DEPARTMENT OF FOOD PROCESSING AND TECHNOLOGY
Course Structure for M.Sc. Food Science
Duration -2 Year (4 Semester)
(Effective from Session 2018-19)

CBCS Based M. Sc. Food Science Course Structure					
S. No.	**Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
Semester- I					
1.	FS-401	Food process Technology	C	3-0-0	3
2.	FS-403	Food Microbiology	C	3-0-0	3
3.	FS-405	Food Chemistry and nutrition	C	3-0-0	3
4.	FS-407	Technology of Food Processing & Preservation	C	3-0-0	3
5.	FS-409	Food Safety and Quality	C	3-0-0	3
6.		**Generic Elective**	GE	3-1-0	4
		PRACTICALS			
7.	FS-451	Food science Laboratory-I*	C	0-0-8	4
		Total		**18-1-8**	**23**
		Total Contact Hours		**27**	
Semester- II					
1.	FS-404	Cereal, Legume and oil crop Technology	C	3-0-0	3
2.	FS-406	Fruits and vegetable Technology	C	3-0-0	3
3.	FS-408	Technology of Meat, Fish and Poultry Products	C	3-0-0	3
4.	FS-410	Technology of Functional Foods and Nutraceuticals	C	3-0-0	3
5.	FS450	Post-harvest Technology	SEC1	3-0-0	3
6.		**DSE-I**	DSE	3-0-0	3

7.		**DSE-II**	DSE	3-0-0	3
		PRACTICALS			
8.	FS-452	Food science Laboratory -II*	C	0-0-8	4
		Total		**18-0-11**	**24**
		Total Contact Hours		**29**	
Semester- III					
1.	FS-501	Advances in Food Process Technology	C	3-0-0	3
2.	FS-503	food Packaging Technology	C	3-0-0	3
3.	FS-505	Techniques in Food Analysis	C	3-0-0	3
4.	FS-507	Technology of Milk and Milk Products	C	3-0-0	3
5.	FS-509	Technology of Fermented Foods	C	3-0-0	3
6.		**DSE-III**	DSE	3-0-0	3
7.		**PRACTICALS**			
8.	FS-551	Food science Laboratory -III*	C	0-0-8	4
	FS-555	Training (4-6weeks duration Summer training after II semester)	SEC2	0-0-0	2
		Total		**18-0-12**	**24**
		Total Contact Hours		**25**	
Semester- IV					
	FS556	Project	-	-	15
		MOOCS courses –I (Open elective)			3
		MOOCS courses –II (Open elective)			2
	Total credits for all semester				**91**

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***Generic Elective (GE)**					
1.	ES-507	Waste Management	GE	3-0-0	3
2.	CH-407	Characterization Techniques-I	GE	3-0-0	3
Discipline Specific Electives (DSE-I)					
1.	FS-412	Food Additives	**DSE**	3-0-0	3
2.	FS-414	Technology of Plantation Crops and Spices	**DSE**	3-0-0	3
3.	FS-416	Snack Food Technology	**DSE**	3-0-0	3
Discipline Specific Electives (DSE-II)					
1.	FS-418	Technology of oilseeds and fats	**DSE**	3-0-0	3
2.	FS-420	Innovative Techniques in Food Processing	**DSE**	3-0-0	
3.	FS-422	Food Supply Chain Management	**DSE**	3-0-0	3
Discipline Specific Electives (DSE-III)					
1.	FS-511	IPR and Patent laws in food sector	**DSE**	3-0-0	3
2.	FS-513	Food plant design and Sanitation	**DSE**	3-0-0	3
3.	FS-515	**Technology of Beverages**	**DSE**	3-0-0	3

**Experiments will be based on Course contents.*

**New course structure will be effective from academic session 2018-19. School/Department will not be bound to run all the courses. Minimum number of students may be fixed to run any elective course*.

Course Structure for M.Sc. Food Science

(Effective from Session 2019-20)

SEMESTER I

FS-401 Food Process Technology (3+0+0)

OBJECTIVES:

1. To understand the area of Food engineering
2. To elaborate the basic concepts of material and energy balance, fluid dynamics, thermal process calculations etc.

Unit –I Unit operation in food engineering, Mass and energy balance, Fluid flow, fluid statics, fluid dynamics, fluid flow applications, Heat transfer-modes of heat transfer, conduction, convection, and radiation, heat exchangers and their designs.

Unit –II Thermal processing evaporation and concentration, dehydration, drying, blanching, pasteurization, sterilization, distillation and crystallization.

Unit –III Refrigeration**:** Refrigeration cycles, refrigeration compressors, refrigeration system balance and multiple evaporation systems. Flash cooling, design of condensers, evaporators, cooling towers, thermo-electric cooling, cryogenics, and different refrigeration systems for ultra-low refrigeration.

Unit –IV Mechanical separation-filtration, membrane concentration, sieving, centrifugation, sedimentation, Mechanical handling conveying and elevation. Size reduction and classification: grinding, mixing, kneading, and blending.

OUTCOMES: **No. of Lecture: 45**

After the completion of the course, the students will be able to:

- Understand various basic aspects of food engineering.
- Grasp the knowledge about fluid flow of foods.
- Comprehend the thermal process calculations.

Books Recommended:

1. Food Engineering Operation - Brennan, Butters, Cowell and Lilly.
2. Food Process Engineering - Heldman, D. R. and Singh, R. P.
3. Fundamental of Food Process Engineering - Romeo T. Toledo
4. Unit Operation of Chemical Engineering - Mc Cabe, Smith & Harriot
5. Mass Transfer Operation - Treybal, R. E.
6. Chemical Engineering (Vol. I & II) - Coulson, J. M. & Richardson, J. F.

Course Structure for M.Sc. Food Science
(Effective from Session 2019-20)
SEMESTER I

FS-403 Food Microbiology (3+0+0)

OBJECTIVE:

- To provide awareness about nutrition and growth of microorganisms.
- To impart knowledge about role of microorganisms in air, water and soil.
- To understand the role of microorganisms in fermented foods, food spoilage, food infections and intoxications.

Unit- I

Development and scope of Microbiology. Introduction to food microbiology: Classification of microbes, Types of microorganism normally associated with food- mold, yeast, and bacteria. Importance of microorganisms in food. Primary sources of microorganisms in food. Growth curve. Parameters affecting the growth of microorganisms.

Unit- II

Biochemical changes caused by micro-organisms, deterioration of various types of food product, Types of microorganisms in food like meat, poultry, sea foods, vegetables, dairy products, fruits and vegetables. Fermented and microbial foods: Fermented milk and milk products, fermented fruits and vegetables, pickles, sauerkraut, fermented meat and fish products, fermented beverages (beer, vinegar and wine), single cell protein.

