



College of excellence **nirf** 2023 – 4<sup>th</sup> rank

Autonomous and Affiliated to Bharathiar University Reaccredited with A<sup>++</sup> grade by NAAC,

An ISO 9001: 2015 Certified Institution

Peelamedu, Coimbatore-641004

**DEPARTMENT OF FOOD PROCESSING TECHNOLOGY AND MANAGEMENT**

**CHOICE BASED CREDIT SYSTEM (CBCS)**

**&**

**LEARNING OUTCOMES- BASED CURRICULUM FRAMEWORK (LOCF)**

**BACHELOR OF FOOD PROCESSING TECHNOLOGY AND MANAGEMENT**

**2021 – 2024 Batch**



**PSGR**  
**Krishnammal College for Women**



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## **DEPARTMENT OF FOOD PROCESSING TECHNOLOGY AND MANAGEMENT**

### **PROGRAMME LEARNING OUTCOMES (PLO's)**

**After Completion of the program, the students will**

<b>PLO1</b>	:	Acquire the knowledge about the chemical, biochemical, physical, microbiological changes that occur during processing and preservation of any food.
<b>PLO2</b>	:	Possess the ability to identify, and solve problems related to Food manufacturing
<b>PLO3</b>	:	Be able to differentiate between processed and safely processed food
<b>PLO4</b>	:	Apply better/good practices and be more innovative in developing the food products as per the current requirements of the market.
<b>PLO5</b>	:	Acquire skills to analyze different food products and interpret the results in an effective manner.
<b>PLO6</b>	:	Be equipped to transfer this knowledge to the consumer

### **PROGRAMME SPECIFIC OUTCOME**

<b>PSO1</b>	:	Graduates with sufficient knowledge in the areas of food science, food chemistry, food processing and preservation of foods.
<b>PSO2</b>	:	Development of a food technologist, food analyst, nutritionist and an administrator
<b>PSO3</b>	:	Equip themselves to higher levels of learning and/or for the development of new products, that will accommodate to start up new venture in areas of food processing.
<b>PSO4</b>	:	Shall keep themselves abreast with the current trends to meet the food industry challenges.



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B.S.C FOOD PROCESSING TECHNOLOGY AND MANAGEMENT  
CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOME BASED  
CURRICULARFRAMEWORK (LOCF)

BACHELOR OF SCIENCE (B.Sc.) – Academic Year 2021-2024

SEM	Part	Subject Code	Title of the Paper	Instruction hours/week	Contact hours	Tutorial	Duration of Examination	Examination Marks			Credits
								CA	ESE	TOTAL	
I	I	TAM2101/ HIN2101/ FRE2101	Language T/H/F Paper I	6	86	4	3	40	60	100	3
	II	ENG2101/ FRE2101	English paper I/Functional English	6	86	4	3	40	60	100	3
	III	BF21C01	<b>Core I</b> Food Science	4	56	4	3	40	60	100	4
	III	BF21C02	<b>Core II</b> Food Chemistry	3	41	4	3	40	60	100	3
	III	BF21CP1	<b>Core Practical I</b> Food Science Practicals	3	45	-	3	20	30	50	3
	III	BF21A01	<b>Allied I</b> Principles of Nutrition	3	41	4	3	20	55	75	3
	III	BF21AP1	<b>Allied Practical I</b> Nutrition Practicals	3	45	-	3	20	30	50	3
	IV	NME19B1/ NME19A1/ NME18ES	Basic Tamil/ Advanced Tamil/WS/AS/GS/ Entrepreneurship	2	28	2	2	50	50	100	2
	I	TAM2102/ HIN2102/ FRE2102	Language T/H/F Paper – II	6	86	4	3	40	60	100	3
	II	ENG2102	English paper II	6	86	4	3	40	60	100	3
	III	BF21C03	<b>Core III</b> Food Microbiology	5	71	4	3	40	60	100	4
	III	BF21CP2	<b>Core Practical II</b> Microbiology Practicals	3	45	-	3	20	30	50	3

II	III	BF21A02	<b>Allied II</b> Principles of Biochemistry	5	71	4	3	20	55	75	3
	III	BF21AP2	<b>Allied Practical II</b> Biochemistry Practicals	3	45	-	3	20	30	50	3
	VI	NM12GAW	Foundation Course I General Awareness	-	Self Study Online			100	-	Grade	-
	IV		Online Course		Self Study Online						
	IV	21PELS1	Professional English	2	30	-	-	100		100	2
	IV	NME19B2/ NME19A2	Basic Tamil II # / Advanced Tamil II		28	2	2	50	50	Grade	-
III	II	ENG2103	English paper III	English	5	71	4	3	50	50	100
	III	BF21C04	<b>Core IV</b> Unit Operations	CC	5	71	4	3	50	50	100
	III	BF21CP4	<b>Core Practical III</b> Unit Operations Practical	CC	4	60	-	3	25	25	50
	III	BF21C05	<b>Core V</b> Principles Of Management	CC	5	71	4	3	50	50	100
	III	TH21A03/	<b>Allied III</b> Numerical and Statistical techniques / Basics of Accountancy	GE	6	86	4	3	50	50	100
	III	BF21SB01/ BF21SBCE	<b>SBS-1</b> Instrumentational techniques /		3	43	1		25	75	100
	III	SB20BFP1	<b>Skill Based Subject</b> Practical – Instrumentation and Analysis		22	-	-	2	-	-	-
	IV	NM21EVS	<b>Foundation Course II</b> Environmental studies	AEC	Self Study				100	-	100
	IV	NM21UHR	<b>Foundation Course-III</b> (Universal Human Values and		2	26	4	-	100	-	100
	VI		Internship	4 weeks						100	2
VI	JOB2019	Job Oriented Course					25	75	100	Grade	
II	ENG2104	English paper IV	English	6	86	4	3	50	50	100	
	III	BF21C06	<b>Core VI</b> Food Preservation	CC	4	56	4	3	50	50	100

IV	III	BF21CP5	<b>Core Practical IV</b> Food Preservation Practical	CC	5	75	-	-	25	25	50
	III	BF21C07	<b>Core VII</b> Principles of Marketing	CC	5	71	4	3	50	50	100
	III	BF21A04	<b>Allied IV</b> Grain processing Technology	GE	5	71	4	3	50	50	100
	III	BF21SB02/ BF2SBCE	<b>Skill based Subject</b> Basics of Instrumentational Techniques in food Analysis/ Coursera - Fundamentals of Food Safety and Microbiology	SEC	3	43	1	2	25	75	100
	V		<b>Extension Activities</b> NSS/NCC/YRC/Sports and Games/Ecowatch/Yinet/ Rot ar			-		-	100	100	1
		NM21DT G	<b>Design Thinking</b>	Finishing school – Part A	2	4			100	100	2
	VI		<b>Job Oriented Course</b>								
V	III	BF21C08	<b>Core VIII</b> Food Biotechnology	4	58	2	3	50	50	100	3
	III	BF21C09	<b>Core IX</b> Food Product Development	4	58	2	3	50	50	100	3
	III	BF21C10	<b>Core X</b> Bakery and Confectionery Technology	4	58	2	3	50	50	100	3
	III	BF21E01	<b>Elective (AOS) I</b> Processing of meat, fish and poultry	5	73	2	3	50	50	100	3
	III	BF21E02	<b>Elective (AOS) II</b> Processing of spices and plantation crops	5	73	2	3	50	50	100	3
	III	BF21E03	<b>Elective (AOS) III</b> Fruit & Vegetable processing Technology	5	73	2	3	50	50	100	3
	III	BF18AC1	<b>ALC I</b> Environmental Issues in Food Industry	Self study	-		3	25	75	100*	5*
	III	BF18AC2	<b>ALC II</b> Food supply Chain	Self study	-		3	25	75	100*	5*

	III	BF21CP6	<b>Core Practical V</b> Food Processing & Food Bioprocessing practical	3	45	-	3	25	25	50	3
	III	BF21PROJ	Project and Viva Voce	5	-	-	-	50	50	100	5
	IV	NM21CS1	Cyber Security 1	2	30	-	-	100	-	100	Grade
	III	BF21SBP1	Instrumentational techniques in food Analysis practical	3	45	-	2	100	-	100	3
	III		Comprehensive Examination	-	-	-	1	-	100		Grade
VI	III	BF21C11	<b>Core XI</b> Food Safety and Quality Assurance	6	88	2	3	50	50	100	5
	III	BF21C12	<b>Core XII</b> Food Packaging Technology	6	88	2	3	50	50	100	5
	III	BF21C13	<b>Core XIII</b> Financial Management	5	73	2	3	50	50	100	4
	III	BF21E04	<b>Elective (AOS) – IV</b> Dairy Technology	5	73	2	3	50	50	100	4
	III	BF21E05	<b>Elective (AOS) – V</b> Convenience Foods	5	73	2	3	50	50	100	
	III	BF21E06	<b>Elective (AOS) – VI</b> Functional Foods and Nutraceuticals	5	73	2	3	50	50	100	
	III	BF18AC3	<b>ALC III</b> Food Adulteration and Toxicology	Self study	-	-	3	25	75	100*	5*
	III	BF18AC4	<b>ALC IV</b> Emerging Technologies in Processing and Preservation	Self study	-	-	3	25	75	100*	5*
	III	BF21CP6	<b>Core Practical VI</b> Food quality control practical	5	75	-	3	25	25	50	4
	III	BF21SBP2	<b>SBS Practical</b> Techniques in Food Analysis practical	3	41	4	-	100	-	100	3
	III	BF21C11	<b>Core XI</b> Food Safety and Quality Assurance	6	88	2	3	50	50	100	5

### SEMESTER I

<b>COURSE NUMBER</b>	<b>COURSE NAME</b>
<b>BF21C01</b>	<b>CORE- I FOOD SCIENCE</b>

#### **Preamble**

To enable the students to

- learn the basic concepts of food science and different methods of cooking
- understand the classification, composition and nutritive values of various foods
- gain knowledge on the cooking of cereals, pulses, meat, and poultry
- familiarize the types of spices and beverages

Category	L	T	P	Credit
Theory	56	4	-	4

fish

#### **Course Outcomes**

On the successful completion of the course, students will be able to

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
CO1	outline the different functions of food and different methods of cooking	K2
CO2	relate the composition and nutritive value of cereals, millets, pulses, nuts & oil seeds	K3
CO3	classify the vegetables and fruits & analyze the loss of nutrients during vegetable cooking	K4
CO4	classify the types of meat, fish, poultry and milk products & explain their cooking methods	K2
CO5	analyze the medicinal values of spices & appraise the processing of tea and cocoa beans	K4



## Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	H	M	H	H	H
CO2	M	H	M	H	H	H
CO3	M	H	M	H	H	H
CO4	M	H	M	H	H	H
CO5	M	H	M	H	H	H

H- High; M-Medium; L-Low

### Core- I Food Science (BF21C01)

(56Hrs)

#### Syllabus

#### Unit I Food Science

(11Hrs)

Introduction to food science – definition, functions of food, food groups, food pyramid, and food in relation to health.

Cooking – objectives of cooking, preliminary preparations, Factors affecting cooking of foods. Gelatinization & factors affecting gel formation, denaturation, colloids, emulsion, foam & factors affecting foam formation & stability, fermentation, browning, rancidity. Cooking methods – moist heat methods, dry heat methods, Combination methods – braising and microwave cooking.

#### Unit II Cereals, Millets, Pulses, Nuts and Oil seeds

(12Hrs)

**Cereals and cereal products** – structure, composition and nutritive value. Specific cereals – wheat, rice (composition and milling).

**Millets** – maize, jowar, ragi, bajra (nutritive value and processing), cereal starch – introduction – effect of moist heat and dry heat.

**Pulses** – composition and nutritive value, processing, toxic constituents, pulse cooking & factors affecting pulse cooking.

**Nuts & oil seeds** – Types, composition and nutritive value, functions of nuts and oilseeds in cookery.

#### Unit III Vegetables and Fruits

(11Hrs)

**Vegetables** – classification – composition and nutritive value, selection of vegetables, pigments – water insoluble and soluble pigments, flavour compounds – bitter compounds – vegetable cookery, loss of nutrition during cooking and its prevention. Effect of cooking on pigments.

**Fruits** – classification – composition and nutritive value, selection of fruits, ripening of fruits, enzymatic and non-enzymatic browning, prevention of browning.

**Unit IV****(11Hrs)****Animal Foods, Milk and Milk Products**

**Egg-** Structure, composition, nutritive value, egg quality grading, effect of heat on egg proteins, functions of egg in cookery.

**Meat** – classes of meat and related products, composition and nutritive value, post-mortem changes, ageing, tenderizing, curing, cuts, grades and meat cookery, Changes during cooking, methods of cooking

**Fish-** classification, composition and nutritive value, selection of fish, spoilage of fish.

**Poultry** – classification, composition and nutritive value.

**Milk-** Composition, nutritive value, properties, role of milk and milk products in cookery, effect of heat on milk, milk processing, milk products, indigenous milk products.

**Unit V Sugar, Spices & Beverages****(11Hrs)**

**Sugar-** Properties, sugar and related products, factors affecting crystallization, role of sugar in cookery, artificial sweeteners

**Spices** – general function, specific species & their medicinal values

**Beverages** – classification, coffee – processing, coffee beverage and methods of preparation- Espresso, soluble and decaffeinated coffee. Tea – Processing of tea, types of tea. Cocoa and chocolate – processing of cocoa beans, malted beverages-Amylase rich food

**Text Books**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Srilakshmi, B	Food Science	New Age International (P) Ltd., Publishers, New Delhi.	2005
2.	Potter, N.	Food Science	CBS Publishers and Distributors, Delhi.	2005
3.	Shakunthala Manay, N and Shadaksharswamy, M	Foods Facts and Principles	New Age International	2 <sup>nd</sup> Edn., 2001

**Reference Books**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	VijayaKhader	Text book of Food Science and Technology	ICAR, New Delhi.	2001
2.	Srivastava, R.P. and Sanjeev Kumar	Fruit and vegetable preservation – principles and practices	International Book Distributing Co., Lucknow.	2002

3.	Swaminathan, M.	Food Science and Experimental Foods	Ganesh and Co., Madras.	1995
4.	Sukhneet Suri	Food science nutrition and safety	Pearson Education Ltd.	2016

**Pedagogy**

Lecture by chalk & talk, power point presentation, e-content, group discussion, assignment, quiz, seminar.

**Course Designers:**

**1. Dr. M. Guhapriya**

**2. Mrs. R. Sugantha**

**Question paper pattern  
Continuous Internal Assessment**

SECTION	MARKS	TOTAL
A – 5 X 2 Marks	10	50
B – 4 X 5 Marks	20	
C - 2/3 X 10 Marks	20	

**End Semester Examination**

SECTION	WORD LIMIT	MARKS	TOTAL
A-11/13 X 2 Marks	One or two sentences	22	100
B - 5/7 X 6 Marks	300	30	
C - 4/6 X 12 Marks	600-800	48	

<b>COURSE NUMBER</b>	<b>COURSE NAME</b>
<b>BF21C02</b>	<b>FOOD CHEMISTRY</b>

Category	L	T	P	Credit
Theory	41	4	-	3

### Preamble

Enable the students to

- understand the types and important properties of water
- gain knowledge about classification, structure and reactivity of carbohydrates
- acquire knowledge about classification and structure of amino acids & proteins
- learn the nomenclature, classification of enzymes/lipids and the enzymatic action
- familiarize with chemistry of vitamins and minerals

### Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	distinguish different types of water	K2
CO2	explain the structure of mono & di carbohydrates	K2
CO3	classify amino acids, proteins and enzymes and analyze the factors affecting enzyme action	K4
CO4	appraise the functions of lipids	K4
CO5	Understand the chemistry of Vitamins and Minerals	K2

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	H	M	H	H	H
CO2	M	H	M	H	H	H
CO3	M	H	M	H	H	H
CO4	M	H	M	H	H	H
CO5	M	H	M	H	H	H

H- High; M-Medium; L-Low

## CORE –II FOOD CHEMISTRY (BF21C02)

(41 Hrs)

### Syllabus

#### Unit I Water in Foods

(8 Hrs) Properties of foods-

chemical, functional and kinetic. Moisture in foods, role and type of water in foods (free, bound and entrapped water), water activity, Molecular mobility and food stability.

#### Unit II Chemistry of Carbohydrates

(8 Hrs)

Carbohydrates - occurrence and classification. Structure of monosaccharides, optical activity of sugars, epimers, enantiomers, pyranose and furanose structures, reactions of monosaccharides, structure of Disaccharides- Maltose, Sucrose, Inversion of sucrose, Lactose, Lactulose, Browning reactions (non-enzymatic), Polysaccharides- homopolysaccharides and hetero polysaccharides, retrogradation

#### Unit III Chemistry of Proteins and Enzymes

(8 Hrs)

**Amino acids** - Classification, essential amino acids, structure, properties of amino acids.

**Proteins**- Classification, Structure of proteins - primary, secondary, tertiary and quaternary and properties.

**Enzymes** –Definition, Chemical nature and properties. Mechanism of enzyme action, factors affecting enzyme action and measures to control, Types of enzymes used in food processing, industrial application of enzymes.

#### Unit IV Chemistry of Fats and oils

(8 Hrs)

**Fats and oils**- Classification, functions, fatty acids – occurrence, types, nomenclature, essential fatty acids, Isomerism in unsaturated fatty acids, physical and chemical properties of fats and oils, modification of fats, hydrogenation, inter-esterification, acetylation, winterization, deterioration of fats, rancidity & antioxidants.

