

# **FACULTY OF Food Science & Technology**

## **SYLLABUS FOR THE BATCH FROM THE YEAR 2022 TO YEAR 2024**

**Programme Code: MSFT**

**Programme Name: M.Sc. Food Technology  
(Semester I- IV)**

**Examinations: 2022-2024**



**Department of Food Science & Technology**

**Khalsa College, Amritsar**

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**(b) Subject to change in the syllabi at any time.**  
**(c) Please visit the College website time to time.**

<b>S.No.</b>	<b>PROGRAMME OBJECTIVES</b>
<b>1.</b>	To prepare students for evaluating thinking and analytical skills to broaden their knowledge of food and its preservation.
<b>2.</b>	Students will be able to recognize the main world problems and their root causes and to develop an ability to resolve these problems
<b>3.</b>	To develop ability to extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools to investigate the complex problem.
<b>4.</b>	To prepare students for understand the societal needs related to nutritional and hygienic foods and to apply reasoning to solve social health, safety, culture and legal issue.
<b>5.</b>	To provide skills of food manufacturing and processing. The knowledge of various processes of food makes this as an ideal choice for a successful career.

<b>S.No.</b>	<b>PROGRAMME SPECIFIC OUTCOMES (PSOS)</b>
PSO-1	To disseminate knowledge of food technology and allied discipline among students which enable them to understand the emerging techniques and advanced methods of food processing and preservation.
PSO-2	To make students understand, evaluate and develop food products, their handling, processing and packaging.
PSO-3	Identification and analysis to solve problems for the development of products, processes, techniques to meet the demands of the society.
PSO-4	To enhance the ability of students in food processing industries to design and process food products as per the needs and specifications or can also emerge as an entrepreneur.
PSO-5	To make them aware of various challenges involved in food processing and their possible solution with best of knowledge attained

COURSE SCHEME							
SEMESTER - I							
Course Code	Course Name	Hours/Week	Max. Marks				Page No.
			Th	Pr	IA	Total	
MSFT51-101	Principles of Food Processing & Preservation	6	50	25	25	100	05
MSFT51-102	Food Microbiology	6	50	25	25	100	07
MSFT51-103	Dairy Technology-I ( Fluid Milk Processing )	6	50	25	25	100	09
MSFT51-104	Technology of Cereal Processing	6	50	25	25	100	11
MSFT51-105	Technology of Fruits & Vegetable Processing	6	50	25	25	100	13

SEMESTER - II							
Course Code	Course Name	Hours/Week	Max. Marks				Page No.
			Th	Pr	IA	Total	
MSFT52-201	Food Chemistry	6	50	25	25	100	15
MSFT52-202	Diary Technology-II (Milk Products Processing)	6	50	25	25	100	17
MSFT52-203	Technology of Legumes & Oilseeds Processing	6	50	25	25	100	19
MSFT52-204	Technology of Egg & Poultry Processing	6	50	25	25	100	21
MSFT52-205	Food Engineering-I	6	50	25	25	100	23
MSFT52-206	In Plant Training	-	-	-	-	-	25

**MSFT52-206 In-plant Training of 4 weeks duration in Food Processing Industry after the completion of 2<sup>nd</sup> Semester. Satisfactory/Non-Satisfactory**

SEMESTER - III							
Course Code	Course Name	Hours/Week	Max. Marks				Page No.
			Th	Pr	IA	Total	
MSFT61-301	Food Packaging	6	50	25	25	100	26
MSFT61-302	Food Engineering-II	6	50	25	25	100	28
MSFT61-303	Technology of Fish & Meat Processing	6	50	25	25	100	30
MSFT61-304	Applied Research Methodology	6	50	25	25	100	32
MSFT61-305	Master's Seminar	3	-	100	-	100	34

SEMESTER - IV							
Course Code	Course Name	Hours/Week	Max. Marks				Page No.
			Th	Pr	IA	Total	
MSFT62-401	Food Quality Assurance & Management	6	50	25	25	100	36
MSFT62-402	Industrial Microbiology and Fermented Foods	6	50	25	25	100	38
MSFT62-403	Advances in Food Nutrition	6	50	25	25	100	40
MSFT62-404	Application of Enzymes in Food Industry	6	50	25	25	100	42
MSFT62-405	M.Sc. Dissertation	3	-	100	-	100	43

**M. Sc. FOOD TECHNOLOGY - SEMESTER –I**  
**COURSE CODE: MSFT51-101**  
**COURSE TITLE: PRINCIPLES OF FOOD PROCESSING & PRESERVATION**

**CREDIT HOURS (per week): 06**

**(T=3, P=3 TOTAL=6)**

**TOTAL HOURS: 90**

**Time: 3 Hours**

**Max. Marks: 100**

**Theory Marks: 50**

**Practical Marks: 25**

**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory:** – Question paper will contain eight questions in all and students will be asked to attempt five

questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

**Practical** – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

**COURSE OBJECTIVES:**

Students shall learn principles of different techniques used in processing and preservation of foods, identification and selection of preservation methods appropriate for specific foods, recent food preservation methods.

**COURSE CONTENTS:**

**Theory:**

**UNIT-I**

Principles of Preservation methods, Microbial, Physical, and chemical preservation of foods.

Food preservation by low-temp: Refrigeration, changes in food during refrigeration storage; freezing, types of freezer, freezing process, thawing, changes in Food during freezing; and freeze-drying.

**UNIT-II**

Preservation and processing methods by high temp: Blanching, canning, pasteurization, sterilization, extrusion cooking; Drying, Types of dryers, Dehydration effect in foods. Non-thermal preservation: Microwave processing, ionizing irradiation, membrane technology, Aseptic processing,

Intermediate Moisture Foods: Principles, Characteristics, Advantages, and Problems in developing new IM foods.

**UNIT-III**

Recent methods in food preservation: Pulse electric field technology, Infrared, High Pressure, Ohmic heating, Hurdle technology.

**Practicals:**

1. Determination of thermal inactivation time of enzymes.
2. Adequacy of blanching
3. Dehydration of foods.
4. Preservation of food products by low temperature.
5. Preservation of food products by concentration method.
6. Use of chemicals in preservation of foods.
7. Cut out examination of canned foods.
8. Visit to a food processing plant.

**BOOKS PRESCRIBED:**

- Arsdel W.B., Copley, M.J. and Morgen, A.I. 1973. Food Dehydration, 2nd Edn. (2 vol.Set). AVI, Westport.
- Bender, A.E. 1978. Food Processing and Nutrition. Academic Press, London.
- Fellows, P. and Ellis H. 1990. Food Processing Technology: Principles and Practice, NY.
- Potter, N.N. 1978. Food Science. 3rd Ed. AVI, Westport.

**COURSE OUTCOMES:**

On completing the course, the students will be able to:

CO1: Understand principles of different techniques used in processing and preservation of foods.

CO2: Identify and select preservation methods appropriate for specific foods.

CO3: Learn the effects of preservation methods on the quality of food.

CO4: Learn about the recent food preservation methods.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –I**  
**COURSE CODE: MSFT51-102**  
**COURSE TITLE: FOOD MICROBIOLOGY**

**CREDIT HOURS (per week): 06**  
**(T=3, P=3 TOTAL=6)**  
**TOTAL HOURS: 90**  
**Time: 3 Hours**

**Max. Marks: 100**  
**Theory Marks: 50**  
**Practical Marks: 25**  
**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory: – Question paper will contain eight questions in all and students will be asked to attempt five**

**questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.**

**Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.**

**COURSE OBJECTIVES:**

Student will be able to understand the importance of microorganisms in food., role and significance of intrinsic and extrinsic factors microbial growth in foods, spoilage of food by microbes and their prevention, ability to identify the characteristics of important pathogens and spoilage microorganisms in foods.