Unit- III

Preservation by Moist Heat, Heat Resistance of microorganisms and spores. Thermal Death Time curves. The behaviour of microorganisms under freezing and refrigeration environment. Growth and lethal effects of low temperature treatments on microorganisms in raw and processed foods. Preservation by drying. The survival of microorganisms after drying. The microbiology of dried foods.

Unit- IV

Food borne diseases: food infection and food intoxication: symptoms, causes and control. Non-bacterial agents of food borne illness- poisonous algae, fungi and food borne viruses. Microbial standards for different foods. HACCP and food safety, hurdle technology and its applications.

OUTCOMES: **No. of Lecture: 45**

After the completion of the course, the students will be able to:

- Appreciate the role played by microorganisms in the field of food
- Know about microorganisms, history, diversity, classification and role of microorganisms in nature.
- Understand about nutrition, growth and metabolism in microorganisms.

Books Recommended:

1. William C. Frazier and & Dennis C. Westfoff. 1987. Food Microbiology, 4th Ed. Tata McGraw-Hill Education, New Delhi
2. James M. Jay. 2000. Modern Food Microbiology, 6th Ed. Aspen Publishers, Inc., Gaithersburg, Maryland, USA.
3. Pelczar,M.J., E.C.S. Chan and N.R. Krieg, "Microbiology", McGraw-Hill New York, 1988
4. Bibek Ray and Arun Bhunia. 2008. Fundamental Food Microbiology, 4th Ed., CRC press, Taylor and Francis Group, USA

Course Structure for M.Sc. Food Science
(Effective from 2019-20)
SEMESTER I

FS-405 Food Chemistry and Nutrition (3+0+0)

OBJECTIVE:

- The course aims to develop the knowledge of students in the basic area of Food Chemistry.
- This is necessary for effective understanding of food processing and technology subjects.
- This course will enable students to appreciate the similarities and complexities of the chemical components in foods.

UNIT-I
Scope, introduction, definition and importance of food chemistry. Chemistry of carbohydrates: classification, functions, chemical and physical properties, pentosans, mannans and galactans, pectic substances, gums. Types of fibers and its constituents, Celluloses, hemicelluloses, soluble fibers, insoluble fibers and their important functions. Enzymes and starchesalpha amylase, beta amylase, modified starches, resistant starches, gelatinization of starches and starch blockers.

UNIT-II
Proteins and amino acids: types, chemical, physical and functional properties, denaturation of protein, gel formation. Proteins from milk, egg and meat. Allergens, toxic constituents and anti-nutritional factors of foods (enzyme inhibitors, trypsin and chymotrypsin inhibitor, amylase inhibitor, flatulence causing oligosaccharids, phytolectins).

UNIT-III
Fats and oils: classification, functions, physico-chemical properties, oxidation of oils and fats, rancidity. Chemistry of emulsifiers, antioxidants, stabilizers and additives used in food industry. Chemical properties and functions of minerals and vitamins. Chemistry of pigments and flavour compounds.

UNIT-IV
Enzymatic and non-enzymatic browning in Foods, reactions of aldehydes and ketones with amino compounds, caramelization, oxidative changes of polyphenols) and their applications in food products. Important chemical changes during storage.

UNIT_V
Foods and nutrients-basic definitions, functions of food and nutrients, levels of nutritional status. Major world health problems- food supply and security, malnutrition, heart diseases, cancer, diabetes etc. Recommended dietary allowances (R.D.A.), ICMR standards, food guide, exchange lists, health promotion guidelines.

OUTCOMES **No. of Lecture: 45**

On completion of the course the students are

• Be able to understand and identify the various food groups; the nutrient components (macro and micro), proximate composition.

- Be able to understand and identify the non-nutritive components in food, naturally present.
- Understand and use effectively, food composition tables and databases.
- Grasp the functional role of food components and their interaction in food products in terms of colour, flavour, texture and nutrient composition

Book Recommended

1. Wang, D. (2012). Food Chemistry: Nova Science Publishers.
2. Chopra, H. K. & Panesar, P. S. (2010). Food chemistry: Alpha Science International Ltd, Oxford, U.K.
3. Coultate, T. P. (2009). Food: The Chemistry of Its Components (5^{th} .): American Chemical Society.
4. Newton, D.E. (2009). Food Chemistry: Facts On File, Incorporated.
5. Damodaran, S., Parkin, K. L., & Fennema, O. R. (2007). Fennema's Food Chemistry: CRC Press, Taylor and Francis group.

Course Structure for M.Sc. Food Science
(Effective from 2019-20)
SEMESTER I

FS-407 Technology of Food Processing & Preservation (3+0+0)
OBJECTIVE:

- To expose the students to the principles and different methods of food processing and preservation.

Unit –I

Aim and objectives of preservation and processing of foods, degree of perishability of natural foods, Quality deterioration and spoilage of perishable foods, intermediate moisture foods, types of food spoilage, viz. microbiological, enzymatic, chemical, physical and their effects on food quality.

Unit -II

Low temperatures Preservation: Storage of foods at chilling temperature, applications and procedures, controlled and modified atmosphere storage of foods, post storage handling of foods. Freezing process, slow and fast freezing of foods and its consequences etc. Technological aspects of pre-freezing, Actual freezing, frozen storage and thawing of foods.

Unit -III

High temperature Preservation: Basic concepts in thermal destruction of microorganisms- D, Z, F, values Heat resistance and thermophilic in microorganisms. Cooking, blanching, pasteurization and sterilization of foods.

Unit -IV

Chemicals Preservation : Definitions and classifications, bacteriostatic agents, fungi static agents, germicidal agents, antioxidant, neutralizers, stabilizers and firming agents, use of sulphur dioxide and benzoic acid, tolerance of chemical preservative, use of antibiotics, sugars and salts. Preservation by fermentation and irradiation; technological aspects and applications of sugar and salt, antimicrobial agents,

Unit-V Radiation Preservation: Irradiation of foods type of radiations, physical and chemical changes induced by radiations, interaction of radiation with living organisms. Radiated foods, cost, shelf life, nutrient and other losses, wholesomeness, safety of working personnel and dosimetry.