#### Unit V Chemistry of Vitamins and Minerals

(9Hrs)

**Vitamins**: History, structure of fat soluble and water soluble vitamins, occurrence of vitamins, vitamins as coenzymes, vitamin retention during processing and storage, vitamins as antioxidants and supplements

**Minerals**: Minerals in foods and its chemistry

**Text Books**

S.No	Authors	Title of the Book	Publishers	Year of Publication
1.	Shakunthala Manay, N. Shadaksharswamy, M	Foods Facts and Principles	New Age International	2 <sup>nd</sup> Edn., 2001
2.	Meyer LH,	Food Chemistry	CBS Publication	1987
3.	Dr. H.-D. Belitz Dr.-Ing. W. Grosch	Food Chemistry	Springer-Verlag Berlin Heidelberg	1999
4.	John M. DeMan	Principles of Food Chemistry	Avi Publishing Co Inc.	1976

**Reference Books**

S. No	Authors	Title of the Book	Publishers	Year of Publication
1	Srinivasan Damodaran, Kirk L. Parkin	Fennema's Food Chemistry	CRC Press	2017
2	John M. de Man John W. Finley, W. Jeffrey Hurst, Chang Yong Lee	Principles of Food Chemistry	Springer	2018
3	Chesworth, JM., Stuchbury, T. and Scaife, JR	An Introduction to Agricultural Biochemistry.	Chapman and Hall	1998
4	Goodwin, T.W. and Mercer, E.I	Introduction to Plant Biochemistry.	Pergamon Press	1991

**Pedagogy:** Lecture by chalk and talk, power point presentation, group learning, group discussion, assignment, quiz, peer learning, student seminar

**Course Designers:**

1. Dr. M. Guhapriya
2. Mrs. R. Sugantha

**Question paper pattern**  
**Continuous Internal Assessment**

SECTION	MARKS	TOTAL
A – 5 X 2 Marks	10	50
B – 4 X 5 Marks	20	
C - 2/3 X 10 Marks	20	

### End Semester Examination

<b>SECTION</b>	<b>WORD LIMIT</b>	<b>MARKS</b>	<b>TOTAL</b>
A-11/13 X 2 Marks	One or two sentences	22	100
B - 5/7 X 6 Marks	300	30	
C - 4/6 X 12 Marks	600-800	48	

<b>COURSE NUMBER</b>	<b>COURSE NAME</b>
<b>BF21A01</b>	<b>ALLIED- I PRINCIPLES OF NUTRITION</b>

Category	L	T	P	Credit
Theory	41	4	-	3

### **Preamble**

To enable the students to

- gain knowledge about nutrition and malnutrition
- determine the energy values of foods
- learn the sources and functions of vitamins and minerals
- know the importance of water and electrolyte balance in the body

### **Course Outcomes**

On the successful completion of the course, students will be able to

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
CO1	classify food groups and explain the scope & importance of nutrition	K2
CO2	calculate and interpret the energy values of food & explain the functions, digestion and absorption of carbohydrates, proteins and fats	K4
CO3	categorize fat soluble and water soluble vitamins and their functions	K4
CO4	list and explain the sources, functions, requirements & deficiency of minerals	K4
CO5	relate the water and electrolyte balance to the various functions of the body and role of dietary fibre in maintaining a healthy lifestyle	K2



## Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	H	M	H	H	H
CO2	M	H	M	H	H	H
CO3	M	H	M	H	H	H
CO4	M	H	M	H	H	H
CO5	M	H	M	H	H	H

H- High; M-Medium; L-Low

## Allied Paper -I Principles of Nutrition (BF21A01)

(41 Hrs)

### Syllabus

#### Unit I Importance of Nutrition

(8Hrs)

Nutrition – introduction, importance and scope of nutrition – balanced diet – food pyramid – food group – classification – recommended dietary allowances – malnutrition – obesity and under nutrition, relation of nutrition to health.

#### Unit II Proximate principles

(9 Hrs)

Energy – sources – determination of energy value of foods – physiological energy value of foods – Basal Metabolic rate – factors affecting BMR – thermogenic effect of foods. Carbohydrate, proteins and fat – classification, functions, digestion and absorption, sources and requirements. Protein quality of foods – Protein Efficiency Ratio (PER), Biological Value (BV) and Net Protein Utilization (NPU), supplementary value of proteins.

#### Unit III Vitamins

(8Hrs)

Fat soluble vitamins – vitamins A, D, E and K – functions, sources, requirements and deficiency – signs and symptoms. Water soluble vitamins – thiamine, riboflavin, niacin, pyridoxine, folic acid, cyanocobalamin, biotin, pantothenic acid and ascorbic acid – functions, sources, requirements and deficiency – signs and symptoms.

#### Unit IV Minerals

(8Hrs)

Minerals – calcium, phosphorus, iron, magnesium, sodium and potassium – functions, sources, requirements and deficiency – signs and symptoms. Trace minerals – zinc, iodine, fluorine and chlorine – functions, sources, requirements and deficiency – signs and symptoms.

#### Unit V

(8Hrs)

**Dietary Fibre:** Components, sources, functions.

**Water Balance:** Introduction, water intake and loss, exchange of water in the body- water exchange between plasma and interstitial fluid, Dehydration, water intoxication, water excretion, thirst.

**Electrolyte Balance:** Introduction, electrolyte concentration in intracellular and extracellular fluids, active transport across cell membranes, variation in electrolyte concentration and ECF volume.

### Text Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Srilakshmi, B	Nutrition Science	New age international Pvt. Ltd. New Delhi.	6 <sup>th</sup> Edn.2018
2.	Mudambi, S.R.,	Fundamentals of foods, nutrition and diet therapy	New Age International, New Delhi	2007
3.	Avanta Sharma	Principles of therapeutic nutrition and dietetics	CBS Publishers and Distributors , New Delhi	2014
4.	Dr. M. Swaminathan	Food and Nutrition	Bappco Publications	2 <sup>nd</sup> Edn.,2000

### Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Raheena Begum	A textbook of foods, Nutrition and dietetics	Sterling Publishers, New Delhi	2000
2.	Sunetra Roday	Food Science and Nutrition	Oxford University Press	2017
3.	Towsend, C.E., and Rath, R.	Nutrition and Diet Therapy	Delmar Publishers, New York.	2000
4.	Shashi Goyal	Food nutrition and Health	S.Chand and Company Pvt Ltd , New Delhi	2012

### Pedagogy

Lecture by chalk & talk, power point presentation, e-content, group discussion, assignment, quiz, seminar.

### Course Designers:

1. Dr. M. Guhapriya
2. Mrs. R. Sugantha

**Question paper pattern**  
**Continuous Internal Assessment**

<b>SECTION</b>	<b>MARKS</b>	<b>TOTAL</b>
A – 5 X 2 Marks	10	50
B – 4 X 5 Marks	20	
C - 2/3 X 10 Marks	20	

**End Semester Examination**

<b>Section</b>	<b>Word Limit</b>	<b>Marks</b>	<b>Total</b>
A-11/13x 2 Marks	One or two sentences	22	100
B - 5/7 X 6 Marks	300	30	
C - 4/6 X 12 Marks	600-800	48	

<b>COURSE NUMBER BF21CP1</b>	<b>CORE PRACTICAL –I FOOD SCIENCE PRACTICALS</b>
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Category	L	T	P	Credit
Core	-	-	45	3

### Preamble

To enable the students to

- learn the preparation of various food products- milk, egg & beverages
- understand the effect of dry & moist heat methods of cooking
- gain knowledge on browning of fruits & effect of acid/alkali/heat on vegetables

### Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	classify the food into five groups and to understand the different methods of cooking	K4
CO2	Understand the various parameters influencing the cooking of different foods	K4
CO3	learn the recipes and understand the chemistry of foods	K4

### Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H

H- High; M-Medium; L-Low

## CORE PRACTICAL- I

### CORE PRACTICAL - I FOOD SCIENCE PRACTICALS (BF21CP1) (45 Hrs)

#### Syllabus

1. Basic five food groups
2. Measuring of food- Solids, Liquids, Butter
3. Different methods of cooking – dry heat and moist heat
4. Separation of gluten from wheat
5. Cooking of Pulses and dhal – soaked, unsoaked, effect of hard water, soft water and baking soda on cooking qualities of pulses
6. Germination of pulses- water quality, temperature, time taken, length of sprouts.
7. Study the effect of acid, alkali, heat and time on the colour, flavor, texture, taste on vegetables
8. Study of enzymatic and non-enzymatic browning in fruits
9. Milk- preparation based on coagulation of milk proteins- recipes.
10. Study of factors affecting coagulation of egg protein and foam formation & stability.
11. Recipes to study the shortening effect of fats and oils
12. Study the different stages of crystallization of sugar - recipes

**Pedagogy:** Demonstration and hands on practicals

**Course Designers:**

1. Dr. M. Guhapriya

2. Mrs. R. Sugantha

#### Text Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Manay Shakunthala, N and Shadaksharaswamy M.	Foods facts and Principles,	New Age International (P) Ltd Publishers,	2005
2	Swaminathan, M.	Food Science and Experimental Foods	Ganesh and Co.Madras.	1995
3	Usha Chandrasekar,	Food Science in Indian Cookery	Phoenix publishers House Private Limited	2002
4	Srilakshmi B.	Food Science	New Age International (P) Ltd Publishers	2005

#### Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Paul and Paulmer	Food Theory and Application	John Wiley and sons, New York	1972

2.	Norman N. Potter and Joseph H. Hotchkiss,	Food Science	CBS Publishers and distributers	1997
3.	Swaminathan M	Food Science, Chemistry and Experimental foods	Bappo Publishers company Ltd	1997
4.	Meyer LH,	Food Chemistry	CBS Publication	1987

<b>COURSE NUMBER</b> BF21AP1	<b>ALLIED PRACTICAL –I</b>  <b>NUTRITION PRACTICALS</b>
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Category	L	T	P	Credit
Allied	-	-	45	3

### Preamble

To enable the students to

- gain knowledge on the energy value of foods and the energy requirements of individual
- understand the measurements of nutritional status.
- To apply the nutritional knowledge in preparing nutritional recipes.

### Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	calculate the energy value of foods and the energy requirements of individual	K4
CO2	Assess the anthropometric measurements	K4
CO3	Prepare nutrient rich recipes and estimate the nutrient content	K4

### Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H

H- High; M-Medium; L-Low

## ALLIED PRACTICAL- I (BF21AP1)

### NUTRITION PRACTICAL

**Total Hours: 45**

**Credits: 3**

1. Calculation of energy values in foods from food composition tables
2. Preparation of food exchange lists
3. Calculation of basal metabolic rate of an individual.
4. Calculation of energy requirements of an individual per day.
5. Methods of Assessing Nutritional status of an individual- BMI, Head circumference, Upper arm, mid arm circumference, skin fold thickness
6. Preparation and standardization of recipes, portion control and calculation of nutritive value
7. Preparation of a day's diet and calculation of Nutritive value- Pregnant Woman, Lactating Mother, Infants, School going children, Adolescents, Adult man, Adult Woman, Elderly people
8. Preparation of a day's diet and calculation of Nutritive value- Formulation, evaluation and calculation of nutritive value – Weaning food and Iron rich food
9. Formulation, evaluation and calculation of nutritive value - Sports Drink
10. Formulation, evaluation and calculation of nutritive value for conditions of underweight and obesity

**Pedagogy:** Demonstration and hands on practicals

**Course Designers:**

**1. Dr. M. Guhapriya**

**2. Mrs. R. Sugantha**

#### Text Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Srilakshmi, B	Nutrition Science	New age international Pvt. Ltd. New Delhi.	6 <sup>th</sup> Edn.2018
2	Mudambi, S.R.,	Fundamentals of foods, nutrition and diet therapy	New Age International, New Delhi	2007
3	Avanta Sharma	Principles of therapeutic nutrition and dietetics	CBS Publishers and Distributors , New Delhi	2014
4.	Dr. M. Swaminathan	Food and Nutrition	Bappco Publications	2 <sup>nd</sup> Edn.,2000



**Reference Books**

<b>S.No.</b>	<b>Authors</b>	<b>Title of the Book</b>	<b>Publishers</b>	<b>Year of Publication</b>
1.	Raheena Begum	A textbook of foods, Nutrition and dietetics	Sterling Publishers, New Delhi	2000
2.	Sunetra Roday	Food Science and Nutrition	Oxford University Press	2017
3.	Towsend, C.E., and Rath, R.	Nutrition and Diet Therapy	Delmar Publishers, New York.	2000

## II SEMESTER

<b>COURSE NUMBER</b>	<b>COURSE NAME</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>BF21C03</b>	<b>CORE-III FOOD MICROBIOLOGY</b>	Theory	71	4	-	4

### **Preamble**

To enable the students to

- learn the types, structure and characteristics of microorganisms
- understand the factors affecting the growth of microorganism
- learn the causes of food spoilage and food borne disease
- gain knowledge on the methods to enumerate the microbes

### **Course Outcomes**

On the successful completion of the course, students will be able to

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
CO1	explain the types and characteristics of microorganisms and to acquire knowledge on biofilms	K2
CO2	identify the factors affecting the growth of microorganisms	K3
CO3	analyze the importance of microorganism in food industry	K4
CO4	appraise the spoilage and food borne disease caused by microbes	K4
CO5	apply the methods involved in the detection of microbes	K4

### **Mapping with Programme Outcomes**

<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
CO1	H	H	M	M	M	M
CO2	H	H	M	M	M	M
CO3	H	H	M	M	M	M
CO4	H	H	M	M	M	M
CO5	H	H	M	M	M	M

H- High; M-Medium; L-Low

**Syllabus****UNIT-I Introduction to Microbiology****(14 Hrs)**

Living cell - Structure, major cell organelles, their structure and functions, Types of microorganisms, classification, Nomenclature and structure of yeast, bacteria and fungi. General characteristics of microbes - physiological, cultural characteristics. Importance of microbes in food industry (desirable and undesirable).

**Biofilms:** Introduction to biofilms in nature, various stages in biofilms development

**UNIT-II Microbiology of Foods****(15 Hrs)**

Food as substrate for micro-organisms- Hydrogen ion concentration(pH)/ Moisture requirements, concept of water activity, oxidation-reduction potential, nutrient content, inhibitory substances and biological structure, combined effects of factors affecting growth, bacterial growth curve and factors affecting the growth of microorganisms.

**Unit III Microorganisms important in food industry****(14 Hrs)**

Microbial and fermented food – fermented milk, cheese, vegetables, meat, fish, beer and vinegar. Food ingredients & additives. Microbial enzymes and food processing, Food bio preservatives of microbial origin. food waste treatment using microbes. biofilms - damage in fresh agricultural products, processed foods and in the food industry.

**Unit IV Food Spoilage****(14 Hrs)**

General principles of spoilage, classification of food by ease of spoilage, chemical changes caused by microorganisms in food, important food spoilage bacteria in plant based and animal based foods.

**Food Borne Diseases**

Food borne infections and intoxications-food poisoning-botulism-salmonellosis-gastroenteritis, food borne pathogens-Clostridium, Bacillus cereus, Staphylococcus aureus, Vibrio, Campylobacter, Yersinia.

**Unit V Enumeration of Microbes****(14 Hrs)**

Detection & Enumeration of microbes in foods; Indicator organisms and microbiological criteria; Rapid and automated microbial methods pathogens: Direct count of cells- using counting chamber, fluorescent dyes, indirect count , viable count, Most probable number, direct and indirect method of microbial biomass.

Controlling measures of biofilms and Quantification of biofilms – methods(outline).

**Text Book**

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	William C Frazier & Dennis C Westhoff	Food Microbiology	Tata McGraw Hill Publications	2013
2	Adams M.R and Moss M.O	Food Microbiology	New Age International Publication	1996
3	K. Ramesh Vijaya	Food Microbiology	M J P Publication	2007
4	James M Jay	Modern Food Microbiology	Springer	2012
5	Azeredo et.al.	Critical review on biofilm methods	Taylor & Francis Group	2016
6	Alvarez-Ordóñez et.al.	Biofilms in Food Processing Environments: Challenges and Opportunities	Annual Review of Food Science and Technology	2019

**Reference Books**

S. No	Authors	Title of the Book	Publishers	Year of Publication
1	Dubey, R.C. and D.K. Maheswari	A text book of Microbiology	S. Chand & Co	2005
2	Pelczar, M.J., E.C.S.Chan and N.R. Krieg.	Microbiology	McGraw –Hill New York	2002
3	Postgate J	Microbes And Man	Cambridge Univ. Press,	2000
4	Power C.B. and H.F.Daginawala.	General Microbiology	Himalaya publishing house	1989
5	Galie et. al.	Biofilms in the food industry: Health aspects and control methods	Frontiers in Microbiology	2018
6	O’Toole et. al.	Microtiter dish biofilm formation assay	Journal of visualized Experiments	2011

**Pedagogy:** Lecture by chalk and talk, power point presentation, group learning, group discussion, assignment, quiz, peer learning, student seminar.

**Question Paper Pattern**  
**Continuous Internal Assessment**

SECTION	MARKS	TOTAL
A – 5 X 2 Marks	10	50
B – 4 X 5 Marks	20	

C - 2/3 X 10 Marks	20	
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**End Semester Examination**

<b>SECTION</b>	<b>WORD LIMIT</b>	<b>MARKS</b>	<b>TOTAL</b>
A-11/13 X 2 Marks	One or two sentences	22	100
B – 7/5 X 6 Marks	300 words	30	
C - 4/6 X 12 Marks	600 - 800 words	48	

**Course Designers:**

**1. Dr. M. Guhapriya**

**2. Ms. R. Sharmila**

<b>COURSE NUMBER</b> <b>BF21CP2</b>	<b>CORE PRACTICAL – II</b> Microbiology Practical
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Category	L	T	P	Credit
Core	-	-	45	3

### Preamble

To enable the students to

- learn and apply cleaning and sterilization techniques
- differentiate between the types of microorganisms
- perform staining methods
- determine the potability of water

### Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	apply cleaning and sterilization techniques	K3
CO2	recognize the type of microorganism	K2
CO3	employ different staining techniques	K3
CO4	examine the potability of water	K3

### Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	M
CO2	H	H	H	H	H	M
CO3	H	H	H	H	H	M
CO4	H	H	H	H	H	M

H- High; M-Medium; L- Low

## CORE PRACTICAL II

### MICROBIOLOGY PRACTICAL (BF2CP2)

**Total Hours: 45**

**Credits : 3**

1. Introduction to microscope, use of autoclave and Laminar air flow system and Laboratory safety
2. Cleaning and Sterilization techniques of glassware.
3. Preparation and sterilization of nutrient broth
4. Cultivation and sub – culturing of microbes
5. Morphological study of bacteria and fungi using permanent slides
6. Plating Techniques and preparation of slants using nutrient agar
7. Simple staining, Gram Staining, Negative staining
8. Staining methods for fungi
9. Standard plate count or total plate count for milk or foods
10. Most probable number for water (MPN)
11. Swab Analysis of food surface areas and hands

**Pedagogy:** Demonstration and hands on practicals

**Course Designers:**

**1. Dr. M. Guhapriya**

**2. Mrs. R. Sugantha**

#### Text Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Dubey, R.C. and D.K. Maheswari	A text book of Microbiology	S. Chand & Co., New Delhi	2005
2	Pelczar, M.J., E.C.S.Chan and N.R. Krieg, Noel R	Microbiology	Mc Graw –Hill New York	2002
3	Power C.B. and H.F.Daginawala	General Microbiology, Vol.I and II	Himalayans Publishing House, New Delhi	1989
4	Kanika Sharma	Manual of microbiology – Tools and Techniques	Anshan Ltd	2007

#### Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Rangaswami, G and D.J.Bagyaraj	Agricultural Microbiology	Asia publishing House, New Delhi	1992
2	Stanier, R.Y. J. Ingtaham, M.C.	The Microbial world	Prentice Hall, England. New Jersey	1986
3	Tauro, P, Kapoor, K.K. and Yadav, K.S.	An Introduction to microbiology	Wiley Publications, New Delh	1989

COURSE NUMBER	COURSE NAME
BF21A02	ALLIED–II PRINCIPLES OF BIOCHEMISTRY

Category	L	T	P	Credit
Theory	71	4	-	3

### Preamble

To enable the students to

- understand the metabolism of carbohydrates, proteins and lipids
- learn the chemistry of enzymes
- gain knowledge about the mechanistic behaviour of hormones

### Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	explain the steps involved in carbohydrate metabolism	K2
CO2	relate the reactions of protein metabolism with their functions	K3
CO3	appraise the metabolism lipids	K4
CO4	differentiate the mechanisms involved in formation of enzyme substrate and enzyme inhibitor	K4
CO5	Perceive the properties and functions of hormones	K2

### Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	M	M	M
CO2	H	H	M	M	M	M
CO3	H	H	M	M	M	M
CO4	H	H	M	M	M	M
CO5	H	H	M	M	M	M

S- High; M-Medium; L-Low



**Syllabus****UNIT-I Carbohydrate Metabolism****(14hrs)**

Fate of absorbed carbohydrate-utilization of glucose-Intermediary metabolism of carbohydrate, steps involved in Glycogenesis, Glycogenolysis, Glycolysis-EMP pathway-citric acid cycle-conversion of pyruvate, acetate, oxaloacetate, electron transport chain, oxidative phosphorylation, pentose metabolism, cori's cycle (excluding structures), disorder of carbohydrate metabolism and inborn errors of metabolism.