**COURSE CONTENTS:**

**Theory:**

**UNIT-I**

Introduction, Bacteria, yeasts and molds important in foods, food viruses, extrinsic and intrinsic factors affecting growth of microorganisms in foods

Growth and Destruction of Microorganisms: Physical and chemical factors affecting the destruction of microorganisms, TDT, Z, F, D values.

**UNIT-II**

*Microorganism in Natural Products and Their Control:* Microbiology of milk and milk products, cereals and cereal products; meat and meat products, fruits and vegetables, fish or fish products: poultry and eggs; sugars and syrups, spices and salt, canned foods.

**UNIT-III**

Food infections, food intoxications, mycotoxins, non-bacterial food poisoning.

Food plant sanitation. Methods of detection of microorganisms in foods. Concept of HACCP

**Practicals:**

1. To study the spoilage of microorganisms present in spoiled Bread, Dry Milk, Raw Milk, Condensed Milk, Jam, Butter etc.
2. The enumeration and identification of micro flora involved in spoilage through SPC and microscopic method.
3. To study microbiological quality of raw milk, pasteurized milk and dry milk.
4. To compare the percentage acidity of milk and curd.
5. To check the quality of pasteurization by phosphate test.
6. To determine to ascorbic acid content of given food material by 2, 6-dichlorophenol indophenol method.

**BOOKS PRESCRIBED:**

- Banwart, G.J. 1989, Basic Good Microbiology. 2<sup>nd</sup> Edition. Van Nostrand Reinhold.
- Frazier, W.C. and Westener, D.C., 1988. Food Microbiology. 4th edition. McGraw Hill Inc., New York.
- Jay, J.M., 1986. Modern Food Microbiology 3rd Edition, Van Nostrand Reinhold.

**COURSE OUTCOMES:** On completing the course, the students will be able to:

CO1: Get knowledge on importance of microbes of different categories and factors affecting microbial growth in food.

CO2: Recognize important microorganisms affecting food quality and safety.

CO3: Identify methods of microorganism control to preserve food and make food consumption safe.

CO4: Get knowledge on food plant sanitation.



**M. Sc. FOOD TECHNOLOGY - SEMESTER –I**  
**COURSE CODE: MSFT51-103**  
**COURSE TITLE: DAIRY TECHNOLOGY-I (Fluid Milk Processing)**

**CREDIT HOURS (per week): 06**  
**(T=3, P=3 TOTAL=6)**  
**TOTAL HOURS: 90**  
**Time: 3 Hours**

**Max. Marks: 100**  
**Theory Marks: 50**  
**Practical Marks: 25**  
**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory:** – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

**Practical** – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

**COURSE OBJECTIVES:**

Students will acquire knowledge about composition, processing and preservation of milk, Organization and operations involved in milk processing unit., Legislation for the quality control of milk, Adulteration of milk and its detection.

**COURSE CONTENTS:**

**Theory:**

**UNIT-I**

**Milk:** Present status of milk production and availability in India and Abroad, sources of milk, Definition, Composition of milk of various species, important characteristics of major constituents of milk viz. milk fat, milk proteins, lactose and minerals. Minor constituents of milk. Factors affecting the quality and quantity of milk produced by milk animals. Physical, chemical and Nutritive properties of milk.

**Market Milk :** Brief introduction to Standard milk, Toned milk, Double toned milk, Flavoured milk, Vitamin enriched milk, Reconstituted milk and recombined milk. Legal and ISI standards of milk. Adulterations of milk and its detection. Common preservatives used in milk and their detection. Collection, transportation and distribution of milk. Clean milk production.

**UNIT-II**

**Milk Processing :** Processes of straining, Filtration and clarification.

**Standardization :** Definition of standardization, purpose and uses of standardization process. Use of Pearson's square method to solve the standardization problems in dairy industry.

**Homogenization :** Definition, Effect of homogenization on milk. Uses of homogenization. Checking the effectiveness of homogenization.

**UNIT-III**

**Pasteurization :** Definition, purposes and objects of pasteurization—LTLT and HTST processes of pasteurization.

**Sterilization:** Definition, Method for manufacturing of sterilized flavoured milk. UHT process.

**Practicals:**

1. Sampling equipment and sampling of milk. Different types of milk samples.
2. Platform tests (Acidity, COB and Alcohol test).
3. Organoleptic Tests: (Physical examination of milk).
4. Determination of milk fat percentage by Gerber's method.
5. Determination of specific gravity by lactometer.
6. Determination of SNF percentage and TS percentage of milk with lactometer.
7. Detection of common adulterants and preservatives of milk.
8. Reporting on the suitability of milk for heat processing.
9. Reporting on the quality of given sample of milk.

10. Visit to milk processing plants.
11. Visit to N.D.R.I Karnal.

**BOOKS PRESCRIBED:**

- Outlines of Dairy Technology by Sukumar De, 1980, Oxford University Press, New Delhi.
- Milk & Milk Products by Eckles, CH, Combs WB, Macy H, 1997, McGraw Hill Book, New Delhi
- Principles of Dairy Processing by Warner JN, 1976, Wiley Science Publishers USA.

**COURSE OUTCOMES:**

On completing the course, the students will be able to:

CO1: Know about composition of milk and important characteristics of milk constituents.

CO2: Study about legislation for the quality control of milk.

CO3: Learn about the adulterations of milk and its detection.

CO4: Learning the processing of milk and working of a few dairy equipment.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –I**  
**COURSE CODE: MSFT51-104**  
**COURSE TITLE: TECHNOLOGY OF CEREAL PROCESSING**

**CREDIT HOURS (per week): 06**  
**(T=3, P=3 TOTAL=6)**  
**TOTAL HOURS: 90**  
**Time: 3 Hours**

**Max. Marks: 100**  
**Theory Marks: 50**  
**Practical Marks: 25**  
**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.**

**Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.**

**COURSE OBJECTIVES:**

Students will acquire the knowledge about composition and milling of various cereal grains, different equipments involved, role of ingredient in baking of different products, manufacture of different cereal products.

**COURSE CONTENTS:**

**Theory:**

**UNIT-I**

General introduction to cereals, Structure and nutrient distribution in cereals.

Wheat: Wheat types, cleaning, conditioning and milling of wheat. Wheat flour quality tests, Physical tests of dough. Flour fortification and treatments. Role of different ingredients in baking. Technology of baking bread and biscuits. Straight-Dough method and Sponge-Dough method.

**UNIT-II**

Rice: Structure and composition of rice; Rice milling. Parboiling of rice, advantages and disadvantages of parboiling, Rice bran processing into oil. Rice products- puffed rice and rice flakes.

**UNIT-III**

Corn: Structure and composition of corn. Wet milling and dry milling of corn, corn sweeteners and syrups. Corn flakes.

Oats: Milling of Oats, Preparation of porridge, Ready-cooked porridge .

**Practicals:**

1. Milling of wheat, Physico–chemical testing of wheat and rice.
2. Parboiling and evaluation of quality of parboiled rice.
3. Evaluation of cooking quality of rice.
4. Determination of gluten
5. Preparation of chapattis
6. Determination of crude fiber, ash, protein and fat
7. Determination of FFA of wheat flour
8. Baking of bread, cookies and cakes.
9. Visit to wheat and rice processing plants.

**PRESCRIBED BOOKS:**

1. Wheat Chemistry and Technology by K. Khan & P.R. Shewry, 4<sup>th</sup> Ed. 2009, AACC International, St. Paul, Minn.
2. Kent's Technology of Cereals by K.A. Rosentrater and A.D. Evers, 5<sup>th</sup> Ed., 2018, Woodhead Publishing Ltd., UK.
3. Principle of Cereal Science & Technology by J.A. Delcour and R.C. Hosney, 3<sup>rd</sup> Edition., 2010, AACC International, St. Paul, Minn.

4. Corn Chemistry and Technology by S.O. Serna-Saldivar, 2019, AACC International, St. Paul, Minn.

**COURSE OUTCOMES:**

On completing the course, the students will be able to:

CO1: Understand composition and structure of different cereals.

