PSGR Krishnammal College for Women

College of excellence nirf 2024 – 7th rank

Autonomous and Affiliated to Bharathiar University Reaccredited with A++ grade by NAAC,

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

2023 – 2026 Batch

PSGR
Krishnammal College for Women

College of excellence nirf 2024 – 7th rank
Autonomous and Affiliated to Bharathiar University Reaccredited with A++ grade by NAAC,
Peelamedu, Coimbatore-641004

DEPARTMENT OF FOOD PROCESSING TECHNOLOGY AND MANAGEMENT

PROGRAMME LEARNING OUTCOMES (PLO's)

After Completion of the program, the students will

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

PROGRAMME SPECIFIC OUTCOME

PSO1	**:**	Graduates with sufficient knowledge in the areas of food science, food chemistry, food processing and preservation of foods.
PSO2	**:**	Development of a food technologist, food analyst, nutritionist and an administrator
PSO3	**:**	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.
PSO4	**:**	Shall keep themselves abreast with the current trends to meet the food industry challenges.

PSGR
Krishnammal College for Women

College of excellence nirf 2024 – 7th rank
Autonomous and Affiliated to Bharathiar University Reaccredited with A++ grade by NAAC,
Peelamedu, Coimbatore-641004

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

BACHELOR OF SCIENCE (B.Sc.) – Academic Year 2023-2024

Sem	Part	Course Code	Title of the Course	Course Type	Instruction hours/week	Contact hours	Tutorial	Duration of Examination	Examination Marks			Credits
									CA	ESE	TOTAL	
I	I	TAM 2301A/ HIN2301A/ FRE2201A	Language T/H/F/ Paper I	Language	4	58	2	3	25	75	100	3
	II	ENG2301A	English paper I	English	4	58	2	3	25	75	100	3
	III	BF23C01	**Core I** Food Science	CC	4	58	2	3	25	75	100	4
	III	BF23C02	**Core II** Food Chemistry	CC	3	43	2	3	25	75	100	3
	III	BF23CP1	**Core Practical I** Food Science Practical	CC	3	45	-	3	25	75	100	3
	III	BF23C03	**Core III** Principles of Management	CC	5	73	2	3	25	75	100	4
	III	BF23A01	**Allied I** Principles of Nutrition	GE	5	73	2	3	25	75	100	4
	IV	NME23B1/ NME23A1/ NME23ES	Basic Tamil / Advanced Tamil / Introduction to Entrepreneurship	AEC	2	28	2	-	100	-	100	2
II	I	TAM2302A/ HIN2302A/ FRE2302A	Language T/H/F Paper – II	Language	4	58	2	3	25	75	100	3
	II	ENG2302A	English Paper II	English	4	58	2	3	25	75	100	3

	III	BF23C04	**Core IV** Food Microbiology	CC	4	58	2	3	25	75	100	3
	III	BF23CP2	**Core Practical II** Microbiology Practical	CC	3	45	-	3	25	75	100	3
	III	BF23C05	**Core V** Properties of Food	CC	5	73	2	3	25	75	100	3
	III	BF23A02	**Allied II** Nutritional Biochemistry	GE	5	73	2	3	25	75	100	3
	III	BF23AP1	**Allied Practical I** Biochemistry Practical	GE	3	45	-	3	15	35	50	3
	IV	NME23B2/ NME23A2	Basic Tamil II / Advanced Tamil II	AEC	-	-	-	-	100	-	100	Grade
	V	23PEAS1	Professional English ForLife Sciences	AEC	2	30	-	-	100	-	100	2
	VI	NM23GAW	**Foundation Course I** General Awareness	AEC	-	Self Study	-	-	100	-	100	Grade
	VI		Online Course	ACC	-	-	-	-	-	-	-	-
III	I	TAM2303A/ HIN2303A/ FRE2303A	Tamil Paper III/ Hindi Paper III/ French Paper III	L	4	58	2	3	25	75	100	3
	II	ENG2303A	English Paper III	E	4	58	2	3	25	75	100	3
	III	BF23C06	Unit Operations	CC	5	73	2	3	25	75	100	3
	III	BF23C07	Fundamentals of Food Processing	CC	4	58	2	3	25	75	100	3
	III	TH23A34/ BF23A03	Numerical and Statistical Techniques/ Basics of Accountancy	GE	5	73	2	3	25	75	100	4
	III	BF23CP3	Unit Operations Practical	CC	3	45	-	3	15*	35*	50*	3
III/ IV	III	CS23SBGP/ BF23SCE1	**GEN-AI/** **Coursera-** Fundamentals of Food Safety and Microbiology	SEC	3	44/ 45	1/-	-	100	-	100	3
	IV	NM23DTG	Design Thinking	AEC	2	30	-	-	100	-	100	2
III	IV	NM22UHR	Universal Human Values and Human Rights #	AECC	-	-	-	-	100	-	100	Gr.

	IV	BFINST1	Field Work/Institutional Training (30 days)	DSE	-	-	-	-	-	-	100	2
	VI	JOB2019	Job Oriented Course	-	-	-	-	-	-	-	-	Gr.
I - IV		COM15SER	Community Services	-	-	-	-	-	-	-	-	-
I - V	VI	16BONL1 16BONL2	Online Course 1 Online Course 2	ACC	-	-	-	-	-	-	-	-
IV	I	TAM2304A HIN2304A FRE2304A	Tamil Paper IV Hindi Paper IV French Paper IV	L	4	58	2	3	25	75	100	3
	II	ENG2304A	English Paper IV	E	4	58	2	3	25	75	100	3
	III	BF23C08	Food Processing and Preservation	CC	5	73	2	3	25	75	100	3
	III	BF23CP4	Food Preservation Practical	CC	3	45	-	3	15*	35*	50*	3
	III	BF23C09	Principles of Marketing	CC	4	58	2	3	25	75	100	3
	III	BF23A04	Bakery and Confectionery Technology	CC	5	73	2	3	15*	35*	50*	3
	III/ IV	CS23SBGP/ BF22SCE1	GEN-AI / Coursera - Fundamentals of Food Safety and Microbiology	SEC	3	44/ 45	1/ -	-	100	-	100	3
	IV	NM23EII	Entrepreneurship and Innovation (IgniteX)	AECC	2	30	-	-	100	-	100	2
	IV	NM23EVS	Environmental Studies	AECC	SS	-	-	-	-	-	Gr.	
	V	COCOACT	Co-Curricular Activities (NSS/NCC/YRC/Sports and Games/ Ecowatch/ Yinet/Rotaract)					100	-	100	1	
I - V	VI	16BONL1 16BONL2	Online Course 1 Online Course 2	ACC	-	-	-	-	-	-	-	
I -IV	VI	COM15SER	Community Service	GC	-	-	-	-	-	-	Gr.	