OUTCOMES **No. of Lecture: 45**

- To understand the principles of food processing and preservation.
- To understand the role of different methods the processing of different foods and their impact on the shelf life, quality, and other physical and sensory characteristics of foods.
- To familiarize with the recent methods of minimal processing of foods to understand the materials and types of packaging for foods

Books Recommended:

1. "Principles of Food Science-Part-II": Physical Method of Food Preservation by M.Karel, O.R. Fennema and D.B.Lund, Marcel Dekkar Inc.
2. 'Principles of Food Preservation' by V.Kyzlink,Elsevier Press.
3. Preservation of fruits and Vegetable processing- Girdhari Lal

Course Structure for M.Sc. Food Science
(Effective from 2019-20)
Semester I

FS-409 Food Safety and Quality (3-0-0)

OBJECTIVES:

• To characterize different type of food hazards, physical, chemical and biological in the industry and food service establishments
• To help become skilled in systems for food safety surveillance
• To be aware of the regulatory and statutory bodies in India and the world

Unit -I

Ways of describing food quality (concept of quality: Quality attributes and their measurement and evaluation; Sensory vis-àvis instrumental methods for testing quality.
Quality control and quality assurance functions.

Unit -II

Total Quality Management; GMP/GHP; GLP, GAP; Sanitary and hygienic practices; HACCP;Quality manuals, documentation and audits; Indian & International quality systems and standards; ISO and Food Codex; Export import policy, export documentation.

Unit -III

Food standards and regulations; Food Safety and Standards Act, 2006; Domestic regulations; Global Food safety Initiative; Various organizations dealing with inspection, traceability and authentication, certification and quality assurance (PFA, FPO, MMPO, MPO, AGMARK, BIS); Labeling issues; International scenario, International food standards.

Unit -IV

Food safety management system; Introduction, prerequisite program of food safety management system, understanding and implementation of food safety management system in food industries, understanding and implementation of ISO 22000.

OUTCOMES: **No. of Lecture : 45**

- Thorough Knowledge of food hazards, physical, chemical and biological in the industry and food service establishments
- Awareness on regulatory and statutory bodies in India and the world

Books Recommended:

1. Quality control in the food industry -S. M. Herschfoerfer
2. Quality control for the food industry -A. Kramer and B.A.Twigg
3. Principles of sensory evaluation of Foods -M. A. Amerine
4. Rheology and Texture in Food Quality -J. M. deMan, P. W. Vowsy
5. Analysis of Fruits and vegetables –Ranganna

Course Structure for M.Sc. Food Science

(Effective from 2019-20)

Semester II

FS-404 Cereals, Legume and oil crops Technology (3+0+0)

OBJECTIVE:

- The course aims to develop the knowledge of students in the area of pulse and oil seed processing and technology.
- This is necessary for effective understanding specific aspects of food processing related to these foods. This course will enable students to appreciate the application of scientific principles in the processing of these materials.

Unit-I

Composition, Structure and Processing characteristic of Cereal grains, Legumes and oilseeds, Post harvest, Processing practices for their safe storage. Parboiling and Milling of paddy, Quality characteristics, Curing and aging of rice, Processed rice products.

Unit-II

Wheat and its quality characteristics for milling into flour and semolina, Flour milling, Turbo grinding and air classification, Flour grades and their suitability for baking purposes, Assessment of flour quality and characteristics, Milling of Durum wheat, Macaroni products.

Unit-III

Ingredients, Technology and quality parameters for baked products: Bread, Biscuits and cakes; Breakfast cereals.

Processing of Oilseeds: Composition, processing of oilseeds as protein concentrations, properties and uses of oil seed meals, technology vegetable protein isolates; Barrier compounds in the utilization of oil seed proteins. Low cost protein foods from oilseeds.

Unit-IV

Dry and Wet milling of corn, Starches and its conversion products, Malting of barley, Pearling of Millets, Milling of legume-pulses by traditional and improved processes.

OUTCOMES **No. of Lecture: 45**

On completion of the course the students are expected to

- Be able to understand and identify the specific processing technologies used for pulses and oil seeds and the various products derived from these materials.

- Understand the application of scientific principles in the processing technologies specific to the materials.

- Grasp the changes in the composition of foods with respect to the type of processing technology used.

Books Recommended:

1. Food Science by N.N.Potter

2. Cereal Technology by S.A.Matz

3. Bakery Technology S.A.Matz

Course Structure for M.Sc. Food Science
(Effective from 2019-20)
Semester II

FS-406 Fruits and Vegetable Technology (3+0+0)

OBJECTIVES:

- The course aims to develop the knowledge of students in the area of vegetable and fruit processing and technology.
- This course will enable students to appreciate the application of scientific principles in the processing of fruits and vegetables

Unit-I

Structural, Compositional and Nutritional aspects of fruits and vegetables. Post harvest changes, storage, handling and preservation of fresh fruits and vegetables, controlled and modified atmosphere storage. Present scenario of fruits and vegetable industry in india.

Unit-II

Techniques of processing and preservation of fruits and vegetables by refrigeration and freezing, canning and bottling, drying and dehydration. Canning: Machinery and equipments, canning of different fruits and vegetables.

Unit-III

Technology of fruits and vegetable products: Juices and pulps, Concentrates and powders, Squashes, cordials nectars, fruit drinks and carbonated beverages and its quality control.

Unit-IV

Other fruits and vegetables products: Jam, Jellies and Marmalades. Preserves, candies and crystallized fruits. Tomato products: Puree, Paste, Ketchup, Sauce and soup. Chutneys, pickles and other products.

Unit-V

Condiments, spice oils, oleoresins, Processing of cashew nuts, coffee and cocoa beans, and tea leaves, Specialty fruit and vegetable products.

OUTCOME **No. of Lecture: 45**

- To develop skills related to Preservation and analytical techniques in fruit and vegetable products.

- Use of various techniques and additives for fruit and vegetable processing and quality analysis.

Books Recommended:

1. Food science by B.Srilakshami;New Age International.

2. Fundamentals of Foods and Nutrition by R. Madambi and M.V. Rajgopal.

3. Foods :Facts and Principles by N Shakuntala manay;New Age International (P) Ltd.

4. Preservation of Fruits and Vegetable by Girdhari lal and Sidappa; CBS Publications

5. Chocolate, Cocoa and Confectionary: Science and Technology by Bernard. W. Minifie

6. An introduction to the Post-harvest physiology and handling of fruits

Course Structure for M.Sc. Food Science

(Effective from 2019-20)
Semester II

FS-408 Technology of Meat, Fish and Poultry Products (3+0+0)

OBJECTIVES:

• The course aims to develop the knowledge of students in the area of animal product processing and technology.

• This course will enable students to appreciate the application of scientific principles in the processing of these materials.

Unit-I

Scope of meat industry: Introduction to meat, fish and poultry industry, Meat production,

processing and consumption trends.

