

## M.Sc. FSTP [2 year] with Research

Sr. No.	Year 1		Year 2	
	Semester 1	Semester 2	Semester 3	Semester 4
1	Food Chemistry (FST603) [CU:4; L-3, P-1] {CC}	Principles of Food Processing and Preservation (FST601) [CU:4; L-3, P-1] {CC}	Technology of Egg, Poultry, Meat & Sea Foods (FSTXXX) [CU:4; L-3, P-1] {CC}	Food Safety, Standards and Public Health (FSTXXX) CU:4; L-4] {CC}
2	Food Microbiology (FST602) [CU:4; L-3, P-1] {CC}	Technology of Cereals, Legumes and Oilseeds Processing-II (FST612) [CU:4; L-3, P-1] {CC}	Food Engineering Operations (FSTXXX) [CU:4; L-4] {CC}	Quality Control and Quality Assurance in Food Industry (FSTXXX) [CU:4; L-3, P-1] {AC}
3	Technology of Cereals, Legumes and Oil Seeds Processing-I (FST607) [CU:4, L-3, P-1] {CC}	Technology of Milk Products Processing (FST614) [CU:4; L-3, P-1] {CC}	Food Packaging Technology (FST601) [CU:4; L-4, P-0] {CC}	Technology of Frozen Foods (FSTXXX) [CU:4; L-4] {SE}
4	Technology of Fruits, Vegetables and Plantation Crops Processing [CU:4, L-3, P-1] {CC}	Any three from (a - f); a) Bakery Technology (FST606) [CU:4; L-3, P-1] {SE}		Functional Foods and Nutraceuticals (FSTXXX) [CU:4; L-4] {SE}
5	Any one from (a - d) a) Technology of Beverages [CU:4, L-4, P-0] {SE}	b) Enzymes in Food Processing (FST606) [CU:4; L-4] {SE}		
6	b) IPR, Biosafety and Bioethics [CU:4, L-4] {SE}	c) Spices Processing and Flavour Technology (FST613) [CU:4; L-4] {SE}		
7	c) Biochemical and Biophysical Techniques [CU:4, L-3, P-1] {SE}	d) Food Extrusion Technology (FST618) [CU:4; L-4] {SE}		

8	d) Confectionery Technology [CU:4, L-3, P-1] {SE}	e) Nutrition and Health (FST617) [CU:4; L-3, P-1] {SE}		
9		f) Technology of Snack Foods (FST615) [CU:4; L-4] {SE}		
10	Behavioural Science: Understanding Self for Effectiveness (PSY601) [CU:1, L-1, P-0] {VAC}	Behavioural Science (PSY610) [CU:1, L-1, P-0] {VAC}	Professional Ethics-I (XXXXXX) [CU:1, L-1] {VAC}	Professional Ethics – II (FSTXXX) [CU:1; L-1] {VAC}
11	Foreign Business Language (French/German) (FOL101/ FOL102) [CU:1, L-1] {VAC}	Foreign Business Language FOL103/FOL104 [CU:1, L-1] {VAC}	Research Work/Dissertation [CU:12, P-12] {VAC}	Research Work/Dissertation [CU:12, P-12] {VAC}
<b>Credits</b>	<b>26</b>	<b>26</b>	<b>25</b>	<b>25</b>

# **Semester 1**

M.Sc. (H) Food Science Technology and Processing (2 year)							
Semester-wise Distribution of Courses				Semester 1			
S. No.	Course Code	Course Title	Course Type	Credits (16-18)			Credit Units
				L	T	P	
1	FST603	Food Chemistry	CC	3	0	1	4
2	FST602	Food Microbiology	CC	3	0	1	4
3	FST607	Technology of Cereals, Legumes and Oil Seeds Processing-I	CC	3	0	1	4
4	FST608	Technology of Fruits, Vegetables and Plantation crops Processing	CC	3	0	1	4
5	FST609	Technology of Beverages	SEC	4	0	0	<b>4+4 (Any two)</b>
6	FST610	Confectionery Technology	SEC	3	0	1	
7	BTY602	IPR, Biosafety and Bioethics	SEC	4	0	0	
8	FST611	Biochemical and Biophysical Techniques	SEC	3	0	1	
9	PSY601	Behavioural Science: Understanding Self for Effectiveness	VAC	1	0	0	1
10	FOL101/FOL102	Foreign Business Language (French/German)	VAC	1	0	0	1
<b>Total Credits</b>							<b>26</b>

CC: Core Course; SEC: specialization elective course; OEC: open elective course; VAC: value addition courses.

## Food Chemistry

L	T	P	SW/FW	Total Credit Units
3	0	1	0	4

### Course content and syllabus

Food Chemistry-1	Teaching Hrs
<b>Unit I: Importance of water in foods</b>	<b>14h</b>
Definition of water in food, Structure of water and ice, Types of water, Physical properties of water, Surface tension, Colligative properties, Water activity & sorption phenomenon, Water activity and shelf-life, Water activity and reaction rate, Water activity in relation to food spoilage, processing & packaging	
<b>Unit II: Food carbohydrates and Proteins</b>	<b>13 h</b>
<b>Carbohydrates:</b> Classification, structure & Importance, Physicochemical properties of carbohydrates: mutarotation, caramelization, crystallization, oxidation & reduction, Modified starch, Resistant starch, Starch hydrolysates <b>Proteins:</b> Protein structure and classification, Nature of food proteins (plant and animal origin), Properties of proteins (electrophoresis, sedimentation, amphoterism, gel formation, denaturation, precipitation & coagulation), Non-enzymatic browning, Effects of processing and storage on food proteins, Functional properties of proteins, Protein intolerance (celiac disease & cow milk allergy)	
<b>Unit III: Technology of edible fats/oils, enzymes &amp; flavour</b>	<b>14 h</b>
<b>Fats/Oils:</b> Nomenclature, classification and physical properties of lipids, Chemical properties of lipids, Rancidity, lipolysis, flavour reversion, auto-oxidation and its prevention, Emulsion & emulsifiers, Technology of edible fats and oils: refining, hydrogenation, fractionation and interesterification, Fat replacers, Designer lipids, Fat frying and effects <b>Enzymes &amp; Flavour:</b> Introduction & classification of enzymes & flavour, Nature & kinetics of enzymes, Immobilization of enzymes, Types of taste, Flavour enhancers, Odour, Astringency, Functional components for food flavour	
<b>Unit IV: Introduction to food minerals, vitamins, colorants &amp; pigments</b>	<b>13 h</b>
<b>Minerals:</b> Types & classification, Interaction of minerals with food components, minerals uptake in canned foods, Deficiency & disorders <b>Vitamins:</b> Classification, structure, importance and stability of vitamins, Uses in foods, Deficiency disorders <b>Colorants &amp; Pigments:</b> Introduction and classification, Systems of colour measurement, Food application, Pigments: classification, importance & food application	

### Lab/ Practical details:

**(36 Hours)**

**Objective:** The laboratory exercises in this section have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment.

### List of Experiments -with basic instructions

1. Preparation of primary and secondary solutions
2. Determination of total ash content in foods
3. Estimation of moisture content
4. Estimation of protein content by spectrophotometer method
5. Determination of refractive index and specific gravity of fats and oils.
6. Determination of smoke point and percent fat absorption for different fat and oils.
7. Determination of percent free fatty acids
8. Determination of fat content of milk using Gerber's method
9. Estimation of saponification value
10. Determination of crude fibres in foods

11. Determination of iron content in food: colorimetric method
12. Estimation of reducing and non-reducing sugars using potassium ferricyanide method.

**Course Learning Outcomes:**

- ▶ Understand the basic role of water in foods.
- ▶ To gain knowledge about importance, uses, and physicochemical properties of proteins and carbohydrates
- ▶ Understand the structure, classification and uses of food lipids, enzymes and flavour
- ▶ Perceive basic knowledge about the food minerals, vitamins, colorants and pigments

**Text / Reference Books:**

Author	Title	Publisher	Year of publication	ISBN	Pages
DeMan, John M.	Principles of Food Chemistry	New York: Springer	2020	9783319636054, 3319636057	625
Damodaran, Srinivasan, and Kirk L. Parkin.	Fennema's Food Chemistry	Boca Raton CRC Press	2017	9781482243611, 148224361X, 9781482208122, 1482208121,	1107
Potter, Norman N.	Food Science	Springer,	2013	1461372631, 9781461372639	623
Sehgal, Shalini,	A Laboratory Manual of Food Analysis,	New Delhi: IK International Publishing House,	2016	9789384588847, 9384588849	162

## Technology of Cereals, Legumes and Oil Seeds Processing-I

L	T	P	SW/FW	Total Credit Units
3	0	1	0	4

### Course Contents/syllabus:

<b>Technology of Cereals, legumes, and Oil Seeds - I</b>	<b>Teaching Hrs</b>
<b>Unit I: Wheat production, varieties, and their quality</b>	<b>14 h</b>
<p><b>Wheat:</b> Production, varieties, and their quality. Structure and composition, environmental effect in relation to processing quality, Enzyme in wheat and their implications in wheat technology.</p> <p><b>Types of wheat grading system,</b> Cleaning, conditioning, and milling of wheat. Principles and machine operations, Fractionation of flour and its application. Flour treatment. Technology of bakery product such as bread, biscuits, cake, crackers, pretzel, etc. Production, equipment, and ingredients.</p> <p>Role of ingredients in bakery products.</p>	
<b>Unit II: Quality evaluation of wheat and wheat products</b>	<b>13 h</b>
<p>Criteria of quality evaluation of flour. Introduction to dough rheology and dough chemistry, Testing properties of flour slurry and dough using instruments– Farinograph, Falling Number, Extensiograph, Amylograph, Mixograph, Rapid Visco Analyser, Alveograph etc.</p> <p>Industrial processes for the production starch and gluten from wheat. Functional properties and uses of wheat starch, chemistry and technology of durum wheat and pasta products.</p>	
<b>Unit III: Rice production, varieties, and rice products</b>	<b>14 h</b>
<p>Rice production, rice types. Rice structure and proximate composition, distribution of various chemical constituents in rice grain. Methods of studying quality of rice with special reference to cooking quality. Production of rice starch uses and evaluation of functional properties of rice starch. Changes during aging of rice. Methods of accelerated aging of rice. Methods of enrichment with vitamins and mineral.</p>	
<b>Unit IV: Rice Processing Technology</b>	<b>13 h</b>
<p>Rice milling, operation, milling machine, degree of milling, milling yields of paddy. Factors affecting milling yield and its effect on nutrition and quality of rice. Methods of parboiling, controlling the degree of parboiling, nutrition, advantages and disadvantages. Rice bran stabilization, methods of stabilization, Technologies of quick cooking rice, infant foods, rice flakes and breakfast cereals. Rice in brewing and manufacture of beer.</p>	

**Objective:** The laboratory exercises in this section have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment.

### **List of Experiments -with basic instructions** **(36 hours)**

- 1) Determination of quality characteristics of flours.
- 2) Rheological properties of dough using Farinograph/ Extensograph/Mixograph.
- 3) Milling of rice and assessment of per cent of head, broken, immature kernels degree of polish etc.
- 4) Parboiling and evaluation of quality of parboiled rice.
- 5) Evaluation of cooking quality of rice.
- 6) Pasting properties of starches using Visco–amylograph/RVA.
- 7) Baking of bread, cookies and cakes and evaluation of their quality.

8) Processing of paste goods and evaluation of their quality.

**Course Learning Outcomes:**

- ▶ Learning of the processing of wheat and rice.
- ▶ Demonstrate quality evaluation of wheat flour and functionality of rice starch by different methods.
- ▶ Compare different rice processing methods
- ▶ Perceive knowledge of product development from wheat flour.