CO2: Know about technology for cereal Milling & their Products along with equipments.

CO3: Evaluate quality of wheat.

CO4: Become aware of the role of different Bakery ingredients.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –I**  
**COURSE CODE: MSFT51-105**  
**COURSE TITLE: TECHNOLOGY OF FRUITS & VEGETABLE PROCESSING**

**CREDIT HOURS (per week): 06**  
**(T=3, P=3 TOTAL=6)**  
**TOTAL HOURS: 90**  
**Time: 3 Hours**

**Max. Marks: 100**  
**Theory Marks: 50**  
**Practical Marks: 25**  
**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.**

**Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.**

**COURSE OBJECTIVES:**

The students shall be able to understand various Post-harvest physiological and biochemical changes occurs in fruits and vegetables, Desirable characteristics of fruits & vegetables for processing., different technologies involved in Processing, Preservation & Value- Addition of Fruits & Vegetables.

**COURSE CONTENTS:**

**Theory**

**UNIT-I**

Post-harvest physiological and biochemical changes in fruits and vegetables; ripening of climacteric and non-climacteric fruits.

Principles and methods of fruits and vegetables preservation, Desirable characteristics of fruits & vegetables for processing. Preparing fruits & vegetables for processing, washing, sorting, grading, peeling, blanching, cutting, de-stoning and pitting. Canning & Bottling of fruits & vegetables products.

**UNIT-II**

Definition, Formulation, Preparation & FPO standards of Fruit juices , Method of juice extraction, Equipment, preservation and clarification. Squashes & Cordials, Fruit syrups, Nectar. Fruit juice concentrates. Jams, jellies & Marmalades. Fermented and non-fermented pickles, Tomato Juice, Tomato Puree, Paste, Chutney, Sauce, Soup & Ketchup. Preserves and candied products.

**UNIT-III**

Freezing: General Methods of Freezing of Fruits & Vegetables: their Packaging & Storage. Dehydration of Fruits & Vegetables.

**Practicals:**

1. Preparation of fruit and vegetable juices.
2. Concentration of fruit and vegetable juices
3. Preparation of squashes, RTS
4. Preparation of Jams, Jellies, Marmalades.
5. Preserve & Candied Fruit
6. Preparation of potato chips.
7. Preparation of pickles
8. Preparation of tomato puree, paste & ketchup.
9. Dehydration and sun drying of fruits & vegetables.
10. Visit to canning industry

**M. Sc. FOOD TECHNOLOGY - SEMESTER –I**  
**COURSE CODE: MSFT51-105**  
**COURSE TITLE: TECHNOLOGY OF FRUITS & VEGETABLE PROCESSING**

**PRESCRIBED BOOKS:**

- Preservation of Fruits and Vegetables–GirdhariLal, Siddhapa and Tondon, ICAR,New Delhi.
- Hand Book of Analysis and Quality Control of Fruits & Vegetable Products–S. RangannaTata McGraw Hill, New Delhi.
- Commercial Vegetable Processing–Wood Roof &Lue.

**COURSE OUTCOMES:**

On completing the course, the students will be able to:

CO1: Understand basic processes and changes in fruits and vegetables.

CO2: Know about different techniques used in processing and preservation of fruits and vegetables.

CO3: Become aware of different technologies and methods to reduce their post-harvest losses in fresh produce.

CO4: Get knowledge on making commercial products like Jams, Jellies, Marmalade etc.

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**M. Sc. FOOD TECHNOLOGY - SEMESTER –II**  
**COURSE CODE: MSFT52-201**  
**COURSE TITLE: FOOD CHEMISTRY**

**CREDIT HOURS (per week): 06**  
**(T=3, P=3 TOTAL=6)**  
**TOTAL HOURS: 90**  
**Time: 3 Hours**

**Max. Marks: 100**  
**Theory Marks: 50**  
**Practical Marks: 25**  
**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory: – Question paper will contain eight questions in all and students will be asked to attempt five**

**questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.**

**Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.**

**COURSE OBJECTIVES:**

- Students shall be aware of the underlying chemistry, properties and effects of processing on food components.
- Understanding of food components reactions and their impact on sensory, nutritional, and functional properties of foods.
- Ability to identify the structure of food constituents and relate the structure to the constituents function and importance in foods with respect to food quality, nutrition, safety, processing, etc.
- Ability to explain influence of factors such as temperature, pH, ionic characteristic and strength, bonding, etc. on chemical changes in food systems and judge how to adjust these conditions to improve or minimize chemical and biochemical deterioration of food systems.

**COURSE CONTENTS:**

**Theory:**

**UNIT-I**

Definition and importance; major food constituents and their physico-chemical properties; role of water in food. Water activity Carbohydrates- chemical reactions, functional properties of sugars and polysaccharides in foods. Important carbohydrates and their applications in foods.

**UNIT-II**

Protein and amino acids: structure, classifications, sources, denaturation and functional properties of proteins.

Lipids: classification, and use of lipids in foods, physical and chemical properties, effects of processing on functional properties. Oxidative and hydrolytic rancidity, reversion, Tests to check purity of fats and oils.

**UNIT-III**

Vitamins and Minerals: Different types and their effect of processing on vitamins and minerals. Deficiency diseases.

**Practicals:**

1. Preparation and standardization of solution.
2. Moisture content by Drying method and Moisture meters
3. Total ash, acid soluble and insoluble ash.
4. Protein content by Biuret method/ Lowry's method and Kjeldhal method
5. Estimation of reducing & non-reducing sugars, total sugars.
6. Lipid estimation by Soxhlet method, Peroxide value and Free fatty acid.

**PRESCRIBED BOOKS:**

- Birch, G.G., Cameron, A.G. and Spencer, M. 1986. Food Science, 3rd Ed. Pergamon Press, New York.
- Fennema, O.R. Ed. 1976. Principles of Food Science: Part-I Food Chemistry. Marcel Dekker, New York.
- Meyer, L.H. 1973. Food Chemistry. East-West Press Pvt. Ltd., New Delhi.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –II**  
**COURSE CODE: MSFT52-201**  
**COURSE TITLE: FOOD CHEMISTRY**

**COURSE OUTCOMES:** On completing the course, the students will be able to:

CO1: Know about the chemistry of foods, role of each component and their interaction.

CO2: Understand the functional aspects of food components and their role in food processing.

CO3: Knowledge about various reactions involved in food

CO4: Evaluate quality of fats and oils.



**M. Sc. FOOD TECHNOLOGY - SEMESTER –II**  
**COURSE CODE: MSFT52-202**  
**COURSE TITLE: DAIRY TECHNOLOGY-II (Milk Products Processing)**

**CREDIT HOURS (per week): 06**  
**(T=3, P=3 TOTAL=6)**  
**TOTAL HOURS: 90**  
**Time: 3 Hours**

**Max. Marks: 100**  
**Theory Marks: 50**  
**Practical Marks: 25**  
**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory: – Question paper will contain eight questions in all and students will be asked to attempt five**

**questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.**

**Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.**

**COURSE OBJECTIVES:**

Student will be able to understand the composition of various milk products, manufacturing methods for the production of various dairy products, various defects in milk products and their possible cause and remedies, different legislation for the quality control of milk products.

**COURSE CONTENTS:**

**Theory:**

**UNIT-I**

**Cream:** Different types of cream, composition, production methods. Factors affecting the richness of cream produced by cream separator. Care of cream separator. Selection of site for setting up creamery. Neutralization and ripening of cream.

**Butter:** Types of butter, composition. Preparation of butter. Defects of butter—their possible causes and remedies. Factors affecting the churnability of cream. Churning theories.