Unit-II

Structure, composition and nutritive value of meat tissues, Postmortem changes, Pre-slaughter handling, Death of the Animal–stunning and bleeding, dressing and cutting, Post slaughter care and post mortem inspection – classification and quality of meat.
Aging, Curing, Smoking, Canning, Irradiation, Freezing and Dehydration of Meat and Meat Products, Formed and Sectioned Meat Production Method, Meat Sausages- Classification, Ingredients and Production Technology. Recent trends in meat processing.

Unit-III

Chemical composition and nutritive value of poultry meat, Pre-slaughter handling, Transport and Dressing of poultry, Antemortem and postmortem examination of poultry.

Egg: Structure, composition, and nutritional aspects of eggs. Grading, Storage and transportation of whole eggs. Microbial spoilage of eggs, Preservation and maintenance of eggs, Processing of eggs and egg products (liquid and solid products)

Unit-IV

Fish: Types of fish, Composition and Nutritive Value, Post-mortem changes in fish. Unit operations in fish processing. Canning, Smoking, Salting, Curing, Freezing and Drying/Dehydration of fishes. Fish spoilage, Fish sausages.

OUTCOME: **No. of Lecture: 45**

On completion of the course the students are expected to

- Be able to understand and identify the specific processing technologies used for meat and such foods and the various products derived from these materials.

- Grasp the changes in the composition of foods with respect to the type of processing technology used.

Books Recommended:

1. Meat and Meat Products Technology (Including Poultry Products Technology) by B.D Sharma
2. Meat Science by R.A. Lawrie,Pergamon Press.
3. Poultry Products Technology by G.J. Mountney.
4. Meat, Poultry and Sea Food Technology by R.L.Henricksons.
5. Poultry Meat and Egg Production by Parkhurst and Mountney

Course Structure for M.Sc. Food Science
(Effective from 2019-20)
Semester II

FS-410 Technology of Functional Foods & Nutraceuticals (3+0+0)

OBJECTIVES:

• To understand the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction.

• To understand the role of Nutraceuticals and functional food in health and disease

Unit-I

Nutraceuticals and functional foods. Nature, scope and types of nutraceutical and functional foods. Applications of nutraceuticals and functional foods and their health benefits. Nutraceutical compounds, classification based on chemical and biochemical nature. Nutraceuticals in prevention of cancer, heart disease, stress, osteoarthritis, hypertension etc.

Unit-II

Antioxidants and other compounds (isoflavones, β-Carotene, lycopenes), its role as nutraceuticals and functional foods. Dietary fibers and complex carbohydrates as functional food ingredients. Protein-functional food ingredient. Herbs as functional, beneficial health promoting activities of common herbs. Products of cereals (oats, wheat bran, rice bran etc) as functional foods.

Unit-III

Vegetable products as functional foods, oil seeds and sea foods. Different beverages (Coffee, tea and other beverages) as functional foods/drinks .Effects of processing, storage and interactions of various environmental factors affecting such foods. Nutritional deficiencies and its correction trough fortification and supplementation of foods. Beneficial effect of spices, honey, spirulina etc.Marketing and regulatory issues for functional foods and nutraceuticals. Modern trends in nutraceutical and functional foods. Transgenic plant foods with health claims. Prebiotics and Probiotics.

OUTCOMES: **No of Lecture: 45**

• Knowledge of the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction

• Understand the role of Nutraceuticals and functional food in health and disease

Books Recommended:

1. Mazza, G (1988). Functional foods – biochemical and processing aspects, Technomic Publ. Lancaster, USA.
2. Kirk, RS (1999). Pearson's composition and analysis of foods. Wesley Longman Inc. California, USA.
3. Wildman, REC (2007) Handbook of nutraceuticals and functional foods.
4. Official Methods of Analysis (2003). Association of official analytical chemists, USA.

Course Structure for M.Sc. Food Science
(Effective from 2019-20)
Semester II

FS450 Post Harvest Technology (3+0+0)

OBJECTIVES:

- The course aims to develop the knowledge of students in the area of vegetable and fruit processing and technology.
- This course will enable students to appreciate the application of scientific principles in the processing of fruits and vegetables

UNIT-I

Fruit and vegetable production, classification, structure and composition; Importance and scope of post-harvest management of fruits and vegetables in Indian economy, Pre-harvest factors affecting post-harvest quality, post-harvest losses,Maturity indices and standards for selected fruits and vegetables, instrumental methods of maturity determination, standards and specifications for fresh fruits and vegetable, Assessment of Fruit Quality, advances in non-destructive quality measurement of fruits and vegetables.

UNIT-II

Advanced harvesting tools and their design aspects, advances in Post-Harvest Handling operations; Cleaning, washing of fruits and vegetables, types of cleaners, screens, types of screens, rotary screens, vibrating screens, machinery for cleaning of fruits and vegetables (air cleaners, washers; Sorting and grading: Sorting, grading, methods of grading,Size grading, color grading, specific gravity grading, screening, equipment for grading of fruits and vegetables, grading efficiency, care and maintenance, Separation: Magnetic separator, de stoners, electrostatic separators, pneumatic separators.

UNIT-III

Post-harvest physiological and biochemical changes in fruits and vegetables; ripening of climacteric and non-climacteric fruits; changes duringripening; Role of ethylene in fruit ripening, ripening chambers, Field heat of fruits and vegetables and primary processing operations Post harvest treatments, advances in pre-cooling, equipment Commodity pretreatments-chemicals,

UNIT-IV

Post-harvest disorders chilling injury and diseases,Biological, Physical and Chemical Control of postharvest Diseases, advances in drying and packaging of fruits and vegetables, cushioning materials used in packaging of fresh fruits, Minimal processing.

OUTCOME **No. of Lecture: 45**

- To develop skills related to Preservation and analytical techniques in fruit and vegetable products.
- Use of various techniques and additives for fruit and vegetable processing and quality analysis.

Books Recommended:

• Haard, N.F. and Salunkhe, D.K. (1975). Postharvest Biology and Handling of Fruits and Vegetable: AVI, Westport.
• Kader, A. A. (1992). Post-harvest Technology of Horticultural Crops, (2ed.): University of California, Division of Agriculture and National Resources, California.
• Salunkhe, D.K. and Kadam, S.S. (2005). Handbook of Fruit Science and technology, Production, Composition, Storage, and Processing: Marcel Dekker, USA.
• Thompson, A.K. 1995. Post-Harvest Technology of Fruits and Vegetables: Blackwell publication.
• Wills-Ron B.H. and Golding,J.B. (2015). Advances in Postharvest Fruit and Vegetable Technology: Taylor and Francis, CRC Press.
• Siddiqui, M. W., (2015).Post-Harvest Biology and Technology of Horticultural Crops: Principles and Practices for Quality Maintenance:Apple Academic Press Inc.

