

## B. Tech. in Food Science (Minor degree)

### Sem III

	<b>Course Code:</b>	<b>Course Title: Food Microbiology</b>	<b>Credits = 2</b>		
			<b>L</b>	<b>T</b>	<b>P</b>
	<b>Semester: III</b>	<b>Total contact hours: 30</b>	<b>1</b>	<b>1</b>	<b>0</b>
<b>List of Prerequisite Courses</b>					
None					
<b>List of Courses where this course will be Prerequisite</b>					
Microbiology Lab, Principle of Food Preservation, Food Safety, Quality and Regulations					

<b>Description of relevance of this course in the MDM in Food Science</b>		
<ol style="list-style-type: none"> <li>1. To understand the concept of general microbiological ecology and control of food and food-based products.</li> <li>2. To identify the conditions, including sanitation practices, under which the important pathogens and spoilage microorganisms are commonly inactivated, killed or made harmless</li> <li>3. To understand beneficial microorganisms in fermented foods and gut health (probiotics)</li> </ol>		
Sr. No.	Course Contents (Topics and subtopics)	Required Hours
1	General microbiology (bacteria, yeasts, fungi and their physiological growth parameters) and the factors affecting spoilage; biochemical changes caused by microorganisms - putrefaction, lipolysis	06
2	Microbiological spoilage problems associated with typical food products such as dairy products, fruits and vegetables, grains and oilseeds, meat/fish and poultry, spices, and their control	06
3	Food borne infections and food poisoning, Microbial toxins, Emerging pathogens.	04
4	Detection methods for <i>E. coli</i> , <i>Staphylococci</i> , <i>Yersinia</i> , <i>Campylobacter</i> , <i>B. cereus</i> , <i>C. Botulinum</i> & <i>Salmonella</i> from food samples.	05
5	Indicator organisms, microbiological quality assurance systems in food industry, use of the hazard analysis critical control points system to ensure microbiological safety and quality of foods, microbiological food standards	04
6	Microbes in fermented foods and gut health	05
<b>Total</b>		<b>30</b>

<b>List of Text Books / Reference Books</b>	
1	Food Microbiology: Frazier W.C. and Dennis C. Westhoff 5th Edn. Tata McGraw-Hill Publishing Co. Ltd. (2013).

2	Modern Food Microbiology- Jay, James M., Loessner, Martin J., Golden, David A, Aspen Publishers, Inc, 7th ed. (2004)
3	Food Microbiology and Fundamentals and Frontiers: Doyle M.P, Beuchat L.R, Montville T.J.2nd Edn. ASM Press, Washington D.C. (2001)
4	Food Borne Bacterial Pathogens: Doyle, M.P. Marcel Dekker Inc. (1989) Basic Food Microbiology; George J. Banwart, Chapman and Hall (1999)
5	Food Microbiology (Third Edition). Martin R. Adams and Maurice O. Moss. RSC Publishing. ISBN 978-0-85404-284-5
<b>Course Outcomes (Students will be able to.....)</b>	
CO1	Describe the general microbiological ecology and different factors associated with microbial spoilage of food and the corresponding biochemical changes in it (K2)
CO2	Explain the spoilage and methods of controlling the microbial spoilage for specific food products and describing the fundamentals of food fermentation (K2)
CO3	Describe different food borne infections and food poisoning, microbial toxins and functions of newer pathogens (K2)

<b>Mapping of Course Outcomes (COs) with Programme Outcomes (POs)</b>															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		K3	K4	K6	K5	K6	K3	K3+S	K3	K3+A	K2+A	K3	K6+A+S	K3	K4
CO1	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO2	K3	3	3	2	2	2	3	3	3	3	3	3	2	3	3
CO3	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO4	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO5	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
Course	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3

3, Strong Contribution; 2, Moderate Contribution; 1, Low Contribution; – No Contribution  
K, knowledge level from cognitive domain; A, Affective domain; S, Psychomotor domain

## Sem IV

	<b>Course Code:</b> <b>FDP1013</b>	<b>Course Title: Pr 1: Food Microbiology</b>	<b>Credits = 2</b>		
			<b>L</b>	<b>T</b>	<b>P</b>
	<b>Semester: IV</b>	<b>Total contact hours: 60</b>	<b>0</b>	<b>0</b>	<b>4</b>
<b>List of Prerequisite Courses</b>					
	Food Microbiology				
<b>List of Courses where this course will be Prerequisite</b>					
	Food Microbiology, Principles of Food Preservation				