<b>Text / Reference Books:</b>					
<b>AUTHOR</b>	<b>TITLE</b>	<b>Publisher</b>	<b>Year of publication</b>	<b>ISBN</b>	<b>Pages</b>
Chakraverty.	Post-Harvest Technology of Cereals, Pulses and Oilseeds,	Oxford & IBH Publishing Co. Pvt Ltd.	2019	9788120409699	368
Kent, N.L.	Technology of Cereal, 5th Ed.	Pergamon Press.	2000	9781855733619	352
Manay, S. and Sharaswamy, M.	Food Facts and Principles.	Wiley Eastern Limited.	2020	9789389802405	574
Marshall.	Rice Science and Technology	Wadsworth Ed. New York: Marcel Dekker.	1993	9780824788872	486



## Technology of Fruits, Vegetables and Plantation crops Processing

L	T	P	SW/FW	Total Credit Units
3	0	1	0	4

### Course Curriculum:

Technology of Fruit Vegetable and Plantation Crops	Teaching Hrs
<b>UNIT I: Importance of fruits and vegetable</b>	<b>14 h</b>
<p>Importance of fruits and vegetable, History and need of preservation, reasons of spoilage. Method of preservation (short &amp; long term).</p> <p>Fruit Maturity - Definition, methods of maturity determination, maturity indices for selected fruits and vegetables. Chemical changes during maturation. Post-harvest handling and storage of fresh fruit and vegetables, Preparation for processing, Minimal processed products, Cold chain logistics, Zero Energy Cool Chambers, Charcoal cool storage rooms,</p> <p><b>Canning and Bottling of Fruits and Vegetables</b></p> <p>Selection of fruits and vegetables, Process of canning for different fruits and vegetables, factors affecting the process- time and temperature, Containers of packing, lacquering, Syrups and brines for canning, Spoilage in canned foods</p>	
<b>UNIT II: Fruit Beverages</b>	<b>13 h</b>
<p><b>Introduction:</b> Processing of fruit juices- selection, juice extraction, deaeration, straining, filtration and clarification, membrane technology, Utilization of Fruits and vegetable juices in fermented/Non-fermented/aerated beverages, health drinks Spoilage, <b>Preservation of fruit juices-</b> pasteurization, chemically preserved with sugars, freezing, drying, tetra-packing, carbonation.</p> <p>Processing of squashes, cordials, nectars, concentrates and powder.</p> <p>Packaging of fruit beverages.</p>	
<b>UNIT III: Intermediate moisture foods</b>	<b>18 h</b>
<p><b>Jams, Jellies and Marmalades:</b> Introduction, <b>Jam:</b> Constituents, selection of fruits, processing &amp; technology. <b>Jelly:</b> Essential constituents, Theory of jelly formation, Processing &amp; technology, defects in jelly. <b>Marmalade:</b> Types, processing &amp; technology, defects. Preservatives and Packaging of jams, jellies and marmalades, Chemistry and Role of pectin in jams, jellies and marmalades, Manufacture of pectin, Role of pectinases</p> <p><b>Pickles and Tomato Products</b></p> <p>Pickles - Processing and Types, Causes of spoilage in pickling.</p> <p>Tomato products -Selection of tomatoes, pulping &amp; processing of tomato juice.</p> <p>Tomato puree, paste, ketchup, sauce and soup. Packaging of pickles and tomato products, chutney, Preservatives,</p> <p><b>Restructured fruits and vegetables:</b> By product utilization</p>	
<b>UNIT IV: Dehydration of Fruits and Vegetables</b>	<b>18 h</b>
<p>Sun drying &amp; mechanical dehydration, Associated quality changes during drying and storage of dehydrated products, Process variation for fruits and vegetables</p> <p>Freezing of fruits and vegetables, Processing of frozen fruits and vegetables, IQF products, packaging, storage and thawing of frozen foods</p> <p><b>Spices:</b> Processing and properties of major and minor spices, Oleoresin and essential Oil</p> <p><b>Tea, Coffee and Cocoa:</b> Processing, Variety and Products.</p> <p><b>Medicinal and aromatic Plants:</b> Therapeutic values</p>	

**Objective:** The laboratory exercises in this section have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment.

### List of Practical's

1. Examination of fresh fruits and vegetables for processing
2. Estimation of total soluble solids, pH, acidity, brix to acidity ratio, ascorbic acid in food
3. Packaging of Fresh fruits and vegetables.; modified atmosphere packaging, controlled atmosphere packaging
4. Steps in canning process.
5. Preparation of fruits and vegetables juice
6. Preparation and analysis of syrups and Brines
7. Canning of fruits and vegetables
8. Making and evaluation of pectin and tomato products.
9. Drying and rehydration of fruits and vegetables.
10. Freezing of fruits and vegetables
11. Extraction and estimation of polyphenol content in tea and coffee.
12. Spices and adulteration.

### Course Learning Outcomes

- ▶ Gaining knowledge about the significance of fruits and vegetable in human health
- ▶ Understanding about the preservation of fruits and vegetables by caning, drying and other methods
- ▶ Learning about methods of making fruit beverages, sterilization methods and packaging
- ▶ Training to prepare jams, jellies, and marmalades from seasonal fruits.
- ▶ Gaining in-depth knowledge of drying vegetables and fruits by different methods, and storage.
- ▶ Knowing about tea coffee production, processing and flavor and aroma determination.

<b>Text / Reference Books:</b>					
<b>Author</b>	<b>Title</b>	<b>Publisher</b>	<b>Year of publication</b>	<b>ISBN</b>	<b>Pages</b>
Thompson, A.K.,	Fruits and vegetables; Harvesting, handling and storage.	Blackwell Publishing.	2003	9781118654040	--
Crusess, W.B.	Commercial fruit and Vegetable Products.	W.V. Special Indian Edition. Agrobios India.	2004	9788177540413	906
Ranganna S.	Handbook of analysis and quality control for fruits and vegetable products.	Tata Mc Graw-Hill publishing company limited, Second edition.	1986	9780074518519	1112

## Confectionary Technology

L	T	P	SW/FW	Total Credit Units
3	0	1	0	4

### Course Contents/syllabus:

Confectionary Technology	Teaching Hrs
<b>UNIT I: Introduction to Confectionary Industry</b>	<b>13 h</b>
Current status and economic importance of Confectionary Industry in India. Raw materials for confectionery products- essential and optional ingredients and their role, Confectionery products & their pertinent standards & regulations, Types of confectionery, Equipment used in confectionery industry, Plant layout for confectionery industry	
<b>UNIT II: Technology of sugars</b>	<b>14 h</b>
Types and sources, Methods of preparation of sugars (jaggery, khandsari, raw and refined sugar), Quality and properties of sugars	
<b>UNIT III: Technology of the processing of confectionary products</b>	<b>14 h</b>
Types of candies: boiled sweets, hard candy, brittle, Technology of sugar panned confectionery products, Confections- ingredients, equipment & processes, Product quality parameters, faults and corrective measures, manufacturing process of toffees, caramels, fudge lozenges, liquorice, chewing gum, bars, Sugar free confectionery, Packaging requirements for confectionery products	
<b>UNIT IV: Technology of cocoa &amp; chocolate processing</b>	<b>13 h</b>
Composition, Cocoa processing: cleaning, roasting, sterilization, winnowing, alkalization etc., Cocoa butter, Rendering and polymorphism of cocoa fat, Properties of fat required for chocolate preparation, Chocolates: General manufacturing process, conching, tempering, enrobing etc., Chocolate defects and their control measures	

### Lab/ Practical details:

**(36 Hours)**

**Objective:** The laboratory exercises in this section have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment.

### List of Experiments

1. Estimation of Sugar solubility, acidity and sulphated ash content of sugar and jaggery
2. Determine the effect of heat on sugar solution and perform the thread and cold-water test.
3. To study the process of inversion, melting, caramelization and crystallization in sucrose.
4. To study the concept of sugar-based product formulation
5. Preparation of fondant/fudge/ brittles.
6. Preparation of candy/ toffee/ fruit drop
7. To study the tempering of fat in chocolate preparation
8. To study the effect of cocoa butter replacer in chocolates
9. Visit to confectionary plant to study equipment and processes

### Course Learning Outcomes

- ▶ Know the status and scope of confectionary industry
- ▶ Understand the related technologies of sugar processing used in confectionary
- ▶ Understand the basics of the technologies used in confectionary products
- ▶ Know the processing and technology of cocoa and chocolate

Text / Reference Books:					
Author	Title	Publisher	Year of publication	ISBN	Pages

Edwards, William. P.	The Science of Sugar Confectionery	The Royal society of Chemistry	2019	9781788011334	221
Lees, R. & Jackson, EB.	Sugar Confectionery and Chocolate Manufacture	Springer	1992	668135971	373
Minifie, B.W.	Chocolate, Cocoa, and Confectionery Science and Technology	Aspen Publication.	2014	9781489957474 9780834213012	904

## Food Microbiology

L	T	P	SW/FW	Total Credit Units
3	0	1	0	4

### Course Contents/syllabus:

Food Microbiology	Teaching Hrs
<b>Unit I: Introduction to Food Microbiology and Instrumentation</b>	<b>14 h</b>
History, development and scope of food microbiology; Inter-relationship of microbiology with other sciences. Instrumentation in microbiology - Construction and working principles of autoclave, hot air oven, pH meter, laminar air flow, incubator, bacterial colony counter, spectrophotometer, membrane filter unit, microscope, freeze dryer, thermocycler. <u>Sterilization</u> - Physical methods - heat, irradiation, filtration, ultrasonic vibration. Chemical methods - alcohol, aldehydes, dyes, halogens, phenols, metallic salts, surface active agents, gases.	
<b>Unit II: Types and Growth Characteristics of Microorganisms in Food</b>	<b>13 h</b>
Types of microorganisms associated with food, their morphology and characteristics, significance of spores in food microbiology. Microbial growth curve, factors affecting the growth of microorganisms in foods. Bacterial generation, doubling time and specific growth rate. Food as a substrate for microorganisms; factors affecting growth of microbes: pH, water activity, O-R potential, nutrient contents, growth inhibitory substances. Microbes as food-contaminants and as food-starters. Probiotics, prebiotics and synbiotics.	
<b>Unit III: Isolation and Enumeration of Food Microorganisms</b>	<b>14 h</b>
Pure culture technique; Methods of isolation and cultivation of beneficial as well as pathogenic food microbes; Challenges in microbiological analysis of foods; Qualitative and quantitative methods; Enumeration of microorganisms- Standard Plate Count (conventional and automated), Agar droplet, Direct Microscopic Count, Direct Epi florescent Filtration Technique; FDA's Bacterial Analytical Manual; Rapid Methods of Detection of microorganisms-immunoassays, PCR, ELISA.	
<b>Unit IV: Microbial Food-Spoilage and Food-Borne Diseases</b>	<b>13 h</b>
Sources of microorganisms in foods, some important food spoilage microorganisms; Spoilage of specific food groups- milk and dairy products, meat, poultry and seafood, cereal and cereal products, fruits and vegetables and canned products. Types of food-borne diseases –infections, intoxications and toxi-infections; Origin and symptoms of common food borne diseases and their preventive Measures; Recent outbreaks and emergence of food pathogens.	

### Lab/ Practical details:

**(36 Hours)**

Objective: The laboratory exercises in this section have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment.

#### List of Experiments -with basic instructions

1. Introduction to good microbiology laboratory practices; glassware washing, drying, cotton plug formation. Study of apparatus used in microbiology lab.

2. Media preparation, pH adjustments and sterilization: Nutrient agar, MRS agar, EMB agar, Potato Dextrose agar, Phosphate Buffer and Normal Saline.
3. Functioning and use of compound microscope.
4. Culturing and sub-culturing of food-related microorganisms; point inoculation, streak inoculation, spread plate method, pour plate method and swab method.
5. Study of bacterial cell wall by Gram's staining.
6. Study of bacterial capsules by negative staining.
7. Study of bacterial endospores by endospore staining.
8. Evaluation of microorganisms in raw and processed products by standard plate count/TPC, Yeast and Mold count. Molecular identification by PCR.
9. Detection of coliforms by MPN method, confirmed and completed tests. Serial dilution technique.
10. *In vitro* probiotic profiling of beneficial food-grade bacteria; gastrointestinal tolerance, antimicrobial activity, antibiotic susceptibility assay.

### Course Learning Outcomes

- Understand the important genera of microorganisms associated with food and their characteristics, their growth pattern and parameters.
- Comparative knowledge about the beneficial as well as harmful role of microorganisms in food systems.
- Identify the role of microorganisms in food borne diseases and control measures
- Demonstrate staining of bacteria
- Understand the laboratory techniques to detect, quantify, and identify microorganisms in foods.