**Cheese:** Classification of cheese. Preparation methods of cheddar cheese. Quality of milk for cheesemaking.

**UNIT-II**

**Condensed and evaporated milk:** Definition, composition & standards. Condensing operations.

**Dried milk products:** Introduction, objects of production, standards and composition. Preparation of dried milk and milk powder by roller and spray drying methods. Packaging and storage. Malted milk powders and infant milk food.

**Ice Cream:** Different types of ice creams and their composition. Ingredients used and their role in processing. Manufacturing process. Defects in ice-cream, their possible causes and remedies.

**UNIT-III**

**Ghee :** Preparation of ghee from cream and from butter, advantages and disadvantages of both methods. Pre-stratification method of ghee preparation. Legal standards, Granularity in ghee.

**Khoa:** Manufacturing of khoa, Physico-chemical changes in milk on its conversion into khoa, shelf life and average composition of khoa.

**Paneer and Channa:** Manufacturing method of paneer, Legal standards and shelf life of paneer. Preparation of channa and its difference from that of paneer.

**Miscellaneous dairy products :** Brief introduction to Kulfi, Srikhand, Lassi and Rabri. BIS and legal standards of milk and milk products.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –II**  
**COURSE CODE: MSFT52-202**  
**COURSE TITLE: DAIRY TECHNOLOGY-II (Milk Products Processing)**

**Practicals:**

1. Preparation of flavoured milk.
2. Cream separation, neutralization and ripening.
3. Preparation of Butter.
4. Preparation of Khoa.
5. Preparation of Paneer and Channa.
6. Preparation of common varieties of ice-cream.
7. Quality evaluation of milk and milk products.
8. Visit to different milk plants to learn about milk condensing and drying operations.
9. Visit N.D.R.I., Karnal.

**PRESCRIBED BOOKS:**

- Outlines of Dairy Technology by Sukumar De, 1980, Oxford University Press, UK
- Milk & Milk Products by EcklesCombs, Henery C, and Willes C, 1997, Tata McGraw Hill Publishers, USA.
- Principles of Dairy Processing by Warner JN, 1976, Wiley Science Publishers, USA.  
Technology of Indian Milk Products by Anya RP, Mathur BN, Chandan RC and Banerjee AK, 2002.. Dairy India Publ.

**COURSE OUTCOMES:**

- CO1: Have knowledge about classification and composition of various milk products.  
CO2: Know about commercial making of various milk products and quality control involved.  
CO3: Identify defects of butter and ice-cream and their possible causes and remedies.  
CO4: Know about Miscellaneous dairy products.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –II**  
**COURSE CODE: MSFT52-203**

**COURSE TITLE: TECHNOLOGY OF LEGUMES AND OILSEEDS PROCESSING**

**CREDIT HOURS (per week): 06**  
**(T=3, P=3 TOTAL=6)**  
**TOTAL HOURS: 90**  
**Time: 3 Hours**

**Max. Marks: 100**  
**Theory Marks: 50**  
**Practical Marks: 25**  
**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory: – Question paper will contain eight questions in all and students will be asked to attempt five**

**questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.**

**Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.**

**COURSE OBJECTIVES:**

Student will be able to understand the structure, composition and processing of pulses and oilseeds, technology involved in Oil Extraction & Oil Seed Processing along with equipments, nutritional importance of oils and fats, Quality assessment test for fats and oils.

**COURSE CONTENTS:**

**THEORY:**

**UNIT-I**

Structure and composition of legumes. Dal milling and processing of pulses, cooking methods, utilization of legumes, anti-nutritional factors in legumes and methods of removal.

Soybean Processing, Soy products- Technology of soymilk, tofu, soy protein concentrate and isolates.

**UNIT-II**

Oilseeds– composition, oil extraction with expellers, solvent extraction processes, purification of crude oil and hydrogenation, interesterification and refining processes for oil.

**UNIT-III**

Nutritional importance of oils and fats. Quality assessment tests for fats and oils. Manufacture of margarine & mayonnaise.

**Practicals:**

1. Preparation of soya milk/tofu.
2. Experimental expeller processing and solvent extraction of oil seeds.
3. Quality evaluation of oil extracted from oilseeds.
4. Experimental Milling of Legumes.
5. Separation and evaluation of starch and protein from different legumes.
6. Cooking quality, textural evaluation and physico–chemical testing of legumes.
7. Preparation of edible flours, protein concentrates and isolates.
8. Determination of trypsin inhibitors.
9. Visit to Legume & Oil seeds processing plants.

**PRESCRIBED BOOKS:**

- Chakrabarty MM. 2003. *Chemistry and Technology of Oils and Fats*.
- Prentice Hall Hamilton RJ & Bhati A. 1980. *Fats and Oils - Chemistry and Technology*. App. Sci. Publ.
- Kay DE. 1979. *Food Legumes*. Tropical Products Institute.
- Mathews RH. 1989. *Legumes Chemistry, Technology and Human Nutrition*. Marcel Dekker.
- Salunkhe DK. 1992. *World Oilseeds: Chemistry, Technology and Utilization*. VNR.
- Swern D. 1964. *Bailey's Industrial Oil and Fat Products*. Inter Sci. Publ.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –II**  
**COURSE CODE: MSFT52-203**  
**COURSE TITLE: TECHNOLOGY OF LEGUMES AND OILSEEDS PROCESSING**

**COIURSE OUTCOMES:** On completing the course, the students will be able to:  
CO1: Understand the structure, composition, quality evaluation of various legumes and oilseeds.  
CO2: Know the processing of pulses and oilseeds.  
CO3: Become aware of the importance & processing of high protein products.  
CO4: Assess the quality of fats and oils.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –II**  
**COURSE CODE: MSFT52-204**  
**COURSE TITLE: TECHNOLOGY OF EGG & POULTRY PROCESSING**

**CREDIT HOURS (per week): 06**  
**(T=3, P=3 TOTAL=6)**  
**TOTAL HOURS: 90**  
**Time: 3 Hours**

**Max. Marks: 100**  
**Theory Marks: 50**  
**Practical Marks: 25**  
**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory: – Question paper will contain eight questions in all and students will be asked to attempt five**

**questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.**

**Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.**

**COURSE OBJECTIVES:**

Students will understand the structure of egg, composition and nutritional quality of egg and poultry, the concept and methods of processing and preservation of egg and poultry, manufacturing practices of egg and poultry meat based products and their processing techniques.

**COURSE CONTENTS:**

**Theory:**

**UNIT-I**

Eggs: Structure and composition of eggs. Functional properties of eggs. Nutritive value of eggs. Interior qualities - Evaluation, quality troubleshooters in eggs, Egg grading. Spoilage of eggs. Preservation of eggs. Handling, packaging, storage and transportation of eggs. Freezing of eggs. Dehydration of eggs - Egg powders, egg foams, factors influencing foaming.

**UNIT-II**

Poultry: Types, factors affecting quality, chemical composition and nutritive value of poultry meat. Slaughtering and dressing of poultry. Rigor mortis and Meat tenderization.

**UNIT-III**

Grading and packaging of poultry meat, storage, transportation of poultry meat. Preservation of poultry meat by different methods. Refrigeration of poultry meat, Waste Utilization of poultry industry by-products. Layout and design of poultry processing Industry.