<b>Description of relevance of this course in the B. Tech. (Food Engg. &amp; Tech.) Programme</b>		
<ol style="list-style-type: none"> <li>1. To understand the principles of different staining techniques used for specific group of microorganism and chemical compounds within the cells</li> <li>2. To identify and enumerate the contaminating microorganisms in the food samples</li> <li>3. To identify the microbial resistance towards different types of disinfectants and the effects of physiochemical factors for microbes</li> <li>4. To develop a specific media and isolate microorganisms from different food samples</li> </ol>		
<b>Sr. No.</b>	<b>Course Contents (Topics and subtopics)</b>	<b>Required Hours</b>
1	Working and handling of common laboratory equipment and materials	04
2	Monochrome staining, Cell wall staining	04
3	Gram staining	04
4	Negative staining. Hanging drop technique	04
5	Capsule staining, Bacterial endospore staining	04
6	Study of Yeast, Mold and Bacteria	04
7	Phenol Coefficient of disinfectant	04
8	Microchemical test for reserve material	04
9	Isolation of Microbes from a food sample	04
10	Composition, preparation, sterilization of routine lab media	04
11	Enumeration, characterization, isolation and maintenance from air and surface	04
12	Effect of physicochemical factors and nutritional requirements on growth of microorganisms	04
13	Isolation and characterization of microbes based on morphological & physiological characteristics	04
14	Evaluations of microbial quality of milk and water samples	04
15	Spread Plate, pour Plate methods for cultivation of microbes, Streaking, and point inoculation methods for bacteria, fungi, and actinomycetes.	04

	<b>Total</b>	<b>60</b>
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**List of Text Books / Reference Books**

1	Laboratory Experiments in Microbiology (10th Edition) - by Ted R. Johnson and Christine L. Case, (2012). Publisher: Benjamin Cummings, ISBN: 0321794389
2	Microbiology Lab Manual (8th Edition) - by John Harley. (2010). Publisher: McGraw-Hill Science, ISBN: 0077292812
3	Fundamental Food Microbiology (3 <sup>rd</sup> Edition) – by Bibek Ray. CRC Press: ISBN - 0-8493-1610-3
4	Modern Food Microbiology (Seventh Edition) – by James M. Jay, Martin J. Loessner and David A. Golden. Springer-Food Science Text Series ISBN 0-387-23180-3
5	{FSSAI Lab Manual 14} Manual of Methods of Analysis of Foods [Microbiological Testing]. FSSAI, MoHFW, GoI - 2012

**Course Outcomes (Students will be able to.....)**

CO1	Describe and analyze the principles of different staining techniques used for bacteria, yeast and chemical compounds within the cells (K4)
CO2	Describe and apply the procedure for enumerating the microorganisms in the food samples (K3)
CO3	Analyse the effect of different media composition and physiochemical factors for microbes (K4)
CO4	Isolate and characterize different microorganisms from food samples (K4)
CO5	Assess the microbial quality of various food samples (K4)

<b>Mapping of Course Outcomes (COs) with Programme Outcomes (POs)</b>															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		K3	K4	K6	K5	K6	K3	K3+S	K3	K3+A	K2+A	K3	K6+A+S	K3	K4
CO1	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO2	K3	3	3	2	2	2	3	3	3	3	3	3	2	3	3
CO3	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO4	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO5	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
Course	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3

3, Strong Contribution; 2, Moderate Contribution; 1, Low Contribution; – No Contribution  
 K, knowledge level from cognitive domain; A, Affective domain; S, Psychomotor domain

## Sem V

	<b>Course Code:</b>	<b>Course Title: Introduction to Food Science and Technology</b>	<b>Credits = 4</b>		
			<b>L</b>	<b>T</b>	<b>P</b>
	<b>Semester: V</b>	<b>Total Contact Hours: 60</b>	<b>3</b>	<b>1</b>	<b>0</b>
<b>List of Prerequisite Courses</b>					
	Food microbiology				
<b>List of Courses where this course will be Prerequisite</b>					
	<b>All the courses of MDM in Food Science</b>				