**UNIT-II Protein and amino acid Metabolism****(14hrs)**

Protein –turnover, half life, signals for protein break down, protein degradation pathway, enzymes for protein degradation. Protein metabolism- Removal of amino group-oxidative deamination, transamination-decarboxylation, transmethylation, disorder of aminoacid metabolism and inborn errors of metabolism. Metabolism of ammonia-detoxification of ammonia-glutamine pathway-omithine cycle.

Nucleic acids-chemistry of nucleic acids, DNA and Gene, RNA-structural organization-chemistry of RNA-comparison between DNA and RNA, properties of nucleic acids-biological significance of nucleic acids (excluding structures)

**UNIT-III Lipid Metabolism****(14 hrs)**

Fatty acid oxidation -activation and transport of fatty acid by acyl-CoA,  $\beta$ -oxidation-reaction sequence of  $\beta$ -oxidation, Ketosis-ketogenesis in liver-regulation of ketogenesis-metabolism of ketone bodies-prevention of ketosis (excluding structures)

**UNIT-IV Enzymes****(15 hrs)**

Definition, classification, specificity, Mechanism of enzyme action- characteristics of enzyme active site. Co-enzymes-Definition, classification, functions-mode of action of co-enzymes-relation between vitamin and co-enzymes, Isoenzymes -Definition, characteristics, structure of LDH, Enzyme regulation-Allosteric enzymes-competitive and Non-competitive inhibition-allosteric inhibition and covalent modification.

**UNIT V Hormones****(14 hrs)**

Classification, Salient features, properties, chemical nature, functions of hormones, hormones of Thyroid gland, parathyroid gland, adrenal gland, Islets of Langerhans, Pituitary gland, Gastrointestinal tract, hormonal regulation in carbohydrate metabolism, protein metabolism and fat metabolism, hormonal disorders, counter regulatory hormones

**Text Book**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	G.S. Sandhu	Textbook of Biochemistry	Campus Books	2004
2	N. Mallikarjuna Rao	Medicinal Biochemistry	New Age International pvt. Ltd	2 <sup>nd</sup> Edn., 2006
3	L. Veerakumari	Biochemistry	MJP Publishers	2004

**Reference Books**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	A. C. Deb	Fundamentals of Biochemistry	New Central Book Agency	Reprint, 2004
2	J.H. Weil	General Biochemistry	Wiley Eastern Ltd, New Age International Ltd	6 <sup>th</sup> Edn., 1990
3	B.C. Rajbir Singh	Biochemistry	Mittal Publishers	1 <sup>st</sup> Edn., 2002

**Pedagogy**

Lecture by chalk & talk, power point presentation, e-content, group discussion, assignment, quiz, seminar.

**Course Designers:**

1. Dr. M. Guhapriya
2. Mrs. R. Sugantha

**Question paper pattern****Continuous Internal Assessment**

SECTION	MARKS	TOTAL
A – 5 X 2 Marks	10	50
B – 4 X 5 Marks	20	
C - 2/3 X 10 Marks	20	

**End Semester Examination**

<b>SECTION</b>	<b>WORD LIMIT</b>	<b>MARKS</b>	<b>TOTAL</b>
<b>A-11/13X 2 MARKS</b>	<b>ONE OR TWO SENTENCES</b>	<b>22</b>	<b>100</b>
<b>B - 5/7 X 6 MARKS</b>	<b>300</b>	<b>30</b>	
<b>C - 4/6 X 12 MARKS</b>	<b>600-800</b>	<b>48</b>	

<b>COURSE NUMBER BF20AP2</b>	<b>ALLIED PRACTICAL – II Biochemistry Practical</b>
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Category	L	T	P	Credit
Allied	-	-	45	3

### Preamble

To enable the students to

- Identify sugars and amino acids.
- Estimate metabolites of blood and urine sample

### Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Identify qualitatively sugars and amino acids	K4
CO2	Estimate the metabolites in blood sample	K4
CO3	Estimate metabolites in urine sample	K4

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	S	S	M
CO2	S	S	M	S	S	M
CO3	S	S	M	S	S	M
CO4	S	S	M	S	S	M

S- Strong; M- Medium; L-Low

**ALLIED PRACTICAL II  
BIOCHEMISTRY PRACTICAL (BF21AP2)**

**Total hours: 45**

**Credit :3**

1. Qualitative - analysis of carbohydrates - monosaccharides, disaccharides and polysaccharides-starch
2. Qualitative analysis of amino acids  
Quantitative analysis
3. Estimation of blood glucose
4. Estimation of iron and hemoglobin content in blood
5. Estimation of urinary creatinine
6. Estimation of urinary urea
7. Estimation of amino acid by Ninhydrin method
8. Estimation of protein and albumin /globulin ratio

**Pedagogy:** Demonstration and hands on practicals

**Course Designers:**

**1. Dr. M. Guhapriya**

**2. Mrs. R. Sugantha**

**Text Books:**

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	Sadasivam and Manickam	Biochemical Methods	New Age International	1996
2	Geetha Swaminathan and Mary George	Laboratory chemical methods in food analysis	Margham Publications	2014

**Reference Books**

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	Beedu Sashidhar, Tao, Vijay, Deshpande	Experimental Biochemistry- A student companion	I. K. International (P)m Ltd	2007, 1 <sup>st</sup> edn.
2	David T Plummer	An Introduction to Practical Biochemistry	Tata McGraw Hill	2007, 3 <sup>rd</sup> edn.
3	Divya Shanthi, Sowbhagya Lakshmi	An easy guide for practical Biochemistry	Jaypee Brothers medical Publishers Pvt. Ltd	2010

### **III SEMESTER**

<b>COURSE NUMBER</b>	<b>COURSE NAME</b>
<b>BF21C04</b>	<b>CORE- IV UNIT OPERATIONS</b>

<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
Theory	71	4	-	3

#### **Preamble**

To enable the students to

- gain Knowledge on the principles of food process engineering and its significance in food industry.
- understand the units, dimensions and formulas related to food processing
- familiarize with food processing unit operations and provide knowledge on various unit operations involved in food industry.

#### **Course Learning Outcomes**

On the successful completion of the course, students will be able to

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
CLO1	list and explain the principles of different types of evaporators and their application.	K1, K2
CLO2	analyze the different mechanical separation techniques	K4
CLO3	appraise the significance of size reduction and energy requirements in food processing	K4
CLO4	illustrate the mechanism of crystallization and distillation	K3

## Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	H	H	M	M	M	M
CLO2	H	H	M	M	M	M
CLO3	H	H	M	M	M	M
CLO4	H	H	M	M	M	M

H- High; M-Medium; L-Low

### Core Paper -IV UNIT OPERATIONS (BF21C04)

(71 hrs)

#### Syllabus

##### Unit I Introduction to Unit operations

(14hrs)

Introduction to unit operations in food processing, Units and Dimensions; Basic principles, Total mass balance and energy balance.

Introduction to material handling equipment-Material handling machines and conveyors. Introduction and importance of physical properties; Properties of food material and their significance in equipment design, processing and handling of food products. Pre-treatment operations- Cleaning, Dehulling/Dehusking, Peeling, Mixing and Forming, Sorting and Grading, Size reduction and separation.

##### Unit II Size reduction processes

(15 hrs)

Size reduction: Principles, Theory, size reduction methods- compression, impact, shearing and cutting; cereal grinding, degree of grinding, size reduction machinery- crusher, grinder, attrition mills, hammer mill, ball mills, rietz mill, standard sieves; oil expression and extractions- hydraulic press, screw press.

### **Unit III Separation processes**

**(14 hrs)**

Definition and Introduction to Separation; Types of Separators- Disk, Indented cylinder, Spiral, Specific Gravity, Destoner, Inclined Draper, Velvet roll, Pneumatic & aspirator, separation-based fluidisation technique, Magnetic, Cyclone Separator and its applications in food industry.

Mechanical Separations: Screening and Screening equipment, sedimentation: principle, equipment and applications. Centrifugation- principle, equipment involved in centrifugation, liquid-liquid centrifugation, liquid- solid centrifugation, clarifiers, desludging, decanting machines and its applications. Filtration: Principles involved in filtration, membrane separation, Pressure and vacuum filtration. Expression: batch and continuous type and its applications in food industry

### **Unit IV Evaporation**

**(14 Hrs)**

Basic principle, need for evaporation, thermodynamics of evaporation; boiling point elevation, heat transfer during evaporation, heat transfer coefficients, design of evaporation system; retention time; single effect evaporator, multiple effect evaporator, thermo compression system.

### **Unit V**

#### **Distillation**

**(14hrs)**

Distillation: Theory, working principles and applications in food industry - liquid vapor equilibrium, distillation of binary mixtures, simple distillation, steam distillation, vacuum distillation, and fractional distillation.

Crystallization: Theory, working principle, nuclei formation- equipment and applications in food industries.



**Text Book**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Rao D.G. (2010)	Fundamentals of food engineering.	PHI learning private limited.	2010
2	Sahay, K. M. and K.K.Singh	Unit operation of Agricultural Processing	Vikas Publishing House Pvt. Ltd., New Delhi	2004
3	Earle, R.L.	Unit Operations in Food Processing	Pergamon Press. Oxford. U.K	2003
4	Geankoplis, C.J.	Transport Process and Unit Operations	Prentice-Hall of India Private Limited, New Delhi.	1999

**Reference Books**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Richardson, J.E. etal.,	Coulson & Richardson's Chemical Engineering" Vol.2 (Particle Technology & Separation Processes	5 <sup>th</sup> Edition, Butterworth – Heinemann / Elsevier	2003
2.	McCabe W.L., Smith J.C.	Chemical Engineering". Volume I to V	The Pergamon Press. New York	1999
3.	McCabe, W.L., J.C.Smith and P.Harriot	Unit Operations of Chemical Engineerin	McGrawHill. Inc. Kosaido Printing Ltd. Tokyo, Japan,	2001
4.	S.K. Ghosal, S.K. Sanyal and S. Dutta.	Introduction to chemical engineering	TMH Publications	1993

**Pedagogy**

Lecture by chalk & talk, power point presentation, e-content, problems, group

**Course Designers:**

- 1. Dr. M. Guhapriya**
- 2. Mrs. R. Sugantha**
- 3. Mrs. A L Iswarya**
- 4. Dr.M.C.Anitha**



H- High; M-Medium; L- Low

**CORE PRACTICAL III –UNIT OPERATIONS PRACTICALS – BF21CP4**

**(60 Hrs)**

**Syllabus**

1. Determination of density and porosity of food grains.
2. Determination of Size, Roundness and Sphericity of Food Grains
3. Physical Properties of Extruded Foods
4. Determination of Size reduction in Ball Mill
5. Determination of particle size of granular foods by sieve analysis.
6. Estimation of thermal conductivity.
7. Analysis of flow rate through flow through pipes.
8. Estimation of Diffusion Coefficient
9. Estimation of vaporization efficiency and thermal efficiency of Steam Distillation
10. Visit to food processing industries

**Pedagogy:** Demonstration and hands on practicals

Course Designers:

1. **Dr. M. Guhapriya**
2. **Mrs. R. Sugantha**
3. Dr.M.C.Anitha
4. Mrs A L Iswarya

COURSE NUMBER	COURSE NAME
BF21SB01/ BF21SBCE	SKILL BASED SUBJECT 1– INSTRUMENTATIONAL TECHNIQUES/COURSERA - FUNDAMENTALS OF FOOD SAFETY AND MICROBIOLOGY

Category	L	T	P	Credit
Theory	43	1	-	-

### Preamble

To enable the students to

- learn the fundamentals of basic analytical procedures
- gain knowledge about different method of separation and purification techniques
- familiarize the volumetric and colorimetric methods of analysis

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	learn the fundamentals of basic analytical procedures	K4
CLO2	Understand the purification and separation techniques	K2
CLO3	Interpret volumetric methods of analysis	K4
CLO4	Explain the principle, working and applications of colorimetric and spectroscopic analysis	K4

### Mapping with Programme Learning Outcomes

CLO's	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	H	H	H	H	H	H
CLO2	H	H	H	H	H	M
CLO3	H	H	H	H	H	H
CLO4	H	H	H	H	M	H

H: High, M: Medium, L: Low

## **SKILL BASED SUBJECT I–INSTRUMENTATIONAL TECHNIQUES**

**(43 hrs)**

### **Syllabus**

#### **Unit I Prerequisites to Analysis**

**(8hrs)**

Laboratory Hygiene and Safety- Storage and Handling of Chemicals- Calibration of burette, pipette and volumetric flask, Care and use of analytical balance, actual weighing process, errors in weighing, requirements of a good balance, electronic balance.

#### **Unit II Volumetric analysis**

**(8 hrs)**

Definition, Standardisation, Experimental requirements for Volumetric Analysis, Concentration units, Types of Titrations, Indicators for Acid Base Titrations, Precipitation titrations, Redox Titrations, Self-Indicators, External Indicators, Complexometric titrations.

#### **Unit III Separation and Purification Techniques**

**(9 hrs)**

Precipitation- Solvent extraction- Chromatography: Basic Principles and Types, Separation techniques: Dialysis, Distillation: Theory of distillation, Technique, Fractional and steam, electrophoresis, sedimentation, ultra-filtration, ultracentrifugation, iso-electric focusing Tests for purity- Melting point, boiling point, Refractive Index, density,

#### **Unit IV Colorimetric analysis and Spectroscopy**

**(9 hrs)**

Colorimetric Analysis: Lambert's law, Beer's law, methods of colour measurement or colour comparison, basic principles and working of Colorimeter, Spectrophotometer, fluorescence, IR, AAS, MS, NMR. Applications.

#### **Unit V Other methods of Analysis**

**( 9 hrs)**

pH metry, conductometry, polarimetry , potentiometry, Thermo gravimetry - Introduction, basic principles, types, procedure & applications, SDS PAGE, Agaros gel, Native gel , Radio Immuno Assay, Scintillation counting(Solid, Liquid, gas) , Elisa,

### Text Book

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Hagris, L.G	Analytical Chemistry – principles and Techniques	Englewood Cliffs, NJ : Prentice-Hall,	1988
2.	Mahindru,S.N.	Food additives. Characteristics, detection and estimation	Tata Mc Graw-Hill Publishing Company Limited	2000
3.	S M Khopkar	Basic Concepts of Analytical Chemistry	New Age International Publishers	2008

### Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	S. Suzzane Neilsen	Introduction to Chemical Analysis of Foods	CBS Publishers and Distributers	2002
2	Pomrenz Y & Meloan CE	Food Analysis - Theory and Practice.	CBS	1996
3.	Skoog, D.A., andLeary, J.J.	Principles of Instrumental Analysis,	Cengage	2014

**Pedagogy:** Lecture by chalk and talk, power point presentation, group learning, groupdiscussion, assignment, quiz, peer learning, student seminar

**Course Designers:**

1. Dr.M.C.Anitha
2. Ms.Iswarya A.L

3. Dr.M.C.Anitha

4. Ms.Krishnapriya M

<b>COURSE NUMBER</b>	<b>COURSE NAME</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
BF21C06	CORE VI – FOOD PRESERVATION	Theory	56	4	-	3

### Preamble

To enable the students to

- understand the role of food preservation and its significance.
- acquire knowledge about preservation of food by drying, use of high and low temperature.
- learn the mode of irradiation, food preservatives and recent trends in preservative technology

### Course Learning Outcomes

On the successful completion of the course, students will be able to

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
CLO1	recall the terms in food preservation and explain concept of shelf life and factors affecting quality of food	K1,K2
CLO2	identify the different heat treatment methods employed in processing of food	K2,K3
CLO3	analyze the different types of drying and food concentration methods	K3
CLO4	compare the various methods of freezing and its changes during preservation	K2,K3



## Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	H	H	M	M	M	M
CLO2	H	H	M	M	M	M
CLO3	H	H	M	M	M	M
CLO4	H	H	M	M	M	M

H- High; M-Medium; L-Low

### CORE -VI - FOOD PRESERVATION (BF21C06)

(56 Hrs)

#### Syllabus

#### UNIT-I Basic principles of food preservation

(11 hrs)

Food preservation - Need, importance, principals and methods. Perishable and non perishable foods, concept of shelf life- definition and factors affecting water activity in food and its significance in food preservation, factors affecting food deterioration – physical factors, chemical factors and microbiological factors.

#### UNIT-II Preservation by drying

(11 hrs)

Drying- Theory and Mechanism, drying characteristics of materials, preliminary processing, Sundrying vs dehydration, Driers - Air convection driers and types, Drum /Roller Drier, Vacuum drier, Belt drier, tunnel drier, spray drier, rotary drier, fluidized bed drier, Freeze drying and microwave drying.