Author	Title	Publisher	Year of publication	ISBN	Pages
Frazier WC, Westoff DC	Food Microbiology 4th Ed.	Tata Mc Graw Hill Publ. Co. Ltd.	2014	9781259062513	492
Jay J M	Modern Food microbiology, 3rd Ed.,	Van No Strand Reinhold Co. Inc.	2005	9780387231808	790
Michael J Pelczar; Eddie C S Chan; Noel R Krieg	Microbiology,	McGraw Hill Book Co., New York	2010	9780074623206	918
Bibek Ray & Arun Bhunia	Fundamental Food Microbiology	CRC Press ,US.	2013	9780815384311	664

## BTY602: IPR, Biosafety and Bioethics

L	T	P	Total Credits
4	0	0	4

### Course content and syllabus

	Teaching Hours
<b>Unit I: Introduction to IPR and Patent Database</b>	<b>18 hrs</b>
<b>Types of IP:</b> Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications. <b>Protection of New GMOs:</b> International framework for the protection of IP. IPs of relevance to Biotechnology and few Case Studies. <b>Patent databases:</b> Invention in context of “prior art”; Searching national/International Databases; Analysis and report formation	
<b>Unit II: Types of patent and patent application</b>	<b>18 hrs</b>
<b>Types of patents:</b> Indian Patent Act 1970; Recent Amendments; Filing of a patent application; Precautions before patenting-disclosure/non-disclosure; WIPO Treaties; Budapest Treaty; PCT and Implications; Role of a Country Patent Office; Procedure for filing a PCT application	
<b>Unit III: Biosafety, GMOs and Biodiversity Act</b>	<b>18 hrs</b>
<b>Biosafety:</b> Introduction; Historical Background: Introduction to Biological Safety Cabinets; Primary Containment for Biohazards; Biosafety Levels; Biosafety Levels of Specific Microorganisms; Recommended Biosafety Levels for Infectious Agents and Infected Animals; Biosafety guidelines - Government of India; <b>Definition of GMOs &amp; LMOs:</b> Roles of Institutional Biosafety Committee, RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs; Risk Analysis; <b>Risk Assessment:</b> Risk management and communication; Overview of National Regulations and relevant International Agreements including Cartagena Protocol. <b>Biodiversity Act 2002:</b> Agricultural biodiversity; International Treaty on Plant Genetic Resources for Food and Agriculture (PGRFA); Conservation strategies for seed gene bank; Climate change and conservation of plant genetic resources; Global efforts for management of crop genetic resources; Strategies on PVFR and Biodiversity Acts. <b>Biodiversity Legislation in India;</b> Indian Biodiversity Act and provisions on crop	
<b>Unit IV: Bioethics, Ethics and the law issues</b>	<b>18 hrs</b>
<b>Bioethics:</b> Concepts; Philosophical considerations; Epistemology of Science; Ethical Terms; Principles & Theories; Relevance to Biotechnology; <b>Ethics and the Law Issues:</b> types and policies; Research concerns; Emerging issues: Biotechnology’s Impact on Society; DNA on the Witness Stand - Use of genetic evidence in civil and criminal court cases; Challenges to Public Policy – To Regulate or Not to Regulate; Improving public understanding of biotechnology products to correct misconceptions.	

### Course Learning Outcomes:

- Understand IPR and its database.
- Evaluate different types of patents and policies

- Compare the biosafety methods and differences between GMOs and LMOs.
- Perceive knowledge of Bioethics and laws.

**Text / Reference Books:**

<b>Author</b>	<b>Title</b>	<b>Publisher</b>	<b>Ed/year</b>	<b>ISBN No</b>	<b>Pages</b>
D N Choudhary	Evolution of patent laws: "developing countries' perspective	Delhi Capital Law House	2006	OCLC Number: 255182178	476



## Biochemical and Biophysical Techniques

L	T	P	Total Credits
4	0	0	4

### Course content and syllabus

Units	Teaching Hours
<b>Unit I -Spectroscopy &amp; Chromatography</b>	<b>18 h</b>
<b>Spectroscopy-</b> Concepts of spectroscopy, Laws of photometry. Beer-Lambert's law, Principles and applications of colorimetry. UV-Visible absorption spectroscopy, Fluorescence spectrophotometry, Mass spectroscopy, CD, X-ray diffraction, X-ray spectroscopy and NMR. Gas Liquid Chromatography, High Performance Liquid chromatography (HPLC), Fast Protein Liquid chromatography, FPLC, UP-HPLC, nano-LC, SCX and SAX-nano HPLC.	
<b>Unit II: Centrifugation &amp; Electrophoresis</b>	<b>18 h</b>
Principle of centrifugation, concepts of RCF, different types of instruments and rotors, preparative, differential and density gradient centrifugation, analytical ultra-centrifugation, determination of molecular weights and other applications, sub-cellular fractionation.	
<b>Unit III: Microscopy</b>	<b>18 h</b>
<b>Microscopy</b> – Bright field, Dark field, Phase contrast and Fluorescence microscopy, Transmission, and scanning, freeze fracture techniques, specific staining of biological materials.	
<b>UNIT IV: Electrophoretic Techniques and Nano biosensors</b>	<b>18 h</b>
Electrophoretic techniques – Principles of electrophoretic separation. Types of electrophoresis including paper, cellulose, acetate/nitrate and gel. Electroporation, Pulse field gel electrophoresis, 2D Gel Electrophoresis. Introduction to Nano-biosensors and their biological applications.	

### Lab/ Practical details:

(18 hours)

**Objective:** The laboratory exercises in this section have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment.

### List of Experiments -with basic instructions

1. To study sedimentation using Swing Out Rotor and Angle Rotor.
2. To study separation of biomolecules by paper chromatography.
3. To study separation of biomolecules by thin layer chromatography.
4. Separation of proteins by ion-exchange column chromatography
5. Separation of proteins by affinity column chromatography.

### Course Learning Outcomes:

- Understand principles of various techniques to quantify and separate biomolecules.
- Describe the methodology of various bioanalytical techniques employed in laboratories.
- Discriminate between various techniques with respect to their applications.
- Evaluate the impact of Nano-biosensors in the advancement of bioanalytical techniques.

**Text / Reference Books:**

<b>Author</b>	<b>Title</b>	<b>Publisher</b>	<b>Ed/year</b>	<b>ISBN No</b>	<b>Pages</b>
Plummer, David T.	An Introduction to Practical Biochemistry	Tata McGraw Hills	3 <sup>rd</sup>	978-0070841659	352
Wilson Keith and Walker John.	Principles and techniques of Biochemistry and Molecular Biology	Cambridge University Press	7 <sup>th</sup>	978-0521731676	759 pages

**PSY601: Behavioural Science: Understanding Self for Effectiveness**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Total Credits</b>
<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

**Course Contents/syllabus:**

	<b>Teaching time</b>
<b>Unit I: Self: Core Competency</b>	<b>5 h</b>
Understanding of Self, Components of Self – Self-identity, Self-concept, Self confidence, Self-image, BIG5 Factors	
<b>Unit II: Techniques of Self Awareness</b>	<b>4 h</b>
Exploration through Johari Window, Mapping the key characteristics of self, Framing a charter for self-Stages – self-awareness, self-acceptance and self-realization	
<b>Unit III: Self Esteem &amp; Effectiveness</b>	<b>5 h</b>
Meaning, Importance, Components of self-esteem, High and low self-esteem, Measuring your self esteem	
<b>Unit IV: Building Positive Attitude and Emotional Competence</b>	<b>4 h</b>
Meaning and nature of attitude, Components and Types of attitude, Importance and relevance of attitude Emotional Intelligence – Meaning, components, Importance and Relevance Positive and negative emotions, Healthy and Unhealthy expression of emotions	

**Course Learning Outcomes:** At the end of this course, the students will be able to:

- The student will apply self-introspection as a tool for self-awareness.
- The student will understand self-concept for self-recognition, self-improvement and perception of others.
- The student will be able to analyze their physical self, social self, the competent self and psychological self.

The student will be able to analyze what motivates his/her actions and the actions of others

**Text / Reference Books:**

<b>AUTHOR</b>	<b>TITLE</b>	<b>Publisher</b>	<b>Year of publication</b>	<b>ISBN</b>
Singh A.	Achieving Behavioural Excellence for Success	Wiley Publication	2012	978812658027
Towers, Marc	Self Esteem	American Media	1995	9781884926297
Pedler Mike, Burgoyne John, Boydell Tom	A Manager's Guide to Self-Development	McGraw-Hill	2006	978-0077114701
Covey, R. Stephen	Seven habits of Highly Effective People	Simon & Schuster Ltd	2013	978-1451639612

Khera Shiv	You Can Win	Macmillan	2005	978-0333937402
Gegax Tom	Winning in the Game ofLife	Harmony Books	1999	978-0609603925
Singh, Dalip	Emotional Intelligence atWork	Publications	2006	9780761935322
Goleman, Daniel	Emotional Intelligence	Bantam Books	2007	9780553095036
Goleman, Daniel	ing with E.I	Bantam Books	1998	9780553104622

## FOL102: Introduction to German Culture & Language

<b>L</b>	<b>T</b>	<b>P</b>	<b>Total Credits</b>
<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

### Course Contents/syllabus:

	Teaching hours
<b>Unit-I Introduction to German Language (Einführung)</b>	<b>5 h</b>
Introduction to German as a global language, Self-introduction and Greetings, Die Alphabeten, Phonetics: the sound of consonants and vowels, Wie buchstabieren Sie Ihren Name?	
<b>Unit-II- Numbers and everyday conversation (die Zahl und Gespräche)</b>	<b>4 h</b>
Counting in German from 1-100, Simple Calculation and verb 'kosten' - Wie viel kostet das? Plural Forms, Vocabulary: Wochentage, Monate, Jahreszeiten, Ordinal numbers and the question - Wann haben Sie Geburtstag?	
<b>Unit-III- Regular verbs and nominative case: articles and pronouns (Regelmässige Verben und Nominativ Kasus: Artikel und Pronomen)</b>	<b>5 h</b>
Introduction to all personal pronouns and conjugation of Regular verbs. Detailed exercise on regular verbs. Reading a text on regular verbs. Introduction to definite. Vocabulary: Schulsachen und Getränke, Nominative case/ Articles (der, die, das) Nominative Pronouns: - Applicability of pronouns for both persons and things. Usage of nominative Personal Pronouns. Introduction of nominative possessive pronouns. usage of nominative possessive pronouns	
<b>Unit-IV- The Family, Work-life and Professions (Familienmitglieder und Berufe) &amp; Interrogative sentences (W-Fragen)</b>	<b>4 h</b>
The Family, Work-life and Professions (Familienmitglieder und Berufe) Vocabulary: Professions and conjugation of the verb 'sein' Introduction to simple possessive pronouns with the help of the verb 'haben' Usage of possessive pronouns. Interrogative sentences (W-Fragen) W-Fragen: who, what, where, when, which, how, how many, how much, etc. Exercises on the question pronouns	

**Course Learning Outcomes:** At the end of this course, the students will be able to express themselves in writing and orally in basic German. This course content focuses on the speech of the students in a lucid and a concurrent manner using appropriate vocabulary and pronunciation techniques. Extra stress will be given on their understanding of grammatical structures and the foreign accent of the language. At the end of the course, the student shall be able to:

- Understand information; Express in his own words; Paraphrase; Interpret and translate.
- Apply information in a new way in a practical context
- Analyse and break-down information to create new ideas
- Evaluate and express opinion in a given context

### Text / Reference Books:

Author	Title	Publisher	Year	ISBN	Pages

Rolf Bruseke	Starten Wir A 1	Langers InternationalPvt Ltd (Max Hueber Verlag)	2017	978- 3190160 006	
Giorgio Motta	Wir Plus Grundk urs Deutsch fur Junge Lerner Book	Ernst Klelt Verlag	2011	978- 8183072 120	
Heimy Taylor, Werner Haas	Station en Deutsch Self Study Course German Guide	Wiley	2007	978- 0470165 515	

## FOL101: Introduction to French Culture & Language

<b>L</b>	<b>T</b>	<b>P</b>	<b>Total Credits</b>
1	0	0	1

### Course Contents/syllabus:

	<b>Teaching hours</b>
<b>Unit-I Introduction to French language</b>	<b>4 h</b>
Brief introduction of French and Francophone countries, presenting oneself, Getting information about someone else, Greeting and taking leave, Asking/giving personal information	
<b>Unit-II- A rendez-vous ; Visiting a place</b>	<b>5 h</b>
Pronouncing and writing numbers in French, Spell and count numbers Telling the time, Temporal expressions, Communicating in class, Fixing an hour, place for a meeting. Describing a person. Identifying a person, object and place, Describing relation in a family, A specific person, object and place	
<b>Unit-III- An interview</b>	<b>5 h</b>
Description of objects, people and places, Nationalities, Speaking about one's professions, Expressing Actions using regular –er ending verbs; avoir, être; reflexive verbs –usage, conjugation, Interview of celebrity	
<b>Unit-IV- At the discotheque</b>	<b>4 h</b>
Portrait by a journalist, Giving a positive or negative reply, Asking questions, Discussion with a person, Activities in a day	