<b>Description of relevance of this course in the MDM in Food Science</b>		
<p>Course objectives</p> <ol style="list-style-type: none"> <li>1. To understand basic physico-chemical properties and chemical structures of food constituents and their role in food quality (sensory and aesthetic-texture, color and flavor), nutrition, food processing and preservation including water</li> <li>2. To understand the properties, method of preparation and applications of food constituents</li> <li>3. To understand the importance and mechanism of the reactions of food constituents taking place during food processing and storage,</li> <li>4. To understand the role of food constituents responsible for components in foods</li> <li>5. To apply course concepts in solving problems related to food constituents</li> </ol>		
<b>Sr. No.</b>	<b>Course Contents (Topics and subtopics)</b>	<b>Required Hours</b>
1	An introduction to food resources and its general composition. proximate analysis of foods, water in food systems – concept of free and bound water, water activity and its impact on food preservation and storage. Basic concept of taste, colour, flavour and texture, sensory analysis, anti-nutritional constituents in foods.	4 (3L+1T)
2	Carbohydrates- classification, structure, properties. Chemical reactions such as caramelization, Maillard reaction, and dehydration; Sucrose – manufacture from sugar cane and sugar beet; hydrolysis of sucrose (inversion), Starches – isolation from varied sources; amylose/amylopectin, size/shape, gelatinization, gelation, retrogradation, pasting behaviour, functional properties, modification; Commercially important products – glucose, glucose syrup, high fructose corn syrup, maltodextrins.  Glycosides in nature; pectin – structure, gelling behaviour of HMP vs. LMP, sources- manufacture and applications; Cellulose and other components of dietary fibre, hydrocolloids (plant/seaweed/ microbial polysaccharides), mucopolysaccharides; chitin and chitosan – sources, structure, manufacture and applications.	16 (12L+4T)

	<b>Nutrition and nutraceutical aspects of carbohydrates</b>	
3	Proteins- chemistry of amino acids, structure, classification and their properties (isoelectric pH, solubility profile), special amino acids, non-protein amino acids; Peptides; Classification of proteins; protein structure (primary, secondary, tertiary and quaternary); Denaturation of proteins; determination of primary sequence; functional properties of proteins; Isolation of food proteins (soya, fish, whey); Maillard browning; Major food protein systems (milk, egg, wheat, meat)  <b>Nutrition and Nutraceutical aspects of proteins</b>	16 (12L+4T)
4	Chemistry of lipids- fatty acids, mono-, di and triacylglycerols; Classification of lipids- simple, compound and derived; unsaponifiable constituents of lipids such as sterols and hydrocarbons and waxes; Rancidity and reversion of fats and oils and thermal stability- its measurement and inhibition; analytical parameters of oils and fats. Extraction, alkali refining, degumming, deodorization, winterization, inter-esterification, hydrogenation etc. of vegetable and animal fats  <b>Nutrition and Nutraceutical aspects of lipids</b>	12 (9L+3T)
5	Vitamins and minerals– classification- water soluble (all the B vitamins and C) and fat soluble (Vitamins A, D, E and K); Chemistry, structure and properties; physiological functions; absorption and metabolism; food sources, deficiency and hypervitaminosis; RDA  Minerals in health and nutrition- Iron, calcium, zinc, sodium, potassium, magnesium and others- food sources, physiological functions, RDA, effect on food processing and preservation	12 (9L+3T)
	<b>Total</b>	<b>60</b>

<b>List of Textbooks / Reference Books</b>	
1	Belitz, H.D, Grosch, W., & Schieberle, P. Food Chemistry; 3 <sup>rd</sup> ed.; Springer, Germany; 2005.
2	Damodaran, S., & Parkin, K.L. Fennema's Food Chemistry; 5 <sup>th</sup> ed.; CRC Press, Boca Raton; 2017.
3	Velisek, J., The Chemistry of Food; Wiley-Blackwell; 2013.
4	Meyer, L.H., Food Chemistry. Cbs Publisher; 2004.
5	Velisek, J., Koplik, R., Cejpek, K. The Chemistry of Food; 2nd ed.; Wiley-Blackwell; 2020
<b>Course Outcomes (Students will be able to.....)</b>	

CO1	Describe the various constituents present in foods and their roles therein and solve practical problems in food quality (K3)
CO2	Describe the properties, method of preparation and applications of food constituents (K2)
CO3	Describe the mechanisms and significance of physicochemical reactions involved in food processing and storage (K2)
CO4	To apply course concepts in solving problems related to food constituents
CO5	Describe and demonstrate the role of food constituents on nutritional/anti-nutritional and aesthetic quality of raw and processed foods (K3)