Food Concentration- purpose, methods of concentration, changes during concentration, Intermediate moisture foods (IMF).

#### Unit III Preservation by high temperature

(11Hrs)

Use of high temperature- principle and equipments: Methods - pasteurization, blanching, sterilization , canning- procedure, canning of acid foods and nonacid foods, aseptic canning nutritive value of canned foods, types of spoilage in canned foods, storage of canned foods, influence of canning on the quality of food,.

**Unit IV Preservation by low temperature****(11 hrs)**

**Freezing and Refrigeration** :Introduction to refrigeration, cold storage and freezing, definition,principle of freezing, freezing curve, changes occurring during freezing, Methods of freezing-Slow and quick freezing, cryogenic freezing, dehydro freezing, freeze drying, , changes duringstorage of frozen food-physical and chemical, thawing.

**Unit V Other preservation techniques****(12Hrs)**

Introduction to recent preservation techniques Irradiation- pulsed electric field, high pressure technology, ohmic heating, microwave heating, hurdle technology.

Natural preservatives and chemical preservatives.

**Text Book**

<b>S.No.</b>	<b>Authors</b>	<b>Title of the Book</b>	<b>Publishers</b>	<b>Year of Publication</b>
1	William C Frazier &Dennis C Westhoff	Food Microbiology	Tata McGraw HillPublications	2013
2	Norman N Potter Joseph H Hotchkiss	Food Science	CBS Publishers	2005
3	Norman W Desrosier James N Desrosier	The Technology of FoodPreservation	CBS Publishers	2006
4	B. Sivasankar P	Food Processing and Preservation	PHI Learning Pvt. Ltd	2002

**Reference Book**

<b>S. No</b>	<b>Authors</b>	<b>Title of the Book</b>	<b>Publishers</b>	<b>Year of Publication</b>
1	Stewart GP and Amerine MA	Introduction to Food Science and Technology	Elsevier	2012
2	Vickie AV	Essentials of Food Science	Springer Science & Business Media	2012
3	James M Jay	Modern Food Microbiology	Springer	2012

**Pedagogy:** Lecture by chalk and talk, power point presentation, group learning, group discussion, assignment, quiz, peer learning, student seminar.

**Course Designers:**

1. **Dr.M.C.Anitha**
2. **Ms. Santhiya R**

<b>COURSE NUMBER BF21CP5</b>	<b>CORE PRACTICAL -IV FOOD PRESERVATION PRACTICAL</b>
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Category	L	T	P	Credit
Core	-	75	-	3

### Preamble

To enable the students to

- gain knowledge on the different methods of freezing and drying of vegetables
- learn to process fruits and vegetables into jam, sauce, syrups and squashes
- qualitatively determine the presence of food preservatives
- understand the different techniques of fruit and vegetable processing in an industry

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	apply different methods to freeze and dry vegetables	K3
CLO2	employ processing methods to prepare food products	K3
CLO3	analyze the presence of food preservatives in food products	K4

### Mapping with Programme Learning Outcomes

CLOs	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6
CLO1	H	H	H	H	H	H
CLO2	H	H	H	H	H	H
CLO3	H	H	H	H	H	H

H : High, M: Medium, L : Low

## CORE PRACTICAL IV- FOOD PRESERVATION PRACTICALS- BF21CP5 (75 hrs)

### Syllabus

1. Drying of vegetables
2. Freezing of vegetables
3. Preparation of jellies- Apple/guava/ wood apple
4. Preparation of mixed fruit jam
5. Preparation of sauces
6. Preparation of syrups and squashes.
7. Preparation of pickles- salt based, oil based, vinegar based.
8. Preparation of cereal based dehydrated products.
9. Estimation of pH and acidity in fruit juices
10. Determination of sulphur dioxide content

Pedagogy: Demonstration and hands on practical

### Text Books

S.No	Authors	Title of the Book	Publishers	Year of Publication
1	Girdhari Lal, G. S.Siddappa, G. L. Tandon,	Preservation of Fruits & Vegetables	Indian Council of Agricultural Research, Publications	1986
2	Shirley J.Vangrade, Margy Woodburn	Food preservation and safety, principles and practice	Surabhi publications	2005
3	Manoranjan kalia, Sangita sood	Food preservation and processing	Kalyani Publishers	2000

**Reference Books**

<b>S. No</b>	<b>Authors</b>	<b>Title of the Book</b>	<b>Publishers</b>	<b>Year of Publication</b>
1	Sivasankar B.	Food Processing and Preservation	Prentice Hall of India pvt. Ltd.	2005
2	P. Fellows	Food Processing Technology: Principles and Practice	CRC Press,	2000
3	Shafiur Rahman M.	Handbook of Food Preservation	CRC Press	2007
4	Ranganna S.	Handbook of Analysis and Quality Control for and Vegetable Products.	Tata-McGraw-Hill.	2001

**Course Designers:**

- 1. Dr.M.C.Anitha**
- 2. Mrs.M.Krishnapriya**

<b>COURSE NUMBER</b>	<b>COURSE NAME</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>BF21A04</b>	<b>ALLIED – GRAIN PROCESSING TECHNOLOGY</b>	Theory	71	4		3

### Preamble

To enable the students to

- learn the production, storage and pest control of food grains.
- understand the composition and milling of rice, wheat, corn, millets and their products.
- gain knowledge on the processing of millets, nuts, oils and fats.

### Course Learning Outcomes

On the successful completion of the course, students will be able to

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
CLO1	Explain the production and storage of grains	K1,K2
CLO2	Recognize the methods to control pest	K3
CLO3	Discuss the composition of rice, wheat, millets, corn ,pulses and its products	K2,K4
CLO4	Employ different methods of milling rice, wheat, corn, millets and pulses, analyze the processing of millets, nuts and oil seeds	K43,K4

### Mapping with Programme Learning Outcomes

<b>CLOs</b>	<b>PLO 1</b>	<b>PLO 2</b>	<b>PLO 3</b>	<b>PLO 4</b>	<b>PLO 5</b>	<b>PLO 6</b>
CLO1	H	H	H	H	H	H
CLO2	H	H	H	H	H	H
CLO3	H	H	H	H	H	H
CLO4	H	H	H	H	H	H

H- High Strong; M-Medium; L-Low



**Syllabus****UNIT-I Introduction to food grains****(14 hrs)**

Introduction and importance of cereal grains, Production trends, supply chain of food grains, physico chemical and physico thermal properties of food grains , nutritional losses during processing.

**Unit – II Storage of Cereals, Pulses and Oilseeds****(15Hrs)**

Grain storage methods- traditional and modern, types of storage structures, Bio-chemical changes during storage.

Agents causing food losses- insects, rodents, microorganisms, birds, physical agents, methods to control the losses, safety measures and integrated pest control, role of SGS, FCI PCI .

**UNIT-III Cereal Processing****(16 hrs)**

**Rice** – Traditional and modern methods, huller machine, destoners, polishers, broken separators, silky polisher, parboiling of rice, aging of rice, rice products

**Wheat**- Classification and structure of wheat grain, Milling –basic concepts, products and by products, flour milling, flour grades, flour treatment- bleaching, maturing

Corn , Barley, Oats- Sorghum and Millets- Milling Methods

**Unit –IV Pulses and Legumes Processing****(12Hrs)**

Pre-treatment of pulses for milling, methods of milling, - modern and traditional methods, factors affecting milling

**Unit – V Oilseed Processing****(14Hrs)**

Oilseeds seeds preparation, oil extraction methods and processing of extracted oil, -refining, hydrogenation, processing of deoiled cake, protein rich products, soybean processing.

**Text Books**

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	Chakravarti	Post-Harvest Technology of Cereals, Pulses and Oilseeds	Oxford Publishing	2017
2	K.M. Singh, k.K.Sahay	Unit operations of Agricultural Processing	Vikas Publishing House	1994

3	N. Shakunthala Manay, M.Shadaksharasw a my	Food Facts and Principles	New Age International Publishers	2001
4	Norman N Potter, Joseph H. HotchKiss	Food Science	CBS Publishers andDistributers	2005

### Reference Books

S. No	Authors	Title of the Book	Publishers	Year of Publication
1	Shukla, Prabhat, KSrivastava, Ram K Gupta	Oilseed Processing Technology	Central Institute of Agricultural Engineering , Bhopal	1992
2	Matz	Bakery Technology and Engineering	CBS	2008
3	Neelam Khaterpaul, Rajabala Grewal, Sudesh Jood	Bakery Science andCereal Technology	Daya Publishing House	2005

**Pedagogy:** Lecture by chalk and talk, power point presentation, group learning, group discussion, assignment, quiz, peer learning, student seminar.

### Course Designers:

2. Dr. M.C.Anitha

3. Mrs.Iswarya A L

COURSE NUMBER	COURSE NAME
BF21SB02	<b>Skill based Subject -</b> Basics of Instrumentational Techniques in foodAnalysis

Category	L	T	P	Credit
Theory	45	1	1	4

### Preamble

To enable the students to

- learn the sampling procedures.
- gain knowledge in chemical analysis of food
- understand the application of spectroscopic techniques in food analysis.

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Illustrate the sampling procedures and categorize the preparation, types of samples analyzed	K4
CLO2	Understand the chromatographic techniques	K4
CLO3	Apply different methods to determine the chemical composition of food	K3
CLO4	Explain the analysis of nutrient components	K2

### Mapping with Programme Outcomes

Cos	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	H	H	H	H	H	H
CLO2	H	H	H	H	H	H
CLO3	H	H	H	H	H	H
CLO4	H	H	H	H	H	H

H- High; M-Medium; L-Low

**BF21SB02****Skill Based Subject - Basics of Instrumentational Techniques in food Analysis Theory (45hrs)****Syllabus****UNIT I Introduction to Food Analysis (9 hrs)**

Trends and demands, government regulations and international standards and policies, sampling and sample preparation- selection of sampling procedures, problems in sampling, preparation of samples.

**UNIT II Spectroscopy and chromatographic techniques in analysis (9 hrs)**

Principle, working of spectroscopy- UV- visible and fluorescence spectroscopy, infrared spectroscopy, Atomic adsorption spectroscopy, chromatography- basic principles of chromatography-paper chromatography, thin layer chromatography, high pressure liquid chromatography, column chromatography, gas chromatography and LCMS.

**UNIT III Physico chemical and nutrient analysis (9 hrs)**

Physical properties of food, pH and titrable acidity, moisture and total solids analysis, total ash analysis, mineral analysis, carbohydrate analysis, protein analysis, protein quality tests –importance and significance; crude fat analysis, fiber analysis.

**UNIT IV Analysis of other constituents (9hrs)**

Analysis of vitamins (vitamin A, B1, B2, B3, C); pigments (chlorophyll, carotenoids, myoglobins); pesticides, mycotoxins and drug residues in foods, extraneous matter.

**UNIT V Rheological principles of food (9 hrs)**

Texture profile and texture measurement, dough testing methods and instruments, analysis of food emulsions. Thermal analysis- Temperature Dependent Properties of Foods, Thermo analytical methods

**Text Book**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	A.Y.Sathe`	A first course in food Analysis	New Age International Publishers	1999
2.	Kirk, RS and Sawyer, R.	Pearson's Chemical Analysis of Foods.	Longman Scientific and Technical	1991

3.	S. Suzanne Nielsen	Introduction to Chemical Analysis of Foods	CBS Publishers and Distributers	2002
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### Reference Books

S. No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Ranganna, S.	Handbook of Analysis and Quality Control for Fruit and Vegetable Products	Tata-McGraw-Hill Publishers	2001
2	Leo ML Nollet	Handbook of food analysis :Physical characterization and nutrient analysis	CRC Press	2004
3	Pomrenz Y & Meloan CE	Food Analysis - Theoryand Practice.	CBS	1996

**Pedagogy :** Lecture by chalk & talk, power point presentation, e-content, groupdiscussion,assignment, quiz, seminar.

COURSE NUMBER- NM21DTG	COURSE NAME – DESIGN THINKING	Category	L	T	P	Credit
		Theory	26	2	-	2

### Preamble:

1. To expose the students to the concept of design thinking as a tool for innovation
2. To facilitate them to analyze the design process in decision making
3. To impart the design thinking skills

### Course Outcome

On the successful completion of the course, students will be able to:

CLO Number	CLO Statement	Knowledge Level
CLO 1	Understand the concepts of Design thinking and its application in varied business settings	K1
CLO 2	Describe the principles, basis of design thinking and its stages	K2
CLO 3	Apply design thinking process in problem solving	K3
CLO 4	Analyze the best practices of design thinking and impart them in business and individual day to day operations.	K4

### Mapping with Programme Outcomes

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
CLO 1	S	M	M	S	S
CLO 2	M	S	S	M	M
CLO 3	S	S	S	M	S
CLO 4	S	S	S	S	S

S-Strong; M-Medium; L-Low

## NM21DTG - DESIGN THINKING

### UNIT – 1 (5 Hours)

Design Thinking Overview: **\*Introduction to Design Thinking\*** and Design Research Strategies - **\*Design Thinking Skills\***

### UNIT – II (5 Hours)

Design Thinking Mindset - **\*Principles of Design Thinking - Basis for design thinking\*** - **\*Design Thinking Hats\*** - Design thinking team

### UNIT – III (5 Hours)

**\*Empathize\*** - definition - Listen & Empathize with the Customers and / or Users - Tools and Techniques

### UNIT – IV (5 Hours)

**\*Define\*** - Definition - Defining the Problem - Tools and Techniques - Journey mapping and **\*Ideate\*** - definition - Ideation techniques

### UNIT – V (6 Hours)

**\*Prototype\*** - Definition - Prototype Alternate Solutions - **\*Test the Solutions\*** - Visualization - Story Telling - Cautions and Pitfalls - Best Practices

(\*Seminar - Internal evaluation only)

### Text Books

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Christian Mueller-Roterberg	Handbook of Design Thinking Tips & Tools for how to design thinking	Amazon Kindle Version	2018
2	Gavin Ambrose Paul Harris	Design Thinking	AVA Publishing Switzerland	2010

<b>Reference books</b>				
<b>Sl. No.</b>	<b>Author(s)</b>	<b>Title of the Book</b>	<b>Publisher</b>	<b>Year of Publication</b>
1	Maurício Vianna Ysmar Vianna Isabel K. Adler Brenda Lucena Beatriz Russo	Design Thinking - Business Innovation	MJV Press	2011
2	Moritz Gekeler	A practical guide to design thinking	Friedrich- Ebert- Stiftung	2019
3	J. Berengueres	The Brown Book of Design Thinking	UAE University College, Al Ain	2014



## SEMESTER –V

<b>COURSE NUMBER</b>	<b>COURSE NAME</b>
<b>BF21C08</b>	<b>Core VIII Food Biotechnology</b>

Category	L	T	P	Credit
Theory	58	2	-	3

### **Preamble**

To enable the students to

- gain knowledge on the principles of food biotechnology.
- understand the recent advances of biotechnology and its significance in food processing industry.
- to gain insight on pre and probiotics; enzymes used in food processing and types of fermenters

### **Course Learning Outcomes**

On the successful completion of the course, students will be able to

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
CLO1	Understanding the concepts of DNA and recombinant DNA technology	K1
CLO2	Acquiring knowledge on different types of probiotics, prebiotics, fermenters	K2
CLO3	Identifying the importance and health effects of food additives	K3
CLO4	Recognizing the concepts and significance of gene cloning	K4
CLO5	Applying different applications of biotechnology in food processing and production	K4

### Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	H	H	H	H	M	M
CLO2	H	H	H	H	M	M
CLO3	H	H	H	M	H	H
CLO4	H	H	H	M	H	H
CLO5	H	H	H	M	H	H

H- High; M-Medium; L-Low

### CORE VIII- FOOD BIOTECHNOLOGY (BF21C08)

58 Hrs

#### Syllabus

#### UNIT I: Recombinant DNA Technology

(13 hrs)

Introduction of recombinant DNA, DNA modifying enzymes: Restriction enzymes and other modifying enzymes; Cloning vectors:-plasmids, bacteriophages, bacterial artificial chromosome's, (BACs), yeast artificial chromosomes (YACs) and mammalian artificial chromosomes (MACs); Steps in gene cloning:- Isolation of DNA [gene of interest] fragments to be cloned, Insertion of isolated DNA into a suitable vector to form recombinant DNA, Introduction of recombinant DNA into a suitable organism known as host, Selection of transformed host cells and identification of the clone containing the gene of interest, Multiplication/Expression of the introduced Gene in the host, Isolation of multiple gene copies/Protein expressed by the gene, Purification of the isolated gene copy/protein; Application of rDNA technology in food processing – a summary; GMOs- current guidelines for the production, release and movement of GMOs; labelling and traceability; trade related aspects.

#### UNIT II: Biotechnology in food Processing

(11 hrs)

Biotechnological approaches –Role, its importance in food processing sector; Fermentation technology - Cereals, pulses, national and oriental foods, brewery (beer, wine, etc), vinegar production, pickles, milk products (cheese, yoghurt, etc), animal foods (meat and seafood products).

#### UNIT III: Pre and Probiotics

(12 hrs)

Prebiotics: definition, types of prebiotics and their bifidogenic effects, health effects of prebiotics and symbiotic. Bacterial food additives and dietary supplements.

Probiotics –. definition, potential benefits, strains – be specific about its types, advantages and disadvantage. **Bioactive peptides** – Definition, Production, types & function

**UNIT IV: Enzymes in Food Production****(11 hrs)**

Enzymes – Definition –Enzymes in Food production – Dairy, bread making, brewery, fish processing, fruit & vegetable & juice extraction, meat processing. Industrial production of enzymes.

**UNIT V: Fermenter & its types****(11 hrs)**

Fermenter – Definition, types of fermenters - Submerged Liquid Fermentations, (Aerated stirred tank batch fermenter), Surface Fermentation Solid-State Fermentation, Factors affecting enzyme production in solid state fermentation systems –Design, instrumentation, control, aeration & agitation, recovery & purification of fermented products

**Textbooks**

S. No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Bielecki Stanishlaw., Tranmper Johannes and Polak Jacek	“Food Biotechnology”	Elsevier Science Publishing Company, New Delhi	2000
2	H. J. Pepler, D.Perlman	Microbial Technology: Fermentation Technology.	Academic Press.	2014
3	T. El-Mansi, C. Bryce, Arnold L. Demain, A.R. Allman.	Fermentation Microbiology and Biotechnology. Second Edition.	CRC Press, USA.	2006
4	Rees, Andy	“Genetically Modified Food: A Short Guide for the Confused	Pluto Press	2006
5	Robert J. Whitehurst and Maarten van Oort	Enzymes in food technology	Wiley - Blackwell	2010
6	Peter F. Stanbury, Allan Whitaker and Stephen J. Hall	Principles of fermentation technology		1995

**Reference Books**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Ahmed, Farid E	“Testing of Genetically Modified Organisms in Food”	Food Products Press	2004

2	Halford, Nigel G	“Genetically Modified Crops”	Imperial College Press	2003
3	Celeste M. Todaro, Henry C. Vogel.	Fermentation and Biochemical Engineering Handbook.	William Andrew Press.	2014

### **E resource**

<http://ecoursesonline.iasri.res.in/mod/page/view.php?id=5150>

### **Pedagogy**

Blended learning, lecture by chalk & talk, power point presentation, e-content, groupdiscussion, assignment, quiz, seminar.