**Course Learning Outcomes:** At the end of this course, the students will be able to express themselves in writing and orally in basic French. This course content focuses on the speech of the students in a lucid and a concurrent manner using appropriate vocabulary and pronunciation techniques. Extra stress will be given on their understanding of grammatical structures and the foreign accent of the language. At the end of the course, the student shall be able to:

- Understand information; Express in his own words; Paraphrase; Interpret and translate.
- Apply information in a new way in a practical context
- Analyse and break-down information to create new ideas
- Evaluate and express opinion in a given context

### Text / Reference Books:

Author	Title	Publisher	Year	ISBN No	Pages
Christine Andant, Chaterine Metton, Annabelle Nachon, Fabienne Nogue	A Propos - A1 Livre De L'Eleve, Cahier D' Exercices	Langers International Private Limited	2010	9789380809069	
Manjiri Khandekar and Roopa	Jumelage - 1 Methode De Fraincais - French	Langers International Private Limited	2020	978-9380809854	

Luktuke					
<u>Michael</u> <u>Magne</u> , Marie-Laure Lions-Olivieri	Version Originale 1: Cahier d'exercices	Maison Des Langue s	2010	978848 443561 7	



# **Semester 2**

<b>M.Sc. (H) Food Science Technology and Processing (2 year)</b>							
<b>Semester-wise Distribution of Courses</b>				<b>Semester 2</b>			
<b>S. No</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>Credits (CU: 12-18)</b>			<b>Credit Units</b>
				<b>L</b>	<b>T</b>	<b>P</b>	
1	FST601	Principles of Food Processing and Preservation	CC	3	0	1	4
2	FST612	Technology of Cereals, Legumes and Oil Seeds Processing-II	CC	3	0	1	4
3	FST614	Technology of Milk Products Processing	CC	3	0	1	4
4	FST606	Bakery Technology	SEC	3	0	1	12
5	FST618	Food Extrusion Technology	SEC	4	0	0	
6	FST617	Nutrition and Health	SEC	3	0	1	
7	FST615	Technology of Snack Foods	SEC	4	0	0	
8	FST605	Enzymes in Food Processing	SEC	4	0	0	
9	FST613	Spices Processing and Flavour Technology	SEC	4	0	0	
10	PSY610	Behavioural Science	VAC	1	0	0	1
11	FOL103/ FOL104	Foreign Business Language	VAC	1	0	0	1
<b>Total Credits</b>							<b>26</b>
CC: Core Course; SEC: specialization elective course; OEC: open elective course							

## Principles of Food Processing and Preservation

L	T	P	SW/FW	Total Credit Units
3	0	1	0	4

### Course content and syllabus:

	Teaching Hrs
<b>Unit I: Food Processing Operations</b>	<b>14 h</b>
<p><b>Refrigeration and Freezing:</b> Requirements of refrigerated storage-controlled low temperature, air circulation and humidity, changes in food during refrigerated storage, progressive freezing, changes during freezing</p> <p><b>Freezing methods</b> -direct and indirect, still air sharp freezer, blast freezer, fluidized freezer, plate freezer, spiral freezer and cryogenic freezing.</p> <p><b>Dehydration:</b> Normal drying curve, effect of dehydration on food properties, change in food during drying, drying methods and equipments; air convection dryer, tray dryer, tunnel dryer, continuous belt dryer, fluidized bed dryer, dryer, drum dryer, vacuum dryer, freeze drying, foam mat drying.</p> <p><b>Thermal Processing of Foods:</b> Classification of thermal processes, Principles of thermal processing, commercial canning operations, Aseptic Processing, UHT.</p> <p><b>Irradiation and microwave heating:</b> Principles, Dosage, Applications of Irradiation, Mechanism of microwave heating and applications</p>	
<b>Unit II: Technology of Colloids in Food</b>	<b>13 h</b>
<p>Characteristics, sols, gels, pectin gels, colloidal sols, stabilization of colloidal system, syneresis, emulsions, properties of emulsions, formation of emulsion, emulsifying agents, food foams, formation stability and destruction of foam, application of colloidal chemistry to food preparation</p>	
<b>Unit III: Wastewater management and minimal processing and hurdle technology in food industry</b>	<b>13 h</b>
<p><b>Water Disposal and Sanitation</b> Wastewater, hardness of water, break point chlorination, physical and chemical nature of impurities, BOD, COD, wastewater treatment, milk plant sanitation, CIP system sanitizers used in food industry.</p> <p><b>Minimal processing and hurdle technology:</b> Contaminants and Regulations</p>	
<b>Unit IV: Food Additives and Contaminants</b>	<b>14 h</b>
<p><b>Food Additives:</b> Introduction, need of food additives in food processing and preservation, Characteristics and classification of food additives, Chemical, technological and toxicological aspects.</p> <p><b>Contaminants in Food:</b> Contamination in Food Physical, chemical (heavy metals, pesticide residues, antibiotics, veterinary drug residues, dioxins, environmental pollutants, radionuclides, solvent residues, chemicals) Natural toxins. Food Laws and Regulations- Codex, HACCP, ISO, FSSAI</p>	

### Lab/ Practical details:

**(36 Hours)**

**Objective:** The laboratory exercises in this section have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment.

### List of Experiments -with basic instructions

1. Canning of foods
2. Preservation of food by the process of freezing
3. Drying of food using Tray dryer/other dryers
4. Estimation of Chemical Oxygen Demand (Demonstration)

5. Preparation of brix solution and checking by hand refractometer
6. Analysis of water
7. Minimal Processing of food
8. Application of colloidal chemistry in food preparation

**Course Learning Outcomes:**

- Understanding the methods of food preservation
- Demonstrate food preservation by canning method
- Compare the flavour and sensory of beer and other alcoholic/non-alcoholic beverages
- Perceive knowledge of food additives, food contaminations, and health-related issues

**Text / Reference Books:**

Author	Title	Publisher	Year of publication	ISBN	Pages
G. Subbulakshmi	Food Processing and Preservation	New Delhi: New Age International	2017	8122412831, 978-8122412833	298
Manay, N S, and M Shadaksharaswamy	Foods: Facts and Principles,	New Delhi: New Age International Ltd.	2008	9788122422153, 8122422152	490
D. K. Salunkhe, S.S. Kadam	Handbook of Fruit Science and Technology: Production, Composition, Storage, and Processing	CRC Press	1998	9780824796433	611

## Technology Of Cereal Pulses and Oilseeds - II

L	T	P	SW/FW	Total Credit Units
3	0	1	0	4

### Course Contents/syllabus:

<b>Technology Of Cereal Pulses and Oilseeds - II</b>	<b>Teaching Hrs</b>
<b>UNIT I: Corn Processing Technology</b>	<b>14 h</b>
Structure of grain and proximate composition, corn types, Quality evaluation, Dry and Wet milling of corn. Functional properties of corn starch. Products of wet milling, corn starch–evaluation method, properties modification, Syrups, germ oil and gluten. By–products of corn milling and their utilization. Alkaline cooked products: processing of Tortillas, Modern method of Alkaline cooked products, preparation of Nixtamalized corn flours, processing of cornflakes, tortillas chips, extruded snacks, corn germ oil–composition, processing and utilization.	
<b>UNIT II: Oats Processing Technology</b>	<b>13 h</b>
Production and trade in the world, Structure of oat grains, proximate composition, chemistry, and technology. Legumes: Production, trade, varieties and structure, chemical composition, processing and cooking methods, utilization of legumes. Criteria of quality evaluation of pulses.	
<b>UNIT III: Legumes in Human Nutrition</b>	<b>14 h</b>
Nutrient composition of raw, cooked, canned and sprouted legumes. Anti-nutritional factors in legumes and their elimination. Technology of legume protein flour, Protein isolates and concentrates: Preparation uses nutritional value, their physico chemical and functional properties. Functional properties of starch and protein from pulses.	
<b>UNIT IV: Processing of soybean products and Oilseeds</b>	<b>13 h</b>
Technology of product of soya milk, tofu, soy protein concentrates and isolates. Oilseeds – Production, trade, composition, oil extraction with expellers, solvent extraction processes, purification of crude oil and hydrogenation, interesterification and refining processes for oil	

### Lab/ Practical details

**(36 Hours)**

Objective: The laboratory exercises in this section have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment.

### List of Practical's:

1. Evaluation of corn: physico–chemical properties, dry and wet milling of corn, corn-based product, evaluation of corn starch,
2. Evaluation of oat and oat products,
3. Preparation of soya milk/tofu.
4. Experimental expeller processing and solvent extraction of oil seeds
5. Quality evaluation of oil extracted from corn germ.
6. Experimental Milling of Legumes
7. Separation and evaluation of starch and protein from different legumes.

8. Cooking quality, textural evaluation and physico–chemical testing of legumes.
9. Preparation of edible flours, protein concentrates and isolates.
- 10 Evaluation starch characteristics of pulses.
11. Visit to Cereal/ Legume and Oil seeds processing plants.

**Course Learning Outcomes**

- Learning of the processing of cereals and pulses
- Gaining knowledge about the methods of the determination of the quality of raw, intermediate, and processed food for end-uses.
- Understanding of the oil processing and preservation
- Know-how about making wines, beer, distilled spirit and alcoholic beverages from cereals.

<b>Text / Reference Books:</b>					
<b>AUTHOR</b>	<b>TITLE</b>	<b>Publisher</b>	<b>Year of publication</b>	<b>ISBN</b>	<b>Pages</b>
B. Tiwari and N. Singh	Pulses Chemistry and Technology	Cambridge, UK : RSC Pub	2012	9781849733311	310
Fereidoon Shahidi; Alton Edward Bailey	Bailey's industrial oil and fat products	Wiley-Interscience,	2005	9780471384601	3616

## Technology of Milk Products Processing

L	T	P	SW/FW	Total Credit Units
3	0	1	0	4

### Course Contents/syllabus:

Technology Of Milk Products Processing	Teaching hrs
<b>UNIT I: Physical properties of milk</b>	<b>14 h</b>
Milk and milk production in India, Colour, taste, pH and buffering capacity, refractive index, viscosity, surface tension, freezing, boiling point, specific heat, electrical conductivity. Problem in milk supply of India, Scope and functioning of milk supply schemes, National and international organization <b>Lactose</b> , Lactose (alpha and beta forms and their differences), Significances of lactose in dairy industry.	
<b>UNIT II: Protein and enzymes, Milk fat</b>	<b>13 h</b>
General structure, Amphoteric nature, difference between casein and serum protein, different types of casein (acid and rennet), uses of casein, fractionation of protein. <b>Enzymes in dairy processing-</b> Catalase, Alkaline phosphatase, lipases and Proteases, Milk fat: Composition and structure, factors affecting melting point, boiling point, solubility and Refractive Index, fat constants (saponification value, iodine value, RM value, Polenske value, peroxide value). Chemical reactions of fat (hydrolysis, auto-oxidation), condition favouring auto-oxidation, prevention, measurement of auto-oxidation	
<b>UNIT III: Liquid milk processing</b>	<b>14 h</b>
Liquid milk processing– filtration/clarification, standardization, pasteurization– (objectives, types, LTLT, HTST, UHT, equipment, advantages), Homogenization (objectives, process, advantages). Systems of collection of milk, Reception, Platform testing, Various stages of processing: Filtration, Clarification, Homogenization, Pasteurization, Description and working of clarifier, cream separator, homogenizer and plate heat exchanger Handling and maintenance of dairy plant equipments,	
<b>UNIT IV: Market milk industry, milk plant equipments and milk products</b>	<b>13 h</b>
Milk powders, whole and SMP, milk powder agglomeration, equipment used and properties and advantages. Special milks: Sterilized, flavored, homogenized, fortified, reconstituted, recombined, toned, double toned, vitaminized, humanized, standardized milk Packaging, storage transport, distribution of liquid milk. Problems of milk supply in India, Fermented milk technology Milk product processing: Cream, Butter, ghee, butteroil, yoghurt, dahi, shrikhand, ice-cream, condensed milk, evaporated milk, milk powders- whole and skimmed milk powder, khoa, chenna, paneer, cheese (cheddar). Cheese spreads, enzyme modified cheese, Judging and grading of milk products In plant cleaning system, Instantization, Dairy plant sanitation and waste disposal HACCP in the milk plant.	