V	III	BF23C10	Food Biotechnology	CC	5	73	2	3	25	75	100	3
	III	BF23C11	Food Product Development	CC	4	58	2	3	25	75	100	3
	III	BF23E01/ BF23E02	Convenience Foods/ Food Entrepreneurship	DSE	4	58	2	3	25	75	100	3
	III	BF22CP5	Food Processing & Food Bioprocessing Practical	CC	3	45	-	3	25*	25*	50*	2
	III	BF23CP6	Food Product Development and Marketing Practical	CC	4	60	-	3	25	75	100	2
	IIIA	BF23SBP1	Food Analysis Practical	SEC	3	41	4	-	100	-	100	3
	III	BF23AC1/ BF23AC2	Environmental Issues in Food Industry/ Food Supply Chain	ACC	SS	-	-	3	25	75	100	5$
	IV	NM21CS1	Cyber Security I	AEC	2	30	-	-	100	-	100	Gr.
	VI	BF23COM	Comprehensive Examination	GC	-	-	-	-	100	-	100	Gr.
	III	BF23PROJ	Project and Viva Voce	DSE	5	-	-	-	25	75	100	5
	IV	BF23INST2	Fieldwork/ Institutional Training (30 days)	DSE	-	-	-	-	100	-	100	2
I - IV	VI	COM15SER	Community Services 30 Hours	GC	-	-	-	-	-	-	-	Gr.
I-V	VI	16BONL1 16BONL2	Online Course Online Course	ACC	-	-	-	-	-	-	-	-

L – Language **E - English**
CC – Core Courses **CA – Continuous Assessment**
GE – Generic Elective **ESE - End Semester Examination**
AEC – Ability Enhancement Course **SEC- Skill Enhancement Course**

ACC-Additional Credit Course AECC - Ability Enhancement Compulsory Course,
 # - Self Study
***CA conducted for 25 and converted into 15, ESE conducted for 75 and converted into 35**

Examination System

One test for the continuous assessment will be conducted on pre-determined dates, i.e., commencing on the 50th day from the date of reopening. The Model Exam will be conducted after completing 85th working days. Marks for ESE and CA with reference to the maximum for the course will be as follows

Question Paper Pattern

Continuous Internal Assessment Pattern

CIA Test - 5 Marks (Conducted for 45 marks after 50 days)
Model Exam - 7 Marks (Conducted for 75 marks after 85days (Each Unit 15 Marks))
Sem/Ass/Quiz - 5 Marks
Class Participation - 5 Marks
Attendance - 3 Marks (91-100% attendance: 3 Marks; 81-90% attendance: 2 Marks; 75-80% attendance: 1 Mark)

Total: 25 Marks

CA Pattern – Core & Elective – Theory - (First 3 Units)

Section A – 3 x 2 = 6 Marks
Section B – 3 x 5 = 15 Marks (either or – same CLO Level)
Section C – 3 x 8 = 24 Marks (either or – same CLO Level)

Total: 45 Marks

Core Practical (25 marks) Lab performance : 12 marks Regularity : 3 marks
Model : 7 marks (Conducted for 100 marks)
Attendance : 3 marks
Total : 25 Marks

Model & ESE Pattern – Core & Elective – Theory

Section A – 5 x 2 = 10 Marks
Section B – 5 x 5 = 25 Marks (either or – same CLO Level)
Section C – 5 x 8 = 40 Marks (either or – same CLO Level)

Total: 75 Marks

ADVANCED LEARNERS COURSE (ALC)

CA Pattern

Section A: 4 questions out of 6 - open choice 4x4 = 16 marks
Section B: 1 question out of 2-open choice 1x9 = 9 marks
Total: 25 marks

Model & ESE Pattern
Section A: 5 questions out of 8 - open choice 5x5 = 25 marks
Section B: 5 questions out of 8-open choice 5x10 = 50 marks
Total: 75 marks

Cyber Security I
Quiz: 60 Marks
Case Study: 20 Marks
Poster: 20 Marks
Total: 100 Marks

COMPREHENSIVE EXAMINATION
At the end of semester V of the UG Programme, an online test will be conducted covering the core courses up to semester V of the UG Programme, and grades will be awarded.

FIELD TRAINING / INSTITUTIONAL TRAINING
At the end of the IV semester, the student must complete a 30 day internship in an industrial establishment/ organization approved by the concerned staff. The student must also maintain a work diary and submit a report in the V semester, followed by a viva voce

Viva : 25 marks
Work diary : 15 marks
Report : 50 marks
Attendance : 10 marks
Total : 100 marks

SEMESTER I

COURSE NUMBER	COURSE NAME
BF23C01	CORE - I FOOD SCIENCE

Category	L	T	P	Credit
Theory	58	2	-	4

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, fish and poultry
- Familiarize the types of spices and beverages

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Gain knowledge on the basic concepts of food science	K1
CLO2	Recognize structure, nutritive value and role of various food groups and describe their nutritional contribution	K2
CLO3	Gain knowledge on various role of food groups in cookery and develop new cookery concepts	K3
CLO4	Demonstrate effect of processing and preservation on composition and quality changes in foods related to practical application	K4

Mapping with Programme Outcomes

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

H- High; M-Medium; L-Low

Core- I Food Science (BF23C01) (58Hrs)

Syllabus

Unit I Food Science (12Hrs)

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** – composition and nutritive value, processing and refining of oils. Specific nuts and oil seeds – coconut, flax seeds, almonds, groundnut, soya bean, sunflower seeds

Unit III Vegetables and Fruit (11 Hrs)

Vegetables – classification – composition and nutritive value, selection of vegetables, pigments – water insoluble and soluble enzymes, flavor 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 Animal Foods, Milk and Milk Products (12 Hrs)

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 and sausages.

