

Master of Science (Food Technology)

Programme Code: MSD

Duration – 2 Years Full Time

**Programme Structure
and
Curriculum & Scheme of Examination
With
Choice Based Credit System (CBCS)
2019**

**AMITY UNIVERSITY
RAJASTHAN**

Credit Summary Sheet

M. Sc. Food Technology					
Semester	CC	DE	VA	OE	Total
1	17	3	4	-	24
2	18	3	4	3	28
3	18	3	4	3	28
4	30	-	-	-	30
Total	84	09	12	09	110

Note:- CC - Core Course, VA - Value Added Course, OE - Open Elective, DE - Domain Elective

List of Open Electives from M. Sc. Food Technology						
Course Code	Course Title	Category	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Credits
From M. Sc. Food Tech. –II Sem.						
MSD203	Functional Foods and Nutraceuticals	CC	3	-	-	3
From M. Sc. Food Tech.–III Sem.						
MSD 304	Food Safety and Quality Management	CC	3	-	-	3

Program Structure

M. Sc. Food Technology: I Semester						
Course Code	Course Title	Category	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Credits
MSD101	Advance Fermentation Technology	CC	3	0	-	3
MSD102	Advance Food Chemistry and Nutrition	CC	3	-	-	3
MSD103	Instrumental Methods of Food Analysis	CC	3	1	-	4
MSD104	Advance Food Processing and Preservation Technology	CC	3	1	-	4
MSD121	Advance Fermentation Technology (Lab)	CC	-	-	2	1
MSD122	Advance Food Chemistry and Nutrition (Lab)	CC	-	-	2	1
MSD123	Instrumental Methods of Food Analysis (Lab)	CC	-	-	2	1
DE Electives: Student has to select 1 course from the list of following DE electives						
MSD130	Cold Chain Management	DE	3	-	-	3
MTB131	IPR & Food regulatory affairs	DE				
MTB132	Industrial Safety & Hazards	DE				
BCS 111	Communicational Skills - I	VA	1	-	-	1
BSS111	Self-Development and Interpersonal Skills - I	VA	1	-	-	1
FLT 111 FLG 111 FLS 111 FLC 111	Foreign Language - I French German Spanish Chinese	VA	2	-	-	2
TOTAL						24

M. Sc. Food Technology: II Semester

Course Code	Course Title	Category	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Credits
MSD201	Meat, Fish and Poultry processing Technology	CC	3	1	-	4
MSD202	Advance Cereal Processing	CC	3	-	-	3
MSD203	Functional Foods and Nutraceuticals	CC	3	-	-	3
MSD204	Advance Biostatistics for Food Technologists	CC	3	-	-	3
MSD205	Advance Food Engineering	CC	3	-	-	3
MSD221	Meat, Fish and Poultry processing Technology Lab	CC	-	-	2	1
MSD222	Advance Cereal Processing Lab	CC	-	-	2	1
DE Electives: Student has to select 1 course from the list of following DE electives						
MSD230	Advance Flavor Chemistry and Technology	DE	3	-	-	3
MSD231	Food Rheology and texture	DE				
MTB232	Advance Nanotechnology and its Applications in Food Industry	DE				
OE	Open Elective -I		3	-	-	3
BCS 211	Communicational Skills - II	VA	1	-	-	1
BSS211	Self-Development and Interpersonal Skills - II	VA	1	-	-	1
FLT 211 FLG 211 FLS 211 FLC 211	Foreign Language - II French German Spanish Chinese	VA	2		-	2
	TOTAL					28