### Lab/ Practical details:

**(36 Hours)**

Objective: The laboratory exercises in this section have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment.

### List of Experiments

1. Sampling of milk and milk products
2. To perform platform tests in milk (Acidity, pH, COB, MBRT, specific gravity, SNF)

3. To estimate milk protein by Folin method.
4. To estimate milk fat by Gerber method.
5. To determine ash content
6. Preparation of flavoured milk.
7. To check the efficacy of Pasteurization of milk.
8. To prepare casein and calculate its yield.
9. Detection of milk adulterant (water, starch, cane sugar, neutralizer etc.)
10. Determination of iodine value of ghee
11. Determination of peroxide value of ghee
12. Determination of saponification value of ghee

### Course Learning Outcomes

- Know-how about principles of dairy science and the composition of milk.
- Understanding about milk processing plants, transportation, preservation, reconstitution and distribution of milk and milk products.
- Perceive knowledge of milk production
- Demonstrate HACCP application in dairy industry

<b>Text / Reference Books:</b>					
<b>Author</b>	<b>Title</b>	<b>Publisher</b>	<b>Year of publication</b>	<b>ISBN</b>	<b>Pages</b>
De, Sukumar.	Outlines of Dairy Technology	Oxford: Oxford University Press.	2007	914164841	539



## BAKERY TECHNOLOGY

L	T	P	Total Credit Units
3	0	1	4

### Course Contents/syllabus:

#### BAKERY TECHNOLOGY

Units	Teaching Hrs
<b>UNIT I: Bakery industry</b>	<b>13 h</b>
Introduction to bakery technology, current status, growth rate, and economic importance of bakery Industry in India. Types of bakery products, nutritional quality and safety, pertinent standards & regulations, safety concerns related to additives used in bakery products.	
<b>UNIT II: Breakfast cereals and Macaroni products</b>	<b>14 h</b>
<b>Bread, Buns and Pizza base</b> Ingredients & processes for breads, buns, pizza base, changes taking place during baking, equipment used, product quality characteristics, faults, and corrective measures	
<b>UNIT III: Cakes &amp; Pastry</b>	<b>13 h</b>
Ingredients & processes for cakes, equipment used, product quality characteristics, faults, and corrective measures. Different types of icings. Ingredients & processes for pastry, product quality characteristics, faults and corrective measures.	
<b>UNIT IV: Biscuits, Cookies &amp; Crackers</b>	<b>14 h</b>
Ingredients & processes, equipment, product quality characteristics, faults and corrective measures. <b>Modified bakery products</b> Modification of bakery products e.g. high fibre, low sugar, low fat, gluten free bakery products, fat and sugar replacers, enzymes, egg replacers and natural preservatives	

#### Lab/ Practical details: (36 Hours)

Objective: The laboratory exercises in this section have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment.

#### List of Experiments

1. Preparation of pizza base and assessment of its quality
2. Preparation of bread and assessment of its quality
3. Preparation of buns and assessment of quality
4. Preparation of butter cake and assessment of its quality.
5. Preparation of sponge cake with icing and assessment of its quality.
6. Preparation of cookies and assessment of quality.
7. Preparation of biscuits and assessment of quality.

#### Course Learning Outcomes

- Knowing about history and development in bakery technology, its current status, and relevance of bakery industry in India.
- Understanding about technology and science of breakfast cereals, processing, packaging and latest developments
- Understanding the science of cake and pastry manufacturing
- Learning about technology of biscuits, cookies and other modified bakery products

#### Text / Reference Books:

Author	Title	Publisher	Year of publication	ISBN	Pages

Barndt, R. L.	Fat & Calorie – Modified Bakery Products.	US: Springer.	1993	978-1-4615- 3114-2	--
Corke, H., De Leyn, I., Nip, W.K. and Cross, N.A.,	Bakery products: Science and Technology.	John Wiley & Sons.	2014	97811199671 56	761
Manley, D. ed.	Manley's technology of biscuits, crackers and cookies.	Elsevier.	2000	97818557353 23	499

## Food Extrusion Technology

L	T	P	Total Credit Units
4	0	0	4

### Course content and syllabus:

Food Extrusion Technology	Total Teaching Hrs
<b>UNIT I: Introduction to Extrusion Technology</b>	<b>13 h</b>
<b>Introduction to Extrusion Technology:</b> definition, introduction to extruders, principles and types, Uses of extruders in the food industry, Single screw extruder: principle of working, net flow, factors affecting extrusion process, Twin screw extruder: counter rotating and co-rotating twin screw extruder, Process characteristics of the twin screw extruder.	
<b>UNIT II: Production of extruded products</b>	<b>14 h</b>
Pre-conditioning of raw materials used in extrusion process, Use of dry extruders in extrusion, Chemical and nutritional changes in food during extrusion.	
<b>UNIT III: Classification of Breakfast cereals</b>	<b>13 h</b>
<b>Classification of Breakfast cereals:</b> Raw materials, process and quality testing of vermicelli, spaghetti: Raw materials, process and quality testing of pasta and macaroni products	
<b>UNIT IV: Texturized vegetable protein</b>	<b>14 h</b>
<b>Texturized vegetable protein:</b> Definition, processing techniques, and foods Ready to eat breakfast cereals by extrusion cooking	

### Course Learning Outcomes

- Learning fundamentals of extrusion technology
- Compare different types of different extruders
- Demonstrate role of starches and proteins in extrusion technology.
- Understanding phenomenon and application of texturized vegetable proteins.

Text / Reference Books:					
Author	Title	Publisher	Year of publication	ISBN	Pages
Frame, N.D.	Technology of Extrusion Cooking	Springer,	2012	978-1-4613-5891-6	253
Maskan and Altan	Advances in Food Extrusion Technology	CRC Press,	2016	9781138199125	412
Harper, J. M.,	Extrusion of Foods	CRC Press,	2021	9780367258979	226
Berk Z.	Food Process Engineering and Technology	Academic Press,	2013	9780128120187	710

## Nutrition and Health

L	T	P	Total Credit Units
3	0	1	4

### Course Content:

	Teaching Hrs
<b>Unit I: Nutrition</b>	<b>13 hrs</b>
Nutrition: Concept and definitions, functions of food and nutrients, nutritional status. Major world health problems- food supply and security, malnutrition and health, Minimal nutrition requirement, Recommended dietary allowances (R.D.A.), Formulation of RDA, Dietary Guidelines, Reference man and women, ICMR standards, food guide, exchange lists, health promotion guidelines.	
<b>Unit II: Energy in human nutrition</b>	<b>14 hrs</b>
Energy in human nutrition, energy and unit energy balance, assessment of energy requirements- deficiency and excess, Determination of energy in foods, BMR and its regulation Carbohydrates: classification, dietary importance, functions, dietary fibers and various health problems. Fats- classification, dietary importance, functions health needs of fat, health problems, essential fatty acids, visible and hidden food fat, cholesterol, lipoproteins. Energy balance-food energy measure, energy control in human metabolism, basal metabolic rate (B.M.R.), factors affecting B.M.R, energy requirements and its estimation.	
<b>Unit III: Proteins and micronutrients in human nutrition</b>	<b>14 hrs</b>
Proteins in nutrition: essential amino-acids, proteins and functions of protein, protein balance, factors influencing protein requirements, comparative quality of food proteins, biological value, net protein utilization, protein efficiency ratio, methods of evaluation of protein quality. Vitamins- nature and classification, functions, clinical applications, sources, requirements. Vitamin toxicity. Minerals: minerals in human health, functions, clinical applications, food sources and requirements, trace elements and their importance in diet	
<b>Unit IV: Specific groups requirements of nutrition</b>	<b>13 hrs</b>
Growth and development from infancy to childhood: somatic, physical brain, mental development, puberty, Menarch, pre-pubertal and nutrition, Psychologic influences on food habits-motivation, perception, vulnerable groups. Drug food interactions- effects on food intake, and on nutrient absorption, vitamin antagonists. Nutrition and weight management-obesity and its causes, body composition, B.M.I., weight for height measures, health implications of obesity, and problems of weight management. Importance of nutrition for ensuring adequate development	

### Lab/ Practical details:

**(36 Hours)**

**Objective:** The laboratory exercises in this section have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment.

#### List of Experiments

1. Process involved in cooking
2. General concepts of weight and measures
3. Eye estimation of raw and cooked food
4. Preparation of food from different food group and their significance in relation to health
5. Preparation of supplementary food for different age group and their nutritional significance

### Course Learning Outcomes

- Learning fundamentals of Nutrition
- To assess nutritional status of individual in various life cycle stages
- To determine the nutrition related conditions and to apply knowledge of metabolism and nutrient function
- Understanding the role of food and nutrients in health and disease

<b>Text/Reference Books</b>					
<b>AUTHOR</b>	<b>TITLE</b>	<b>Publisher</b>	<b>Year of publication</b>	<b>ISBN</b>	<b>Pages</b>
ICMR	Nutrient Requirement & RDA	ICMR, New Delhi	2011		
Elia, Ljungqvist, & Stratton	Clinical Nutrition	Wiley-Blackwell	2013	978-0632056262	496
Brian, A. F. & Allen, G	Food Science, Nutrition & Health	CRC Press	2006	9780340809488	332
Hegarty, V.	Nutrition Food and the Environment	Eagen Press	1992	978-0962440748	433
Williams, S. R	Essentials of Nutrition and Diet Therapy	Times Mirror / Mosby College Publishing	1990	9780323529716	640
Macrae, R., Robinson, R. K. & Sadler, M.J	Encyclopedia of Food science, Food technology and Nutrition	Academic Press	2003	9780122270550	6000

## Technology of Snack Foods

L	T	P/S	SW/FW	Total Credit Units
4	0	0	0	4

### Course Contents/syllabus:

Technology of Snack Foods	Teaching Hrs
<b>Unit I: Introduction to Extrusion Technology</b>	<b>14 h</b>
<b>Extrusion:</b> 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	
<b>Unit II: Breakfast Cereals</b>	<b>13 h</b>
<b>Breakfast cereals:</b> 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.	
<b>Unit III: Technology for grain-based snacks</b>	<b>14 h</b>
<b>Technology for grain-based snacks:</b> 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.	
<b>Unit IV: Technology for fruit and vegetable-based snacks</b>	<b>13 h</b>
<b>Technology for fruit and vegetable-based snacks-</b> chips, wafers, Technology for coated nuts- salted, spiced and sweetened chikkies, Equipments for frying, baking, drying, toasting, roasting, flaking, popping, blending, coating and chipping	

### Course Learning Outcomes:

- Understand science of extrusion cooking.
- Demonstrate extrusion cooking
- Compare different breakfast cereals
- Perceive knowledge of technology of snacks manufacturing

### Text / Reference Books:

Author	Title	Publisher	Year of publication	ISBN	Pages
Booth, R. G.	Snack Food	CBS, New Delhi.	1997	9780442237455	401
Edmund, W. L. & Rooney, L. W.	Snack Foods Processing	CRC. London.	2001	9781566769327	639
Guy, R.	Extrusion Cooking:	CRC Press ; Cambridge,	2001	9780849312076	206

	Technologies and Applications	Eng. : Woodhead,			
Riaz, M. N.	Extruders in Food Applications	Technomic, Lanchester.	2000	9781566767798	225

### Enzymes in Food Processing

L	T	P	SW/FW	Total Credit Units
4	0	0	0	4

#### Course Contents/syllabus:

Enzymes in Food Processing	Teaching Hrs
<b>UNIT I: Fundamentals of Enzymes</b>	<b>18 h</b>
Fundamentals of enzymes- enzyme general properties, classification, co-enzymes and inhibitors. A brief overview of enzyme kinetics. Factors affecting enzymatic action. Immobilization of enzymes-methods of immobilization and food applications. Isolation of enzymes from different sources-microbial, plant and animal.	
<b>UNIT II: Enzymes in starch processing, Baking and Oil Industry</b>	<b>18 h</b>
Enzymes in starch industry – production of different corn syrups and crystalline dextrose. Significance of enzymes in baking industry: fungal $\alpha$ -amylase for bread making; maltogenic $\alpha$ -amylases for anti-staling; proteases; xylanases and pentosanes as dough conditioners; lipases or dough conditioning; synergistic effect of enzymes. Enzymes in fats and oils industry.	
<b>UNIT III: Enzymes in dairy and fruit industry</b>	<b>18 h</b>
Natural enzymes in milk and their roles, hydrogen peroxidase system, rennin, lactose intolerance, enzymes in cheese making and whey processing. Catalase, alkaline phosphatase, lipases and proteases. Enzymes in fruits and vegetables products: i) Distribution of pectic substances and pectic enzymes in fruits. cell wall degrading enzymes. ii) Specific applications of enzymes in juice technology like clarification, debittering, anthocyanases and discolouring of dark coloured juices etc.	
<b>UNIT IV: Enzymes in meat and brewing industry</b>	<b>18 h</b>
Meat tenderization, proteases bromelain and papain, enzymes in egg processing; enzymes in brewing, mashing and beer finishing operations.	