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		K3	K4	K6	K5	K6	K3	K3+S	K3	K3+A	K2+A	K3	K6+A+S	K3	K4
CO1	K3	3	3	2	2	2	3	3	3	3	3	3	2	3	3
CO2	K2	3	2	1	2	1	3	3	3	3	3	3	1	3	2
CO3	K2	3	2	1	2	1	3	3	3	3	3	3	1	3	2
CO4	K2	3	2	1	2	1	3	3	3	3	3	3	1	3	2
CO5	K3	3	3	2	2	2	3	3	3	3	3	3	2	3	3
Course	K3	3	3	2	2	2	3	3	3	3	3	3	2	3	3

3, Strong Contribution; 2, Moderate Contribution; 1, Low Contribution; – No Contribution  
K, knowledge level from cognitive domain; A, Affective domain; S, Psychomotor domain

## Sem VI

	<b>Course Code:</b>	<b>Course Title: Principles of Food Preservation</b>	<b>Credits = 2</b>		
			<b>L</b>	<b>T</b>	<b>P</b>
	<b>Semester: VI</b>	<b>Total Contact Hours: 30</b>	<b>1</b>	<b>1</b>	<b>0</b>
<b>List of Prerequisite Courses</b>					
	Introduction to Food Science and Technology, Food Microbiology				
<b>List of Courses where this course will be Prerequisite</b>					
	Food Safety, Quality and Regulations				

<b>Description of relevance of this course in the MDM in Food Science</b>		
<ul style="list-style-type: none"> <li>• To understand the fundamentals of food preservation through dehydration, high and low temperature processing of food</li> <li>• To explain the principles of advanced thermal and non-thermal processing of food</li> <li>• To explain the principles of food preservation by fermentation, chemical preservatives, bio-preservatives and hurdle technology</li> </ul>		
Sr. No.	Course Contents (Topics and subtopics)	Required Hours
1	<b>Introduction to food preservation:</b> Food spoilage; Underlying principles of different modes of food preservation; Preservation methods with emphasis on inactivation, inhibition, and avoiding recontamination.	02
2	<b>Dehydration and drying of foods:</b> Drying curve and drying time calculation; Water activity and moisture absorption isotherms; Psychrometric chart; Different types of dryers- Conductive, convective, and combined; IMF foods; osmotic dehydration.	05
3	<b>Thermal processing of food products:</b> Sterilization and Pasteurization; Canning of food products; Classifications and structure of cans, corrosion, Lacquering; Spoilage in canned foods (1) Thermal death time (TDT) concept; Process time calculation for canned foods; Retort processing; Aseptic packaging.	07
4	<b>Newer techniques in thermal processing:</b> Concept of HTST; UHT; Ohmic, Dielectric, Infra-red Heating; Microwave heating; Frying method.	03
5	<b>Non-thermal processing of food:</b> High pressure processing; Pulsed electric field processing; Cold extrusion; Plasma processing; Ionizing Radiations; Ultrasound processing; UV and Pulsed light processing; Membrane Technology.	04
6	<b>Low temperature storage and preservation:</b> Chilling and Freezing; Freezing curve and water activity; Properties of frozen foods; Enthalpy change during freezing; Plank's equation for freezing time; Cold storage and Refrigeration load; Refrigeration cycle; Cryogenic freezing and IQF; Freeze concentration and freeze drying.	06
7	<b>Hurdle technology:</b> Role of acidity and pH in food preservation; Preservation by fermentation	03



	– Curing, Pickling and Smoking; Controlled and modified atmospheric packaging and storage; Chemical and Bio-preservatives; Antimicrobials.	
	<b>Total</b>	<b>30</b>

#### List of Text Books / Reference Books

1	Toledo, R.T. Fundamentals of Food Process Engineering, Chapman and Hall; 2000,
2	Fellows, P.J. Food Processing Technology: Principles and Practice, CBS Publishers; 2005.
3	Rahman, M.S. Handbook of food preservation, CRC Press; 2007.
4	Cullen, P.J., Brijesh, K.T., Vasilis, Valdramidis, P. Novel Thermal and Non-Thermal Technologies for Fluid Foods, Elsevier Academic Press; 2012.
5	Zhang, H.Q., Barbosa-Cánovas, G.V., Balasubramaniam, V.M., Dunne, C.P., Farkas, D.F., Yuan, J.T.C. Non-thermal Processing Technologies for Food, John Wiley & Sons; 2011.
6	Shakuntala, N., & Many, O. Food: Facts and Principles, New Age International; 2001.