M. Sc. Food Technology: III Semester

Course Code	Course Title	Category	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Credits
MSD301	Processing of Foods of Plant Origin	CC	3	-	-	3
MSD302	Novel Food Packaging Technology	CC	2	-	-	2
MSD303	Minor Project (critical review of one research publication)	CC	2	-	-	2
MSD304	Food Safety and Quality Management	CC	3	-	-	3
MSD305	Advance Dairy Technology	CC	3	1	-	4
MSD306	Industrial training report	CC	-	-	-	2
MSD321	Processing of Foods of Plant Origin Lab	CC	-	-	2	1
MSD322	Novel Food Packaging Lab	CC	-	-	2	1
DE Electives: Student has to select 1 course from the list of following DE electives						
MSD330	Food Business Management	DE	3	-	-	3
MSD331	Food Toxicology	DE				
MSD332	Process Equipment Design and Plant Layouts	DE				
OE	Open Elective-II	OE	3	-	-	3
BCS 311	Communicational Skills - III	VA	1	-	-	1
BSS311	Self-Development and Interpersonal Skills - III	VA	1	-	-	1
FLT 311 FLG 311 FLS 311 FLC 311	Foreign Language - III French German Spanish Chinese	VA	2	-	-	2
TOTAL						28

M. Sc. Food Technology: IV Semester

Course Code	Course Title	Category	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Credits
MSD460	Major Project /Dissertation	CC	-	-	-	30
TOTAL						30

Program Learning Outcomes of Master of Science in Food Technology Program

1. After completion of MSc program, students will be having knowledge and skills of the technological and science base for the production, processing and preservation of foods;
2. Students will be able to elaborate methods to modify and control food quality and safety by means of chemical, microbiological and sensory analysis techniques;
3. Students will be capable to provide high-level research-based solution to food security problems by manipulating the Farm to fork multi-disciplinary approach
4. Students will be well trained to choose and design technologies for the industrial manufacture of food products, with due regard to raw materials, energy, economics and sustainability in the system of industrial food technology and nutrition.

ADVANCED FERMENTATION TECHNOLOGY

Course Code: MTF101

Credit Units: 04

Course Objective:

The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important products.

Course Contents:

Module I

Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Major agroindustrial waste products used for fermentation, Media formulation sterilization, thermal death kinetics, batch and continuous sterilization system. Modern strain improvement techniques, Sterilization of Industrial Media, Air and Fermenter

Module II

Transport phenomena in bioprocess – Mass transfer, mass transfer co-efficient for gases and liquids. Rate of oxygen transfer. Determination of oxygen transfer coefficient. Rheological properties of intermedium. Biological heat transfer, Heat transfer coefficients.

Bioprocess control and monitoring variables such as temperature, agitation, pressure, pH etc.

Module III

Kinetics of microbial growth, substrate utilization and product formation Batch, Fed-batch, CSTR types of reactors – CSTR, tower, airlift, bubble column, packed bed, immobilized cells, Control and monitoring, online and off-line control, Computers in bioprocess control systems. Solid state and submerged fermentation process.

Module IV

Industrial production of enzymes and biomolecules: cellulase, amylase, protease; organic acids: citric acid, acetic acid, lactic acid; ethanol, biomass, antibiotics: classification, penicillins, tetracyclins, chloramphenicol; vitamins: B₁₂, riboflavin, Production by batch, continuous and fed batch techniques, isolation, purification and characterization of biomolecules from fermentation media and storage. Major fermentation industries in India and abroad.

Module V

Biomass: Bakers and distillers yeast production using various raw materials, “bio” factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses.

Fermented milk products – Production, purification and packaging of Curd, Cheese, acidophilus milk, Yoghurt, Kefir, Single cell protein (SCP) production

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Fermentation Technology, Peter F Stanbury, Allan Whitaker, Stephen J Hall, Aditya Text Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers

- Industrial Microbiology: An Introduction, Michael J. Waites, Neil L. Morgan, John S. Rockey, Gary Higton, Blackwell Science Ltd

References:

- Biochemical Engineering, Bailey and Ollis.
- Principles of Biochemical Engineering, Humphrey.

ADVANCED FOOD CHEMISTRY AND NUTRITION

Course Code: MTF102

Course Credits: 3

Credit Hours: L: 3 T: 0 P: 0

Course Objective: To acquaint with properties, role of various constituents in foods, interaction and changes during processing and importance of various foods and nutrients in human nutrition.