Course Structure for M.Sc. Food Science

(Effective from Session 2019-20)

Semester-II

FS-412 Food Additives (3+0+0)

OBJECTIVES:

1. To get an insight into additives that are relevant to processed food industry for shelf life extension, processing aids and sensory appeal.
2. To explain about role of food additives in food quality control.
3. To explain the techniques of best use of food additives.
4. To describe the role of food additives in health maintenance and cure of diseases

Unit-I

Definition of food additives, General principles for the use of food additives. GRAS and regulatory aspects (FAO, WHO, WTO) of food additives, functions, types, modes of action, consequences of use, risks and benefits of food additives

Unit-II

Food preservatives (antioxidants agents and antimicrobial agents), Emulsifying and stabilizing agents, Anti-caking agents, thickeners, Firming agents. Flour bleaching agents and Bread improvers

Unit-III

Definitions, uses and functions:Acid, Base, Buffer systems, Salts and chelating/sequestering agents, Masticatory substances. Nutritional and non nutritive sweeteners, Polyols.

Unit-IV

Colorants, Flavoring agents and related substances, Clarifying agents. Gases and

Propellants. Tracers and other additives.

OUTCOMES: **No. of Lecture: 45**

After the completion of the course, the students will be able to:

1. Understand about the use of food additives in food formulations.
2. Apprehend the suitable application of food ingredients in health foods and convenience food preparation.
3. Grasp the techniques of food additives stability and use level.
4. Understand the role of food additives in health maintenance and cure of diseases

Books Recommended:

1. O.R.Fennema Food Chemistry
2. N.S.Manay Food Acts and Principles

3. PFA Rules 1955 PFA Act 1954

Course Structure for M.Sc. Food Science

(Effective from Session 2019-20)

Semester-II

FS – 414 Technology of Plantation Crops and Spices (3+0+0)

OBJECTIVES:

To enable the students to understand about

- Coffee and its processing techniques, instant coffee, and quality grading
- Different types of tea and its manufacturing techniques, instant tea, quality parameters of tea

Unit-I

Importance of plantation crops, chemical composition and processing of tea, coffee, cocoa and their quality assessment. Instant coffee and tea production and processing

Unit-II

Cocoa processing, chocolate, processing of raw and refined sugar.Spices - black pepper, green pepper, white peper, oleoresin and volatile. Cardamom, ginger, chillies, turmeric; powder, oleoresin and volatile components.

Unit-III

Minor spices - Ajwain, coriander, cumin, cinnamon, fenugreek, garlic, mustard, mace and nutmeg, onion, saffron, tamarind, cloves, mint, vanilla, asafetida and spice production, processing of spices.

Unit-IV

Grinding, processing and handling of seed spices, packaging and transportation and storage of various spices in different condition.

OUTCOMES: **No. of Lecture : 45**

- On completion of the subject, students will be able to understand the processing steps involved for different plantation products and spices.

Books recommended

1. Varnam and Sutherland Beverages- Technology, Chemistry and Microbiology, ASPE

Course Structure for M.Sc. Food Science

(Effective from Session 2019-20)

Semester-II

FS-416 Snack Food Technology **(3+0+0)**

OBJECTIVE
To impart knowledge related to various snack foods and their manufacturing techniques.

UNIT-I
Extrusion: Introduction to extruders and their principles, types of extruders. Extruders in the food industry: History and uses. Single screw extruder: principle of working, factors affecting extrusion process, co-kneaders. Twin screw extruder: Feeding, screw design, screw speed, screw configurations. Pre-conditioning of raw materials used in extrusion process: operations and benefits and devolatilization. Chemical and nutritional changes in food during extrusion. Addition and subtraction of materials, shaping and forming at the die. Post-extrusion processes-colouring, flavouring and packaging of extruded snack foods.

UNIT-II
Breakfast cereals: Introduction and classification (flaked cereals, oven puffed cereals, gun puffed cereals, shredded products). Breakfast cereal-manufacturing processes (traditional and modern methods), High shear cooking process and steam cookers. Texturized vegetable protein: definition, processing techniques. Direct expanded (DX) and third generation (3G) snacks: types. Concept of junk & fried foods and their impact on human health.

UNIT-III
Technology for grain-based snacks: Whole grains- roasted, toasted, puffed, popped, flaked. Coated grains- salted, spiced and sweetened. Formulation, processing and quality assessment of chips and wafers, papads, instant premixes of traditional Indian snack foods.

UNIT-IV
Technology for fruit and vegetable-based snacks- chips, wafers; Technology for coated nuts-salted, spiced and sweetened chikkies. Equipments for frying, baking, drying, toasting, roasting, flaking, popping, blending, coating and chipping.

OUTCOMES: **No. of Lecture: 45**
Students shall be able to understand various technological aspects of traditional and modern snack
foods.

Recommended Readings:
1. Booth, R. G. (1997). Snack Food: CBS, New Delhi.
2. Raymond, W. L. & Rooney, L. W. (2001). Snack Foods Processing: CRC. London.
3. Lusas, E. W. & Rooney, L. W. (2015). Snack Foods Processing: CRC. London.
4. Guy, R. (2001). Extrusion Cooking: Technologies and Applications: Woodhead, USA.
5. Riaz, M. N. (2000). Extruders in Food Applications: Technomic, Lanchester**Books**

Course Structure for M.Sc. Food Science

(Effective from Session 2019-20)

Semester-II

FS-418 Technology of oilseeds and fats (3-0-0)

OBJECTIVE:

- The course aims to develop the knowledge of students in the area of pulse and oil seed processing and technology.
- This is necessary for effective understanding specific aspects of food processing related to these foods. This course will enable students to appreciate the application of scientific principles in the processing of these materials.

Unit- I

Introduction: Importance and functions of fats and oils in foods and health, composition of fats/oils from different animal sources and oilseeds.

Oil extraction: Different methods of oil extraction, oil expression from oilseeds like, mustard/rapeseed, coconut, sunflower, groundnut, sesame, cotton. Machines (Mechanical expellers and solvent extractors) used in the expression of oils, Calculations based on the extraction processes.

Unit- II

Oil/fat purification: Refining techniques, bleaching, refining losses and deodorization, Batch and continuous refining losses.

Hydrogenation: Chemistry of hydrogenation, Effect of process conditions, Hydrogenation in Practice, Catalysts and catalysis.

Unit- III

Chemistry of fats and oils: Lipolysis, auto-oxidation, thermal decomposition, chemistry of frying oils, effects of ionizing radiation in fats, inter-esterification, reversion.

Technology of individual fat products: Butter, Margarine, Shortening, Lard, Salad, cooking and frying oil.

Unit- IV

Different quality parameters: Peroxide value, Saponification value, Iodine value, acid value, TBA, RM value, P-value, Kries value, Adulteration in oils and fats.