### **Course designers:**

1. Dr Guhapriya M
2. Ms. Sharmila R
3. Dr.M.C.Anitha
4. Ms Krishnapriya M
5. Mrs.Iswarya A L

COURSE NUMBER	COURSE NAME	Category	L	T	P	Credit
BF21C09	CORE IX FOOD PRODUCT DEVELOPMENT	Theory	58	2	-	3

### Preamble

To enable the students to

- Understand the process of development of new food products.
- To learn and apply the various steps involved in the evaluation of a food product
- Learn the requirements of setting up a food processing unit

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Learn the trends and dimensions in food product development according to food consumption pattern	K1
CLO2	Acquire knowledge on the steps involved in food product testing and evaluation	K2
CLO3	Understand the techniques of setting up of a food processing unit	K3
CLO4	Apply the principles in food product development and design	K4
CLO5	Develop entrepreneurial skills by evaluating the behavior of market segment and end user	K4

### Mapping with Programme Learning Outcomes

CLOS	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	H	H	H	H	H	H
CLO2	H	H	H	H	H	M
CLO3	H	H	H	H	H	H
CLO4	H	H	H	H	M	H
CLO5	H	H	H	H	H	H

H-High, M-Medium ,L-Low

**Syllabus****UNIT I Need for new product development****(12 hrs)**

Introduction: factors influencing /need of new product development; pharma foods health concern, impact of marketplace influence and technology, government influences.

Defining new food products, classification and enlist characterization techniques of New Food Products; innovative or value – added products, creative products.

**UNIT II Steps in Product Development****(12 hrs)**

Idea generation, screening, technology and knowledge in product development, tacit knowledge in product development, Feasibility, Product Strategy, Formulation- Statistical Experimental Methods, Modeling for process and recipe, facilities, packaging, labeling, and distribution.

Methods of shelf-life testing of newly developed products; safety, Finances, Test marketing, Commercialization and Product life cycle.

**UNIT III Evaluation of new Product****(12 hrs)**

Product evaluation- Standard Sensory Practices, Sensory testing environment, Evaluation area, Climate control, factors to be considered for a test protocol, Sample design, Panelist considerations -Used of Human subjects, Panelist recruitment, selection and screening, training of panelists, types of sensory tests – Analytical tests, Affective tests (preference and Acceptance tests) Development of score card ,analysis of data (brief)

**UNIT IV Consumer behavior****(11 hrs)**

Meaning, understanding consumer behavior, Models of consumer behavior, Indian Consumers, market segmentation, Determinants of Consumer Behavior: Factors influencing consumer behavior, consumer and food relationship, Consumer buying process, consumer involvement at different stages of product development, Motivation and Involvement; Consumer satisfaction.

**UNIT V Setting up of a food processing unit****(11 hrs)**

**Physical layout** -Importance of a suitable layout, general plant layout, analysis of men and material movement, maintenance of a clean working environment, worker's safety, regulations and standards followed in food processing units. Packaging regulations; labels, wet symbol.

**Equipment and Machinery**- Equipment selection, installation and maintenance of equipment- inspection practices and schedule, ergonomics, minimization of equipment downtime.

Plant Sanitation and Effluent Treatment-Importance of Plant Sanitation with respect to Food Safety, Risks and Hazards, Properties and Requirements of Potable Water and wastewater / effluent treatment in food process industry.

#### Text Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Frewer, L. and Van Trijp, H	Understanding consumers of food products	CRC Press	2007
2.	Norman. N. Potter & Joseph. H. Hotchkiss	Food Science	CBS Publishers	1999
3.	Fuller, G.W.	Food, consumers and the food industry: catastrophe or opportunity?	CRC Press	2001
4.	Natarajan S	Fundamentals of Packaging Technology	PHI	2014

#### Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	S Roday	Food Hygiene and Sanitation	Tata Mc. Graw Hill	1998
2.	Michael H Morris	Corporate Entrepreneurship and Innovation in Corporations	CENGAGE Learning	2010
3.	Jerry Katz	Entrepreneurship Small Business	Tata McGraw-Hill Publishing Company Ltd	2007

#### E References:

1. Harry T. Lawless, Hildegard Heymann, (2010) Sensory Evaluation of Food, Principles and Practices, Second Edition, Springer.
2. Mary Earle, Richard Earle and Allan Anderson, Food Product Development, (2001), Woodhead Publishing, CRC press
3. Gordon W. Fuller, New Food Product Development from Concept to Market place, third edition (2011), CRC Press.

**Pedagogy**

Blended Learning, lecture by chalk & talk, power point presentation, e-content, group discussion, assignment,quiz, seminar.

**Course Designers:**

- 1. Dr. M. Guhapriya**
- 2. Mrs. R. Sugantha**
- 3. Dr.M.C.Anitha**
- 4. Mrs. Iswarya A L**



COURSE NUMBER	COURSE NAME
BF21C10	Bakery and Confectionery Technology

Category	L	T	P	Credit
Theory	58	2	-	3

### Preamble

To enable the students to

- understand the rheological characteristics of the dough
- explain the role of each ingredient and processes involved in baking technology
- learn about manufacturing of confectionery products

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO	CLO Statement	Knowledge Level
CLO1	Understand the role of ingredients and its characteristics to design, formulate and prepare bakery products	K1
CLO2	Gain knowledge on appropriate preparation, baking and decorating of bakery products	K2
CLO3	Demonstrate the safe operation & maintenance of baking equipments	K3
CLO4	Analyze the methods of making bread, biscuits and cookies and analyze faults and corrective measures	K4
CLO5	Describe and plan to set up a bakery unit	K4

### Mapping with Programme Learning Outcomes

CLOs	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6
CLO1	H	H	H	M	H	H
CLO2	H	H	H	M	H	H
CLO3	H	H	H	M	H	H
CLO4	H	H	H	M	M	M
CLO5	H	H	H	H	H	H

H- High; M-Medium; L-Low

**Syllabus****Unit I Classification of Bakery Products (12 hrs)**

Introduction to Baking techniques, Types of wheat, baking principles - Role of ingredients and its chemistry, Dough rheology, Classification of bakery products – Biscuits, Cookies, Bread, Cakes, Pastry products – puff, pancake, donuts, pie, macaroon, muffins and truffle. Equipment used for manufacturing of bakery products. Equipment and tools used. Bakery layout and design.

**Unit II Manufacturing of Bread and Cakes (12 hrs)**

Bread making methods- Straight dough/bulk fermentation, Sponge and dough, Activated dough development, Chorleywood bread process, No time process. Characteristics of good bread- Internal and external characteristics, Role of yeast, bread spoilage and remedies. Cake-types of cakes - role of ingredients - cake mixing methods – Preparation. Fancy cakes and preparation, Cake faults and remedies.

**Unit III Manufacturing of Biscuit and Cookies (12 hrs)**

Biscuit making - Ingredients and their functions. Types of dough – Developed dough, short dough, semi-sweet and enzyme modified dough and batters. Production of biscuits and cookies. Selection and preparation of mold; Cookies: - classification, Quality control for biscuits and cookies; faults and causes.

**Unit IV Confectionery and its types (11 hrs)**

Introduction – types of confectioneries, importance of sugar confectionery. Ingredients used. Manufacturing of Caramel, Toffee and Fudge, Nougat, Praline, hard boiled candies, chewing gums, lozenges, marshmallows, fruit candy. Aerated confectionery- Methods. Equipment used. Confectionery product quality parameters, faults and corrective measures (compositional effects, prevention of re-crystallization, stickiness, etc).

**Unit V Chocolate and traditional Confectioneries (11 hrs)**

**Cocoa products** and its uses in confectionery; **Types of chocolates**—milk chocolate, white chocolate, dark chocolate, unsweetened chocolate, bittersweet chocolate, semi – sweet chocolate and equipment used.

**Traditional confectioneries** - Groundnut Chikki, rasgulla, milk peda, soan papdi, etc.

**Text Book**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Samuel A. Matz	Bakery Technology and Engineering	Chapman and Hall	2005
2	Cauvain, Stanley, P. and Young, Linda S	Technology of Bread Making	Aspen Publication	1999
3	Servet Gulum Sumnu and Serpil Sahin	Food Engineering Aspects of Baking Sweet Goods	CRC Press	2008
4	Ferenc A. Mohos	Confectionery and Chocolate Engineering: Principles and Applications	Wiley Blackwell	2010

**Reference Books**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Bernard, W. Minifie	Chocolate, cocoa and Confectionery	CBS Publishers and Distributors	1997
2	Pomeranz. Y.	Modern Cereal Science and Technology	MVCH Publications	1987
3	<a href="http://eacharya.inflibnet.ac.in/index.php/content/index/594515d68007bef81d3c4dfb">http://eacharya.inflibnet.ac.in/index.php/content/index/594515d68007bef81d3c4dfb</a>			

**Pedagogy**

Blended learning, lecture by chalk & talk, power point presentation, e-content, group discussion, assignment, quiz, seminar.

**Course Designers:**

1. Dr. M. Guhapriya
2. Ms. R. Sharmila
3. Dr.M.C.Anitha

COURSE NUMBER	COURSE NAME	Category	L	T	P	Credit
BF21E01	Elective (AOS) I Processing of Meat, Fish and Poultry	Theory	73	2	-	3

### Preamble

To enable the students to

- study the processing techniques of animal food products.
- gain knowledge on equipment used in processing of animal foods
- familiarize with the preservation and quality standards.

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Gain knowledge in basic structures of meat, fish and poultry.	K3
CLO2	Understand the basic functional properties and processing conditions of meat, fish and poultry.	K3
CLO3	Understand the different processing methods and preservation techniques related to animal products.	K3
CLO4	To gain insight into basic equipment's related to processing and preservation of meat, fish and poultry products.	K3
CLO5	Able to examine and evaluate the quality standards of animal products.	K3

### Mapping with Programme Learning Outcomes

CLOs	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6
CLO1	H	H	H	H	M	M
CLO2	H	H	H	H	M	M
CLO3	H	H	H	H	M	M
CLO4	H	H	H	H	M	M
CLO5	H	H	H	H	M	H

H- High; M-Medium; L-Low

**Elective (AOS) I - Processing of meat, fish and poultry (BF21E01)****(73 Hrs)****Syllabus****Unit I: Processing of meat****(15 hrs)**

Common and commercially important meats, cuts and grades. Meat processing techniques and Changes during processing, Storage of meat, Meat tenderization and Meat quality evaluation. Preservation techniques - aging, pickling, smoking. Dried and Cured meat, Canned meat, Frozen meat, Sausages.

**Unit II: Processing of fish****(14 hrs)**

Types of fish, commercially important fish, Processing of fish, storage and transport, shipboard operations, spoilage factors, Post-mortem changes in fish. Preservation-chilling, freezing, canning, smoking, curing, salting and drying; Fish products - fish meal and fish oils, ready-to-eat fish, FPC and other sea food products of commercial importance.

**Unit III: Processing of Egg and Poultry****(15 hrs)**

Types of Egg, Functional properties of eggs and its uses in food industry, Quality assessment, Factor affecting egg quality, Egg products: dehydrated and frozen egg products, etc.

Types of poultry meat, production and processing techniques, Quality assessment. Packaging, storage. types of poultry products of commercial importance.

**Unit IV: Equipment used in processing of animal foods****(15 hrs)**

Meat processing equipment – slicer, grinder, mincer and mixer, sausage stuffer, hand crank meat tenderizer. Poultry processing equipment – defeathering equipment, cutter, slaughter machine, Bone and meat cutter. Fish processing equipment – slicing machine, gutting machine, fish grader, fish de-scaling machine.

**Unit V: Preservation and Quality Standards****(14 hrs)**

Methods of preservation of animal foods - types - Thermal processing, preservation using antibiotics, preservation by freezing, irradiation and current techniques. Packaging Techniques, packaging of retail cuts. Quality Control - Indian regulation and quality standards, Kosher and Halal certification, HACCP, Good Manufacturing Practices, meat plant sanitation and safety.

**Text Book**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Panada P.C	Text book on Egg and Poultry Technology	Vikas Publishing House Pvt. Ltd., New Delhi,	1996
2	Gunter Heinz and Peter Hautzinger	Meat Processing Technology	Rap Publication	2007
3	Mead G.C	Poultry Meat Processing and Quality	CRC Press	2004
4	K.K. Balachandran	Post harvest Technology of fish and fish products	Dayapublishing house	2001

**Reference Books**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	W.J. Stadelman and O. J. Cotterill,	Egg science and Technology	AVI Publishing Co	1995
2	V.P. Singh and Neelam Sachan	Principles of meat technology	New India publishing agency	2012
3	<a href="http://msue.anr.msu.edu/program/smprv/proper_amount_of_nitrite">http://msue.anr.msu.edu/program/smprv/proper amount of nitrite</a>			
4	<a href="https://meathaccp.wisc.edu/">https://meathaccp.wisc.edu/</a>			

**Pedagogy**

Blended learning, lecture by chalk & talk, power point presentation, e-content, group discussion, assignment, quiz, seminar.

Course Designers:

1. Dr. M. Guhapriya
2. Ms. R. Sharmila
3. Dr.M.C.Anitha

COURSE NUMBER	COURSE NAME	Category	L	T	P	Credit
		BF21E02	Elective (AOS) II - Processing of Spices and Plantation Crops	Theory	73	2

### Preamble

To enable the students to

- understand classification and importance of spice processing.
- gain knowledge on processing of plantation and tuber crop.
- understand tea and coffee processing methods.

### Course Learning Outcomes

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the chemistry and functional properties of different spices and plantation crops.	K1
CLO2	Study about the processing condition of spices and plantation crops.	K2
CLO3	Gain knowledge on different processing methods related to different spices and plantation crops.	K3
CLO4	Understand the quality specifications needed for packaging and grading of spices.	K4
CLO5	Able to gain knowledge on value addition of by-products from plantation crops.	K4

### Mapping with Programme Learning Outcomes

CLOs	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6
CLO1	H	H	H	M	H	H
CLO2	H	H	H	M	H	H
CLO3	H	H	H	M	H	H
CLO4	H	H	H	M	M	M
CLO5	H	H	H	M	M	H

H-High; M-Medium; L-Low

**Elective (AOS) II - Processing of Spices and Plantation Crops (BF21E02) (73 Hrs)**

**Syllabus**

**Unit I: Classification and chemistry of spices (15 hrs)**

Importance of spices and condiments, Types of Spices – Major and Minor spices, stages and methods of its harvesting and its properties. Chemistry and importance of the volatile compounds present in spices and condiments.

**Unit II: Processing of spices (15 hrs)**

Processing of spices – Major and minor spices – cardamom, pepper, turmeric, chilli, ginger, cinnamon, clove, nutmeg, cumin, coriander and Garlic: - Dried Garlic, Powder, Oil. etc. Cleaning, grinding (including low temperature grinding to minimize loss of volatiles), fumigation, methods to reduce microbial load using different techniques like ethylene oxide treatment, propylene oxide, irradiation and steam treatment and other recent techniques.

**Unit III: Processing of plantation and tuber crops (15 hrs)**

Types of plantation and tuber crops and its commercial importance. Chemical composition and processing of tuber crops - tapioca, sugar beet, potato and yam; starch and sago – production, grading and manufacturing of other by-products. Plantation crops – banana, cashew, Coconut – Origin, Importance, Chemical composition, post-harvest processing and its application.

**Unit IV: Processing of tea (14 hrs)**

Tea – occurrence, chemical constituents, harvesting, types of tea- green, oolong and CTC, Chemistry and technology of CTC tea. Manufacturing process – Green tea blends, Instant tea, etc. Grading of tea. Quality specifications

**Unit V: Processing of Coffee (14 hrs)**

Coffee- Occurrence, chemical constituents, harvesting, grading, processing - fermentation of coffee beans, drying, roasting and grinding- manufacture of Instant coffee, Chicory chemistry: Quality grading of coffee.



**Text Book**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Kumar K., Md Abdul Kadar JBM., Rangaswamy P. and Irulappan I	Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants	Oxford and IBH Publishing	2006
2	Chakraverty, A, Arun S. Mujumdar, G.S.Vijayaraghavan, and Hosahalli. S. Ramaswamy	Handbook of Post Harvest Technology: Cereals, Fruits, Vegetables, Tea and Spices	Marcel Dekker. Inc. New York	2003
3	Kader, A. A.	Postharvest Technology of Horticultural Crops, Second Edition	California University	1992
4	National Institute of Industrial Research (NIIR) Board	Handbook on Spices	Asia Pacific Business Press Inc.	2004

**Reference Books**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Shanmugavelu K.G., Kumar N. and Peter K.V	Production Technology of Spices and Plantation Crops	Jodhpur Agrobios (India) Agro House	2005
2	Minifie Bernard W	Chocolate, Cocoa and Confectionery Technology	Springer Netherlands	2012
3	<a href="http://agritech.tnau.ac.in/horticulture/horti_plantation%20crops_cocoa.html">http://agritech.tnau.ac.in/horticulture/horti_plantation%20crops_cocoa.html</a>			
4	<a href="https://answers.practicalaction.org/our-resources/community/food-processing-1-2">https://answers.practicalaction.org/our-resources/community/food-processing-1-2</a>			

**Pedagogy**

Blended learning, lecture by chalk & talk, power point presentation, e-content, group discussion, assignment,quiz, seminar.

**Course Designers:**

- 1. Dr. M. Guhapriya**
- 2. Ms. R. Sharmila**
- 3. Mrs.Iswarya A L**

COURSE NUMBER	COURSE NAME
BF21E03	Elective AOS(III) - Fruit and Vegetable processing Technology

Category	L	T	P	Credit
Theory	73	2	-	3

### Preamble

To enable the students to

- understand the importance and significance of fruits and vegetables
- gain knowledge about preparation of value added products from fruits and vegetables
- familiarize the concept of minimal processing and its role
- acquire knowledge about waste utilization of fruits and vegetables.