Course Contents:

Module I

Definition and importance of major food constituents, Importance of water in food, Phases of water, Role of water as a solvent in food systems, Concept of water activity and moisture migration.

Module II

Carbohydrates, proteins and lipids: classification, nomenclature, physical, chemical and functional properties and their structural correlations; Major types of starch, Process of starch gelatinization, Process of staling, Modified starches and other polysaccharides used in foods.

Module III

Lipids as emulsifiers, Amino acid and protein interaction, External factors that influence protein systems in foods, Protein modification, Fat replacers; Properties of minerals, vitamins, pigments, flavor components, Interaction of constituents in food systems; Changes during storage and processing; Browning reactions in foods; influences on color, flavor, and texture

Module IV

Food groups and their typical composition; essential nutrients- sources, functions, deficiency diseases; requirements and recommended dietary allowances; digestion, absorption, transport and metabolism of nutrients in human system;

Module V

Food allergy and intolerance, Allergens, toxins and anti-nutritional factors in foods

Examination Scheme:

Components	CT	Attendance	Assignment/Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & Reference reading materials:

Text:

- Belitz HD.1999. Food Chemistry. Springer Verlag.
- DeMan JM. 1976. Principles of Food Chemistry. AVI.
- Fennema OR.1996. Food Chemistry.Marcel Dekker.
- Meyer LH. 1987. Food Chemistry.CBS.
- Swaminathan M. 1974. Essentials of Foods and Nutrition. Vol. II. Ganesh & Co.

INSTRUMENTAL METHODS OF FOOD ANALYSIS

Course Code: MTF103

Course Credits: 4

Credit Hours: L: 3 T: 1 P: 0

Course Objectives:

Food analysis is an important component of food technology. This course is based on presenting the basic principles and practice of food analysis. We will be presenting information about how samples are taken, how it is analyzed, and what techniques are being used. The course will have four major components: 1) sample and sampling techniques, 2) spectrophotometric analysis of samples taken 3) chromatography based analysis of food samples, and 4) sample extraction for different techniques. This will include a discussion of principles of different analytical techniques and the recent advancement in food analysis with some case studies.

Course Contents:

Module I

Sampling techniques; Water activity, its measurements and significance in food quality; Calibration and standardization of different instruments.

Module II

Spectroscopic techniques using UV/Vis, fluorescence, IR spectroscopy, atomic absorption spectroscopy, polarimetry, refractometry, microscopic techniques in food analysis (SEM, TEM, XRD, particle size analysis).

Module III

Chromatographic techniques: Adsorption, column, partition, affinity, ion exchange, size exclusion, GC, GLC, HPLC, HPTLC, GCMS, LCMS.

Module IV

Separation techniques: Gel filtration, dialysis, electrophoresis, sedimentation, ultrafiltration and ultracentrifugation, solid phase extraction, supercritical fluid extraction, isoelectric focusing.

Module V

Immunoassay techniques; biosensors; thermal methods of food analysis (Differential scanning calorimetry and Differential thermal analysis).

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & Reference reading materials:

Text Book:

- James CS (1998). Analytical chemistry of foods, Blackie Acad, UK.
- Winton, AL (1999). Techniques of food analysis, Allied Science Publication, New Delhi.
- Suzanne Nielson S (2003) Food analysis, Kluwer Academic Press, New York.

- Winton AL (1999) Techniques of food analysis, Allied Science, Official methods of analysis, Association of official analytical chemist USA.

References:

- Song, DWS (1996) Mechanism and theory in food chemistry Champasian and Hall Inc. New York.