Soap processing: Chemistry, physical properties of soap, processing and finishing, different types of soaps, soaps in cosmetics and toiletries.

OUTCOMES **No. of Lecture: 45**

On completion of the course the students are expected to

- Be able to understand and identify the specific processing technologies used for pulses and oil seeds and the various products derived from these materials.

- Understand the application of scientific principles in the processing technologies specific to the materials.

Books Recommended:

1. Chrysam, Erickson and others Bailey's Industrial Oil and Fat Products Volume-3
2. Fennema Food Chemistry
3. Meyer Food Chemistry
4. Lawson Food oils and fats
5. Maran Fats in food products
6. Oilseeds and Oil Milling in India A cultural and History Survey

Course Structure for M.Sc. Food Science
(Effective from Session 2019-20)
Semester-II

FS-420 Innovative techniques in Food Processing (3+0+0)

OBJECTIVES:

- The course aims to develop the knowledge of students in the area of emerging or alternative technologies applied to food processing.

- This course will enable students to understand the advantages and disadvantages over existing technologies.

Unit – I
Membrane technology: Introduction to pressure activated membrane processes: microfiltration, ultra-filtration, Nano filtration, reverse osmosis and their industrial application. Supercritical fluid extraction: Concept, property of near critical fluids NCF, extraction methods.
Unit – II
Microwave and radio frequency processing: Definition, Advantages, mechanism of heat generation, application in food processing: microwave blanching, sterilization and finish drying. Hurdle technology: Types of preservation techniques and their principles, concept of hurdle technology and its application.
Unit – III
High Pressure processing: Concept, equipments for HPP treatment, mechanism of microbial inactivation and its application in food processing. Ultrasonic processing: Properties of ultrasonic, application of ultrasonic as processing techniques.
Unit – IV
Novel techniques in food processing: Application of technologies of high intensity light, pulse electric field, ohmic heating, IR heating, inductive heating and pulsed X-rays in food processing and preservation. Nanotechnology: Principles and applications in foods.

OUTCOMES: **Number of Lectures: 45**

On completion of the course the students are expected to

• Be able to understand and identify the different processing technologies and therir application.

• Understand the application of scientific principles in the processing technologies specific to the materials.

Books Recommended:

1. New Methods of Food Preservation by G. W. Gould

2. Introduction to Food Engineering by R.P.Singh

3. Novel Food Processing Technologies Barbosa-Canovas

Course Structure for M.Sc. Food Science

(Effective from Session 2019-20)

Semester-II

FS- 422 Food Supply Chain Management (3+0+0)

OBJECTIVE

To provide an introduction to the concepts and tools of supply chain management in the food and beverage industry

Unit- I

Introduction and overview of Food supply chain management, present status of Food Supply Chains in India and challenges thereof, Inbound and outbound logistics, Supply chain as a source of competitive advantage.

Unit- II

Inbound logistics, Buyer-Vendor co-ordination, Procurement, Vendor development and evaluation, reduced sourcing and supplier partnership - benefits, risks and critical success factors, multi-level supply control. inventory control systems of stock replenishment, cost elements, EOQ and its derivative models, use of computers for materials function.

Unit- III

Outbound logistics, System view of logistics-Coordination and management of transportation, inter model transportation and third party transportation services, characteristics of different transportation services, carrier selection, contracting and evaluation methods, inventory order processing, purchasing ware housing materials handling, packaging and customer service standards, physical distribution planning, channel considerations, inventory strategies and management, transportation infrastructure and management, facility location, materials handling.

Unit- IV

Strategic considerations for supply chain, Porter's industry analysis and value-chain models, the concept of total cost of ownership, supply stream strategies, classification and development guidelines, measuring effectiveness of supply management, logistics engineering.

Unit- V

Operations Research Models for operational and strategic issues in supply chain management.

The Bullwhip Effect and supply-chain management game

OUTCOME **No of Lecture 45**

- To demonstrate an awareness of the role of supply chain management in competitive strategy in the food and drinks industry

- To get a critical understanding of the buyer-supplier relationship debate

- To be aware of the challenges involved in identifying, acquiring and managing the various resources required in food supply chains

- To develop a conceptual appreciation of the key supply chain management processes and their role in satisfying customer demands

Books Recommended:

1. Chopra, S, and P. Meindl, Supply Chain Management – Strategy, Planning and Operation, Pearson Education.
2. Raghuram, G. and N. Rangaraj, Logistics and Supply Chain Management: Cases and Concepts; Macmillan, New Delhi.
3. Simchi-Levi, D., P. Kaminski and E. Simchi-Levi, Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies; Irwin, McGraw-Hill.
4. Shapiro, J., Modelling the Supply Chain; Duxbury Thomson Learning.

Course Structure for M.Sc. Food Science
(Effective from Session 2019-20)
Semester-III

FS501 Advances in Food Process Technology (3+0+0)

OBJECTIVES:

- The course aims to develop the knowledge of students in the area of emerging or alternative technologies applied to food processing.

- This course will enable students to understand the advantages and disadvantages over existing technologies.

Unit – 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 etc.

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

Unit – II

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.

Unit – III

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.

Unit – IV

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, micronization in food processing and preservation

Nanotechnology: Principles, mechanism and applications in foods

OUTCOMES: **Number of Lectures: 45**

On completion of the course the students are expected to

- Be able to understand and identify the different processing technologies and their application.

- Understand the application of scientific principles in the processing technologies specific to the materials.

Books Recommended:

1. G. W. Gould.New Methods of Food Preservation (Non-Thermal Processing of Foods)
2. R. P. Singh. Introduction to Food Engineering

3. Food processing technology. Fellows, P. J.

Course Structure for M.Sc. Food Science

(Effective from Session 2019-20)

Semester-III

FS-503 Food Packaging Technology

OBJECTIVE:

- The course aims to develop the knowledge of students in the area of packaging of foods and the related technology used.
- This course will enable students to appreciate the application of scientific principles in the packaging of foods.

Unit -1

Active packaging techniques, intelligent & smart packaging techniques, Current use of novel packaging techniques, Consumers and novel packaging. Oxygen scavenging technology, Selection of right type of oxygen scavenger, Ethylene scavenging technology, Carbon dioxide and other scavengers.

Unit -II

Antimicrobial agents, constructing an antimicrobial packaging system, Factors affecting the effectiveness of antimicrobial packaging. Advantages of NMBP, Inherently bioactive synthetic polymers: types and application, Polymers with immobilized bioactive compounds, Applications of polymers with immobilized bioactive compounds.