#### Course Outcomes (Students will be able to.....)

CO1	Apply the principles and develop operations using thermal technologies for food preservation (K4)
CO2	Apply the principle, technology and operations of various non-thermal technologies for food preservation (K3)
CO3	Apply the principles of hurdle technology in food preservation (K3)

#### Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		K3	K4	K6	K5	K6	K3	K3+S	K3	K3+A	K2+A	K3	K6+A+S	K3	K4
CO1	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO2	K3	3	3	2	2	2	3	3	3	3	3	3	2	3	3
CO3	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO4	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO5	K3	3	3	2	2	2	3	3	3	3	3	3	2	3	3
Course	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3

3, Strong Contribution; 2, Moderate Contribution; 1, Low Contribution; – No Contribution  
K, knowledge level from cognitive domain; A, Affective domain; S, Psychomotor domain

## Sem VII

	<b>Course Code:</b> FDP 1018	<b>Course Title: PR6: Food Analysis - I</b>	<b>Credits = 2</b>		
			L	T	P
	<b>Semester: VII</b>	<b>Total Contact Hours: 60</b>	<b>0</b>	<b>0</b>	<b>4</b>
<b>List of Prerequisite Courses</b>					
	None				
<b>List of Courses where this course will be Prerequisite</b>					
	Food Safety, Quality and Regulations				
<b>Description of relevance of this course in the B. Tech. (Food Engg. &amp; Tech.) Programme</b>					
<ol style="list-style-type: none"> <li>1. To give students hands on training on chemical analysis or food compositions (moisture, fat, protein, fiber, ash and carbohydrate) determinations of wide range of fruit, vegetables, cereal, legume based food products available in the market</li> <li>2. To train them acquire laboratory skills required for performing a range of chemical and physicochemical analyses of food components</li> <li>3. To train them for the understanding of nutritional labelling</li> </ol>					
<b>Sr. No.</b>	<b>Course Contents (Topics and subtopics)</b>				<b>Required Hours</b>
1	Analysis of tea and coffee				04
2	Analysis of liquid milk, condensed milk and skim milk powder				08
3	Analysis of honey and golden syrup				04
4	Analysis of wheat flour				04
5	Analysis of beer and wine				08
6	Analysis of jam, jelly and squash				08
7	Analysis of fish				04
8	Analysis of spices				04
9	Analysis of vinegar				04
10	Analysis of ghee and edible oil				04
11	Analysis of bread				04
12	Analysis of Cake, Biscuits				04
<b>Total</b>					<b>60</b>

<b>List of Text Books / Reference Books</b>	
1	Sehgal S. (2016). A Laboratory Manual of Food Analysis. I.K. International Publishing House Pvt. Ltd.
2	Nielsen, S. Suzanne (2017). Food Analysis Laboratory Manual II. (Ed.) 5th edition. Springer, New York
3	The Food Safety and Standards Act along with Rules and Regulations (2011). Delhi: Commercial Law Publishers (India) Pvt Ltd.
<b>Course Outcomes (Students will be able to.....)</b>	
CO1	Apply the fundamental knowledge in the analysis of plantation crops/animal-based products/dairy based products (K3)
CO2	Analyse the unit operations involved in the processing of different plantation crops/animal products/milk and dairy products (K4)
CO3	Select and demonstrate a suitable extraction/isolation technique for high value compounds from plantation crops/milk/animal products (K4)
CO4	Develop new products and processes for value-addition of plantation crop/dairy/animal products (K4)
CO5	Develop strategies related to processing of dairy/plantation crops/animal based products and do troubleshooting (K4)

<b>Mapping of Course Outcomes (COs) with Programme Outcomes (POs)</b>															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		K3	K4	K6	K5	K6	K3	K3+S	K3	K3+A	K2+A	K3	K6+A+S	K3	K4
CO1	K3	3	3	2	2	2	3	3	3	3	3	3	2	3	3
CO2	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO3	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO4	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO5	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
Course	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3