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the basic agricultural aspects of fruits and vegetables.	K2
CLO2	Familiarize with processing and manufacturing of fruits and vegetables and its products.	K4
CLO3	Understand the importance of different processing methods employed in preservation of fruit and vegetable products.	K4
CLO4	Gain knowledge on quality aspects of storage and packaging of different types of fruit and vegetable products.	K4
CLO5	Obtain knowledge on fruit and vegetable by-products and waste utilization.	K2

### Mapping with Programme Learning Outcomes

CLOs	PLO 1	PLO 2	PLO 3	PLO 4On	PLO 5	PLO 6
CLO1	H	H	H	M	H	H
CLO2	H	H	H	M	H	H
CLO3	H	H	H	M	H	H
CLO4	H	H	H	M	M	M
CLO5	H	H	H	M	M	H

H- High; M-Medium; L-Low

**Elective AOS(III) - Fruits and vegetable processing technology (BF21E03) (73 Hrs)**

**Syllabus**

**Unit I: Post harvest processing of fruit and vegetable (14 hrs)**

Harvesting of important fruits and vegetables. Physical, Textural characteristics. Maturity standards; Importance, Determinations maturity indices. Fruit ripening- chemical changes, methods of ripening.

**Unit II: Products and byproducts of Fruits (15 hrs)**

Production of Jams/Marmalades, Squashes/cordials, Ketchup/sauces, Chutneys, Fruit Bar, Soup powder from tomato and Candied Fruits. By- Products from fruit waste – leaf protein, banana fiber, fruit pectin, lycopene from tomato, vinegar preparation, use of mango kernels for starch, acid production (from fruit waste).

**Unit III Vegetable Products (15 hrs)**

Dried Leafy Vegetables. (Spinach, Fenugreek, Coriander leaves, Curry leaves). Dried Onion, Powder Potato: Wafer; starch, Papad, Carrot: Preserve, candy, Pickle, Jam. Cauliflower and cabbage: Dried cauliflower and cabbage, Sauerkraut, Pickle Leafy vegetables. Bitter gourd: Pickle, Dried bittergourd. Vegetable Fibres- General and specific processing, different packing including aseptic.

**Unit IV Minimal processing (14 hrs)**

Introduction, quality changes, Processing – physiological and microbiological impacts, Fresh cut products – Fresh produce quality and safety. Strategies for minimizing quality loss improving quality, bio-control agents, browning inhibition. Storage and packaging. Fresh-cut chain – harvest to market. Equipment requirements. Traceability of fresh cut products.

**Unit V Storage methods (15 hrs)**

Storage of fruit and vegetables - under ambient conditions, cold store, **zero energy cool chamber (ZECC)**, Freezing – Air blast, Fluidized bed and immersion freezer. Controlled and modified atmosphere storage - concepts and methods. Bead atmosphere. hypotactic storage. Irradiation. Waxing, stores striation.

**Text Book**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Hui Y.H.	Handbook of fruits and fruit processing	Blackwell Publishing	2000
2	Desrosier N.W.	The Technology of Food Preservation	CBS Publisher and Distributions	2006
3	Wim Jongen	Fruit and Vegetable Processing- Improving Quality	Wood Head Publishing Ltd	2002
4	Thompson A.K	Fruits and Vegetable - Harvesting, Handling and Storage	Blackwell Publishing	2003

**Reference Books**

S.No	Name of The Authors	Title of the Book	Publishers	Year of Publication
1	Lal G., Siddappa G. and Tondon G.L.	Preservation of Fruits and Vegetables	Indian Council of Agricultural Research	1986
2	V.P. Singh and Neelam Sachan	Principles of meat technology	New India publishing agency	2012
3	<a href="http://nptel.ac.in/courses/103107088/module20/lecture1/lecture1.pdf">http://nptel.ac.in/courses/103107088/module20/lecture1/lecture1.pdf</a>			
4	<a href="http://www.angrau.ac.in/media/10841/fdst215.pdf">http://www.angrau.ac.in/media/10841/fdst215.pdf</a>			

**Pedagogy**

Blended learning, lecture by chalk & talk, power point presentation, e-content, group discussion, assignment, quiz, seminar.

**Course Designers:**

1. Dr. M. Guha Priya
2. Ms. R. Sharmila
3. Mrs. Iswarya A L

COURSE NUMBER	COURSE NAME
BF18AC1	ALC I Environmental Issues in Food Industry

Category	L	T	P	Credit
Theory	-	-	-	5*

### Preamble

To enable the students to

- Understand the generation of waste from different food processing industries
- Acquire knowledge on air quality aspects, waste management and effluent treatment
- To understand the utilization of by products from food industry

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CLO1	Understand about the various environmental issues related to food Industry	K1
CLO2	Perceive the air quality parameters required in a food industry setup	K2
CLO3	Summarise the methods of waste water treatment	K3
CLO4	explain the method used in treatment of food industry waste and it's disposal	K4
CLO5	Recognize methods of utilizing wastes to make value added products	K2

### Mapping with Programme Learning Outcomes

CLOS	PLO 1	PLO 2	PLO 3	PL 04	PLO 5	PLO 6
CLO1	H	H	H	H	H	H
CLO2	H	H	H	H	H	M
CLO3	H	H	H	H	H	H
CLO4	H	H	H	H	M	H
CLO5	H	H	H	H	H	H

**H- High; M- Medium; L – Low**

## **ALC I Environmental Issues in Food Industry (BF18AC1)**

### **Syllabus**

#### **UNIT I Environmental issues of food industry**

Introduction: Types of waste and magnitude of waste generation in different food processing industries; concept scope and maintenance of waste management and effluent treatment. Bioorganic pollution; microbial toxicants and pollutants, biodegradation. Environmental Protection Act and specification for effluent of different food industries.

#### **UNIT II Air Quality Aspects**

Control of Air Quality- Air duct design and room air distribution; air conditioning systems; air filtration systems, hygienic air quality for food industries, clean-room air conditioning; important pollutants of air; properties of particulate matter and air pollution control methods; legal requirements.

#### **UNIT III Wastewater Treatment**

Wastewater characteristics - Temperature, pH, Oxygen demands (BOD, COD, TOD), fat, oil and grease content, metal content, forms of phosphorous and Sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues standards for disposal, measurement of organic content. Processing of wastewater treatment- Primary treatment, Secondary treatment, Operations in wastewater treatment- Physical unit, chemical unit, biological unit.

#### **UNIT IV Waste Disposal Management**

Storage & Disposal of Waste-Types of waste generated; non-degradable & biodegradable wastes, biological treatment of food industry wastes- Biological composting, drying and incineration, Landfill Digester, Vermi composting Pit, storage and disposal of liquid and gaseous waste; generation of biogas, extraction of specific components, use in animal feeds, zero emission plants; recovery & recycling of materials, pests & their control legal aspects related to storage and disposal

#### **UNIT V Waste Utilization from food industries**

Methods of utilizing wastes to make value added products- Characterization and utilization of by-products from cereals, oil processing, fruits & vegetable processing and sugar processing industries, Characterization and utilization of by-products from dairy, eggs, meat, fish and poultry processing industries.as case studies from each type of industries.

**Text Books**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	H. Panda	The complete book on managing food processing industry waste	Asia Pacific Business Press Inc.	2011
2.	Roday, S	Hygiene and Sanitation in Food Industry	Tata McGraw – Hill Publishing	1999
3.	Moorthy, C.K.	Principles and Practices of Contamination Control and Clean rooms	Book Syndicate	2003
4.	Potter, N. and Hotchkiss, J.H.	Food Science	CBS	1996

**Reference Books**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Wilson, C.L.	Microbial Food Contamination	CRC Press	2008
2.	Hester, R.E. and Harrison, R.M.	Food Safety and Food Quality”, (Issues in Environmental Science and Technology),	RSC	2001
3.	V.K. Joshi and S.K. Sharma	Food Processing Waste Management : Treatment and Utilization Technology	New India Publishing Agency	2011

**Pedagogy:** Blended learning, lecture by chalk & talk, power point presentation, e-content, group discussion, assignment, quiz, seminar.

**Course Designers:**

1. Dr. M. Guhapriya
2. Mrs. R. Sugantha
3. Mrs. Iswarya A L



COURSE NUMBER	COURSE NAME	Category	L	T	P	Credit
		BF18AC2	ALC II Food Supply Chain	Theory	-	-

### Preamble

To enable the students to

- Understand the importance of food supply chain.
- Gain knowledge about online retailing in food logistics.
- Know the application of supply chain management in various sectors

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CLO1	Understand the fundamentals of supply chain management	K2
CLO2	Identify the ICT trends in agri-food logistics	K2
CLO3	Interpret the technology trends in International food supply chain system	K3
CLO4	Relate the demand and supply sustainability	K3
CLO5	Understand the application of supply chain management in various sectors and the quality standards	K4

### Mapping with Programme Outcomes

Cos	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6
CLO1	H	H	H	M	H	H
CLO2	H	H	H	M	H	H
CLO3	H	H	H	M	H	H
CLO4	H	H	H	M	M	M
CLO5	H	H	H	M	M	H

H- High; M-Medium; L-Low

## ALC II Food Supply Chain (BF18AC2)

### Syllabus

#### Unit I Introduction to food supply chain

Food production, Entities in the agriculture supply chain, Agriculture and poverty alleviation, barriers to the development of the agri-industry. Future steps for the agriculture sector, Food manufacturing - importance of food processing, Changing market conditions, Inventory management, procurement.

#### Unit II Logistics

The retail environment, Movement of food to the consumer, Online grocery retailing, Challenges to the future of food retailing, Purchasing models, Supplier segmentation, Sustainable procurement, Food Logistics- ICT future trends in agri-food logistics, Packaging in logistics, Temperature-controlled supply chains.

#### Unit III International food supply chain

International food supply chains, Factors affecting the future of International food systems, Managing challenges in International food supply chains, Trends in supply chain relationships, Risk management and uncertainty. Technology trends in food supply chains- Traceability and use of technology.

#### Unit IV Challenges in food supply chain

Sustainable food supply chains, Measuring sustainability, Developing sustainability within food supply chains, Food hubs, Moving up the value chain, Factors affecting the future of the food supply chain, Balancing demand and supply sustainability.

#### Unit V Innovations and safety regulations

Food innovation-Product development in food supply chains-Innovations within food supply chains, Benefits and risks associated with FDI in retail sector of India. Food Manufacturing Restaurant and Hospitality Industry, Food supply chain regulations, safety and quality-Attributes to design food supply chains.

### Text Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Chopra, S., and Meindl, P.	Supply Chain Management Strategy, Planning and Operation	Pearson Education	2004
2	Pullman, M., and Wu, Z.	Food Supply Chain Management: Economic,	Taylor & Francis Group	2011

		Social and Environmental Perspectives		
3	Raghuram, G., and Rangaraj, N.	Logistics and Supply Chain Management: Cases and Concepts	Macmillan	2000
4	Simchi, L.D., Kaminski. P., and Simchi, L.E.	Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies	Irwin/McGraw-Hill	2003

#### Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Janat, S.	Supply Chain Management: Text and Cases	Pearson Education	2009
2	Sanders N R	Supply chain management: A global perspective	Wiley publications	2011

#### Pedagogy

Blended learning, lecture by chalk & talk, power point presentation, e-content, group discussion, assignment, quiz, seminar.

#### Course Designers:

1. Dr. M. Guhapriya
2. Ms. R. Sharmila

<b>COURSE NUMBER</b> <b>BF21CP6</b>	<b>Core Practical V FOOD PROCESSING &amp; FOOD BIOPROCESSING PRACTICAL</b>	Category	L	T	P	Credit
		Core	-	-	45	3

### Preamble

To enable the students to

- Acquire practical knowledge on characteristics of food.
- Study the structure and physical properties of food materials.
- Understand the sensory parameters of various food products.
- Analyze the qualitative parameters of microorganisms in food products

### Course Learning Outcomes

On the successful completion of the course, students will be able to

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
CLO1	Describe the characteristics and determine the physical properties of foods	K3
CLO2	Demonstrate the quality characteristics of food products upon processing	K4
CLO3	Gain knowledge on manufacturing and sensory evaluation of bioprocessed foods	K4
CLO4	Access the characteristics of microorganisms	K4
CLO5	Apply the processing techniques in developing bioprocessed foods	K4

### Mapping with Programme Outcomes

<b>Cos</b>	<b>PLO 1</b>	<b>PLO 2</b>	<b>PLO 3</b>	<b>PLO 4</b>	<b>PLO 5</b>	<b>PLO 6</b>
CLO1	H	H	H	H	H	H
CLO2	H	H	H	H	H	H
CLO3	H	H	H	H	H	H
CLO4	H	H	H	H	H	H
CLO5	H	H	H	H	H	H

H:High; M-Medium; L-Low

## CORE PRACTICAL- V

### Food Processing & Food Bioprocessing practical (BF21CP6)

Total Hours: 45

Credits : 3

1. Preparation & sensory analysis of wine from grapes
2. Experiments on rehydration characteristics of dried foods.
3. Preparation & Sensory analysis of probiotic dairy products:
  - a) Probiotic curd b) Probiotic yoghurt c) Kefir d) Bulgarian buttermilk e) Cheese
4. Studies on Minimal Processing of fruits and vegetables.
5. Preparation and calculation of overrun percentage of ice cream.
6. Preparation and sensory analysis of cakes, bread and Cookies.
7. Studies on Textural Profile Analysis of Baked goods.
8. Preparation and sensory analysis of Toffee, Candy and Chocolate.
9. Preparation & sensory analysis oriental fermented products a) Tempeh b) Tofu
10. Anatomy of Fermentor, cleaning of Fermentor, Assembling and final pre-sterilization of Fermentor, Anatomy and calibration of fermentor electrodes / probes, Post – sterilization procedures, Aseptic techniques in inoculation of fermentors (Demonstration)
11. Qualitative assessment of Extracellular activities of microorganisms- amylase, gelatinase, lipase, caseinase
12. Isolation of Plasmid DNA and Analysis by Agarose Gel Electrophoresis
13. Estimation of DNA (DPA method) & Estimation of RNA (Orcinol method) from food product (Demonstration)

#### Text Books

S. No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Sharma Shri K., Mulvaney Steven J. and	Food Process Engineering: Theory and	Wiley Inter-science	1999
2	Rizvi Syed S. H	Laboratory Experiments		2000
3	Rao M., Syed. S.H. Rizvi and Ashim K. Datta	Engineering Properties of Foods	CRC Press	2005
4	Kavitha Marwaha	Food Process Engineering: Theory & Laboratory Experiments	Gene Tech Books	2010

#### Course Designers:

1. Dr. M. Guhapriya
2. Ms. R. Sharmila
3. Ms. Krishnapriya M

<b>COURSE NUMBER</b>	<b>SKILL BASED SUBJECT</b>
<b>BF21SBP1</b>	<b>Instrumentational Techniques in Food Analysis Practical</b>

<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
Practical		-	45	3

### Preamble

To enable the students to

- learn to determine the quality parameters
- gain knowledge in determining specific gravity, acidity of food samples
- understand the estimation of nutrients in food

### Course Learning Outcomes

On the successful completion of the course, students will be able to

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
CLO1	Estimate bulk density and specific gravity of food samples	K4
CLO2	Apply different chemical test to find the salt and acidity content in Foods	K3
CLO3	Estimate moisture and ash content in foods	K3
CLO4	Carry out experiments to determine nutrient content	K3

### Mapping with Programme Learning Outcomes

<b>CLOs</b>	<b>PLO 1</b>	<b>PLO 2</b>	<b>PLO 3</b>	<b>PLO 4</b>	<b>PLO5</b>	<b>PLO6</b>
CLO 1	H	H	H	H	H	H
CLO 2	H	H	H	H	H	H
CLO 3	H	H	H	H	H	H
CLO 4	H	H	H	H	H	H

H- High, M- Medium, L- Low

## SKILL BASED SUBJECT

### Instrumentational techniques in food analysis practical

Total hours: 45

BF21SBP1

Credits :3

1. Techniques of operating analytical balance & Calibration of volumetric equipment's
2. Demonstration of chromatography HPLC, AAS, IR and GC
3. Determination of pH of food samples using pH meter & aqueous acidity in foods
4. Centrifugation- Centrifugation of a colloidal suspension
5. Preparation of standard solutions.
6. Acid Base titration- Estimation of sodium carbonate using hydrochloric acid
7. Determination of moisture content in food samples.
8. Determination of total ash & acid insoluble ash content in food samples.
9. Estimation of fibre content of foods
10. Estimation of Vitamin C content in foods
11. Estimation of Vitamin A content in foods

#### Text Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	A.Y.Sathe`	A first course in food Analysis	New Age International Publishers	1999
2.	Dr. Geetha Swaminathan Ms. Mary George	Laboratory Chemical Methods in Food Analysis	Margham Publishers	2002
2.	Kirk, RS and Sawyer, R.	Pearson's Chemical Analysis of Foods.	Longman Scientificand Technical	1991
3.	S. Suzzane Neilsen	Introduction to the chemical analysis of foods	CBS	2001

#### Reference Books

S.N o.	Authors	Title of the Book	Publishers	Year of Publication
1.	Pomrenz Y & Meloan CE	Food Analysis- Theory andPractice.	CBS	1996
2.	Food safety and standards Authorityof India, Ministry of health and family welfare	FSSAI Manual of methods for analysis of foods	Government of India	2016
3.	David T Plummer	An Introduction to Practical Biochemistry	Tata McGraw Hill	2007, third edn.

#### E references

<https://nptel.ac.in/content/storage2/courses/122101001/downloads/lec-38.pdf>

[http://www.egyankosh.ac.in/bitstream/123458789/15897/1/Experiment\\_12.p](http://www.egyankosh.ac.in/bitstream/123458789/15897/1/Experiment_12.p)

## SEMESTER VI

COURSE NUMBER	COURSE NAME
<b>BF21C11</b>	<b>Core XI</b> Food Safety and Quality Assurance

Category	L	T	P	Credit
Theory	88	2	-	5

### **Preamble**

To enable the students to

- Acquire knowledge about importance of food safety
- Aware of national and international organizations for food safety and quality control
- Familiarize the quality control measures of foods

### **Course Learning Outcomes**

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understanding the different types of food hazards, classification and characterization	K3
CLO2	To gain knowledge about the systems and organization's involved in food safety	K2
CLO3	Recognize the regulating authorities for food safety	K2
CLO4	Understand the safety aspects of foods	K3
CLO5	Understand about the quality control measures available in food industries	K4

### **Mapping with Programme Outcomes**



<b>CLOs</b>	<b>PLO1</b>	<b>PLO2</b>	<b>PLO3</b>	<b>PLO4</b>	<b>PLO5</b>	<b>PLO6</b>
CLO1	H	H	H	M	H	H
CLO2	H	H	H	M	H	H
CLO3	H	H	H	M	H	H
CLO4	H	H	H	M	M	M
CLO5	H	H	H	M	M	H

H- High; M-Medium; L-Low

## **Core XI - Food Safety and Quality Assurance (BF21C11)**

**(88 Hrs)**

### **Syllabus**

#### **Unit I: Introduction to food safety**

**(18 hrs)**

General principles of food safety. Characterization of food Hazards - physical, chemical and biological. Food spoilage and food borne infection. Adulteration and its types. Food Quality and Quality Attributes-Classification of Quality Attributes and their role in food Quality.