#### Course Learning Outcomes

- ▶ Knowing about the fundamentals of enzymes and their kinetics.
- ▶ Understanding the role of enzymes in the production of different food products
- ▶ Understanding the application of enzymes in baking, dairy, oil and beverage industry.
- ▶ Understanding how enzymes help in improving the texture of meat and meat products and eggs.
- ▶ Enzymes and their applications in beer manufacturing.

Text / Reference Books:					
Author	Title	Publisher	Year of publication	ISBN	Pages
Nagodawithana T & Reed G.	Enzymes in Food Processing.	Academic Press.	1993	9780125136303	480



Tucker GA & Woods LFJ.	Enzymes in Food Processing.		1991	9780216929777	288
Whitehurst R & Law B.	Enzymes in Food Technology.	Blackwell Publ.	2002	9781405183666	368

## Spices and Flavour Technology

L	T	P	SW/FW	Total Credit Units
4	0	0	0	4

### Course Contents/syllabus:

#### Spices and Flavour Technology

Units	Teaching Hrs
<b>UNIT I: Spices processing &amp; technology</b>	<b>13 h</b>
Chemical constituents of spices, Cryo-milling of spices, Spice oleoresins and encapsulated spices and spice emulsion, Packaging of spices and spice products, Microbial contamination and insect infestation in spices and its control, Quality standards for processed spices and their products	
<b>UNIT II: Definition and description of flavour</b>	<b>14 h</b>
Definition and description of flavour, flavour profile and its principal chemical constituents, Sensation of flavour vs taste odour/smell, and mouth feel, Influence of chemical constituents on flavour and their interaction with flavour characteristics, flavour emulsions,	
<b>UNIT III: Flavour constituents of foods</b>	<b>14 h</b>
Natural and synthetic flavouring substances and their chemical characteristics, Flavour components / constituents of fruit and vegetables, coffee, tea and cocoa bean, spices and condiments, Analysis of flavours components (subjective and objective)	
<b>UNIT IV: Flavour production during food processing</b>	<b>13 h</b>
Production of flavouring compounds during food processing (Lipid oxidation, maillard reaction etc.), Biological routes for the production of flavours, Enzymes and microbial production of flavouring compounds	

### Course learning outcomes

- Define constituents of various spices and their processing
- Understand the basics of flavour and its sensation approach
- Recognize various flavour components in foods
- Perceive the knowledge of production of flavour during processing of foods

### Text / Reference Books:

Author	Title	Publisher	Year of publication	ISBN	Pages
Peter K.V.,	Handbook of Spices	Woodhead Publishers, UK.	2001	9780857090393	640
Burdock GA	Fenaroli's Handbook of Flavor Ingredients. 6 <sup>th</sup> Edition	CRC Press	2010	978-1-4200-9077-2	2135
Deibler D & Delwiche J	Handbook of Flavor, Characterization : Sensory Analysis, Chemistry and Physiology	Marcel Dekker	2004	0-8247-4703-8	428

## Behavioural Science: PSY610

L	T	P	Total Credit Units
1	0	1	1

### Course Contents/syllabus:

	Teaching Hrs
<b>Unit-1- Individual differences &amp; Personality</b>	<b>5 h</b>
Personality: Definition & Relevance, Importance of nature & nurture in Personality Development, Importance and Recognition of Individual differences in Personality, Accepting and Managing Individual differences Intuition, Judgment, Perception & Sensation (MBTI) BIG5 Factors	
<b>Unit-2- Managing Diversity</b>	<b>4 h</b>
Defining Diversity, Affirmation Action and Managing Diversity, Increasing Diversity in Work Force, Barriers and Challenges in Managing Diversity	
<b>Unit-3- Socialization, Patriotism and National Pride</b>	<b>5 h</b>
Nature of Socialization, Social Interaction, Interaction of Socialization Process, Contributions to Society and Nation, Sense of pride and patriotism Importance of discipline and hard work, Integrity and accountability	
<b>Unit-4- Human Rights, Values and Ethics</b>	<b>4 h</b>
Meaning and Importance of human rights, Human rights awareness Values and Ethics- Learning based on project work on Scriptures like- Ramayana, Mahabharata, Gita etc.	

### List of Professional Skill Development Activities (PSDA):

- Project on Understanding Diversity
- Term Paper on Patriotism among Youth

### Course Learning Outcomes: On completion of the course:

- To recognize individual differences
- To manage individual differences
- To develop patriotic feelings
- To recognized their self in relation to society & nation

### Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN	Pages
Department of English, University of Delhi	The Individual & Society	Pearson Education	2010	978-8131704172	266
Umang Malhotra	Individual, Society, and the World	iUniverse	2004	978-0595662401	188
Tonja R. Conerly & Kathleen Holmes	Introduction to Sociology 3e	Openstax	2015	9781711493978	458

Daksh Tyagi	"A Nation of Idiots"	Every Protest	2019	978-8194275015	350
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### French Grammar: FOL103

L	T	P	Total Credits
1	0	0	1

#### Course content and syllabus

	Teaching Hours
<b>Unit I: My family and my house</b>	<b>5 h</b>
Descriptors/Topics, Talk about your family members, Usage of possessive adjectives, Describe your house/apartment, Prepositions of location Negation	
<b>Unit II: Lifestyle</b>	<b>4 h</b>
Descriptors/Topics, Talk about your hobbies and pastimes, Usage of appropriate articles: definite and contracted, Talk about your daily routine, Usage of pronominal verbs	
<b>Unit III: In the city</b>	<b>5 h</b>
Descriptors/Topics, Filling up a simple form, Ask for personal information	
Usage of interrogative adjectives, Give directions about a place, Ordinal numbers, Usage of demonstrative adjectives.	
<b>Unit IV: Week-end</b>	<b>4 h</b>
Descriptors/Topics, Talk about your week-end plans, Usage of disjunctive pronouns, Usage of Near Future tense, Talk about weather, Write a simple post card	

**Course Learning Outcomes:** At the end of this course, the students will be able to interact in a simple way on everyday topics. This course content focuses on the speech of the students in a lucid and a concurrent manner using appropriate vocabulary and pronunciation techniques. Extra stress will be given on their understanding of grammatical structures and the foreign accent of the language. At the end of the course, the student shall be able to:

- Understand information; Express in his own words; Paraphrase; Interpret and translate.
- Apply information in a new way in a practical context
- Analyze and break-down information to create new ideas
- Evaluate and express opinion in a given context

#### Text / Reference Books:

Author	Title	Publisher	Ed/year	ISBN No	Pages
Christine Andant, Catherine Metton, Annabelle Nachon, Fabienne Nugue	A Propos - A1, Livre de l'élève et Cahier d'exercices.	Langers International Pvt. Ltd.	2010	978-9380809069	---

Collins Dictionarie s	Easy Learning French Complete Grammar, Verbs and Vocabulary	Collins	2016	978- 0008141721	---
Nikita Desai, Samapita DeySarkar	Apprenons La Grammaire Ensemble - French	Langers Internationa IPvt. Ltd.	2017	978- 8193002681	---

**German Grammar: FOL104**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Total Credits</b>
<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

**Course content and syllabus:**

	<b>Teaching Hours</b>
<b>Unit I: Time (Uhrzeit); People and the World: Land, Nationalität und Sprache</b>	<b>5 h</b>
Introduction of time, Read text related to time and teach the students the time expressions, Exercises related to Time, Adverbs of time and time related prepositions, Vocabulary: Countries, Nationalities, and their languages, Negation: "nicht/ kein", Ja/Nein Fragen. All the colors and color related vocabulary, adjectives, and opposites, Exercises and comprehension for the same	
<b>Unit II: Irregular verbs (unregelmässige Verben)</b>	<b>4 h</b>
Introduction to irregular verbs and their conjugation e.g. fahren, essen, lesen etc., Read a text related to the eating habits of Germans, Vocabulary: Obst, Gemüse, Kleiderstück with usage of irregular verbs, Free time and hobbies, Food and drinks	
<b>Unit III: Accusative case: articles and pronouns (Akkusativ Kasus: Artikel und Pronomen)</b>	<b>4 h</b>
Introduction to the concept of object (Akkusativ), Formation of sentences along with the translation and difference between nominative and accusative articles, Usage of accusative Definite articles, Usage of accusative Indefinite articles	
<b>Unit IV: Accusative case: possessive pronouns (Akkusativ Kasus: Possessivpronomen) Family and Relationship</b>	<b>5 h</b>
Accusative Personal Pronouns: - Revision of the nominative personal pronouns and introduction of accusative. Applicability of pronouns for both persons and things. Usage of accusative Personal Pronouns, Introduction of accusative possessive pronouns, Difference between nominative and accusative possessive pronouns, usage of accusative possessive pronouns.	

**Course Learning Outcomes:** After completing these modules, the students will be capable of constructing sentences with possessive and demonstrative adjectives in German. In addition, they will be proficient in formulating meaningful sentences as they will be capable of applying their knowledge of all the irregular verbs they have learnt during the session. They will also have an idea of German culture by studying about various German festivals.

At the end of the course, the student shall be able to:

- Understand information; Express in his own words; Paraphrase; Interpret and translate.
- Apply information in a new way in a practical context
- Analyse and break-down information to create new ideas
- Evaluate and express opinion in a given context

**Text / Reference Books:**

<b>Author</b>	<b>Title</b>	<b>Publisher</b>	<b>Ed/year</b>	<b>ISBN No</b>	<b>Pages</b>
Dora Schulz, Heinz Griesbach	Deutsche Sprachlehre Für Ausländer	Max Hueber Verlag	1984	978- 3190010066	---
Hartmut Aufderstrasse , Jutta Müller, Helmut Müller	Themen Aktuell: Glossar Deutsch	Max Hueber Verlag	2003	978- 3190816903	---
Giorgio Motta	Wir Plus Grundkurs Deutsch für Junge Lerner Book German Guide	Goyal Publishers	2011		248



# **Semester 3**

<b>M.Sc. (H) Food Science Technology and Processing (2 year)</b>							
<b>Semester-wise Distribution of Courses</b>				<b>Semester 3</b>			
<b>S. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>Credits (16-18)</b>			<b>Credit Units</b>
				<b>L</b>	<b>T</b>	<b>P</b>	
1	FST701	Technology of Egg, Poultry, Meat & Sea Food Processing	CC	3	0	1	4
2	FST702	Food Engineering Operations	CC	4	0	0	4
3	FST703	Food Packaging Technology	CC	4	0	0	4
4		Professional Ethics-I	VAC	1	0	0	1
5		Research Work/Dissertation	NTCC	0	0	12	12
		<b>Total Credits</b>					<b>25</b>

CC: Core Course; SEC: specialization elective course; OEC: open elective course; VAC: Value Addition Course

## Technology of Egg, Poultry, Meat & Sea Food Processing

L	T	P	SW/FW	Total Credit Units
3	0	1	0	4

### Course Contents/syllabus:

Technology of Egg, Poultry, Meat & Sea Food Processing	Teaching Hrs
<b>UNIT I: Egg Processing &amp; Technology</b>	<b>14 h</b>
Status of egg industry in India, Structure & composition of egg, Packaging, storage & transportation of eggs, Factors affecting egg quality, measurement of egg quality (candling, albumen index, haugh unit, shape index, yolk index etc.), methods for egg preservation (refrigeration, oil coating, thermostabilization, antibiotics etc), Grading of egg, Pasteurization, dehydration, freezing and desugering of egg, Technologies of the production of egg powder, albumen, flakes & calcium tablets etc	
<b>UNIT II: Meat Processing &amp; Technology</b>	<b>14 h</b>
Status of livestock and poultry industries in India, Terminology used for animals and birds based on age, sex, cuts, use etc., Structure and composition of meat tissue, Factors affecting meat quality, Eating quality of meat (colour, flavour, tenderness, juiciness, water holding capacity, warmed over flavour etc), Meat tenderization methods and role of enzymes, Aging of meat, Effects of feed, breed and stress on production of meat animals and their quality, Restructured meat products (sausages and comminuted meat products), ingredients used and their significance, Curing, smoking, freezing, canning & dehydration of meat, poultry and products	
<b>UNIT III: Slaughter process and by-products utilization</b>	<b>13 h</b>
Layout of abattoirs, Antemortem examination of meat animals, Traditional and scientific methods of slaughter of meat animals and birds, Humane methods of slaughter, Conversion of muscle into meat, Post-mortem changes in meat, thaw rigor, cold shortening, pre-rigor processing, Utilization of meat, fish and egg industry by-products: importance, food and non-food applications	
<b>UNIT IV: Fish Processing &amp; Technology</b>	<b>13 h</b>
Status of fish industry in India, Classification of fish, Drying and salting of fish, water activity and shelf-life, salting process, salting methods (brining, pickling, kench curing, gaspe curing), Effect of heat processing on fish, Canning, smoking & glazing of fish, Manufacturing of fish paste, fish sauces, fish oil, fish protein concentrate	

### Lab/ Practical details:

**(54 Hours)**

Objective: The laboratory exercises in this section have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment.