3, Strong Contribution; 2, Moderate Contribution; 1, Low Contribution; – No Contribution  
 K, knowledge level from cognitive domain; A, Affective domain; S, Psychomotor domain

## Sem VIII

	<b>Course Code:</b>	<b>Course Title: Food Safety and Quality Regulations</b>	<b>Credits = 2</b>		
			<b>L</b>	<b>T</b>	<b>P</b>
	<b>Semester: VIII</b>	<b>Total contact hours: 30</b>	<b>1</b>	<b>1</b>	<b>0</b>
<b>List of Prerequisite Courses</b>					
	Food Microbiology, Introduction to Food Science and Technology, Principles of Food Preservation				
<b>List of Courses where this course will be Prerequisite</b>					
	None				

<b>Description of relevance of this course in the MDM in Food Science</b>		
<ol style="list-style-type: none"> <li>1. To explain the functional role and safety issues of food contaminants, food adulteration,</li> <li>2. To describe the hygiene and sanitation in food processing plant, equipment, storage and handling</li> <li>3. To explain the various quality attributes of food and emphasizing on microbial quality control in food and water quality</li> <li>4. To conduct a food safety-based risk assessment at different stages of production of food and thereby designing the HACCP, VACCP and TACCP system</li> <li>5. To explain the role, standard and law set by Indian and global regulatory authorities with respect to food quality control</li> </ol>		
Sr. No.	Course Contents (Topics and subtopics)	Required Hours
1	<b>India Regulations</b> Overview of FSSAI. Detail of FSS Regulations relevant to products and labelling. (FSS Licensing & Registration including Schedule IV, Product Standards & Additives, Labelling & Display, Advertisement & Claims) Introduction to food safety and security: Hygienic design of food plants and equipment,	10
2	<b>Food quality:</b> Various Quality attributes of food, Instrumental, chemical and microbial Quality control. Sensory evaluation of food and statistical analysis. Water quality and other utilities.	08
3	<b>Food Safety Management System:</b> Food Safety, Threat and Fraud Management based on international standards (HACCP / VACCP / TACCP)	07
4	<b>Global regulations:</b> FAO, Technical Cooperation programmes, Bio-security in Food and Agriculture, World Health Organization (WHO), World Animal Health Organization (OIE), International Plant Protection, Convention (IPPC) Codex Alimentarius Commission - Codex India – Role of Codex Contact point, National Codex contact point (NCCP), National Codex Committee of India – ToR, Functions, Shadow Committees etc. <b>Overview of US and EU regulations for food</b>	05
<b>Total</b>		<b>30</b>

<b>List of Text Books / Reference Books</b>	
1	Handbook of Food Toxicology by S. S. Deshpande

2	The Food Safety Information Handbook by Cynthia A. Robert, 2009
3	Nutritional and Safety Aspects of Food Processing by Tannenbaum SR
4	Microbiological Safety of Food by Hobbs BC, 1973
5	Food Safety Handbook by Ronald H. Schmidt, Gary E. Rodrick
<b>Course Outcomes (Students will be able to.....)</b>	
CO1	Describe the functional role and safety issues of food contaminants, food adulteration, food additives, food packaging & labelling (K2).
CO2	Design the hygiene and sanitation in food processing plant, equipment, storage, and handling (K3)
CO3	Analyse the various quality attributes of food and especially on microbial quality control of food and water in Food Processing Industry (K4)
CO4	Identify and analyze the critical quality control point in different stages of production of food and thereby designing the HACCP system. (K4)
CO5	Explain the role, standard and law set by Indian and global regulatory authorities with respect to food quality control (K2)

<b>Mapping of Course Outcomes (COs) with Programme Outcomes (POs)</b>															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		K3	K4	K6	K5	K6	K3	K3+S	K3	K3+A	K2+A	K3	K6+A+S	K3	K4
CO1	K2	3	2	1	2	1	3	3	3	3	3	3	1	3	2
CO2	K3	3	3	2	2	2	3	3	3	3	3	3	2	3	3
CO3	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO4	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO5	K2	3	2	1	2	1	3	3	3	3	3	3	1	3	2
Course	K4	3	3	2	3	2	3	3	3	3	3	3	2	3	3

3, Strong Contribution; 2, Moderate Contribution; 1, Low Contribution; – No Contribution  
K, knowledge level from cognitive domain; A, Affective domain; S, Psychomotor domain