#### **Unit II: Food quality assurance**

**(18 hrs)**

Objectives, importance and functions of quality control, Importance of safety in marketing of Food products - domestic and export markets.

International organizations: ISO, CAC, WTO, USFDA, Codex, EIC. National organizations: FSSAI, BIS, CCFS, Agmark and APEDA, Good Laboratory Practices.

#### **Unit III: Regulations of food safety and quality**

**(17 hrs)**

Food laws - Food Safety and Standards Act (FSSAI) and standards of foods, Packaged Commodities Rules, QA Audit, HACCP, GMP, standard sanitary procedures- GAP, GFSI; function and roles of USFDA, USDA and EPA, ASTA.

#### **Unit IV: Safety of special foods**

**(17 hrs)**

Regulation of special category Foods: Regulation of Irradiated foods; Regulation of Genetic Modifications; Regulation of Dietary Supplements, Functional Foods and Nutraceutical, Infant

foods and formula foods. Labeling and packaging standards of special category food products. Usage of additives like colours, preservatives, emulsifiers, stabilisers, antioxidants -permissible limits, concept of safe food.

**Unit V: Quality Control Measures**

**(18 hrs)**

Quality Control Measures - International standards for export and quarantine requirements for export of food products. Quality Improvement Plans(QIP), Quality Control Circles( QCC), Total quality management (TQM).

**Text Book**

<b>S.No</b>	<b>Name of the Authors</b>	<b>Title of the Book</b>	<b>Publishers</b>	<b>Year of Publication</b>
1	Inteaz Alli	Food Quality Assurance: Principles and Practices	Taylor and Francis	2014
2	Andres Vasconcellos J	Quality Assurance for theFood Industry: A Practical Approach	CRC Press	2004
3	Manoranjan Kalia	Food analysis and Quality control	Kalyani Publishers	2002
4	David Kilcast	Sensory Analysis for Food and Beverage Quality Control: A Practical Guide	Woodhead Publishing Ltd	2010

**Reference Book**

<b>S.No</b>	<b>Name of the Authors</b>	<b>Title of the Book</b>	<b>Publishers</b>	<b>Year of Publication</b>
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1	Singh, S. P	Food Safety, Quality Assurance, and Global Trade: Concerns and Strategies	Food Safety, Quality Assurance, and Global Trade: Concerns and Strategies	2009
2	<a href="http://www.thanut-swu.com/images/BOT331/food%20quality%20assurance.pdf">http://www.thanut-swu.com/images/BOT331/food%20quality%20assurance.pdf</a>			
3	<a href="http://www.fao.org/3/a-t0451e.pdf">http://www.fao.org/3/a-t0451e.pdf</a>			

**Pedagogy**

Lecture by chalk & talk, power point presentation, e-content, group discussion, assignment, quiz, seminar.

**Course Designers:**

1. Dr. M. Guhapriya
2. Ms. R. Sharmila
3. Dr.M.C.Anitha

<b>COURSE NUMBER</b>	<b>COURSE NAME</b>
<b>BF21C12</b>	<b>Core XII Food Packaging Technology</b>

Category	L	T	P	Credit
Theory	88	2	-	5

### **Preamble**

To enable the students to

- learn the purpose of a packaging and understand the types of packaging materials.
- Recognizing modern packaging systems.
- gain knowledge on process of packaging and the different equipment used
- get familiarized with the packaging rules and regulations

### **Course Learning Outcomes**

On the successful completion of the course, students will be able to

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
CLO1	Understand the packaging systems	K2
CLO2	Acquaint with traditional and modern packing techniques	K4
CLO3	Understand the hazards of a packaging material	K3
CLO4	Categorize the packaging systems involved in food products	K3, K4
CLO5	Identify the different quality parameters rules and regulations involved in national and international level	K4

### **Mapping with Programme Learning Outcomes**

Course	Programme Outcome					
<b>CLOS</b>	<b>PLO 1</b>	<b>PLO 2</b>	<b>PLO 3</b>	<b>PL O4</b>	<b>PLO 5</b>	<b>PLO 6</b>
CLO1	H	H	H	H	H	H
CLO2	H	H	H	H	H	M
CLO3	H	H	H	H	H	H

CLO4	H	H	H	H	M	H
CLO5	H	H	H	H	H	H

H-High, M- Medium, L- Low

**Core XII Food Packaging Technology (BF21C12)**

**(88 hrs)**

**Syllabus**

**Unit I Conventional Packaging**

**(18 hrs)**

Definitions, objectives and functions of packaging and packaging materials - types of packaging materials: paper: glass, methods of bottle making; metals: tinplate containers, tinning process, components of tinplate, types of cans, aluminum containers, lacquers; plastics: types of plastic films laminated plastic materials, co extrusion, edible films and biodegradable plastics-advantages and disadvantages.

**Unit II Modern Packaging Systems**

**(18Hrs)**

Different forms of packaging such as rigid, semi rigid and flexible forms, reportable pouches, tetra pack, Advancement in packaging Technology: Smart packaging, Active packaging, CAP/ MAP, Vacuum Packaging, Gas Packaging, Anti-microbial packaging. Eco friendly packaging material, equipment, quality parameters and benefits of usage.

**Unit III Quality parameters of packaging materials**

**(18Hrs)**

Tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, methods of testing and evaluation; barrier properties of packaging materials; theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate and its measurement, water vapor transmission rate and its measurement

**Unit IV Packaging process and labelling of foods**

**(17Hrs)**

Packaging material and process used for grains, pulses, dairy and its products, fruits and vegetables, meat, seafoods, fats/oils- fresh, dehydrated, frozen forms, Labelling of Foods

**Unit V Hazards and handling of Packaging material**

**(17 hrs)**

Quality Control- Evaluation of Packaging materials- toxicity, corrosion prevention, minimization of transport losses, Hazards in handling and storage of packaging materials, and their minimization

Packaging laws and regulation – FSSAI and International guidelines

**Text Books**

<b>S.No</b>	<b>Name of the Authors</b>	<b>Title of the Book</b>	<b>Publishers</b>	<b>Year of Publication</b>
1.	Vijaya Khader	Text book of food science and technology	Indian Council of Agricultural Research	2016
2.	P. Jacob John	A Handbook on Food Packaging	DAYA Publishing House	2013
3.	NIIR Delhi	Food packaging technology Handbook	Engineers India Research Institute	2018
4.	Natarajan S	Fundamentals of Packaging Technology	PHI	2014

**Reference Books**

<b>S.No</b>	<b>Name of the Authors</b>	<b>Title of the Book</b>	<b>Publishers</b>	<b>Year of Publication</b>
1.	Coles R, McDowell D and Kirwan MJ	Food Packaging Technology	CRC Press	2003

2.	Robertson GL	Food Packaging – Principles and Practice	CRC Press Taylor and Francis Group	2012
3.	Paine FA and Paine HY	A Handbook of Food Packaging	Blackie Academic and Professional	1992

**Pedagogy**

Lecture by chalk & talk, power point presentation, e-content, group discussion, assignment, quiz, seminar.

**Course Designers:**

- 1. Dr. M. Guhapriya**
- 2. Mrs. R. Sugantha**
- 3. Dr.M.C.Anitha**

COURSE NUMBER- <b>BF21C13</b>	COURSE NAME – <b>FINANCIAL MANAGEMENT</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		<b>Core 13</b>	73	2	-	4

### Preamble

1. To understand the basic concepts, principles and objectives of financial management.
2. To deepen knowledge on all the components of the financial environment of business.
3. To equip necessary skills to take decisions on various financial matters.
4. To convey sufficient knowledge for organizing financial transaction effectively.

### Course Outcomes

On the successful completion of the course, students will be able to:

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
<b>CLO1</b>	Understand the basic concepts of financial management to gain a broader understanding of the objectives of financial management and to identify different sources of finance including digital money.	<b>K1</b>
<b>CLO2</b>	Recognize how the time value of money, cost of capital, capital structures, capital budgeting, working capital, dividend and analytical decisions are used for financial management.	<b>K2</b>
<b>CLO3</b>	Analyze the financing decisions by implementing the tools such as time value of money, cost of capital, capital structures, capital budgeting and working capital management techniques for management of financial resources.	<b>K3</b>
<b>CLO4</b>	Apply the critical thinking skills for effective decision-making by using various financial management tools, techniques and analytics functions for efficient financial planning and forecasting.	<b>K4</b>

### Mapping with Programme Outcomes

<b>CLOs</b>	<b>PLO1</b>	<b>PLO2</b>	<b>PLO3</b>	<b>PLO4</b>	<b>PLO5</b>
CLO1	S	S	M	S	S
CLO2	S	S	M	S	S
CLO3	S	S	S	M	S
CLO4	S	S	S	S	S

S-Strong; M-Medium; L-Low



## **FINANCIAL MANAGEMENT - BF21C13**

**(73 Hours)**

### **UNIT – I Theory (13 Hours)**

**Introduction to Financial Management:** Meaning of finance – Definition and scope of finance function – **\*Objectives and importance of financial management\*** - Sources of finance - long term-Equity – Preference – Debt – Short term bank and non-bank sources. Robotic process Automation in financial management for food business-Financial Planning and Forecasting in food industry- AI based financial forecasting in food industry.

### **UNIT – II-Theory and Problems (15 Hours)**

**Time Value of money** – Present value, Future Value, Lump sum & Annuity (Simple problems).

Leverage - **\*Meaning – Functions\*** - Operating Leverage – Financial Leverage – Combined Leverage. (Simple problems).

### **UNIT – III-Theory (15 Hours)**

**Capital structure** –Introduction- **\* Factors influencing capital structure\*** – Approaches – MM – Optimalcapital structure- Introduction to AI based Prediction of Capital structure. Dividend decisions – Determinants- Types of Dividend Policies-Forms of dividend.

### **UNIT – IV-Theory and Problems (15Hours)**

**Capital Budgeting** – Meaning-**\*Factors affecting capital Budgeting\***-Methods of appraisal-PayBack – ARR – NPV – IRR-Profitability Index. (Simple problems). Impact of AI on capital budgeting in food industry

### **UNIT – V-Theory (15 Hours)**

Working capital management: Meaning – Concepts – Kinds –Advantages-**\*Determinants\*** - Importance of working capital in food industry. Working Capital Financing – Importance and Types. Cash Management: Motives for Holding Cash – Objectives of Cash Management. The role of cash management in food industry. Financial Analytics: Meaning–Significance- its application in food industry. Introduction

to Fintech-Emerging trends and technologies in Fintech.

**Note: Simple problems from Unit II & IV**

**Theory 80 % and Problems 20 %**

**\* Highlighted Text offered in blended mode (Links Provided)**

**TEXT BOOK:**

Sl. No.	Author	Book name	Publisher	Year of Publication
1.	Sharma RK and Gupta SP	Financial Management	Kalyani Publications: (9th edition)	2020
2.	Prasanna Chandra	Financial Management Theory & Practice	McGraw Hill	2019 Revised 10 <sup>th</sup> Edition

**REFERENCE BOOK:**

Sl. No.	Author	Book name	Publisher	Year of Publication
1.	I.M. Pandey	Financial Management	Pearson Education Limited: 12 <sup>th</sup> edition	2021 Revised 12 <sup>th</sup> Edition
2.	MY Khan &PK Jain	Financial Management Approach	Tata McGraw HillPublishing	2018 Revised 8 <sup>th</sup> Edition

**Pedagogy:** Chalk & Talk, lecture, Seminar, PPT, Group Discussion and Case Study.

<b>COURSE NUMBER</b>	<b>COURSE NAME</b>
<b>BF21E04</b>	<b>Elective (AOS) – IV Dairy technology</b>

Category	L	T	P	Credit
Theory	73	2	-	4

### **Preamble**

To enable the students to

- Understand the properties of milk and gain knowledge on handling and processing
- Familiarize with the types of equipment used in milk processing
- acquire knowledge about manufacturing of milk products

### **Course Learning Outcomes**

On the successful completion of the course, students will be able to

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
CLO1	recognize the properties of milk	K4

CLO2	Study the quality tests and processing of milk	K4
CLO3	Illustrate the working principles of equipment used in dairy industry	K3
CLO4	Analyze the methods involved in storage of milk	K4
CLO5	Acquire knowledge on the types of milk products	K4

### Mapping with Programme Learning Outcomes

COs	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6
CLO1	H	H	H	M	H	H
CLO2	H	H	H	M	H	H
CLO3	H	H	H	M	H	H
CLO4	H	H	H	M	M	M
CLO5	H	H	H	M	M	H

H- High; M-Medium; L-Low

### Elective (AOS) – IV Dairy Technology (BF21E04)

(73 Hrs)

#### Syllabus

#### Unit I: Milk and its properties

(14hrs)

Milk- Scope and importance of Dairy industry, types of market milk; Physico-chemical properties of milk: Color, Flavor, Specific Gravity, Boiling point, Freezing point, Refractive Index, Acidity and pH, Viscosity, Surface Tension; Contaminants - microbiology of milk.

#### Unit II: Quality test and processing of milk

(15 hrs)

Milk reception- construction details. Platform tests of milk: Smell, Appearance, Temperature, Sediment, Acidity, Lactometer Reading, Fat, Solids-Not-Fat, Dye Reduction Test: MBRT test, Resazurin tests, Mastitis test.

Milk collection - cooling and milk transport - milk reception, Milk Processing flow sheet – Filtration / clarification, Storage of milk, Standardization – simple problems in standardization,

Homogenization, Pasteurization – Types of pasteurization process.

**Unit III: Equipment used in dairy industry**

**(15hrs)**

Cream separating centrifuges, Pasteurizers (Heat Exchangers), Homogenizers, Spray dryer, Bulk coolers, Evaporators, Butter churner, Separators, Milk Chillers, Plant piping, Pumps, Bottle and pouch fillers – components, construction and working principles.

**. Unit IV: Storage and cleaning**

**(15 hrs)**

Chilling and storage- basic principles and methods- milk coolers, transport and storage tanks. Cleaning – agents and methods. Can washer - Rotary type and Straight through type. Selection and maintenance of can washers, CIP - Types of CIP system, Design of CIP system, CIP of dairy equipment.

**Unit V: Non-fermented and Fermented dairy products**

**(14hrs)**

Manufacture of cheese – composition & classification – cheddar and cottage cheese; equipment for cheese production – cheese vats and press, Manufacture of ice-cream - ingredients – preparation of ice cream mix - overrun- freezing –refrigeration requirements of mixes- ice cream freezers –batch and continuous freezers, Manufacturing of milk powders

Fermented Milk Products: Yoghurt - Curd – cultured butter milk Bulgarian butter milk – Kefir – paneer - acidophilus milk etc.; Concept of Probiotics and prebiotic milk products.

**Text Book**

<b>S.No</b>	<b>Name of the Authors</b>	<b>Title of the Book</b>	<b>Publishers</b>	<b>Year of Publication</b>
1	Sukumar De	Outlines of Dairy Technology	Oxford University Press	2006
2	Tufail Ahmad	Dairy Plant Engineering and Management	Kitab Mah al Publishers	2016

3	Farrall,A.W	Engineering for dairy and food products	John Wiley and Sons	1987
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### Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Walstra. P et al	Dairy Technology	Taylor & Francis	2005
2	<a href="http://www.agrimoon.com/wp-content/uploads/Dairy-Engineering-1.0.pdf">http://www.agrimoon.com/wp-content/uploads/Dairy-Engineering-1.0.pdf</a>			
3	<a href="http://nptel.ac.in/courses/103107088/module30/lecture1/lecture1.pdf">http://nptel.ac.in/courses/103107088/module30/lecture1/lecture1.pdf</a> .			

### Pedagogy

Lecture by chalk & talk, power point presentation, e-content, group discussion, assignment, quiz, seminar.

### Course Designers:

1. Dr. M. Guhapriya
2. Ms. R. Sharmila
3. Dr.M.C.Anitha

COURSE NUMBER	COURSE NAME
BF21E05	Elective (AOS) – V Convenience Foods

Category	L	T	P	Credit
Theory	73	2	-	4

### Preamble

To enable the students to

- learn about the convenience food market
- gain knowledge about convenience food and snack food
- familiarise with the toxicological hazards and safety regulations

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the growth and trends of convenience foods	K2
CLO2	Acquire knowledge about processing of different types of convenience foods	K2
CLO3	Understand the different equipment used in the snack food industry	K2
CLO4	Perceive the microbial safety of convenience foods	K2
CLO5	Gain knowledge on the microbial and toxicological aspects of convenience foods	K3

### Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	H	H	H	M	H	H
CLO2	H	H	H	M	H	H

CLO3	H	H	H	M	H	H
CLO4	H	H	H	M	M	M
CLO5	H	H	H	M	M	H

H- High; M-Medium; L-Low

**Elective (AOS) V Convenience Foods (BF21E05) (73Hrs)**

**Syllabus**

**Unit I: Market trends of convenience foods (15 hrs)**

History, Definition, need for convenience and snack foods, classification of convenience foods, types of snack food having higher market value, consumption pattern of processed foods, pros and cons of convenience food industry, growth trends, retail market prospects of Indian convenience foods.