Fish- classification, composition and nutritive value, selection of fish, fish products, fish

protein concentrate, spoilage of fish. **Poultry** – classification, composition and nutritive value. **Milk**- Composition, nutritive value, properties, role of milk and milk products in cookery, effects 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 – Ajwain, Aniseed, asafoetida, cardamom, chillies, cinnamon, clove, coriander seed, cumin seed, fenugreek, garlic, ginger, nutmeg, mustard, onion, pepper, poppy seeds, saffron, turmeric, role of spices in cookery. **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 nd Edn., 2001

Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Vijaya Khader	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

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

COURSENUMBER	COURSE NAME
BF23C02	Core II FOOD CHEMISTRY

Category	L	T	P	Credit
Theory	43	2	-	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 chemistry of vitamins and minerals
- Familiarize Industry 4.0

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Gain knowledge on structure, types of food and its components	K1
CLO2	Understand the physiochemical properties of nutrient and the concepts of industry 4.0	K2
CLO3	Demonstrate the effect of processing on the physiochemical properties	K3
CLO4	Apply the concepts of industry 4.0 in relation to advances in chemistry of foods	K4

Mapping with Programme Outcomes

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

H-High; M-Medium; L-Low

CORE –II FOOD CHEMISTRY (BF23C02) (43 Hrs)

Syllabus

Unit I Water in Foods (8 Hrs)

Properties of foods - physiochemical 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 Carbohydrates, Fats & Oils (9 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, Polysaccharides- homopolysaccharides and hetero polysaccharides, retrogradation.

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 III Chemistry of Amino acids, Proteins and Enzymes (9 Hrs)

Amino acids - Classification, essential amino acids, structure, properties of amino acids. **Proteins -** Classification, Structure of proteins - primary, secondary, tertiary and quaternaryand properties. **Enzymes** – classification, chemical nature and properties, Mechanism of enzyme action and factors affecting enzyme action, Industrial application of enzymes.

Unit IV - Chemistry of Vitamins and Minerals (9 Hrs)

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 – Sodium, Potassium, Magnesium, Calcium, Chloride,Phosphorus, Minerals during processing of foods.

Unit V Introduction to Industry 4.0 **(8 Hrs)**

Need – Reasons for Adopting Industry 4.0 - Definition – Goals and Design Principles. Technologies of Industry 4.0- Skills required for Industry 4.0- Advancements in Industry 4.0-

–Impact of Industry 4.0 on Society, Business, Government and People - Introduction to 5.0

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	2nd 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.	P. Kaliraj, T. Devi	Higher Education for Industry 4.0 and Transformation ɒ Education 5.0,	CRC Press	2020

Reference Books

S. No	Authors	Title of the Book	Publishers	Year of Publication
1	John M. DeMan	Principles of Food Chemistry	Avi Publishing Co Inc.	1976
2	John M. de Man John W. Finley, W. Jeffrey Hurst, Chang YongLee	Principles of Food Chemistry	Springer	2018
3	Chesworth, JM., Stuchbury, T. and Scaife, JR	An Introduction to Agricultural Biochemistry.	Chapmanand Hall	1998

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

COURSE NUMBER	COURSE NAME
BF23A01	ALLIED- I PRINCIPLES OF NUTRITION

Category	L	T	P	Credit
Theory	73	2	-	4

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 Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Gain basic knowledge on the basic concepts of nutrition, food groups and meal planning	K1
CLO2	Understanding the sources, digestion and absorption of carbohydrates, proteins and fats	K2
CLO3	Understand the role of food and nutrients in health and disease prevention.	K3
CLO4	Able to conceptualize, implement and evaluate the functions, requirements and effects of deficiency of nutrients	K4

Mapping with Programme Outcomes

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

H-High; M-Medium; L-Low

Allied Paper -I Principles of Nutrition (BF23A01) (73 Hrs)

Syllabus

UnitI Introduction and Importance of Nutrition (14 Hrs)

Nutrition – introduction, importance and scope of nutrition – balanced diet –food pyramid– Recommended Dietary Allowances (RDA) – Factors affecting RDA- Reference man &women Menu planning- Portion control - Malnutrition – Relation of nutrition to health.

Energy – sources – determination of energy value of foods – physiological energy valueof foods Basal Metabolic rate – factors affecting BMR – thermogenic effect of foods.

Unit II Proximate principles (15 Hrs)

Carbohydrate, proteins and fat – classification, functions, digestion and absorption, sources and requirements. Proteinquality of foods – Protein Efficiency Ratio (PER), Biological Value (BV) and Net Protein Utilization(NPU), supplementary value of proteins.

Unit III Vitamins (14 Hrs)

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 (15 Hrs)

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 Dietary Fibre, **Water and Electrolyte Balance (15Hrs)**

Dietary Fibre: Types, Components, sources, role in health

Water and Electrolytes:

Water – Daily requirement, Regulation and distribution of body water .Exchange of water in the body- water exchange between plasma and interstitial fluid. Overhydration, Dehydration and water intoxication

Electrolytes- Types, composition of body fluid, maintenance of fluid and electrolyte balance and electrolyte imbalance

Text Books

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

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

Course Designers:

1. Dr. N. Deepa Sathish

2. Ms. Santhiya R

COURSE NUMBER	CORE PRACTICAL –I
BF23CP1	FOOD SCIENCE PRACTICALS

Category	L	T	P	Credit
Core	-	-	45	3

Preamble

To enable the students to

- learn the preparation of various food products- milk, egg & beveragesunderstand the e dry & moist heat methods of cooking
- gain knowledge on browning of fruits & effect of acid/alkali/heat on vegetablesdetermi point, smoking point and flash point of fats

Course Learning Outcomes

On successful completion of the course

CLO Number	CLO Statement	Knowledge Level
CLO1	Classify the food groups and understand its properties	K1
CLO2	Recognize the effect of processing on structural changes of different food	K2
CLO3	Gain knowledge on the factors affecting properties of food	K3
CLO4	Apply the concepts of the changes and develop products	K4

Mapping with Programme Outcomes

CLOs	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

CORE PRACTICAL - I FOOD SCIENCE PRACTICALS (BF23CP1) (45 Hrs)