**Practicals:**

1. Determination of Egg components.
2. Determination of proximate composition of eggs.
3. Grading and quality evaluation of eggs.
4. Effect of high temperature on coagulation time of egg contents.
5. Preservation of eggs.
6. Determination of egg density.
7. Preparation of egg products, boiled, fried, poached, scrambled, omelette.
8. Slaughtering and dressing of poultry.
9. To make retail cuts of dressed chicken and calculating % yields.
10. Preparation of chicken pickle
11. Preparation of chicken patties.
12. Visit to poultry processing industry

**BOOKS PRESCRIBED:**

- Egg Science & Technology by Staddelman
- Poultry Products Technology by G.J. Mountney

**M. Sc. FOOD TECHNOLOGY - SEMESTER –II**  
**COURSE CODE: MSFT52-204**  
**COURSE TITLE: TECHNOLOGY OF EGG & POULTRY PROCESSING**

**COURSE OUTCOMES:** On completing the course, the students will be able to:  
CO1: Know about egg structure, composition, nutritive value of egg and poultry.  
CO2: Understand the egg preservation methods and assessment of egg quality.  
CO3: Become aware of slaughtering and dressing of poultry and their waste utilization.  
CO4: Make layout and design of poultry processing Industry.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –II**  
**COURSE CODE: MSFT52-205**  
**COURSE TITLE: FOOD ENGINEERING-I**

**CREDIT HOURS (per week): 06**  
**(T=3, P=3 TOTAL=6)**  
**TOTAL HOURS: 90**  
**Time: 3 Hours**

**Max. Marks: 100**  
**Theory Marks: 50**  
**Practical Marks: 25**  
**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.**

**Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.**

**COURSE OBJECTIVES:**

Students will understand

- Basics of Fundamentals of Food Processing Operations, principles of heat and mass transfer.
- Working of equipments in Food Industry related to transport of Fluids, Thermal Processing and Material Handling along with basics as applied to Food Processing Operations.
- Basics of Psychometrics & its applications.
- Mathematical Calculations related to above Engineering Applications.

**COURSE CONTENTS:**

**Theory**

**UNIT-I: Basics of Food Engineering**

- **Units and Dimensions:** Fundamental and derived units, system of measurement, brief introduction to dimensions, Application of mathematical techniques in process calculation.
- **Material and Energy Balance Calculations:** General principles, process calculations and application in food processing operations.
- **Material Handling Equipments:** Introduction, Types of conveyors, Working operation, principle, and application in food industry.

**UNIT-II: Fluid Flow and Pumps:**

- **Fluid Flow:** Properties and classification of fluid, Concept of viscosity and its measurement- Capillary tube and rotational viscometer, Newtonian and non Newtonian fluids, Reynold's number, equation of continuity, Bernoulli's theorem, Poiseuille's equation, flow measuring devices- Pitot tube, Venturimeter, orifice meter, Rheology of foods and application of rheological models.
- **Pumps:** Liquid Transport system, Selection criteria of pipes for processing plants, types of pumps.

**UNIT-III Principles of Heat and Mass Transfer**

- **Heat Transfer:** Steady and unsteady heat transfer. Conductive heat transfer- Fourier's law, thermal conductivity, conduction through rectangular slab, hollow cylinder, spherical shell, composite rectangular wall (series), and composite cylinder. Convective heat transfer- convective heat transfer coefficient, free and forced convection, overall heat transfer coefficient. Types of Heat exchangers.
- **Mass Transfer:** Basic concepts of analogy between heat, mass and momentum transfer, Fick's Law of diffusion, interphase mass transfer, Convective mass transfer coefficient, Basic mass transfer equations for molecular diffusion in solids, liquids and gases
- **Psychrometry:** Properties of dry air, water vapor and water vapor mixture, psychrometric chart and its application

**Practicals:**

1. Design calculations of of belt conveyor, bucket elevator and screw conveyor.
2. Calculation of Reynold's Number.
3. To calculate coefficient of discharge using venturimeter.
4. To calculate coefficient of discharge using orificemeter.
5. To check the performance of pump using given fluid.
6. Study of psychrometrics-use and application.
7. Determination of heat transfer coefficient in free and forced convection.
8. Study of boiling point elevation.
9. Determination of thermal conductivity of food materials.
- 10.

**Suggested Readings:**

- Earle RL. 1985. *Unit Operations in Food Processing*. Pergamon Press.
- McCabe WL & and Smith JC. 1971. *Fundamental of Food Engineering*. AVI Publ.
- Singh RP &Heldman DR. 2013. *Introduction to Food Engineering, 5<sup>th</sup> edition*.

**COURSE OUTCOMES:** On completing the course, the students will be able to:

CO1: Know the basics of Food Engineering.

CO2: Know how to design food plant and various systems involved.

CO3: Understand principles of fluid flow, heat and mass transfer, steam, psychrometrics etc.

CO4: Perform Mathematical Calculations involved in food processing operations.



**M. Sc. FOOD TECHNOLOGY - SEMESTER –II**  
**COURSE CODE: MSFT52-206**  
**COURSE TITLE: IN PLANT TRAINING**

**CREDIT HOURS (per week): 03**

**COURSE OBJECTIVES:**

Students will acquire

- Practical knowledge and skill.
- Understands the working of food industry.

**In-plant Training of 4 weeks duration in Food Processing Industry after the completion of 2<sup>nd</sup> Semester.**

**COURSE OUTCOMES:**

On completing the course, the students will be able to:

CO1: Get a learning platform where they can enhance their employ ability skills.

CO2: Enhance practical knowledge reagrding food technology.

CO3: Have self- confidence that helps them in understanding their job skill.

CO4: Become entrepreneurs and provide sill to others also.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –III**  
**COURSE CODE: MSFT61-301**  
**COURSE TITLE: FOOD PACKAGING TECHNOLOGY**

**CREDIT HOURS (per week): 06**  
**(T=3, P=3 TOTAL=6)**  
**TOTALHOURS:90**  
**Time: 3 Hours**

**Max. Marks: 100**  
**Theory Marks: 50**  
**Practical Marks:25**  
**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.**

**Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.**

**COURSE OBJECTIVES:**

Students shall gain knowledge on the different types of materials used for packaging foods, manufacturing processes for different packaging materials, quality testing techniques for different packaging materials, laws, regulation and the monitoring agencies involved in food safety.

**COURSE CONTENTS:**

**Theory**

**UNIT-I**

Definitions, objectives and functions of packaging and packaging materials. Packaging requirements and selection of packaging materials.

Types of packaging materials:

*Paper:* pulping, fibrillation and beating, types of papers and their testing methods.

*Glass:* composition, properties, types of closures, methods of bottle making.

*Metals:* Tinsplate containers, tinning process, components of tinsplate, tin free steel (TFS), types of cans, aluminum containers, lacquers.

*Plastics:* Types of plastic films, laminated plastic materials, co-extrusion, edible films, biodegradable plastics.

**UNIT-II**

Properties of materials such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength; tear strength, their methods of testing and evaluation.

Barrier properties of packaging materials: Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement.

**UNIT-III**

Food packaging systems: Different forms of packaging such as rigid, semi-rigid, flexible forms and different packaging system for (a) dehydrated foods (b) frozen foods (c) dairy products (d) fresh fruits and vegetables (e) meat, poultry and sea foods f) fats and oils

New trends in food packaging: Retortable pouch technology. Aseptic processing of food products.

Packaging machinery: form fill and seal, thermoform, shrink wrap. Package standards and regulations.

**Practicals:**

1. Identification and testing of packaging materials.
2. Determination of wax from wax paper.
3. Testing of lacquered tin plate sheets.
4. Measurement of tin coating weight by Clarke's method.
5. To conduct ferricyanide paper test for porosity.
6. Determination of equilibrium moisture content.
7. Determination of water vapour transmission rate of packaging material.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –III**  
**COURSE CODE: MSFT61-301**  
**COURSE TITLE: FOOD PACKAGING TECHNOLOGY**

8. Testing the compression strength of the boxes.
9. Packaging the food material in seal and shrink packaging machine and study its shelf life.
10. Testing the strength of glass containers by thermal shock test.
11. Testing the strength of filled pouches by drop tester.
12. Testing the compression strength of boxes.

**PRESCRIBED BOOKS:**

- Crosby NT.1981. *Food Packaging: Aspects of Analysis and Migration Contaminants*. App. Sci. Publ.
- Kadoya T. (Ed). 1990. *Food Packaging*. Academic Press.
- Mahadeviah M & Gowramma RV. 1996. *Food Packaging Materials*. Tata McGraw Hill.
- Palling SJ. (Ed). 1980. *Developments in Food Packaging*. App. Sci. Publ.
- Painy FA. 1992. *A Handbook of Food Packaging*. Blackie Academic.
- Sacharow S & Griffin RC. 1980. *Principles of Food Packaging*. AVI Publ.
- Stanley S & Roger CG.1970. *Food Packaging*. AVI Publ.