Unit -III

Definition and classification of TTIs, Requirements for TTIs, Development of TTIs, Maximization for effectiveness of TTIs, Using TTIs to monitor shelf life during distribution. Compounds indicating the quality of packaged food products, Freshness indicators, Pathogen indicators, other methods for spoilage detection .Factors affecting flavour absorption, Role of the food matrix, Role of different packaging materials, Flavour modification and sensory quality. Silica gel, Clay, Molecular sieve, Humectant salts, Irreversible adsorption.

Unit-IV

Novel MAP gases, testing novel MAP applications, High O_2 MAP, Recyclability of packaging plastics, improving the recyclability of plastic packaging, Testing the safety and quality of recycled material, Using recycled plastics in packaging. Problem of plastic packaging waste, Range of biopolymers, developed novel biodegradable materials. The supply chain for perishable foods, Role of packaging in the supply chain, Creating integrated packaging, storage and distribution: alarm systems and TTIs. New packaging techniques and the consumer,

Methods for testing consumer responses, Consumer attitudes towards active and intelligent packaging

OUTCOMES **No. of Lecture: 45**

To gain knowledge on

- The different types of materials

and media used for packaging foods.

- Hazards and toxicity associated with packaging materials and laws, regulations and the monitoring agencies involved food safety, labelling of foods
- Methods of packaging, shelf life and food factors affecting packaging

Books Recommended:

1. Ahvenainen, Novel Food Packaging Techniques
2. Robertson, Food Packaging
3. Hanlon, Kelsey & Forcinio, Handbook of Package Engineering

Course Structure for M.Sc. Food Science
(Effective from Session 2019-20)
Semester-III

FS-505 Techniques in Food analysis

OBJECTIVE To enable the students to understand the principles and methods of advanced techniques in the analysis of foods

Unit -1

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

Unit - II

Non-destructive techniques using UV/Vis, fluorescence, IR, FTIR, NIR, NMR, atomic absorption microscopy, SEM, TEM, XRD, particle size analysis, image analysis etc.).

Unit - III

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

Unit - IV

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

Unit - V

Miscellaneous techniques: Immunoassay techniques; Isotopic, non-isotopic and enzyme immunoassays; surface tension; enzymatic methods of food analysis; thermal methods in food analysis (Differential scanning colorimetry and others).ICP, polarimetry, refractometry, microscopic techniques in food analysis.

OUTCOME **Number of Lectures: 45**

The students will learn the following skills:

- To apply different methods of extracting food components
- To use different types of spectrophotometers
- To use instruments that analyze the physical properties of foods

Books Recommended:

1. AOAC International. 2003. Official methods of analysis of AOAC.International. 17th Ed. Gaithersburg, MD, USA, Association of Analytical Communities.
2. Kirk RS & Sawyer R. 1991. Pearson's Chemical Analysis of Foods. 9th Ed. Longman Scientific & Technical.
3. Leo ML. 2004. Handbook of Food Analysis. 2 nd Ed. Vols. I-III.
4. Linden G. 1996. Analytical Techniques for Foods and Agricultural Products. VCH.
5. Macleod AJ. 1973. Instrumental Methods of Food Analysis. Elek Sci.Marcel Dekker.

Course Structure for M.Sc. Food Science
(Effective from Session 2019-20)
Semester-III

FS-507 Technology of Milk and Milk Products

OBJECTIVE
- To introduce the students to dairy industry, properties and processing of milk, manufacture of dairy products, sanitation and effluent treatment in dairy industry

Unit-1

Milk: definitions, Sources, and composition, factors influencing raw milk quality, physico-chemical properties of milk. Microbiology of milk: Milk as a substrate for bacteria, spoilage microorganism, pathogenic microorganism, sources of contamination, hygienic measures.

Unit-II

Fluid milk processing: Principles, mechanism, equipments and energy requirements of Reception, Separation, Pasteurisation, Homogenization, Sterilization, UHT treatment.

Milk processing and value addition: cream, butter, ghee, condensed and evaporated milk, milk powder, cheese (mozzarella, cottage and processed cheese). Fermented milk products: Yoghurt, acidophilus milk, bulgaricus milk, kefir, kumiss. Improvements in the pasteurization and sterilization of milk: Modelling and risk assessment, UHT sterilization, Aseptic packaging and storage.

Unit-III

Flavour generation in dairy products in raw and heat-treated milk, fermented milk products.

Testing the authenticity of milk and milk products: Detection of foreign fats, milk of other species, water, non-milk proteins, and casein/whey protein ratio.

Good hygienic practice in milk processing: Principal hazards, cleaning and disinfection in a dairy industry, future trends.

OUTCOME: **No. of Lecture: 45**
- The students **will** gain knowledge about dairy processing and understand the manufacturing processes of various dairy products

Books Recommended:

1. Outlines of Dairy Technology by Sukumar De,Oxford University Press.

2. Principles of Dairy Processing by James N.Warner, Wiley Eastern Ltd.

3. Milk and Milk Products by Eckles,Combs; and Macy,Tata McGraw Hill.

4. Technology of Indian Milk Products by Aneja et al. A Dairy India Publication.

5. PFA Act 1954 & Rules 1955 as amended to date.

Course Structure for M.Sc. Food Science
(Effective from Session 2019-20)
Semester-III

FS-509 Technology of Fermented Foods

OBJECTIVES:

- To understand the Enzyme kinetics, Inhibition kinetics, Immobilization
- To understand the concept of basic fermentation processes and its control systems etc.

Unit-I

Introduction to fermentation: Rate of microbial growth and death. Fermentation kinetics, Types of fermentation sub-merged/solid state, Batch /continuous fermentation.

Unit-II

Fermenter design, operation, measurement and control in fermentation, Aeration and agitation in fermentation: Oxygen requirement, measurement of adsorption coefficients, sterilization of air and media; scale up in fermentation.

Unit-III

Production of beer, wine and vinegar, Traditional fermented foods like idli and dosa. Principles of downstream processing and Product recovery. Fermentative Production of Beer, Wines, Cider and Vinegar. Fermented Vegetables (Pickles).Production of Baker's Yeast, Microbial Proteins and fats,

Unit-IV

Food enzymes and Food additives. Oriental fermented foods. Production of alcohols, organic acids, enzymes and immobilization of enzymes. Use of genetically modified microorganisms in food processing. Biological waste treatment.

OUTCOMES: **No. of Lecture: 45**

The student will be able to

- Understand the fundamentals of Enzyme kinetics, Inhibition kinetics and Immobilization Understand the concept of basic fermentation processes and its application during scaleup operations.