Syllabus

1. Basic five food groups
2. Measuring of food- Solids, Liquids, Butter
3. Effect of dry heat and moist heat on starch granules- Roasting, boiling,steam cooking, pressure cooking, grain identity
4. Separation of gluten from wheat
5. Cooking of Pulses and dhal – soaked, unsoaked, effect of hard water, softwater 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 of vegetables
8. Study of enzymatic and non-enzymatic browning in fruits
9. Milk- scum formation, preparation based on coagulation of milk proteins- cottage cheese, basundi, khoa, cream of tomato soup, fruit milkshakes, fruitcustard.
10. Study the structure of egg- factors affecting coagulation of egg proteins andfoam formation- - hardboiled egg, poached egg, egg custard,
11. Studies on foam formation and stability- foamy, soft peak, stiff peak, dry peak, preparation of omelet, fluffy omelet, soufflé, French salad dressing/mayonnaise,cake
12. Recipes to study the shortening effect of fats and oils
13. Study the different stages of crystallization of sugar recipe

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 inIndian 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 anddistributers	1997
3.	Swaminathan M	Food Science, Chemistry and Experimental foods	Bappo Publishers company Ltd	1997
4.	Meyer LH,	Food Chemistry	CBS Publication	1987

Pedagogy: Demonstration and hands on practical's

Course Designers:

1. Dr. M. Guhapriya

2. Mrs. R. Sugantha

SEMESTER II

COURSE NUMBER	COURSE NAME
BF23C04	**CORE– IV FOOD MICROBIOLOGY**

Category	L	T	P	Credit
Theory	58	2	-	3

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 Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	To gain knowledge on the types and characteristics of microorganism	K1
CLO2	To understanding the importance of microbes in food industry	K2
CLO3	To impart knowledge on spoilage and food borne disease caused by microorganisms	K3
CLO4	To enhance the understanding skills on hygiene and sanitation related to food safety	K4

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 -IV - FOOD MICROBIOLOGY (BF23C04) (58 Hrs)

Syllabus

UNIT I Introduction to Microbiology (12 Hrs)

Definition - Microbiology in daily life - General characteristics of microbes - physiological, cultural characteristics. Morphology and classification of microorganisms. Importance of microbes in food industry.

Food as substrate for microorganisms, Factors affecting the growth of microorganisms - intrinsic and extrinsic factors - Hydrogen ion concentration (pH), Moisture requirements - concept of water activity, oxidation-reduction potential; Growth of microorganisms - nutrient content., bacterial growth kinetics

Unit II Microbiology of foods (12 Hrs)

Important food spoilage bacteria in plant based (cereal & cereal products; plantation crops - tea, coffee, cocoa; canned foods; fruits & sugars and animal based foods (milk and milk products, flesh foods - meat, fish, poultry, egg). Microbiological Examination of milk - MBRT, alkaline phosphatase test

Unit III Microbial food products (12 Hrs)

Microorganisms as food - probiotics and its uses. Fermentation, Fermenter and its principle; processing of microbial & fermented food - milk products (curd, yogurt, cheese, kefir), vinegar, wine, beer, fermented vegetables (sauerkraut, kimchi,pickles), fermented meat - sausage. Microbiology of honey

Unit IV Food Borne Diseases (11 Hrs)

Food poisoning, Food borne infections (Salmonellosis, Gastroenteritis, E.Coli, shigellosis) and intoxications with types - Symptoms, Control measures; Food borne pathogens - Clostridium, Bacillus cereus, Staphylococcus aureus, Vibrio, Campylobacter, Yersinia.

Unit V Food Spoilage and Sanitation **(11 Hrs)**

Food spoilage - Definition, classification of food by ease of spoilage.

Microbiology in Food Sanitation, Contamination of food through various sources and cross contamination. Definition - Food Safety and Food Defense. Control of Microorganisms - disinfectants, antimicrobial agents & their mechanism of action; Introduction to Food additives; Definition & importance of food bio preservatives

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: Challengesand Opportunities	Annual Review of Food Science and Technology	2019

Reference Books

S. No	Authors	Title of the Book	Publishers	Year of P
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 & 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.

Course Designers:

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

COURSE NUMBER	Course Name
BF23CP2	CORE PRACTICAL – II Microbiology Practical

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 Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Understanding the concepts and techniques	K1
CLO2	Recognizing the type of microorganism and employing different staining techniques	K2
CLO3	Examining the potability of water and bacterial counting by biosensors	K3

Mapping with Programme Learning Outcomes

CLOs	PLO 1	PLO2	PLO 3	PLO4	PLO5	PLO6
CLO1	H	H	H	H	H	M
CLO2	H	H	H	H	H	M
CLO3	H	H	H	H	H	M
CLO4	H	H	H	H	H	M

H- High; M-Medium; L- Low

CORE PRACTICAL II -FOOD MICROBIOLOGY PRACTICAL (BF23CP2)-
Under DBT scheme

Total Hours: 45 **Credits : 3**

1. Introduction to microscope, use of autoclave and Laminar air flow system and Laboratory safety and Biosafety measures
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 methods for bacteria
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
12. Food bacterial count by biosensor techniques
13. To study bacterial growth curve
14. Visit to beverage industry

Pedagogy: Demonstration and hands on practicals

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 – Hi	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
1	Rangaswami, G	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 Delhi	1989

Course Designers:

1. **Dr. M. Guhapriya**
2. **Mrs. R. Sugantha**
3. **Ms. Santhiya R**
4. **Dr. M.C.Anitha**

COURSE NUMBER	COURSE NAME
BF23C05	CORE– V PROPERTIES OF FOODS

Category	L	T	P	Credit
Theory	73	2	-	3

Preamble

To enable the students to

- To impart knowledge related to various engineering properties of food materials
- To make aware related to the determination of the various engineering properties of food materials.
- To acquaint about the applications of engineering properties of foods in processing of foods and designing of equipments
- To make students able to suggest suitable alteration in the processing of the characteristics of food materials.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Discuss the concepts of engineering properties of food materials.	K1
CLO2	Understand and apply the engineering properties determination techniques for characterisation of foods.	K2
CLO3	Suggest the modifications in the processing line for maintaining the quality retention in processing of foods.	K3
CLO4	Apply the concept of engineering properties in the development of novel food processing techniques.	K4

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 V - PROPERTIES OF FOODS (BF23C05)

Syllabus 73 hrs

Unit I : Physical & Frictional Properties (15 hrs)

Physical Properties of food and measuring methods- Shape, size, volume, density, porosity and surface area. Structure of seeds & grains.