### List of Experiments

1. Estimation of moisture content of meat
2. Estimation of protein content of meat
3. Cut out analysis of canned meats/retort pouches
4. Analysis of frozen meat/meat emulsion products
5. To study shelf-life of eggs by different methods of preservation
6. Evaluation of eggs for quality parameters (market eggs branded eggs)
7. To perform freezing of yolk/albumen
8. Meat/Egg product formulation
9. Quality evaluation of fish/prawn.
10. Subjective evaluation of Fresh Fish.
11. Cut out examination of canned fish (Sardine, Mackerel, Tuna)
12. Fish product formulation.

### Course Learning Outcomes

- Gaining knowledge about the status of the livestock and poultry industry, production, future demands
- Understanding about the meat quality, flavour and texture
- Skilled for the by-products utilization of meat, poultry and fish industries
- Gaining in-depth knowledge of fish processing and preservation technologies

<b>Text / Reference Books:</b>					
<b>Author</b>	<b>Title</b>	<b>Publisher</b>	<b>Year of publication</b>	<b>ISBN</b>	<b>Pages</b>
Lawrie, R. A.	Lawrie's Meat Science. 5th ed.	England: Woodhead Publishing Ltd.	1998	9781855733954	336
Parkhurst, C., & Mountney, G. J.	Poultry Meat and Egg Production.	New Delhi: CBS Publishers.	1997	9789401170550	308
Fernandes, R	Fish and Seafood. 2 <sup>nd</sup> Edition	Leatherhead Pub., Royal Society of Chemistry	2009	9781905224760	258
Shai, Barbut.	Poultry Products Processing.	CRC Press.	2005	9781587160608	548
Stadelman, W. J., Newkirk, D., & Newby, L.	Egg science and technology. 4th ed.	New Delhi: CBS Publication.	2002	9781560228554	591

## Food Engineering Operations

L	T	P/S	SW/FW	Total Credit Units
4	0	0	0	4

### Course Contents/syllabus:

Food Engineering Operations	Teaching Hrs
<b>UNIT I: Introduction to Food Engineering</b>	<b>18 h</b>
Concept of Unit operation, Units and dimensions, Unit conversions, dimensional analysis Mass and Energy Balance, Related numerical <b>Design of food plant and grinding &amp; mixing unit operation</b> Important considerations for designing of food plants Types of layouts, Design and layout of storage godown, Principle and equipment used in grinding in food industry, Principle and equipment used in mixing in food industry	
<b>UNIT II: Fluid Flow in food Processing</b>	<b>18 h</b>
Liquid Transport systems Newton's Law of Viscosity Principle of Capillary tube and rotational viscometer Properties of Non-Newtonian fluids Flow characteristics, Reynolds Number, Bernoulli's Equation Concept of Flow Measurement devices Related basic numerical	
<b>UNIT III: Refrigeration and Freezing</b>	<b>18 h</b>
Concept and selection of a refrigerant Description of a Refrigeration cycle Pressure Enthalpy charts and Tables Mathematical expressions useful in analysis of vapour compression refrigeration cycle, Numerical on VCR system using R -134 a, R-717 including super heating and sub cooling, freezing time calculation using Plank equation Frozen food storage, Related basic numerical	
<b>UNIT IV: Heat and Mass Transfer</b>	<b>18 h</b>
Systems for heating and cooling food products Thermal Properties of Food, Modes of heat transfer <b>Psychometrics, Steam, Evaporation and Dehydration</b> Properties of dry air, water vapour, air vapour mixture, Psychrometric Chart and its application, Generation of steam, Construction and functions of fire tube and water tube boilers, Thermodynamics of Phase change, Steam tables, Boiling point elevation Types of evaporators, Design of single effect evaporators, Basic Drying Process Moisture content on wet basis and dry basis, numerical, Dehydration systems, Dehydration system Design, Numerical Application of steady state heat transfer- estimation of conductive heat transfer coefficient, convective heat transfer coefficient, overall heat transfer coefficient and, design of tubular heat exchanger, related basic numerical <b>Fick's Law of Diffusion</b> Membrane separation systems-Electrodialysis system, Reverse Osmosis, Ultra filtration, Membrane devices used for RO and UF: Plate and Frame, Tubular, Spiral wound and hollow fiber devices,	

### Course Learning Outcomes

- Knowledge of the fundamentals of food engineering.
- Capability to design food plants for storage, processing and preservations.
- Understood about principle of food flow dynamics of fluid under different conditions.
- Learn about refrigerants, and their applications in different freezing systems
- Gain in depth knowledge about psychometrics, steam, evaporation and dehydration and its kinetics through numerical.

<b>Text / Reference Books:</b>					
<b>Author</b>	<b>Title</b>	<b>Publisher</b>	<b>Year of publication</b>	<b>ISBN</b>	<b>Pages</b>
Earle, R.L.	Unit Operations in Food Processing, 2 <sup>nd</sup> edition.	Pergamon press.	1989	9780080255361	207
Fellows, P.	Food processing technology.	Woodhead publication, 3rd edition	2022	9780323857376	962
Rao, D.G.	Fundamentals of food engineering	PHI learning private ltd.	2010	9788120338715	614
Singh, R.P and Heldman DR.	Introduction to food engineering. 5th edition.	Academic press.	2014	9780123985309	867
Toledo Romeo T.	Fundamentals of Food Process Engineering	Aspen Publishers	1999	9783030079338	465

## Food Packaging Technology

L	T	P/S	SW/FW	Total Credit Units
4	0	0	0	4

### Course Contents/syllabus:

Food Packaging Technology	Teaching Hrs
<b>UNIT I: Food Packaging</b>	<b>18 h</b>
Introduction to Food Packaging Definitions, status of packaging industry in India and globally Packaging functions, Barcodes & RFID	
<b>UNIT II: Food Packaging Materials</b>	<b>18 h</b>
Manufacturing of paper, types of paper and corrugated fiber board (CFB). Food grade plastics, properties, methods of manufacturing (Injection molding and Blow molding) Biodegradable plastics, edible packaging Metals, Tinplate, tin free can (TFC), types of can Glass: Composition, Properties, methods of bottle making, types of closures. <b>Regulatory Aspects of Food Packaging</b> Environment concerns (RRRR), LCA and method of its estimation Food Packaging and Labelling Laws (FSSAI) Retort packaging, Active and Intelligent packaging systems	
<b>UNIT III: Package Designing for Foods</b>	<b>18 h</b>
Factors affecting spoilage, package requirement and package designing for: Fresh horticultural produce, Animal foods, Dry and moisture sensitive foods Frozen foods, Fats and oils, Thermally processed foods	
<b>UNIT IV: Testing of Food Packaging</b>	<b>18 h</b>
Testing Procedures for Packaging Materials- thickness, tensile properties, puncture resistance, bursting strength, seal strength, water vapor permeability, gas transmission rate (CO <sub>2</sub> and O <sub>2</sub> permeability), grease resistance, Compatibility and shelf-life studies Evaluation of transport worthiness of filled packages	

### Course Learning Outcomes

- Knowing concepts of food packaging material, technology and their suitability for packaging of different kind of food products
- Understanding about manufacturing of different kinds of packaging material such as biodegradable plastic, edible films, etc.
- Learning technological innovations in packet designing for different food items
- Learning about testing of packaging material and its relationship to the shelf life and food quality and sensory etc.

### Text / Reference Books:

Author	Title	Publisher	Year of publication	ISBN	Pages
Coles, R. and Kirwan, M.	Food and Beverage Packaging Technology,	Wiley-Blackwell publication	2011	9781405189101	326
Coles, R., McDowell, D.& Kirwan, MJ.	Food Packaging Technology.	Blackwell publication	2003	9781841272214	346

## Professional Ethics-I

<b>L</b>	<b>T</b>	<b>P</b>	<b>Total Credits</b>
<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

### Course content and syllabus

	Teaching Hours
<b>Unit I: [Origins of Morality and Ethics]</b>	<b>5 h</b>
Moral Diversity, Moral Universals, Evolution of Morality, Reciprocal Altruism, Culture influence on our thought and action, Moral Differences, Kinds of Societies, Conservatives and Liberals, Disgust and Honor, Religion and Morality. Morality as Part of Our Nature, Skepticism About the Self, Free Will and the Situation. Utilitarian Ethics (outcome based), Deontological Ethics (duty based), Virtue Ethics (virtue based), and Communitarian Ethics (community based).	
<b>Unit II: [Research Design: Inquiry and Discovery]</b>	<b>4 h</b>
The Process of Inquiry, What is Curiosity, The components of enquiry design, What is a theory, Using inquiry as individuals, Elements of Critical Thinking, Inquiry Approaches: Quantitative, Qualitative, and Mixed Methods, Relationships Between Variables, Questions and Hypotheses, Conceptualization and Operationalization, What is Literature Review	
<b>Unit III: [Gender justice and workplace safety]</b>	<b>4 h</b>
Introduction to Gender Justice- Notion and Significance, International and Constitutional Perspectives on Gender Equality, Protection of Women at Workplace, Gender Violence- Within and Beyond	
<b>Unit IV: [Gene technology and Ethics]</b>	<b>5 h</b>
History of genetics and genomics, Recent Developments in Cloning, Cloning and Conservation, DNA Fingerprinting, Individual Identification and Ancestry Next Generation Science Standards. Genomics in Medicine, Genetically Modified Organisms and food, Mapping Morality: The Rights and Wrongs of Genomics, Societal implications of genetically modified organisms and food	

### **Course Learning Outcomes:**

- Learn the concept of ethics and morality.
- How to design experimental research – inquiry and discovery
- Learn the problems of gender bias
- Ethical issue related with gene technology

### **Text / Reference Books:**

Author	Title	Publisher	Ed/year	ISBN No	Pages
Daniel McGuire	Synthetic Biology:	SyrawoodPublishing House	2016	978-1682863374	278
R. Subramanian	Professional Ethics	Oxford University press	2017	978-0199475070	472



### **Dissertation Work**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Total Credits</b>
<b>0</b>	<b>0</b>	<b>12</b>	<b>12</b>

### **Course content and syllabus**

The students will undertake research work under the supervision of a faculty member.

# **Semester 4**

<b>M.Sc. (H) Food Science Technology and Processing (2 year)</b>							
<b>Semester-wise Distribution of Courses</b>				<b>Semester 4</b>			
<b>S. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>Credits (4-12)</b>			<b>Credit Units</b>
				<b>L</b>	<b>T</b>	<b>P</b>	
1		Food Safety, Standards and Public Health	CC	4	0	0	4
2		Quality Control and Quality Assurance in Food Industry	AC	3	0	1	4
3		Technology of Frozen Food Processing	SEC	4	0	0	<b>4 Any one</b>
4		Functional Foods and Nutraceuticals	SEC	4	0	0	
5		Professional Ethics – II	VAC	1	0	0	<b>1</b>
6		Research Work/Dissertation	NTCC	0	0	12	<b>12</b>
		<b>Total Credits</b>					<b>25</b>
CC: Core Course; SEC: specialization elective course; OEC: open elective course							

## Food Safety, Standards and Public Health

L	T	P	SW/FW	Total Credit Units
4	0	0	0	4

### Course Contents/syllabus:

<b>Food Safety, Standards and Public Health</b>	
Units	Teaching Hrs
<b>UNIT I: Introduction to Food-Borne Hazards and Contaminants</b>	<b>16 h</b>
Introduction to food safety and its importance in global scenario; hazard, risk and harm. Types of food hazards (physical, chemical and biological) and contaminations. Factors affecting food safety. New and emerging pathogens. genetically modified foods \ transgenics. Mode of entry of hazards in food systems.	
<b>UNIT II: Food Laws, Standards and Hazard Management Tools</b>	<b>20 h</b>
Introduction to food standards, specifications and limits: National Food Regulation-FSSA and important regulatory Agencies – FSSAI, BIS, APEDA; International regulatory scenario and role of organizations - Codex, WHO, FAO, ISO, GMP, GHP, GTP, GAHP	
<b>UNIT III: Food Safety Risk Analysis</b>	<b>20 h</b>
Risk analysis and its components: Risk Management (generic framework, preliminary activities, selection and implementation of risk management option, monitoring and review), Risk assessment (forming a team, risk ranking, structured risk assessment, functional separation), Risk Communication (importance, key communication elements, participation of external stakeholders, worldwide examples, practical aspects, role of Govt. and media).	
<b>UNIT IV: Case Studies related to Food Safety</b>	<b>16 h</b>
Case studies related to: biological (bacteria, viruses and parasites), chemical (toxic constituents / hazardous materials) pesticides residues / environmental pollution / chemicals) and physical factors. Trends in food safety and food frauds; recent literature references.	