**COURSE OUTCOMES:**

On completing the course, the students will be able to:

- CO1: Get deep knowledge on different functions performed by packaging material.  
CO2: Understand properties of packaging materials, their methods of testing and evaluation.  
CO3: Get knowledge about packaging requirements for fresh and processed food.  
CO4: Get knowledge about food packaging laws and regulations.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –III**  
**COURSE CODE: MSFT61-302**  
**COURSE TITLE: FOOD ENGINEERING-II**

**CREDIT HOURS (per week): 06**  
**(T=3, P=3 TOTAL=6)**  
**TOTAL HOURS: 90**  
**Time: 3 Hours**

**Max. Marks: 100**  
**Theory Marks: 50**  
**Practical Marks: 25**  
**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.**

**Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.**

**COURSE OBJECTIVES:**

Students will be able to understand the basics of Fundamentals of Food Processing Operations, Working of equipments in Food Industry.

**COURSE CONTENTS**

**UNIT-I: Basic Units Operations**

- **Filtration:** Theory, constant rate and constant pressure filtration, Equipments
- **Centrifugation:** Theory, Settling equations in centrifuge, Equipments
- **Membrane Separation:** Theory, Performance equation, Types of membrane separation units
- **Size Reduction:** Definition and requirements of size reduction, forces used in size reduction, equipment for size reduction. Critical speed in a tumbling mill. Modes of operation, energy requirements calculation for comminuting of solids.

**UNIT-II: Food Engineering operations-I**

- **Evaporation:** Parts of evaporator, single effect and multiple effect evaporator, different types of evaporators, steam economy, design of evaporator, thermal and mechanical vapour recompression system.
- **Distillation:** Vapor liquid equilibrium relations, Distillation methods, McCabe Thiele method.
- **Refrigeration:** Components of refrigeration system, refrigeration cycle and calculation of refrigeration load.

**Unit-III: Food Engineering operations-II**

- **Freezing:** Types of freezing systems, Calculation of freezing time by Plank's equation
- **Dehydration:** Theory of drying, free and bound, critical moisture content, equilibrium moisture content, drying rate curves, drying time prediction, types of driers

**Practicals:**

1. Determination of freezing time by using Plank's equation.
2. To calculate the refrigeration load in cold storage plant.
3. Study of dehydration characteristics of food materials using tray drier.
4. Study of distillation operation.
5. To study working operation of hammer mill
6. To study working operation of roller mill.
7. To calculate the particle size of given flour sample using sieve analysis.
8. To calculate specific cake resistance and filter medium resistance in a filtration process.
9. To study working principle of rotary vacuum evaporator.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –III**  
**COURSE CODE: MSFT61-302**  
**COURSE TITLE: FOOD ENGINEERING-II**

**PRESCRIBED BOOKS:**

- Earle RL. 1985. *Unit Operations in Food Processing*. Pergamon Press.
- McCabe WL & and Smith JC. 1971. *Fundamental of Food Engineering*. AVI Publ.
- Singh RP &Heldman DR. 2013. *Introduction to Food Engineering, 5<sup>th</sup> edition*.

**COURSE OUTCOMES:**

On completing the course, the students will be able to:

CO1: Know about the principles of Unit operation.

CO2: Understand principles of separation and size reduction processes in food.

CO3: Know about the fundamentals of food engineering and its process.

CO4: Do mathematical calculations related to food processing operations.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –III**  
**COURSE CODE: MSFT61-303**  
**COURSE TITLE: TECHNOLOGY OF FISH & MEAT PROCESSING**

**CREDIT HOURS (per week): 06**  
**(T=3, P=3 TOTAL=6)**  
**TOTAL HOURS: 90**  
**Time: 3 Hours**

**Max. Marks: 100**  
**Theory Marks: 50**  
**Practical Marks: 25**  
**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.**

**Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.**

**COURSE OBJECTIVES:**

Students will understand the structure, composition, post-mortem changes and nutritional quality of meat and fish and the technology behind preparation of various meat and fish products and byproduct utilization.

**COURSE CONTENTS:**

**Theory**

**UNIT-I**

*Meat:* Chemical composition and microscopic structure of meat. Postmortem biochemical changes. Physico-chemical properties of meat.

Slaughtering of animals- beef and pig. Packaging, Storage and Transportation of meat.

**UNIT-II**

Deboning of meat by mechanical methods. Meat tenderization and effects of processing on meat tenderization.

Meat Sausages and Restructured meat products. Intermediate moisture and dried products.

Meat plant sanitation and safety, Byproduct utilization. Inspection and grading of meat.

**UNIT-III**

*Fish:* Types of fish, composition, structure, post-mortem changes in fish. Handling, storage and transportation of

fish. Preservation of fish: Curing, smoking, freezing and drying of fish, Comminuted Fish Products. Fish pastes and sauces. Fish oils, fish protein concentrates, fishmeal. By products utilization of fish industry.

**Practicals:**

1. To study the slaughtering of animals.
2. To evaluate the meat quality.
3. Preparation of Meat pickle and meat patties.
4. Preparation of cured meat.
5. To study the manufacturing of meat sausages.
6. Shelf-life studies on processed meat products.
7. To evaluate the quality of raw fish.
8. To determine meat to bone ratio of fish meat.
9. Dressing of fish and to calculate the dressing percentage of fish.
10. Preparation of fish products.
11. Dehydration and Freezing of fish.
12. Visit to local slaughterhouse.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –III**  
**COURSE CODE: MSFT61-303**  
**COURSE TITLE: TECHNOLOGY OF FISH & MEAT PROCESSING**

**PRESCRIBED BOOKS:**

- Principles of Meat Science by Forrest et.al. 1975.
- Developments in Meat Science by Lawrie–Vols. 1,2,3,4, 1998.
- Processed Meats by Pearson (1996).
- Fish Processing Technology by George M. Hall (1997).

**COURSE OUTCOMES:**

On completing the course, the students will be able to:

CO1: Understand the structure, composition, and nutritional value of meat and fish.

CO2: Know about postmortem and biochemical changes in meat and fish.

CO3: Understand processing, preservation and quality control of meat and fish.

CO4: Become aware of manufacturing practices of meat based and fish based by products & their uses.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –III**  
**COURSE CODE: MSFT61-304**  
**COURSE TITLE: APPLIED RESEARCH METHODOLOGY**

**CREDIT HOURS (per week): 06**  
**(T=3, P=3 TOTAL=6)**  
**TOTAL HOURS: 90**  
**Time: 3 Hours**

**Max. Marks: 100**  
**Theory Marks: 50**  
**Practical Marks: 25**  
**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory: – Question paper will contain eight questions in all and students will be asked to attempt five**

**questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.**

**Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.**

**COURSE OBJECTIVES:**

- Develop skills in qualitative and quantitative data analysis and presentation.
- Develop advanced critical thinking skills.

**COURSE CONTENTS:**

**Theory**

**UNIT-I**

- **Introduction:** Types and objectives of research, research process, principle of research design, Principles of research design and methodology.
- **Planning and designing:** Choosing research topic, literature review, formulation a research problem, articulating hypothesis.
- **Research ethics:** Ethics, scientific conduct, intellectual honesty, publication ethics.
- **Sampling and analysis of data:** Random sampling, complex sampling, data collection, frequency distribution and its representation, Measurement of central tendency, dispersion, skewness and kurtosis.

**UNIT-II**

- **Data analysis:** correlation, regression analysis.
- **Testing of hypothesis:** Concept of probability, probability distribution, Normal, Poisson, Chi-square, t-test, z-test, F-test, level of significance, confidence intervals, testing of correlation coefficients.