**Unit II Convenience and Snack foods (15 hrs)**

Technology for breakfast cereals(RTE) – maize, rice, sorghum,ragi and legume based – roasted, toasted, puffed, popped, flaked; types and manufacturing of ready-to cook foods (RTC)

Snack Bars, grains & nuts – salted, spiced, sweetened, Batter-Based and Dough-Based Products, Fruit and vegetable based Snacks - Potato Chips and French Fries, Papad and Namkin, Banana Chips, fruit bars other ready to eat beverages

**Unit III Equipment used in convenience food products (15 hrs)**

Equipment used in manufacturing of RTC and RTE, Heat transfer mechanism, specialised equipment for frying, Baking-Ovens, Electronic Ovens, Driers, Toasting ovens, Specialized Equipment for Popcorn processing, Poppers, Sifters, Coaters , other equipment like Peelers, Slicers, dicers, graders etc

**Unit IV Extruded Products and it's Technology (15hrs)**

Extrusion: definition, principles and types. Introduction to extruders, uses of extruders in the food industry, Classification of extruder, components and functions of an extruder; Noodle production, Cereal based pasta production and tortilla manufacture, Use of extruders in the snack processing industry, pre and post preparation of extruded foods; extruded baked type



snacks, extruded fried type snacks. Modification of nutritional & functional properties of food components during extrusion,

### Unit V Microbial and toxicological safety of convenience foods

(13 hrs)

Food – borne pathogens in convenience foods and its Microbial safety.

Toxicological hazards- Acrylamide in ready to eat foods, furan in processed foods, biogenic amines and disinfection by products, Safety regulations.

#### Text Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Dr. Himadri Panda	The complete technology of snack foods	NIIR Project consultancy services	2013
2.	Chavan U.D. and Patil J.V	Industrial Processing of Fruits and Vegetables	Daya Publishing House	2013
3.	Samuel AM	Snack Food Technology	AVI Publishing	1976
4.	Lal Girdhari, Siddappa.G.S, and TandonG.L.	Preservation of fruits and vegetables	Indian Council of Agricultural Research	1998

#### Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Edmund WL.	Snack Foods Processing	AVI	2001
2.	Frame ND.	The technology of Extrusion Cooking	Blackie Academic.	1994
3.	Gordon BR	Snack food	AVI	1997

#### E- Resources

[https://shodhganga.inflibnet.ac.in/bitstream/10603/101927/11/11\\_chapter%203.pdf](https://shodhganga.inflibnet.ac.in/bitstream/10603/101927/11/11_chapter%203.pdf)

[https://nptel.ac.in/content/storage2/nptel\\_data3/html/mhrd/ict/text/126105015/lec23.pdf](https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/126105015/lec23.pdf)

**Pedagogy:** Lecture by chalk & talk, power point presentation, e-content, group discussion, assignment, quiz, seminar.

**Course Designers:**

1. Dr. M. Guhapriya

2. Mrs. R. Sugantha

3. Dr.M.C.Anitha

COURSE NUMBER	COURSE NAME	Category	L	T	P	Credit
BF21E06	<b>Elective (AOS) – VI</b> Functional Foods and Nutraceuticals	Theory	73	2	-	4

#### Preamble

To enable the students to

- Understand the basic concepts of functional food, Nutraceuticals, their nature and types
- Know about the role of Nutraceuticals and phytochemicals in health and disease.
- Acquaint on the legal aspects of phytochemicals and Nutraceuticals

#### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand about Nutraceuticals and functional foods	K1
CLO2	Gain knowledge about the types of Nutraceuticals and its properties	K2
CLO3	Describe the types, sources, function of Functional foods	K3

CLO4	Identify the usage of functional foods in the treatment of various disorders	K4
CLO5	Understand the legal aspects related to manufacturing and labelling of functional foods and Nutraceuticals	K5

### Mapping with Programme Learning Outcomes

Course	Programme Outcome					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	H	H	H	H	H	H
CLO2	H	H	H	H	H	M
CLO3	H	H	H	H	H	H
CLO4	H	H	H	H	M	H
CLO5	H	H	H	H	H	H

H: High, M: Medium, L: Low

### Elective (AOS) VI Functional Foods and Nutraceuticals (BF21E06) (73Hrs)

#### Syllabus

#### Unit I Functional Foods – Properties and functions (15 hrs)

Alkaloids, terpenoids, glycosides, natural phenols – resveratrol. Isoprenoid derivatives. Polyphenols – sources, classification, properties and functions. Chitin, chitosan, glucosamine, chondroitin sulphate and other polysaccharides of animal origin, probiotics and prebiotics- sources, classification, properties and functions.

#### Unit IV Functional Foods & therapeutic benefits (15hrs)

Nutraceuticals- bridge between drug and food, treatment for cognitive decline, Nutraceutical remedies for common disorders like Arthritis, Bronchitis, circulatory problems, hypoglycemia, Nephrological disorders, Liver disorders, Osteoporosis, Psoriasis and Ulcers. Metabolic and lifestyle disorders

#### Unit III Introduction to Nutraceuticals (14 hrs)

Background/ history, current scenario of nutraceuticals and functional food market, definitions. Importance, difference between nutraceuticals and functional foods, basis of claims for a compound as a nutraceutical, types of nutraceutical compounds and their health benefits.

**Unit-IV Nutraceuticals - types and health benefits****(15hrs)**

Types of nutraceutical compounds – Phytochemicals, phytosterols and other bioactive compounds, peptides and proteins, carbohydrates (dietary fibers, oligosaccharides and resistant starch), lipids (Conjugated Linoleic Acid, omega-3 fatty acids, fat replacers), vitamins and minerals; their sources and role in promoting human health.

**Unit V****(14 hrs)****Legal Aspects**

Stability of nutraceuticals. Safety, Consumer acceptance and assessment of health claims, labeling, marketing and regulatory issues related to nutraceuticals and functional foods. International scenario for Nutraceuticals and Health benefits

**Text Books**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Ghosh D et al	Innovations in Healthy and Functional Foods	CRC Press	2012
2.	Pathak YV	Handbook of nutraceuticals Volume 2	CRC Press	2011
3.	Wildman, Robert	“Handbook of Nutraceuticals and Functional Foods	CRC Press	2006

**Reference Books**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Wildman REC,	Handbook of Nutraceutical and Functional Foods,	CRC Press	2001
2.	Gibson, G.R. and C.M.Willams.	Functional Foods : Concept to Product	Woodhead	2000
3.	Hanson, James R.	“Natural Products: The Secondary Metabolites	Royal Society of Chemistry	2003

**E References**

ROBERT E. C. WILDMAN, Handbook of Functional Foods and Nutraceuticals, II Edition, (2007), CRC Press.

<http://egyankosh.ac.in/bitstream/123456789/38355/1/Unit-9.pdf>

[https://nptel.ac.in/content/storage2/nptel\\_data3/html/mhrd/ict/text/126105015/lec55.pdf](https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/126105015/lec55.pdf)

### **Pedagogy**

Lecture by chalk & talk, power point presentation, e-content, group discussion, assignment, quiz, Seminar

### **Course Designers:**

- 1. Dr. M. Guhapriya**
- 2. Mrs. R. Sugantha**

<b>COURSE NUMBER</b>	<b>COURSE NAME</b>
BF18AC3	<b>ALC III</b> Food Adulteration and Toxicology

Category	L	P	Credit
Theory	-	-	5

### Preamble

To enable the students to

- Know the harmful effects of adulterants
- understand the different sources of toxins in foods
- gain knowledge about environmental contaminants in food
- familiarize about safety and toxicological evaluation

### Course Learning Outcomes

On the successful completion of the course, students will be able to

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
CLO1	Understand food adulteration, causes and effects	K2
CLO2	Gain knowledge about food toxicology	K2
CLO3	List the sources of naturally occurring toxins in food	K3
CLO4	Explain contamination of food due to excess use of pesticide and fungicides	K4
CLO5	Interpret the causes for toxin production during processing of food	K3

### Mapping with Programme Learning Outcomes

Course	Programme Outcome					
	<b>PLO 1</b>	<b>PLO 2</b>	<b>PLO 3</b>	<b>PLO 4</b>	<b>PLO 5</b>	<b>PLO 6</b>
CLO1	H	H	H	H	H	H
CLO2	H	H	H	H	H	M
CLO3	H	H	H	H	H	H

CLO4	H	H	H	H	M	H
CLO5	H	H	H	H	H	H

H- High; M-Medium; L-Low

### **ALC III Food Adulteration and Toxicology (BF18AC3)**

#### **Syllabus**

##### **Unit I Food Adulteration**

Introduction, Food Adulteration, Foods commonly adulterated, common adulterants- classification of adulterants, harmful effects of adulterants, methods of detection of common adulterants in (theoretical aspects) Spices, Grains, pulses, Coffee, Tea, Oil fats, Food Colours, Milk, Honey, sugar, Jaggery, fruits and Vegetables, seafoods

##### **Unit II Food Toxicology and Risk Assessment**

Food Toxicology- Concept, Definition, importance, Classification of toxins and its effects, permissible dose, determinants of toxins in foods; Risk assessment in food toxicology.

##### **Unit III Types of toxins**

Toxins of plant and animal origin; Microbial toxins (e.g. Algal toxins, bacterial toxins and fungal toxins), occurrence, toxicity and significance. Food poisoning; Mycotoxicoses of significance.

##### **Unit IV Environmental Contaminants**

Environmental Contaminants and Drug Residues in Food: Fungicide and pesticide residues in foods; heavy metal and their health impacts; use of veterinary drugs (e.g. Malachite Green in fish and  $\beta$ - agonists in pork); Other contaminants in food-radioactive contamination of food, potential toxicity of food adulterants.

##### **Unit V Toxication of food Additives**

Toxication of food additives. Safety of food additives; toxicological evaluation of food additives; food processing generated toxicants: nitroso compounds, heterocyclic amines, Dietary Supplements and Toxicity related to Dose: Common dietary supplements; relevance of the dose; possible toxic effects

#### **Text Books**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Helferich, W., and	Food Toxicology	CRC Press	2001

	Winter, C.K.			
2.	Deshpande, S.S	Handbook of Food Toxicology	Marcel Dekker Inc. NY	2002
3.	Tönu, P	Principles of Food Toxicology	CRC Press	2007
4.	Srilakshmi, B	Food Science	New Age International (P) Ltd., Publishers, New Delhi.	2005

#### Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Shibamoto, T. and Bjeldanes, L	Introduction to Food Toxicology	Elsevier Inc.,	2009
2.	Stine, K.E. and Brown, T.M.	Principles of Toxicology	CRC Press	2006
3.	William H. W.,	Essentials of Environmental Toxicology	Taylor & Francis	

#### Pedagogy

##### Course Designers:

1. Dr. M. Guhapriya
2. Mrs. R. Sugantha
3. Dr.M.C.Anitha



COURSE NUMBER	COURSE NAME	Category				Credit
		L	T	P		
BF18AC4	ALC IV Emerging Technologies in Processing and Preservation	Theory	-	-	-	5

### Preamble

To enable the students to

- learn the basic concepts of non- thermal processing of foods
- understand the different types of non -thermal processing
- gain knowledge about the use of high intensity light and ohmic heating
- acquaint the industrial applications of cryogenic grinding

### Course Outcomes

On the successful completion of the course, students will be able to

CLO Number	CIO Statement	Knowledge Level
CLO1	List the characteristics of non-thermal processing of foods	K2
CLO2	Understand the microwave and IR technique to achieve maximum output with minimum damage	K2
CLO3	Describe the different techniques of High pressure processing techniques used in fruit and vegetable processing	K4
CLO4	Outline the mechanism of ohmic heating and its application in liquid food processing,	K3
CLO5	Compare cold plasma technology and cryogenic grinding	K4

### Mapping with Programme Learning Outcomes

Course	Programme Outcome					
CLOS	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6

CLO1	H	H	H	H	H	H
CLO2	H	H	H	H	H	M

CLO3	H	H	H	H	H	H
CLO4	H	H	H	H	M	H
CLO5	H	H	H	H	H	H

H- High; M- Medium; L - Low

#### **ALC IV Emerging Technologies in Processing and Preservation (BF18AC4)**

##### **Syllabus**

#### **Unit I Non - thermal Processing Techniques**

Introduction- Need for, non- thermal processing techniques, scope, non- thermal techniques- membrane technology, High Pressure Processing, Pulse electric field, Ultra sound, Super critical fluid extraction techniques- Concept, property of near critical fluids NCF and extraction methods. Application of SCFE in food processing

#### **Unit II Microwave and Radio Frequency**

Microwave and radio frequency, IR drying: Definition, Advantages, mechanism of heat generation, inductive heating in food processing and preservation. Application in food processing: microwave blanching, sterilization and finish drying.

#### **Unit III High Pressure Processing of foods**

High Pressure processing: Principle, Mechanism and Effect of HPP on -fruit juices, meat products, jam. Types of equipment, mechanism of microbial inactivation,

#### **Unit IV High Intensity Light and Ohmic Heating**

High intensity light generation system, Application of high intensity light in food processing, Pulse electric field-mechanism of inactivation, PEF generation system, PEF treatment chambers, Mechanism of ohmic heating and its application in liquid food processing,

#### **Unit V Cold Plasma Technology and Cryogenic Grinding**

Principle of cold plasma technology and its generation systems and its application, Cryogenic grinding- Properties of cryogenes, systems, and their different application

##### **Text Books**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Barbosa-Canovas	Novel Food Processing Technologies.	CRC Press	2002
2.	Dutta AK & Anantheswaran RC	Handbook of Microwave Technology for food Applications	CRC Press	1999

3.	Tönu, P	Principles of Food Toxicology	CRC Press	2007
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#### Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	P J Fellows	Food Processing and Technology	Wood head Publishing	2009
2.	Gould GW	New Methods of Food Preservation	CRC Press	2000
3.	O. P. Chauhan	Non Thermal Processing of Foods	CRC Press	2019

#### E resources:

- <https://nptel.ac.in/courses/126/103/126103017/>
- <https://drive.google.com/file/d/1VhXap8A11I2HnJW9wIOJi-IiN4n46EMQ/view>
- <https://drive.google.com/file/d/1bDC91XgI6QAEhdbaGy9nIm2gsVnQ34M7/view>
- Awsi Jan, Monika Sood, \*SA Sofi, Tsering Norzom, Non-thermal processing in food applications: A review, International Journal of Food Science and Nutrition, Volume 2; Issue 6; November 2017; Page No. 171-180

## Pedagogy

### Course Designers:

1. Dr. M. Guhapriya
2. Mrs. R. Sugantha

<b>COURSE NUMBER BF21CP6</b>	<b>Core Practical VI FOOD QUALITY CONTROL PRACTICALS</b>	Category	L	T	P	Credit
		Core	-	-	75	4

### Preamble

To enable the students to

- Gain knowledge on the quality assessment of foods.
- Evaluate the food items through standard procedures.

### Course Learning Outcomes

On the successful completion of the course, students will be able to

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
CLO1	Detect the adulterants in foods	K3
CLO2	Analyze the quality of specific foods	K4
CLO3	Determine the quality assessment of raw materials before processing	K4
CLO4	Gain knowledge on various analytical techniques in food analysis	

### Mapping with Programme Learning Outcomes

<b>CLOs</b>	<b>PLO1</b>	<b>PLO2</b>	<b>PLO3</b>	<b>PLO4</b>	<b>PLO5</b>	<b>PLO6</b>
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CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H

H - High; M-Medium; L-Low

## Core Practical VI

### Food quality control Practical (BF21CP6)

**Total Hours: 75**

**Credits : 4**

1. Detection of adulterants in common food ingredients
2. Determination of Iodine content in iodized salt.
3. Detection of anti-oxidant in spices.
4. Estimation of synthetic food color in a given food sample
5. Detection of oil soluble color in spices powder.
6. Determination of alkaline phosphatase test and MBRT in milk.
7. Estimation of saponification value of Fats/ Oils.
8. Estimation of free fatty acid in oils
9. Estimation of total acidity in vinegar
10. Estimation of peroxide value in oils
11. Determination of SO<sub>2</sub> in processed foods

#### Text Books

S. No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Sadasivam S., and Manickam A.	Biochemical Methods	New Age International	1996
2	Suzanne Nielsen S.	Food Analysis Laboratory Manual	Springer	2010
3	B Srilakhmi	Food Science	New Age International	2003

3	Manual of Methods of Analysis of Foods – Food Additives	FSSAI	2012
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**Course Designers:**

**1. Dr.M.C.Anitha**

**2. Ms. Sujithra S**

COURSE NUMBER	SKILL BASED SUBJECT	Category	L	T	P	Credit
BF21SBP2	Techniques in food analysis practical	Practical	-	-	4 1	3

### Preamble

To enable the students to

- learn to determine the quality parameters
- gain knowledge in determining specific gravity, acidity of food samples
- understand the estimation of nutrients in food

### Course Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Gain a clear understanding of the analytical procedures used to analyze specific food components	K1
CLO2	Gain scientific knowledge of food composition of different food materials	K2
CLO3	Describe various analytical methods employed to quantify the composition various food components.	K3
CLO4	Apply valid sampling techniques to food materials	K4

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PL O5	PLO 6
CLO1	H	H	H	H	H	H



CLO2	H	H	H	H	H	H
CLO3	H	H	H	H	H	H
CLO4	H	H	H	H	H	H

H- High, M- Medium, L- Low

### SKILL BASED SUBJECT

#### Techniques in food analysis practical

Total hours: 41

**BF21SBP2**

Credits :3

1. Estimation of total lipids in egg yolk
2. Estimation of thiamine
3. Estimation of riboflavin
4. Estimation of calcium in milk and curd
5. Estimation of iron
6. Estimation of phosphorus
7. Estimation of lycopene
8. Determination of total phenols
9. Determination of total antioxidant capacity
10. Demonstration of carbohydrate estimation
11. Demonstration of protein estimation by Kjeldahl method
12. Demonstration of fat estimation by Soxhlet method

#### Text Book

S. No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	A.Y.Sathe`	A first course in food Analysis	New Age International Publishers	1999
2.	Dr. Geetha Swaminathan Ms. Mary George	Laboratory Chemical Methods in Food Analysis	Margham Publishers	2002

2.	Kirk, RS and Sawyer, R.	Pearson's Chemical Analysis of Foods.	Longman Scientific and Technical	1991
3.	S. Suzzane Neilsen	Introduction to the chemical analysis of foods	CBS	2001

### Reference Books

S. No	Authors	Title of the Book	Publishers	Year of Publication
1.	Pomrenz Y & Meloan CE	Food Analysis - Theory and Practice.	CBS	1996
2.	Food safety and standards Authority of India, Ministry of health and family welfare	FSSAI Manual of methods for analysis of foods	Government of India	2016
3.	David T Plummer	An Introduction to Practical Biochemistry	Tata McGraw Hill	2007, third edn.

### E references

<https://nptel.ac.in/content/storage2/courses/122101001/downloads/lec-38.pdf>

<http://www.egyankosh.ac.in/bitstream/123456789/15897/1/Experiment-12.pdf>

### Course designers:

1.Ms. Santhiya R