ADVANCE IN FOOD PROCESSING AND PRESERVATION

Course Code: MTF104

Course Credits: 4

Credit Hours: L: 3 T: 1 P: 0

Course Objective:

To Emphasis the various properties of the raw material used in food processing, different processing technologies required in transforming them into quality food products and material handling equipment involved in food processing operations

Course outcomes

The course makes the students to understand about:

1. Properties of food material
2. Drying technology for food products
3. Low temperature and high temperature preservation of food
4. Preservation of food by advanced technology

Course Contents:

Module I

Modeling of Microbial Food Spoilages: Microbial growth dynamics models, partial differentiation equation models, application of models in thermal preservation, Concept, mechanism of microbial destructions, equipments.

Module II

Membrane Technology: Introduction to pressure activated membrane processes, performance of RO/UF and NF and industrial application

Module III

Supercritical Fluid Extraction: Property of near critical fluids (NCF), solubility and efficiency of NCF extraction, equipment and experimental techniques used in NCF extraction and industrial application.

Use of Microwave Energy in Foods: Theory of microwave heating, dielectric properties of food materials, working principle of magnetron, microwave blanching, sterilization and finish drying

Module IV

Hurdle Technology: Types of preservation techniques and their principles, concept of hurdle technology and its application.

High Pressure Processing of Foods: Concept of high pressure processing, quality changes, effects of pressure on microorganisms and its application in food processing

Module V

Ultrasonic in Food Processing: Properties and generation of ultrasonic, ultrasonic imaging, application of ultrasonics as an analytical tool and processing techniques.

Newer Techniques in Food Processing: Application of technologies of high intensity light, pulse electric field, ohmic heating, smart packaging, fortification.

Nanotechnology: Principles, mechanism and applications in foods.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text: Reference

- Sivasankar, B. 2011. Food processing and preservation, Eastern Economy Edition, BHI Publishers, New Delhi.
- Shafiur Rahman, M. 2007. Handbook of Food Preservation, Second Edition. CRC Press, *Muscat, Sultanate of Oman*.
- Bhattacharya, S. 2015. Conventional and advanced food processing technologies. Chichester: Wiley-Blackwell.
- Fellows, P. 2016. Food processing technology. Kent: Woodhead Publishing/Elsevier Science.

Advance Food Chemistry (LAB)

Course Code: MTF122

Course Credits: 1

Credit Hours: L: 0 T: 0 P: 2

Course Objectives:

The objective of this course is to provide the practical exposure to the various chemical analysis methods to know the properties of food. Experiments are designed in such a way that students will carry out the sample extraction and then use the instruments for further analysis of particular analyte.

List of Practical's:

1. Preparation and standardization of solution
2. Isolation and purification of enzyme,
3. Determination of activity of enzyme,
4. Preparation, specificity, inhibition and kinetics of enzymatic reaction.
5. Detection and estimation of amino acid by paper and colum chromatography.
6. Determination of Vitamin C in food samples
7. Estimation of b-carotene in food sample
8. Estimation of sugars in food samples
9. Formal titration of Folin-ciocalteries method

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

INSTRUMENTAL METHODS OF FOOD ANALYSIS (LAB)

Course Code: MTF123

Course Credits: 1

Credit Hours: L: 0 T: 0 P: 2

Course Objectives:

The objective of this course is to provide the practical exposure to the students for handling various analytical instruments. Experiments are designed in such a way that students will carry out the sample extraction and then use the instruments for further analysis of particular analyte.

List of Practical's:

1. Determination of protein in given food sample using UV-Vis spectrophotometer.
2. Detection of food adulteration in food sample using nanotechnology based colorimetric methods.
3. Detection of glucose in given food sample using lateral flow based strips.
4. Estimation of water activity in food sample using water activity meter.
5. Determination of viscosity using viscometer.
6. To determine the color using lovibond tintometer.
7. Demonstration of HPLC and GLC.
8. Demonstration of Flame photometer.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

Required Books and Materials:

Text Book:

- Suzanne Nielson S (2003) Food analysis, Kluwer Academic Press, New York.
- Winton AL (1999) Techniques of food analysis, Allied Science, Official methods of analysis, Association of official analytical chemist USA.

References:

- Song, DWS (1996) Mechanism and theory in food chemistry Champasian and Hall Inc. New York.