**UNIT-III**

- ANOVA- One way and Two way ANOVA.
- **Statistical software:** Basics and application of statistical softwares.
- **Synopsis and Thesis Writing:** Synopsis and thesis writing Chronology. References writing methods, ethical consideration in research.
- Writing review paper and research papers.

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**Practicals:**

Student will required to review literature on their respective given problem and submit the same for evaluation.



**M. Sc. FOOD TECHNOLOGY - SEMESTER –III**  
**COURSE CODE: MSFT61-304**  
**COURSE TITLE: APPLIED RESEARCH METHODOLOGY**

**PRESCRIBED BOOKS:**

- Kothari, C.R. (2004). Research Methodology: Methods and Techniques, New Age International Publishers, New Delhi.
- Arya, P.P. and Pal, Y. (2001). Research methodology in management: Theory and case studies, Deep and Deep publishers Pvt. Ltd., New Delhi.

**COURSE OUTCOMES:**

On completing the course, the students will be able to:

CO1: Get knowledge regarding the principles of research design and its methodologies.

CO2: Write synopsis, thesis and analyse data.

CO3: Write review of literature, formulating a research problem, articulating hypothesis.

CO4: Understand basics and application of statistical softwares.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –III**  
**COURSE CODE: MSFT61-305**  
**COURSE TITLE: MASTER’S SEMINAR**

**CREDIT HOURS (per week): 03**

**TOTAL HOURS:45**

**Max. Marks: 100**

**COURSE OBJECTIVES:**

Students will be able to improve scientific aptitude and presentation skills .

**COURSE OUTCOMES:**

On completing the course, the students will be able to:

CO1: Develop scientific aptitude

CO2: Build confidence for delivering lectures

CO3: Improve their presentation skills

CO4: Improve their writing skills

**M. Sc. FOOD TECHNOLOGY - SEMESTER –IV**  
**COURSE CODE: MSFT62-401**  
**COURSE TITLE: FOOD QUALITY ASSURANCE & MANAGEMENT**

**CREDIT HOURS (per week): 06**  
**(T=3, P=3 TOTAL=6)**  
**TOTAL HOURS: 90**  
**Time: 3 Hours**

**Max. Marks: 100**  
**Theory Marks: 50**  
**Practical Marks: 25**  
**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory: – Question paper will contain eight questions in all and students will be asked to attempt five**

**questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.**

**Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.**

**COURSE OBJECTIVES:**

- Able to analyze color, flavor, texture and other sensory characteristics of food for quality assurance.
- To understand the Methods of quality assessment of food materials fruits, vegetables, cereals, dairy products, meat, egg and processed products.
- Understand and apply the principles of sensory science in product development and optimization, studies of alternative processing, packaging and storage, as well as relating sensory to physical properties of food.
- Able to measure consumer perception and acceptance of food products.

**COURSE CONTENTS:**

**Theory:**

**UNIT-I**

Concept of quality: Objectives, importance and functions of quality control, Quality attributes- physical, chemical, and sensory Quality Attributes: their measurement and evaluation; Sensory and instrumental methods for testing quality.

**UNIT-II**

Methods of quality assessment of food materials fruits, vegetables, cereals, dairy products, meat, egg and processed products. Concept of HACCP & GMP

**UNIT-III**

Sampling procedures and plans; Food Safety and Standards Act, 2006; Various organizations dealing with inspection, certification and quality assurance (PFA, FPO, MMPO, MPO, AGMARK, BIS). Quality assurance, Total Quality Management; GHP; GLP. Food adulteration.

**Practicals:**

1. Testing and evaluation of quality attributes of raw and processed foods.
2. Objectives, importance and functions of quality control.
3. Methods of quality assessment of food materials fruits, vegetables, cereals, dairy products, meat, egg and processed products.
4. Sensory methods for measuring food quality.
5. Analysis of products for FPO specifications.
6. Qualitative and quantitative Determination of adulterants in food products.
7. Determination of food additives and food constituents.
8. Visit to Units with HACCP certification.

**PRESCRIBED BOOKS:**

- Amerine MA, Pangborn RM & Rosslos EB. 1965. *Principles of Sensory Evaluation of Food*. Academic Press.
- Early R. 1995. *Guide to Quality Management Systems for Food Industries*. Blackie Academic.
- Furia TE. 1980. *Regulatory status of Direct Food Additives*. CRC Press.
- Jellinek G. 1985. *Sensory Evaluation of Food - Theory and Practice*. Ellis Horwood.
- Krammer A & Twigg BA. 1973. *Quality Control in Food Industry*. Vol. I, II. AVI Publ.
- Macrae R, Roloson R & Sadlu MJ. 1994. *Encyclopedia of Food Science & Technology & Nutrition*. Vol. XVI. Academic Press.

- Piggot J.R. 1984. *Sensory Evaluation of Foods*. Elbview Applied Science.
- Ranganna S. 2001. *Handbook of Analysis and Quality Control for Fruit and Vegetable Products*. 2nd Ed. Tata-McGraw-Hill.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –IV  
COURSE CODE: MSFT62-401**

**COURSE TITLE: FOOD QUALITY ASSURANCE & MANAGEMENT**

**COURSE OUTCOMES:**

On completing the course, the students will be able to:

CO1: Learn about various quality attributes of foods and various aspects of food safety.

CO2: Understand involvement of food agency for implementing various food laws in India.

CO3: Understand the concept of quality control and assurance, risk assessments, GMPs etc.in food sector.

CO4: Know the importance of sensory evaluation and quality control in food.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –IV**  
**COURSE CODE: MSFT62-402**  
**COURSE TITLE: INDUSTRIAL MICROBIOLOGY & FERMENTED FOODS**

**CREDIT HOURS (per week): 06**  
**(T=3, P=3 TOTAL=6)**  
**TOTALHOURS:90**  
**Time: 3 Hours**

**Max. Marks: 100**  
**Theory Marks: 50**  
**Practical Marks:25**  
**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.**

**Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.**

**COURSE OBJECTIVES:**

- To understand the processing methods of Filtration , precipitation, centrifugation, cell disruption, Liquid extraction, drying & crystallisation.
- Knowledge about the beneficial role of microorganisms in different types of fermented foods.

**Course Contents:**

**Theory**

**UNIT-I**

Introduction : History of fermentation processes

Fermentor Design : Fermentor parts and instrumentation.

**UNIT-II**

Downstream processing methods : Filtration , precipitation, centrifugation, cell disruption, Liquid extraction, drying & crystallisation.

Production of products: Potable and fuel alcohols, amino acids, organic acids, enzymes and vitamins, Antibiotics.

**UNIT-III**

Fermented milk products : Curd, yogurt, acidophilus milk, Bulgarian milk, butter milk, Kefir, Kumiss.

Legume based fermented foods: Soya sauce, miso, tempeh, idli.

Fermented vegetable products: Sauerkraut, cucumbers.

Fermented meat products: Meat sausage.

**Practicals:**

1. To prepare the fermented food sauerkraut and study its microbiology and spoilage.
2. To determine and compare effect of deep-freezing and refrigeration on the viability of microorganisms.
3. To isolate and recognize the microorganisms responsible for the fermentation of yoghurt.
4. To study the production of wine, vinegar, amylase, protease.
5. To study of design of fermentor (batch and continuous for production of yeast)
6. To determine the Dissolved oxygen concentration of fermented broth.
7. To study the kinetics of growth of yeast in batch/continuous culture.