Basic concepts of friction in food materials, solid friction, rolling resistance, angle of repose and internal friction

Unit II : Rheological properties (15 hrs)

Introduction to rheology, Rheology of solids- Uniaxial stress, Young's modulus, Bulk modulus, Shear modulus, Rheology of liquid foods - Newton's law of viscosity, Viscous foods - Newtonian fluids , Non-newtonian fluids, Plastic fluids, Time dependant properties, Viscosity measurement - Capillary flow viscometer, Orifice type viscometer, Falling ball viscometer, Rotational Viscometer.

Unit III :Thermal & Electrical Properties (15 hrs)

Thermal Properties of Foods Definitions & significance- specific heat, enthalpy, conductivity and diffusivity, surface heat transfer coefficient.

Electrical Properties of Foods - Introduction , Electrical conductivity - Solid and liquid foods , Measurement of electrical conductivity.

Unit IV :Aerodynamic & Mechanical Properties (13 hrs)

Aerodynamic Properties of Foods - Drag coefficient, terminal velocity and their application in the handling and separation of food materials.

Mechanical properties related terms and their definition, Types of mechanical damage, causes of damage, Mechanical damage in grains, fruits & vegetables, Damage of food materials under static, impact and vibration.

Unit V: Magnetic & Electromagnetic Properties (15 hrs)

Introduction to magnetic properties of foods - Materials, Magnetization - Application of Magnetic field

forces, Magnetic resonance - Application of NMR.

Introduction to Electromagnetic Properties of foods - Electrical polarization, Microwave heating - Mechanism of microwave heating, Dielectric Properties - Conversion of microwave energy into heat, Microwave heating of foods, Application of electromagnetic field.

Text Book

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	. Shafiur Rehman	Food Properties Handbook	CRC Press Inc. New York	1995
2	Nuri N. Mohsenin	Physical Properties of Plant and Animal Materials	Gordon and Reach Science Publishers	1970
3	Nuri N. Mohsenin	Thermal Properties of Food & Agricultural materials	Gordon and Reach Science Publishers	1970
4	Sahay K M and Singh K K	Unit operations of Agricultural Properties	Vikas Publising House Pvt Ltd, New Delhi	2004

Reference Books

S. No	Authors	Title of the Book	Publishers	Year of P
1	M.A.Rao and S.S.H.Rizvi	Engineering Properties of Foods	Mercel Dekker inc. New York	1998
2	J.H.Prentice	Measurements in the Rheology of Food Stuffs	Elsevier Applied Science Publishers	1984

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

Course Designers:

1. **Ms.Sujithra.**

COURSE NUMBER	COURSE NAME
BF23A02	**ALLIED–II NUTRITIONAL BIOCHEMISTRY**

Category	L	T	P	Credit
Theory	73	2	-	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 behavior of hormones

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Introduce the concepts of metabolism of nutrients	K1
CLO2	Understand he properties of nucleic acids, characteristics of enzymes and functions of hormones.	K2
CLO3	Relate the reactions of metabolism with their functions	K3
CLO4	Explain the inborn errors	K4

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

ALLIED –II - NUTRITIONAL BIOCHEMISTRY (BF23A02) (73Hrs)

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)

UNIT-II Protein and amino acid Metabolism (15hrs)

Protein –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.

UNIT-III Lipid Metabolism (14 hrs)

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

UNIT-IV Enzymes (15 hrs)

Definition, classification, Mechanism of enzyme action- characteristics of enzyme active site. Coenzymes-Definition, classification, functions of action of co-enzymes- relation between vitamin and co-enzymes.) Isoenzymes – definition, Disorder of carbohydrate metabolism and inborn errors of metabolism

UNIT V Hormones (15 hrs)

Classification, functions, properties and chemical nature 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 hormone

Text Books

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	2nd 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	6th Edn., 1990
3	B.C. Rajbir Singh	Biochemistry	Mittal Publishers	1st 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

3. Dr. M.C. Anitha

COURSE NUMBER	Course Name
BF23AP2	ALLIED PRACTICAL – II Biochemistry Practical

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 Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Identify techniques for sugars and amino acids	K1
CLO2	Qualitatively estimate the sugars and amino acids	K2
CLO3	Quantitatively estimate the metabolites in blood sample and urine sample	K3

Mapping with Programme Outcomes

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

S- Strong; M- Medium; L-Low

ALLIED PRACTICAL II BIOCHEMISTRY PRACTICAL (BF23AP2)

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 heamoglobin 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 practical

Course Designers:

1. Dr. M. Guhapriya

2. Mrs. R. Sugantha

3. Dr. M.C. Anitha

Text Books:

S. No.	Authors	Title of the Book	Publishers	Year of
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	K. International(P) m Ltd	2007, 1st edn.
2	David T Plummer	An Introduction to Practical Biochemistry	Tata McGraw Hill	2007, 3rd edn.
3	Divya Shanthi, Sowbhagya Lakshmi	An easy guide for practical Biochemistry	Jaypee Brothers medical Publishers pvt. Ltd	2010

SEMESTER III

COURSE CODE	COURSE NAME	Category	L	T	P	Credit
BF23C06	Unit Operations	Theory	73	2	-	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

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the basic concepts of unit operations in food processing	K1, K2
CLO2	Outline the working principles of various equipment & methods	K2
CLO3	Demonstrate the significance of processing methods in unit operations	K3
CLO4	Apply the knowledge of various operation methods in food processing industry	K4

Mapping with Programme Learning Outcomes

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

S- Strong; M-Medium

UNIT OPERATIONS (BF23C06) (73 hrs)

Syllabus

Unit I Introduction to Unit operations (14 hrs)

Fundamentals of unit operation, 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 (14 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; oil expression and extractions- hydraulic press, screw press

Unit III Separation processes (15 hrs)

Definition and Introduction to Separation; Types of Separators 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 machines and its applications.

Filtration: Principles involved in filtration, membrane separation, Pressure and vacuum filtration.

Unit IV Drying and Evaporation (15 Hrs)

Drying – Theory of drying, Factors influencing drying rate, traditional and modern methods of drying and types of driers.

Evaporation - Basic principle, need for evaporation, design of evaporation system; retention time; types - single effect evaporator, multiple effect evaporators.

