong. (2018). Mechanism & Theory in Food Chemistry. Springer International Publishing
4. Belitz, H. D. (2009). Food Chemistry. Springer Science & Business Media
5. John M. deMan. (2018). Principles of Food Chemistry. Springer International Publishing
6. Joshi, V. K. and Sing., R.K. (2012). Food Biotechnology principles & Practices. I. K. International Publishing House Pvt. Ltd., New Delhi, Bangalore, India
7. Andrew J Taylor. (2010). Food Flavor Technology. Wiley Blackwell Publishing Ltd
8. Branen, A.L., Davidson, P.M., and Salminen, S. (2001). Food Additives. CRC Press

FT23103CR

Food Processing Technology (4+0+0)

UNIT I

- Principles of Food Preservation
- Food Dehydration: Drying curves, factors affecting food dehydration, effect of dehydration on food quality. Types of driers.
- Evaporation: Single and multiple effect evaporators, Types of evaporators.
- Significance of water activity in shelf stability of foods. Intermediate moisture foods.
- Thermal processing: blanching, pasteurization, sterilization. Aseptic processing.

UNIT II

- Food Irradiation– Principle, mechanism and applications in foods. Safety concerns.
- Refrigeration and freezing: Principle of refrigeration, freezing curve. Types of freezers, Freezing and chilling injuries.
- Membrane processing–types of membranes, equipments, applications in foods, Advantages.
- Minimally processed foods– Preservation and packaging of minimally processed foods.
- Chemical preservatives.

UNIT III

- High Pressure Processing of Foods: Concept of high pressure processing, effects of pressure on microorganisms and its application in food processing.
- Ultrasonic in Food Processing: Properties and generation of ultrasonic, Cavitation, Ultrasonics as a processing techniques.
- Cold plasma for Food Processing – Principle and generation of cold plasma. Application of cold plasma Technology.
- Pulse electric field - Principle, PEF system, Mechanism of microbial inactivation, Factors effecting pulse electric field efficiency. Applications of PEF.

Unit IV

- Ohmic heating – principles and applications.
- Microwave processing–mechanism, equipment and applications.
- Supercritical Fluid Extraction: Properties of super critical fluids, Principle and applications in Food Processing.
- Micronization in food processing- techniques and benefits

References:

1. P. Fellows. (2022). Food Processing Technology. Woodhead Publishing
2. Desrosier. The Technology of Food Preservation. AVI Publishing Company, 1959
3. Potter, N.N. (2013). Food Science. Springer Science & Business Media
4. Introduction to Food Science and Technology by Stewart. Elsevier 2012
5. Handbook of Food Preservation by M. Shafiur Rahman. CRC Press 2020
6. Novel Food Processing Technologies by Gustavo V. Barbosa-Canovas, Maria S. Tapia, M. Pilar Cano. CRC Press 2004

FT23104CR

Food Packaging (3+0+1)

Unit I

- Definition and functions of packaging.
- Types of packaging used in foods-chemistry and applications.
- Properties of packaging materials - Barrier properties - gas transmission rate (GTR) and water vapour transmission rate (WVTR); Mechanical properties. Migration
- Metals: Tinplate containers, tinning process, Low tin steels, tin free steel (TFS). Can-manufacturing, types and lacquering.

Unit II

- Glass and paper packaging.
- Plastics: Polymer processing methods.
- Innovative technologies in food packaging: active packaging & intelligent packaging.
- Biodegradable and Edible packaging. Concept of green plastics and nanosensors.

Unit III

- Modified and controlled atmospheric packaging: Design and application.
- Shelf –life assessment and prediction methodologies.
- Packaging requirements- Dairy, cereal, meat, spices, fruit & vegetable.
- Food packaging- regulations and labeling.

Unit IV (Practical)

1. Identification of films
2. Determination of WVTR and OTR of packages
3. Determination of shelf life of packaged foods
4. Porosity of tinplate
5. Shrink and vacuum packaging of different foods.

References:

1. Food Packaging Principles by Gordon Robertson. CRC Press 2005

2. Handbook of Food Packaging by Paine and Paine. (2012). Springer Science & Business Media
3. Food Packaging- Science & Technology by Lee. (2008). Taylor & Francis
4. Innovations in Food Packaging by Jung M. Han. (2014). Academic Press
5. Principles of Food Packaging by Saccharow and Griffin. AVI Publishing Company, 1980
6. Innovations in Food Packaging by Jung H. Han. Elsevier, 2005

FT23105DCE

Food Engineering (3+0+1)

Unit I

- Material and energy balance: Basic principles, total mass and energy balance, numerical problems based on dilution, concentration, dehydration, and energy balance.
- Modes of heat transfer- conduction, convection and radiation.
- Thermal process calculations- D value, Z value, F value for canned foods.
- Heat Exchangers: Design, types and applications.

Unit II

- Types of evaporators- Design of Single effect and multiple effect evaporators.
- Refrigeration– Principle, refrigeration cycle, Thermodynamics of refrigeration
- Psychrometric charts and their application.
- Rheological studies: Viscosity, Newtonian and non-Newtonian fluids, Storage and loss Modulus and its applications in foods. Concept of Farinograph, Amylograph, Rheometer, and texture analyzer.