COLD CHAIN MANAGEMENT

Course Code: MTF130

Course Credits: 3

Credit Hours: L: 3 T: 0 P: 0

Course Objectives:

This course will review major aspects of cold chain management and frozen foods. The area of cold chain is growing worldwide and has emerged as a major trend in the food industry. This course is concentrated in the fundamentals facility storage and application technology for cold chain management. The course gives the knowledge of facilities for the cold chains. It enables the students to understand quality and safety aspects of frozen foods. The course gives the knowledge about various packaging material for frozen foods and packaging machinery.

Course Content:

Module I: Introduction to Frozen Food

Introduction to technology of cold chain management, Market demand, current status and future scope of frozen foods.

Module: II Fundamentals of Freezing

Glass transitions in frozen foods and biomaterials, Microbiology of frozen foods, Thermo physical properties of frozen foods, Freezing loads and Freezing time calculation, Innovations in freezing process

Module III: Facilities for the Cold Chain

Freezing methods and equipment, Cold store design and maintenance, Transportation of frozen foods, Retail display equipment and management, Household refrigerators and freezers, Monitoring and control of the cold chain.

Module IV: Quality and Safety during cold chain

Quality and safety of frozen meat and meat product, Quality and safety of frozen poultry and poultry products, Safety and quality of frozen fish, shellfish, and related products, Quality and safety of frozen vegetables and fruits, Quality and safety of frozen dairy products, Quality and safety of frozen ready meads, Quality and safety of frozen bakery products, Quality and safety of frozen eggs and egg products

Module V: Packaging of Frozen Foods

Introduction to frozen food packaging, Plastic packaging of frozen foods, Paper and card packaging of frozen foods, Packaging of frozen foods with other materials, Packaging machinery

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Required Books and Materials:

Text book:

- Quality of Frozen Foods, Erickson, M.C and Hung, Y.C International Thompson Publishing, Newyork
- Handbook of Frozen Foods, Isabel Guerrero Legaretta

Reference book:

1. Handbook of Frozen Food Processing and Packaging, Second Edition, Da-Wen Sun, CRC press
2. Managing Frozen foods, Kennedy Chris J CBS, New Delhi

INDUSTRIAL SAFETY AND HAZARDS

Course Code: MTB132

Credit Unit:03

Theory

Course Objective:

Course addresses management and engineering design concepts required for process safety in chemical and biotechnology systems, with pharmaceutical manufacturing applications. Content focuses on sound engineering principles and practices as they apply to industrial situations, project design, risk mitigation, process and equipment integrity, and engineering codes and standards.

Course Contents:

Module I: Hazards

Chemical hazards classification. Radiation hazards and control of exposure to radiation. Types of fire and fire prevention methods. Mechanical hazards. Electrical hazards

Module II: Psychology and Hygiene

Industrial psychology Industrial hygiene. Safety in plant site selection and plant layout. Industrial lighting and ventilation. Industrial noise.

Module III: Occupational diseases and control

Occupational diseases and prevention methods. Safe housekeeping, Instrumentation for safe operation. Personal protective equipments. Safety in chemical operations and processes.

Module IV: Management

Safety organization – safety committee – safety education and training. Management process. Philosophy and need for Industrial safety. Role of Government in Industrial safety.

Module V: Laws

Factory Act. ESI Act, Environmental Act. Workment - comperation Act. Advantages of adopting safety laws.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Guide for Safety in the Chemical laboratory second edition, Manufacturing Chemists Allocation. Van vostrand Reinhold Company, New York.
- Anonymous (1972). Guide for Safety in the Chemical Laboratory , 2nd Ed., Van Nostrand Reinhold Co., Litton Educational Publishing, Inc., New York
- Fawcett, H.H. & Wood, W.S. (1982). Safety and Accident Prevention in Chemical Operation, 2nd Ed. John Wiley and sons, New York.

References:

- Industrial Safety and Laws by Indian School of Labour Education, Madras.