Unit V

Distillation & Crystallization (15 hrs)

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 Books

S.No	Name of the Authors	Title of the Book	Publishers	Year and Edition
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 and Edition
1.	Richardson,J.E.etal.,	Coulson & Richardson's Chemical Engineering" Vol.2 (Particle Technology & Separation Processes	5th Edition, Butterworth – Heinemann / Elsevier	2003
2.	McCabeW.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 Engineering	Mc GrawHill. 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

Blended learning, lecture by chalk & talk, power point presentation, e-content, problems, group

Course Designers:

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

COURSE CODE	COURSE NAME	Category	L	T	P	Credit
BF23CP4	Unit Operations Practical	Practical	-	-	45	3

Preamble

To enable the students to

- Gain knowledge on the basic principles of food processing techniques andits applications.
- Apply the skill of material balance and energy balance in unit operation processes.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Analyze the separation, collection and absorption efficiency of separators	K3
CLO2	Analyze performance evaluation of different types of mills and steam distillation process	K3
CLO3	Calculate the energy requirement and performance characteristics in size reduction process	K4
CLO4	Estimate the thermal efficiency of steam distillation	K4

Mapping with Programme Learning Outcomes

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

S- Strong; M-Medium

CORE PRACTICAL III –UNIT OPERATIONS PRACTICALS – BF23CP3 (45 Hrs)

Syllabus

1. Determination of density and porosity of food grains
2. Determination of drying characteristics of food materials.
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 CODE	COURSE NAME	Category	L	T	P	Credit
BF23C07	Fundamentals of Food Processing	Theory	58	2	-	3

Preamble

To enable the students to

- Understand about the production, harvesting & importance of different food commodities
- Gain knowledge on the ideologies of food processing
- Familiarize with importance of processing in food industries

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	To gain knowledge on basic trends and production of different food	K1, K2
CLO2	To know about the processing involved in processing of different food	K2
CLO3	To enable students to learn the different methods and techniques in processing	K3
CLO4	To study about the equipment used for processing of foods	K4

Mapping with Programme Learning Outcomes

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

S - Strong; M-Medium

Fundamentals of Food Processing (BF23C07) (58 hours)

Syllabus

UNIT I Cereal and Pulse Processing (13 Hrs)

Cereals – Properties of paddy, Varieties and quality characteristics. **Paddy** – parboiling, physico-chemical changes during parboiling. Milling of rice - traditional and modern methods. **Wheat & Maize** - Milling –basic concepts, products and by-products. **Millets** – milling methods of sorghum, finger millet & pearl millet

Pulses – pre-treatment and milling – methods (traditional & modern)

Grain storage methods - traditional and modern

UNIT II Fruits and Vegetable processing (12 Hrs)

Harvesting, Post harvest losses - causes, Processing: canning – principle and steps, problems in canned foods. Drying & dehydration – principles, drying curve, osmotic dehydration. Intermediate moisture foods – characteristics and importance. Minimal processing & Hurdle technology – principle techniques. Fruits and vegetable processing – ketchup/sauce, fruit bar, soup powder, dehydrated fruits and vegetables, fermented vegetables

UNIT III Nuts & Oilseeds processing (10 Hrs)

Handling and storage - processing of oil seeds - coconut, groundnut, sesame, sunflower; methods - traditional method - Ghani, expeller, hydraulic presser & modern method - solvent extraction of oil and refining. Processing of cashewnut, arecanut, walnut, hazelnut, almonds, pistachios

UNIT IV Dairy processing (10 Hrs)

Physico - chemical properties of milk constituents, quality evaluation of milk – processing of milk and milk products – milk powder, butter, cheese, ghee, yoghurt. Equipments – working principle of retort, pasteurizer, evaporator & condenser, boilers.

UNIT V Meat, Fish and Poultry processing (13 Hrs)

Meat – Sources of meat, Slaughtering – methods, ante mortem & postmortem changes, shelf life of meat. Processed meat products – cured, smoked, pickled, frozen, salted, canned and dehydrated meat.

Fish – cuts of fish, pre-preparation and processing of fish – curing, smoking, drying, chilling, salting,canning. & byproducts – fish oil, fish meal, fish silage, fish ambrigeris, fish squalene

Poultry – ante and post mortem inspection, Processing of poultry, different cuts of poultry meat

Egg – processing of egg products – frozen egg, egg powder (WEP,EYP,EWP)

Text Books

S.No	Name of the Authors	Title of the Book	Publishers	Year and Edition
1	B.Sivashankar	Food Processing &Preservation	PHI Learning	2009
2	Sukumar De	Outlines of Dairy technology	Oxford university Press	1980
3	Sahay, K. M. and K.K.Singh	Unit operation of Agricultural Processing	Vikas Publishing House Pvt. Ltd., New Delhi	2004
4	Srivastava, R.P. and Kumar,	S Fruit and Vegetable Preservation: Principles and Practices.	International Book Distributing Co. Lucknow	1998
5.	Nanda Vikas	Meat, Egg and Poultry	Tech Sar Pvt Ltd	2014

Reference books

S.No	Name of the Authors	Title of the Book	Publishers	Year and Edition
1.	P.Fellows	Food Processing Technology- principles & Practices	CRC press	2000
2.	Earle, R.L.	Unit Operations in Food Processing	Pergamon Press. Oxford. U.K	2003
3.	Chakraverty A, Mujumdar A.S, Raghavn G.S.V & Ramasamy H.S	Hand book of Post Harvest Technology	Marcel Dekker Press, USA	1998

Pedagogy

Blended learning, lecture by chalk & talk, power point presentation, e-content, group

Course Designers:

1. **Dr.N.Deepa Sathish**
2. **Ms. Sujithra.S**
3. **Ms. Santhiya R**
4. **Ms. Dharrshne S V**

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
TH23A34	**ALLIED - NUMERICAL AND STATISTICAL TECHNIQUES**	**THEORY**	**73**	**2**	**-**	**5**

Preamble

To

- present students the Basic concepts of Numerical Methods and Statistics.
- To enable the students to find the practical applications to the real world problems.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall basic Mathematics and Statistical concepts	K1

CLO2	Interpret results from the application of standard statistical and numerical methods.	K2
CLO3	Understand the concepts of Numerical differentiation and Theoretical distributions	K3
CLO4	Applying numerical and statistical methods to solve complex problem.	K3

Mapping with Programme Learning Outcomes

CLOs\PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	M	S	S	S
CLO2	S	S	M	S	S
CLO3	S	S	S	M	S
CLO4	S	S	S	S	M

S- Strong; M-Medium; L-Low

SEMESTER III – ALLIED - NUMERICAL AND STATISTICAL TECHNIQUES (TH23A34)
II B.Sc (FPTM)

Credits : 5 **Hours : 73**

Syllabus

Unit I **15 Hrs**

Solution of Linear Simultaneous Equations: Gauss elimination - **Gauss Jordan** - Gauss Jacobi methods - simple problems. **Interpolation: Newton Forward** and Backward Interpolation Formulae.