Unit III

- Size reduction – Elastic stress limit, yield point, Kicks law, Rittengers law, Bonds law.
- Equipment for fibrous, dry and liquid foods.
- Mixing – Theory of solids mixing, theory of liquids mixing, equipment for low, medium and high viscosity foods.
- Separation Processes: Sedimentation, Filtration, Centrifugal Separation.

Unit IV

- To study drying rate characteristics of different food materials.
- Determination of freezing curve and freezing time of selected food material.
- Demonstration of steam distillation.
- To study particle size by using sieve analysis.

References:

1. Introduction to Food Engineering by R.P. Singh and D.R. Heldman. Academic Press, 2013
2. Fundamentals of Food Process Engineering by R.T. Toledo. Springer Science & Business Media, 2007
3. Industrial Engineering and Management by O. P. Khanna. Dhanpat Rai, 1980
4. Food Processing Technology by P. Fellows. (2022). Woodhead Publishing

FT23106DCE

Experiments in Food Chemistry (Practical) (0+0+2)

1. Preparation and standardization of solution.
2. Proximate analysis of foods.
3. Qualitative tests for Carbohydrates
4. Protein separation and characterization using SDS-PAGE electrophoresis
5. Smoke, Flash and Fire points of oils and fats
6. Determination of free fatty acids
7. Peroxide value and TBA for measuring lipid oxidation
8. Estimation of Total phenolic content
9. Pasting properties of starches using RVA.
10. Sensory methods for measuring food attributes- Difference tests and Rating tests.
11. Determination of adulterants in milk, ghee, edible oil, chillies, honey.

References

1. Handbook of Analysis and Quality Control for Fruit and Vegetable products by Ranganna. Tata McGraw-Hill, 1986
2. Food Analysis by S. Suzanne Nielsen. (2017). Springer Science & Business Media
3. Chemical Analysis of Foods and Food Products by Jacobs, Morris B. (1939). New York,; D. Van Nostrand company, inc.
4. Physical Properties of Food by R.Jowitt & Fescher. (1983)
5. Sensory Evaluation Practices by Stone. (2012). Elsevier Science

FT23107DCE

Experiments in Microbiology (Practical) (0+0+2)

1. Microscopy.
2. Techniques of inoculation.
3. Staining techniques-gram staining, Positive staining, Negative staining.
4. Enumeration of micro-organisms– TPC, Yeast and mould count, ANPC.
5. PCR
6. Production of biocolors
7. Identification of bacteria on the basis of:
 - a. Cultural characteristics
 - b. Morphological characteristics
 - c. Biochemical characteristics -Indole Test/ MVIC test, Starch-hydrolysis, Oxidase Test, TSI test, Coagulase test, Catalase test

References

1. Textbook of Practical Microbiology by Subhash Chandra Parija. Elsevier 2016
2. Laboratory Manual in Microbiology by Gunasekaran. (2007). New Age International (P) Limited
3. Bergey's Manual of Systematic Bacteriology. (2012). Springer New York.

FT23001GE

INTRODUCTORY LIPID TECHNOLOGY (2+0+0)

UNIT 1

- Lipids-classification and sources
- Nomenclature of saturated and unsaturated fatty acids
- Physicochemical properties of Lipids.
- Extraction and rendering of lipids- Physical and chemical refining
- Hydrogenation, interesterification and Winterization of oils

UNIT II

- Chemistry of frying of oils- physical and chemical changes. Decomposition products
- Mechanism of Lipid oxidation
- Factors affecting lipid oxidation
- Role of prooxidants and antioxidants
- Fat replacements

References

1. Food Lipids: Chemistry, nutrition and biotechnology by Casimer C. Akoh and David B. Min (2017). CRC Press
2. Fats and oils by Richard D-O' Brien. (2008). CRC Press
3. Food Chemistry, Third Edition. Hong Kong: Taylor & Francis, 1996.
4. Bailey's Industrial Oil and Fat Products, 7 Volume Set. United Kingdom: Wiley, 2020.

FT23002OE

ELEMENTARY FOOD PROCESSING (2+0+0)

Unit – I

- Status of Indian food industry– Exports scenario of fruits, vegetables, spices, and their processed products; Driving forces for food industry and constraints
- Causes of food spoilage.
- Thermal Processing – Canning, Sterilization, Pasteurization, Aseptic processing.
- Preservation by low temperature- Refrigeration and Freezing

Unit–II

- Concept of water activity; Intermediate moisture foods.
- Fermentation– Types, nutritional importance of fermented foods.
- Hurdle Technology
- Controlled atmospheric storage – Principle, design considerations, effects of CA storage on food quality.

References:

1. Fellows, P.J. Food Processing Technology: Principles and Practice. United Kingdom: Elsevier Science, 2009.
2. Desrosier, J. N.. Technology of Food Preservation. India: CAB Publishers., 1998.
3. Potter, Norman N. Food Science. United States: Avi Publishing Company, 1973.
4. Stewart, George. Introduction to Food Science and Technology. United States: Elsevier Science, 2012.