Books Recommended:

1. Industrial Microbiology - Prescott & Dunn
2. Industrial Microbiology - L.E. Casida

3. Principle of Fermentation Technology - Whittaker and Stanbury
4. Handbook of Indigenous Fermented Foods - K.H. Steinkrus

Course Structure for M.Sc. Food Science

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Semester-III

FS-511 IPR and Patent laws in Food Sector

OBJECTIVES:

- Follow research ethics
- Understand relevance and significance of IPR

Unit-I

Introduction - GATT - A historical perspective, objectives, fundamental principles, GATT rounds. WTO Historical background- Objectives, scope, function and structure, membership and withdrawal, dispute settlement.

Unit-II

Conventions and treaties (WTO, GATT, Paris convention, Madrid protocol, Berne convention, Budapest treaty, etc). Trade related aspects of Intellectual property rights (TRIPs) agreement - An overview, WIPO and its role.

Unit-III

Patents - Indian Patent law, meaning, scope, objectives, patentability criteria, patentable and non-patentable inventions. Kinds of patent applications, procedure for obtaining patent. Patent specification (provisional, complete specification), drafting, patent claims. Patent opposition, enforcement and revocation, fee structure. Patent Cooperation Treaty, Sources of patent information, patent databases.

Unit-IV

Protection of biological material and biotechnology. IPR and Biodiversity. IPR and Plant Breeders Rights (UPOV and PPVandFR Acts). US and European patent system - comparison with Indian patent system. Copyrights - Introduction, how to obtain, scope, term, treaties, infringement. Trademarks- Introduction, how to obtain, scope, term, different types of marks (collective, certification, service).

UNIT-V

Industrial designs - Definition, how to obtain, features, international design registration.Geographical indications, Trade secrets, Layout design of Integrated circuits.IP-licensing and technology transfer- licensing agreements, issues in licensing, valuation of technology, data exclusivity.IP infringement issues and enforcement.

OUTCOMES: **Number of Lectures : 45**

At the end of this course, students will be able to
• Understand research problem formulation.
• Analyze research related information

Books Recommended:

1. Bhandari Surendra, World Trade Organization and Developing Countries, Deep and Deep Publications, New Delhi.
2. Kumar Ratnesh, World Trade Organization, Deep and Deep Publications, New Delhi.
3. Mittal D.P., Indian Patent Law [As Patent (Amendment) Act, 2005], Taxman's Allied Service (P) Ltd., New Delhi.
4. Ganguli Prabhddh, Gearing up for Patents: The Indian Scenario, University Press, Hyderabad.
5. Wadehra B.L., Law Relating to Patent Trademark Copyright Designs and Geographical Indications, Universal Law

Course Structure for M.Sc. Food Science
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Semester-III

FS-513 Food Plant Design and Sanitation

OBJECTIVE: • To enable the students understand the various concepts of process development, design consideration and cost estimation in food industry

Unit-1

Sanitary considerations of (a) Exterior aspects (b) Interior Aspects. Exterior aspects - Site selection and plant location, Grounds, Exterior, Design, Layout, roof of a food industry. Interior Aspects - Walls and priming, door & doorways, ceiling, floor, lighting, noise, elevators, stairwell and stairs, ventilation, paint/white washing of a food industry.

Unit-II

Personal Hygiene: Sanitary considerations of personal Hygiene in terms of
(a) Physical examinations (b) Hand washing (c) Use of caps and gloves (d) Rest room facilities (e) Clothing (f) Jewellery (g) Eating and personal habits.

Unit-III

Food Transport sanitation Regulatory aspects, of transport sanitation, importance of inspection in receiving, loading, unloading, sanitary design considerations of transport vehicle, pest & rodent control by fumigation, spray.

Unit-IV

Cleaning and sanitization Differentiation between cleaning and sanitization, typs of soil, cleaning agents. Soaps detergent, mechanism of cleaning criterion for selection of a cleaning agent, water for cleaning, cleaning system like CIP, sanitising agents for food industry, selection of a sanitising agent for a food industry, dry cleaning & vacuum cleaning.

Unit-V

Water Sanitation: Water & Steam for food industry sanitation, source & quality of water treatment like chlorination, deionisation, and coagulation/filteration.

OUTCOME: **Number of Lectures : 45**

• The students will be able to apply their knowledge to design projects for setting up a Food Processing Industry

Books Recommended:

1. Sanitary design principles for food processing plants - Stinsom W.S.

2. Food plant Sanitation - J.H. Litcfield, ME Parber,

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Semester-III

FS-515 Technology of Beverages

OBJECTIVE

To provide an understanding of the science and technology for processing different types of beverages.

UNIT-I

Beverages, importance of beverages in our diet, treatment of water for food industry. Technology of alcoholic and non-alcoholic beverages- wine, cider, brandy, perry, toddy. Fruit juice beverages methods of production, preservation and packaging, physiological aspects of fruit juice production and methods of fruit juice clarification.

UNIT-II

Technology of soft drinks, mineral water, ingredients, and additives used in production of soft drinks. Manufacturing of carbonated and non-carbonated beverages, technology of carbonation, and application of CO2 in juice preservation.

UNIT-III

Citrus beverages, whey beverages and utilization of whey in development of fortified drinks, use of low calorie sweeteners in beverages. Equipments and machineries for juice pressing, methods of bottling, enzymatic clarification and debittering of juices. Fruit juice beverages, squash, cordial, crush, RTS, nectar, syrups, their types and
production, blending of juices.

UNIT-IV

Production, processing and chemistry of tea manufacturing, tea products such as soluble tea, tea concentrate, de-caffeinated and flavoured tea. Production, processing, roasting and brewing of coffee, soluble coffee manufacture, standards and specifications of coffee products, de-caffeinated coffee, and coffee brew concentrate and chicory. Cocoa processing and cocoa beverages.

OUTCOME: **Number of Lectures: 45**

Students shall have thorough knowledge of processing of fruit juice beverages, carbonated beverages, citrus beverages, tea and coffee.

Books Recommended:

1. Rao, L. J. M. & Ramalakshmi, K. (2011). Recent trends in soft beverages: AFST, India.

2. Priest, F. G. & Campbell, I. (1996). Brewing Microbiology (2nd ed.): Chapman and Hall, London.

3. Hui, Y. H. (2004). Handbook of Food and Beverage Fermentation Technology: Marcel Dekker, New York.

4. Varnam, A. H. & Sutherland, J. P. (1994). Beverages: Technology, Chemistry and Microbiology: Chapman, London.

5. Varnam, A. H. & Sutherland, J. P. (2009). Beverages Technology, Chemistry and Microbiology: Springer, UK

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Semester-IV

FS-556- Project	(15 Credits)
MOOCS courses –I (Open elective)	3 Credits
MOOCS courses –II (Open elective)	2 Credits