Unit II **15 Hrs**

Numerical Differentiation: Newton's Forward Difference - Newton's Backward Difference, **Numerical Integration**: Introduction: Trapezoidal rule, Simpson's 1/3 and 3/8 rules.

Unit III **15 Hrs**

Correlation analysis: Introduction - Significance of the study of correlation - correlation and causation - **Types of correlation** - Methods of studying correlation - Graphic method - Karl Pearson's coefficient of correlation - **Properties of the coefficient of the correlation** - Rank correlation coefficient - Features of Spearman's correlation coefficient, **Regression analysis**.

Unit IV **15 Hrs**

Probability: Introduction - probability defined - **Importance of the concept of probability** - Calculation of probability - Theorems of probability (statements only) – **Mathematical expectation**-Simple problems.

Unit V **13 Hrs**

Theoretical Distributions: **Binomial distribution - Poisson distribution and Normal distribution** (without derivations & proof).

Text Books

S.No	Author	Title of the book	Publishers	Year & Edition
1	B.S. Grewal	Numerical Methods in Engineering and Science with Programs in C & C++	Khanna Publishers	2014, XI
	Unit I : Chapter III &VII: 3.3:(3,4), 3.5:(1,2) &7.1-7.3 Unit II: Chapter VIII : 8.1, 8.2:(1,2),8.4,8.5:(I,II,III)			
2	S.P. Gupta	Statistical methods	Sultan Chand & Sons Publications	2005, XLXI
	Unit III: Volume I: Chapter 10,11.(pg: 329-341, 377- 412, 435- 454) Unit IV : Volume-II Chapter 1(till Baye's theorem) (pg: 751-771) Unit V : Volume-II Chapter 2 (pg:805-824, 826-834, 836-856)			

Reference Books

S.No	Author	Title of the book	Publishers	Year of Publication
1	P.A.Navanitham	Business Mathematics And Statistics	Jai Publishing Company	2003
2	S.C Gupta and V.K. Kapoor	Fundamentals of Mathematical Statistics	Sultan Chand & Sons Publications	2001
3	P.Kandasamy, K.Thilagavathy and K.Gunavathy	Numerical Methods	S.Chand and company LTD Reprint	2007
4	V.K.Kapoor	Fundamentals of Statistics	Applied Statistics Sultan Chand & Sons	2007

MOOC learning

https://nptel.ac.in/courses/111/107/111107105/

(Lectures by Prof. Ameeya Kumar Nayak and Prof. Sanjeev Kumar, Department of

Mathematics, Indian Institution of Technology Roorkee)

Lecture 02 Gaussian elimination with partial pivoting

Lecture 04 Jacobi and Gauss Seidel methods

Lecture 20 Newton's Forward Difference & Newton's Backward Difference

Lecture 34 Simpsons 1/3rd rule and 3/8 rule https://nptel.ac.in/courses/111/106/111106112/ (6 Lectures by Prof. G.Srinnivasan, Department of Management Studies, Indian Institution of Technology Madras)

Lecture 12 Probability

Lecture 13 Rules of probability

Lecture 19 Binomial distribution

Lecture 20 Poisson distribution

Note

Question paper setters to confine to the above text books only

Course Designer:

1. Mrs K.Sharmilaa, Assistant Professor

2. Mrs.S Aishwarya, Assistant Professor

COURSE CODE	COURSE NAME	Category	L	T	P	Credit
CS23SBGP	Generative- AI	Theory	44	1	-	3

Preamble

The objective of this course is to understand the breadth and depth of Generative Artificial Intelligence (Gen AI) and to impart knowledge on its ethical implications, practical applications, and emerging trends

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the fundamental concepts and ethical considerations of Generative AI.	K2
CLO2	Apply AI principles in practical settings using basic AI tools and platforms	K3
CLO3	Develop advanced skills in specialized AI applications such as text analysis, natural language processing, and image recognition.	K3
CLO4	Explore emerging trends in AI, integrating advanced AI tools into diverse professional practices.	K4

Mapping with Programme Outcomes

CLOs	PO1	PO2	PO3	PO4	PO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	S
CLO3	S	S	M	S	S
CLO4	S	M	S	M	S

S- Strong; M-Medium

SBS I: Gen-AI - CS23SBGP (45 Hrs)

Unit 1: Introduction to Gen AI (9 hours)

Understanding Gen AI: Definition and scope of Gen AI - Overview of its applications in various fields - Introduction to essential skills needed for Gen AI. Ethical Considerations: Discussion on ethical guidelines and responsible use of AI - Understanding the impact of AI on society and individuals.

Hands-on Activity: Exploring AI Tools

- Working with appropriate content creation Gen-AI tools to engage with ChatGPT to explore various subjects, simulate interviews, or create imaginative written content.
- Working with appropriate writing and rephrasing Gen-AI tools to drafting essays on designated topics and refining the content with improved clarity, coherence, and correctness.

Unit 2: Basic AI Concepts (8 hours)

Introduction to AI: Basic concepts and terminology of artificial intelligence - Examples of AI in everyday life - Real-world examples of AI applications in different domains. Machine Learning Basics: Understanding the principles of machine learning - Overview of supervised and unsupervised learning.

Hands-on Activity: Simple AI Projects

- Working with appropriate educational content creation Gen-AI tools to generate quizzes and flashcards based on classroom material.
- Working with appropriate language learning Gen-AI tools to practice and enhance language skills through interactive exercises and games across multiple languages.

Unit 3: AI in Practice (9 hours)

Text Analysis and Natural Language Processing (NLP): Introduction to NLP concepts and techniques - Hands-on exercises analyzing text data and extracting insights. Image Recognition and Processing: Basics of image recognition algorithms and techniques - AI Tools for Text and Image Processing

Hands-on Activity: Text and Image Projects

- Working with appropriate image processing Gen-AI tools to experiment with AI-generated images.
- Working with appropriate object recognition Gen-AI tools to identify various objects such as text, images, products, plants, animals, artworks, barcodes, and QR codes.