### Course Learning Outcomes

- Understanding food safety and hazards associated with foods.
- Awareness about International food laws and standards, and important regulatory agencies
- Learning about hazards management in food systems

<b>Text / Reference Books:</b>					
AUTHOR	TITLE	Publisher	Year of publication	ISBN	Pages
Blackburn, C.D.W. and Mc Clure, P.J.	Food borne pathogens. Hazards, risk analysis & control	Cambridge: Woodhead, 2001.	2005	9781855734548	521

De Vries	Food Safety and Toxicity	New York: CRC	1997	9780849394881	349
Mortimore S. and Wallace C.	HACCP-A Practical Approach.	Boston, MA Springer US	2018	9783319671642	437
WHO and FAO	Food Safety Risk Analysis- a guide for national food safety authorities	World Health Organization (WHO) and Food and Agriculture Organization of the United Nations (FAO)	2006	978-92-5-105604-2	119

## Quality Control and Quality Assurance in Food Industry

L	T	P	SW/FW	Total Credit Units
3	0	1	0	4

### Course content: Quality Control and Quality Assurance in Food Industry

Units	Teaching Hrs
<b>UNIT I: Fundamentals of Food Quality</b>	<b>10 h</b>
Concept of quality: introduction, objectives, importance and functions of quality control and quality assurance in food industry. Basics of process control and in-process quality assurance (IPQA). Quality attributes- physical, chemical, nutritional, microbial, and sensory; their measurement and evaluation; Sensory vis-à-vis instrumental methods for testing quality.	
<b>UNIT II: Quality Management Tools and Regulations in Food Industry</b>	<b>18 h</b>
Concepts of quality management: Objectives, importance and functions of quality control; Quality management systems in India [HACCP, TQM, ISO: 22000]; Sampling procedures and plans; Food Safety and Standards Act, 2006; FSSAI; Domestic regulations; Global Food safety Initiative; Various organizations dealing with inspection, traceability and authentication, certification and quality assurance (EIC, AGMARK, APEDA, BIS); Labelling issues; Traceability	
<b>UNIT III: Analysis and Instrumentation</b>	<b>16 h</b>
QC analysis of raw material and finished products. Sensory evaluation: introduction, requirement, panel screening selection, methods and factors affecting sensory and consumer acceptance. Instrumentation: techniques of food analysis and principle (colorimeter, spectrophotometer, fluorometry and polarimetry, chromatography: HPLC and GC, hyphenated techniques: LCMS/MS, GCMS/MS, ICPOES.	
<b>UNIT IV: Sanitation and Waste Management in Food Industry</b>	<b>10 h</b>
Hygiene and Sanitation in Food Industries - general principles and practices of hygiene, sources of contamination, sanitation and methods of control using physical and chemical agents. sanitizers used in food industry. CIP, Waste Disposal, Pest and Rodent Control, Effluent Treatment Plant system.	

#### Practical –

1. Microbiological testing of industrial food products.
2. Preparation of HACCP charts for meat and dairy industry.
3. Detection and estimation of food additives.
4. Analysis of food adulterants.
5. Estimation of ascorbic acid in fruits/vegetables
6. To examine the quality milk and milk products.
7. Instrumental techniques for evaluation of color and textural properties of food
8. Qualitative determination of adulterants in milk.
10. Sensory methods for measuring food quality.
11. Identification and ranking of food product attributes.
12. Visit to Food Processing industry/ quality control lab implementing GMP/ISO/HACCP

#### Outcomes:

- Theoretical understanding of continuous improvement, total quality management (TQM) and different theories of quality.
- Perceive knowledge of various aspects of food facilities audits and inspection, supply quality programs, product quality audits, shelf life, and sampling.
- Demonstrate applications and implementing of Quality Control Systems in Food Industry.

**RECOMMENDED BOOKS:**

Marriott, Norman G.	Principles of Food Sanitation	SPRINGER,	2019	9783030097929	467
Early R.	Guide to Quality Management Systems for Food Industries		1995		
M.A. Amerine, R.M. Rangborn and E.B. Roessler	Principles of Sensory Evaluation of Foods				
Kramer and Tuig	Quality Control in Food Industry				

## Technology of Frozen Food Processing

L	T	P/S	SW/FW	Total Credit Units
4	0	0	0	4

### Course Contents/syllabus:

Technology of Frozen Food Processing	Teaching Hrs
<b>Unit I: Introduction to Frozen Food Industry</b>	<b>14 h</b>
Status of frozen food industry in India, physical aspect of freezing process: heat transfer during freezing, freezing time, convective (air freezing, brine freezing, cryogenic freezing) and conductive processes (contact and scraped freezers) of freezing, changes during freezing, glass transitions, thermophysical properties of frozen foods, freezing load, Individual Quick Freezing (IQF); freezing time calculations.	
<b>Unit II: Innovations in Freezing Processes</b>	<b>13 h</b>
Innovation in freezing process, freeze concentration, de-hydro freezing, freeze drying, cryogenic freezing, freeze damage, changes during frozen storage, thawing techniques and microbial quality of thawed foods; Freezing methods and equipment, cold store design, transportation of frozen foods, retail display equipments, household refrigerators and freezers, monitoring, and control of the cold chain.	
<b>Unit III: Quality and safety of frozen foods</b>	<b>14 h</b>
Quality and safety of frozen foods: quality and safety of frozen meat, fish, poultry and their products, quality and safety of frozen vegetables, fruits, dairy products, ready meals, bakery products, eggs and eggs products; sensory analysis and shelf-life evaluation of frozen foods.	
<b>Unit IV: Packaging of frozen foods</b>	<b>13 h</b>
Packaging of frozen foods: Introduction to frozen food packaging, different materials used for packaging, packaging machinery; Recent trends in frozen food packaging: active packaging, intelligent packaging, vacuum packaging and application of edible films on frozen foods.	

### Course Learning Outcomes:

(54 Hours)

- Understand concepts of food freezing technology.
- Acquire knowledge about equipment and process used for food freezing.
- Understand maintenance of quality of frozen food.
- Perceive knowledge of advanced packaging technology of frozen foods

Author	Title	Publisher	Year of publication	ISBN	Pages
Hui Y. H., Legarretta I. G., Lim M. H., Murrell K.D. & Nip W.	Handbook of Frozen Foods	CRC Press	2004	9780824747121	1293
Sun D.	Handbook of Frozen Food Processing and Packaging, Second Edition,	CRC Press	2011	9781138627147	936
Evans J. A.	Frozen Food Science and Technology	Wiley-Blackwell.	2011	9781444302325	355



## Functional Foods and Nutraceuticals

L	T	P/S	SW/FW	Total Credit Units
4	0	0	0	4

### Course content and syllabus

Functional Foods and Nutraceuticals	Total Teaching Hrs
<b>UNIT I: Introduction to Nutraceuticals</b>	<b>18 h</b>
<b>Introduction</b> Definitions and history Difference between nutraceuticals and functional foods Current status of nutraceuticals and functional foods in India Market trends of nutraceuticals and functional food	
<b>UNIT II: Types of nutraceuticals and health benefits</b>	<b>18 h</b>
Types of nutraceuticals: phytochemicals- isoprenoids, polyphenolics, phytosterols; carbohydrates- (dietary fibers, oligosaccharides and resistant starch); proteins and peptides, lipids- conjugated linoleic Acid, omega-3 fatty acids, fat replacers; vitamins and minerals; microbial- probiotics, probiotics and symbiotic; sources and stability of nutraceuticals <b>Health benefits-</b> cardiovascular diseases, cancer, diabetes, cholesterol management, obesity, joint pain, immune enhancement, age-related macular degeneration, endurance performance and mood disorders – compounds and their mechanisms of action	
<b>UNIT III: Functional Foods and health benefits</b>	<b>18 h</b>
Types of functional foods - Cereal and cereal products, milk and milk products, egg, oils, meat and products, sea foods, nuts and oilseeds, functional fruits and vegetables, herbs and spices, beverages (tea, wine), fermented foods. Potential health benefits and role in cardiovascular diseases, hypertension, and diabetes. Development, formulation and fabrication of functional foods.	
<b>UNIT IV: Legal Aspects of food safety</b>	<b>18 h</b>
Safety, Consumer acceptance, Assessment of health claims, Labelling, marketing and regulatory issues, Future prospects.	

### Course Learning Outcomes

- Learning fundamentals of biological active biological molecules and their role in food
- Know-how about types of nutraceutical molecules and their roles in prevention of chronic diseases
- Study of functional foods from cereal, milk, fruits, vegetables, nuts and oilseeds.
- Understanding legal aspects, claims, labelling and ethical issues of functional foods

Text / Reference Books:					
Author	Title	Publisher	Year of publication	ISBN	Pages
Pathak, Y.V.	Handbook of nutraceuticals. Volume 2	CRC Press.	2011	9781420082210	400
Wildman, R.E.C.	Handbook of Nutraceutical and Functional Foods.	CRC Press	2001	9781498703727	336

	Various journals of food technology, food science and allied subjects				
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## Professional Ethics – II

L	T	P	Total Credits
1	0	0	1

### Course content and syllabus

	Teaching Hours
<b>Unit I: [Ethics and Empathy]</b>	<b>4 hrs</b>
Religion and Morality. Morality as Part of Our Nature, Skepticism About the Self, Free Will and the Situation, Culture mixing and its consequences, Factors affecting Evaluative Responses to Culture Mixing, Culture as a Knowledge Structure, Multi-Culture Mindsets, Biculturalism & Frame Switching, Assimilation to a Cultural Frame, Globalization and the Forces Shaping the Behaviour.	
<b>Unit II: [Importance of Sampling and Ethical Issues in Research]</b>	<b>5 hrs</b>
Sampling and its Importance, Basic Statistics Concepts, Reliability and Validity, Creating a Representative Sample, Ethical Issues Overview, Voluntary Participation, No Harm to Participants, other Ethical Issues	
<b>Unit III: [A bias neutral workplace]</b>	<b>4 hrs</b>
Creating a Bias Neutral Work Environment, management strategies for workplace bias and personal bias, effective communication methods and how to measure outcomes, strengthening the position of women in society	
<b>Unit IV: [Sustainability, Responsibility and Ethics]</b>	<b>5 hrs</b>
Concepts of sustainability, such as social, environmental and economic dimensions, and the importance of time, Ecological Sustainability. responsible business and research practices, Different approaches to responsibility in research and corporate organizations, such as social responsibility, social entrepreneurship, or corporate citizenship. Environmental Ethics, Land ethics, Deep ecology, Ecofeminism.	

### Course Learning Outcomes:

- Understand basic concepts of morality in mixed cultures.
- Learn to resolve the issues in research.
- Learn to create a bias free work culture.
- To learn the concept of Sustainability and Responsibility

### Text / Reference Books:

Author	Title	Publisher	Ed/year	ISBN No	Pages
Rita Gupta	Sexual Harassment at Workplace, 2013	Lexis Nexis	2013	978-9351430537	320

### Dissertation Work

<b>L</b>	<b>T</b>	<b>P</b>	<b>Total Credits</b>
<b>0</b>	<b>0</b>	<b>12</b>	<b>12</b>

### **Course content and syllabus**

The students will undertake a research work under the supervision of a faculty member.