**PRESCRIBED BOOKS:**

- Baiely, J.E. and Ollis, D.F. Bio Chemical Engineering Fundamentals (1986), Mcgraw Hills. Rehm, H.J. and Reed, G. (ed), Biotechnology, Vol 1-2, Verlagchemie.
- Stanbury, P.E. and Whitaker A., Principles of Fermentation Technology (1984), Prgamon Press.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –IV**  
**COURSE CODE: MSFT62-402**

**COURSE TITLE: INDUSTRIAL MICROBIOLOGY & FERMENTED FOODS**

- Pirt, S.J. Principles of Microbial and Cell Cultivation. Blackwell Scientific Publication, London.
- Moo-young, M. Comprehensive Biotechnology, Vol. 1-4, Pergamon Press, Oxford.
- Industrial Microbiology by Prescott SC & Dunn CG, 2006 CBS Publishers, New Delhi.
- Industrial Microbiology by Casida LE, 1968, New Age International Publishers Ltd., New Delhi.

**COURSE OUTCOMES:** On completing the course, the students will be able to:

CO1: Know about fermentor, its parts and instrumentation involved.

CO2: Understand processing methods of downstreams and extraction of products.

CO3: Know about the technical aspects involved in the production of various fermented products.

CO4: Correlate relevance of fermentation in food technology.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –IV**  
**COURSE CODE: MSFT62-403**  
**COURSE TITLE: ADVANCES IN FOOD NUTRITION**

**CREDIT HOURS (per week): 06**  
**(T=3, P=3 TOTAL=6)**  
**TOTALHOURS:90**  
**Time: 3 Hours**

**Max. Marks: 100**  
**Theory Marks: 50**  
**Practical Marks:25**  
**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory: – Question paper will contain eight questions in all and students will be asked to attempt five**

**questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.**

**Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.**

**COURSE OBJECTIVES:**

Students will get the knowledge about relationship between food, nutrition and health, understanding the concept of balanced diets and menu planning along with different methods of cooking and ways to prevent nutrient losses, Plan and prepare meals and nutritious dishes for various age groups and patients.

**Course Contents:**

**Theory**

**UNIT-I**

Importance of nutrition to health and growth; Relation of food and diseases; Nutritional requirement of human body & RDA.

Preparation of balanced diets; Deficiencies of essential nutrients; Effect of cooking and processing on nutrients; Nutritional value of processed foods; Therapeutic nutrition.

**UNIT-II**

Nutritional requirements of special group of people such as infants, pregnant and lactating mothers, patients, aged people.

Functional foods and nutraceuticals with attributes to control cardiovascular diseases, cancer, obesity, ageing.

**UNIT-III**

Functional aspects of dietary fibre, amino acids & peptides, antioxidants, vitamins, fatty acids etc. Assessment of nutritional quality of food.

**Practicals:**

1. Identification of food sources for various nutrients.
2. Instruction to diet planning using food exchange list.
3. Calculation of BMI & BMR.
4. Evaluation of own diet.
5. Planning of diet for children, adult and old people.
6. Planning of diet for patient suffering from Ulcer, Anaemia, Diabetes, Diarrhoea and Cardiac diseases.

**PRESCRIBED BOOKS:**

- Bamji MS, Rao NP & Reddy V. 2003. *Textbook of Human Nutrition*. Oxford & IBH.
- Joshi SA. 1999. *Nutrition and Dietetics*. Tata McGraw Hill.
- Khanna K, Gupta S, Passi SJ, Seth R & Mahna R. 1997. *Nutrition and Dietetics*. Phoenix Publ.
- Swaminathan M. 1974. *Essentials of Foods and Nutrition*. Vol. II. Ganesh

**M. Sc. FOOD TECHNOLOGY - SEMESTER –IV**  
**COURSE CODE: MSFT62-403**  
**COURSE TITLE: ADVANCES IN FOOD NUTRITION**

**COURSE OUTCOMES:**

On completing the course, the students will be able to:

CO1: Make relationship between food, nutrition and health.

CO2: Understand various metabolic processes involved while consuming food.

CO3: Know about concept of balanced and healthy diets for various age groups.

CO4: Use food as medicine.



**M. Sc. FOOD TECHNOLOGY - SEMESTER –IV**  
**COURSE CODE: MSFT62-404**  
**COURSE TITLE: APPLICATION OF ENZYMES IN FOOD INDUSTRY**

**CREDIT HOURS (per week): 06**  
**(T=3, P=3 TOTAL=6)**  
**TOTAL HOURS: 90**  
**Time: 3 Hours**

**Max. Marks: 100**  
**Theory Marks: 50**  
**Practical Marks: 25**  
**Internal assessment: 25**

**INSTRUCTIONS FOR PAPER SETTERS:**

**Theory: – Question paper will contain eight questions in all and students will be asked to attempt five**

**questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.**

**Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.**

**COURSE OBJECTIVES:**

The course will educate the students about fundamental principles of enzymes and their applications in food processing for quality enhancement of various foods.

**Course Contents:**

**Theory:**

**UNIT-I**

**Classification:** Classes of enzymes, mechanism of enzyme action, Michaelis-Menten equation, Enzyme inhibition, factors affecting enzyme activity.

**UNIT-II**

Significance of amylases, protease, lipoxidases, lipase and pentosanase in baking industry.

Enzymes in starch industry – Production of modified starches, corn syrups containing glucose, maltose, glucose and fructose etc.

Enzymes in dairy industry:

- i) Natural enzymes in milk
- ii) Hydrogen peroxide Catalase treatment.
- iii) Rennin and its formation
- iv) Lactose and Miscellaneous application.

**UNIT-III**

Enzymes in fruits and vegetables products:

- i) Distribution of pectic substances and pectin enzymes in fruits.
- ii) Specific applications of enzymes in juice technology like clarification, debittering, etc. Enzymes in meat industry–Tenderization of meat

Enzymes in brewing, mashing and beer finishing operation. Immobilized enzymes

**Practicals:**

1. Estimation of absolute and specific activity of alkaline phosphatase from crude cell extract
2. Determination of activity in presence of activators.
3. Determination of activity in presence of inhibitors.
4. Determination of optimum pH
5. Determination of optimum temperature
6. Determination of  $K_m$  &  $V_{max}$
7. Determination of Competitive, non-competitive inhibitors

**M. Sc. FOOD TECHNOLOGY - SEMESTER –IV**  
**COURSE CODE: MSFT62-404**  
**COURSE TITLE: APPLICATION OF ENZYMES IN FOOD INDUSTRY**

**BOOKS PRESCRIBED:**

- Palmer, and Philip, Enzymes: Biochemistry, Biotechnology and Clinical Chemistry, Horwood Publishing Group, Chichester, 2007.
- Price, N. C. and Stevens, L., Fundamentals of Enzymology. The cell and molecular biology of catalytic proteins. Oxford University Press.
- Pandey, A. Webb, C., Soccol C. R. and Larroche, C. Enzyme Technology. Asiatech Publishers, INC. New Delhi, 2004.
- Tucker, G.A. and Taybor, A.J., Enzymes in food processing. Springer Publisher, 1995.
- Moll, M. (1999), Brewing Science, Vol I.
- Reed Gerald, Enzymes in food processing. Academic Press Inc; 2nd edition, 2005.

**COURSE OUTCOMES:**

On completing the course, the students will be able to:

CO1: Understand the role of various enzymes used in food technology and their working mechanisms.

CO2: Understand factors affecting enzyme activity.

CO3: Understand the significance of different enzymes in baking industry at industry level.

CO4: Use enzymes for quality enhancement of foods.

**M. Sc. FOOD TECHNOLOGY - SEMESTER –IV**  
**COURSE CODE: MSFT62-405**  
**COURSE TITLE: M. Sc. Dissertation**

**CREDIT HOURS (per week): 03**  
**TOTAL HOURS:45**

**Max. Marks: 100**

**COURSE OBJECTIVES:**

Students develop a scientific temper and a sense of enquiry through various food technology papers.

**COURSE OUTCOMES:**

On completing the course, the students will be able to:

CO1: Write synopsis for research topic.

CO2: Develop research and project writing skills

CO3: Understand the techniques of data collection and analysis

CO4: Write dissertation.