Unit 4: AI for Productivity and Creativity (9 hours)

AI-enhanced Productivity and creativity Tools: Overview of productivity and creativity tools enhanced with AI capabilities - Tips for integrating AI into daily tasks and workflows. AI and Jobs: Exploring how

AI impacts jobs and industries - Discussion on opportunities and challenges - Exploration of AI-powered creative tools and applications.

Hands-on Activity: Productivity and Creativity

- Working with appropriate content creation Gen-AI tools to generate interactive videos / blog posts / art / drawing / music and storytelling experience.
- Working with appropriate resume generation Gen-AI tools to create professional resumes efficiently.

Unit 5: Future of Gen AI and Final Project (9 hours)

Emerging Trends in Gen AI - Applications of Generative AI - Ethical and Societal Impact of Gen AI - Future Directions and Challenges - Case Studies in Generative AI.

Hands-on Activity: Trends in Gen AI

- Working with appropriate speech generation Gen-AI tools to customize synthetic speech for virtual assistance across different applications.
- Working with appropriate data analysis Gen-AI tools to perform data analysis, visualization, and predictive modeling tasks.
- Working with appropriate Gen-AI design tools to simplify the creation of visually appealing presentations.
- Working with appropriate website builder Gen-AI tools to develop professional websites with AI assistance.

Pedagogy

Demonstration of AI Tools, Lectures and Case studies.

Course Designer

1. **Mrs. S. Ponmalar**

COURSE CODE	COURSE NAME	Category	L	T	P	Credit
NM22DTG	Design Thinking	Theory	30	-	-	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 Learning 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 Learning Outcomes

CLOs	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

NM22DTG - DESIGN THINKING

Syllabus **(30 Hrs)**

UNIT – 1 **(6 Hours)**

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

UNIT – **(6Hours)**

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

UNIT – III **(6 Hours)**

Empathize: Definition - Listen & Empathize with the Customers and / or Users - Tools and Techniques

UNIT – IV **(6 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

Text Books:

S.No.	Author(s)	Title of the Book	Publisher	Year and Edition
1.	Christian Mueller-Roterberg	Handbook of Design Thinking Tips& Tools for how to design thinking	Amazon Kindle Version	2018
2	Gavin AmbrosePaulHarris	Design Thinking	AVA Publishing Switzerland	2010
3	Sambhrant Srivastavaand Vijay Kumar	A Text Book of DESIGN THINKING	Vayu Education of India	2022

Reference Books:

S. No.	Author(s)	Title of the Book	Publisher	Year and Edition
1	Maurício Vianna Ysmar Vianna Isabel K. Adler Brenda Lucena Beatriz Russo	Design Thinking - BusinessInnovation	MJV Press	2011
2	Moritz Gekeler	A practical guide to designthinking	Friedrich- Ebert-Stiftung	2019
3	J. Berengueres	The Brown Book of DesignThinking	UAE University College, Al Ain	2014

Blended Learning Links

UNIT	TOPICS	LINK
UNIT I	Introduction to Design Thinking	https://www.digimat.in/nptel/courses/video/10910 4109/L01.html
	Design Thinking skills	https://www.youtube.com/watch?v=b-9Id-Jt_PI
UNIT II	Principles & Basis of Design Thinking	https://youtu.be/6-NRiom8K9Y
	Design Thinking hats	https://www.youtube.com/watch?v=bc-BvFQDmmk
UNIT III	Empathize	http://acl.digimat.in/nptel/courses/video/109104109/L02.html http://acl.digimat.in/nptel/courses/video/109104109/L03.html https://youtu.be/ls2mqHs02B0
UNIT IV	Define	http://acl.digimat.in/nptel/courses/video/10910410 9/L04.html https://youtu.be/veixQsRnZZU https://youtu.be/6-bDSKZJEAM
	Ideate	http://acl.digimat.in/nptel/courses/video/109104109/L11.html http://acl.digimat.in/nptel/courses/video/109104109/L12.html http://acl.digimat.in/nptel/courses/video/109104109/L13.html
UNIT V	Prototype	http://acl.digimat.in/nptel/courses/video/10910410 9/L15.html
	Testing	http://acl.digimat.in/nptel/courses/video/109104109/L16.html http://acl.digimat.in/nptel/courses/video/109104109/L17.html http://acl.digimat.in/nptel/courses/video/109104109/L18.html http://acl.digimat.in/nptel/courses/video/109104109/L19.html

SEMESTER IV

COURSE CODE	COURSE NAME	Category	L	T	P	Credit
BF23C08	Food Processing and Preservation	Theory	73	2	-	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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the basic concepts of preservation and processing	K1,K2
CLO2	identify the different treatment methods employed in processing of food	K2,K3
CLO3	analyze the different methods of preservation using low temperature, high temperature and drying	K3
CLO4	Gaining knowledge on the recent techniques and advancements in processing and preservation	K2,K3

Mapping with Programme Learning Outcomes

CLOs	PLO1	POL2	PLO3	POL4	PLO5	PLO6
CLO1	S	S	M	M	M	M
CLO2	S	S	M	M	M	M
CLO3	S	S	M	M	M	M
CLO4	S	S	M	M	M	M

S - Strong; M-Medium

Food Processing and Preservation (BF23C08) (73 Hrs)

Syllabus

UNIT-I Basic principles of food processing and preservation (15 hrs)

Food preservation - Need, importance, principles and methods. Natural preservatives and chemical preservatives. Food Additives and Bio preservatives; Perishable and non perishable foods.; Food deterioration- causes.

Water activity - definition and factors affecting water activity in food and its significance in food preservation, concept of shelf life.

Food processing - Principles of heat and mass transfer- factors affecting – applications

Unit II Preservation by drying and high temperature (16 Hrs)

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

Use of high temperature- principle and equipments: Methods - blanching, pasteurization, sterilization, canning- procedure, aseptic canning

Unit III Preservation by low temperature (16hrs)

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. Thawing.

Zero energy cooling chamber (ZECC), Cellar storage

Unit IV Non Thermal Processing (16Hrs)

Introduction to recent preservation techniques - irradiation, pulsed electric field, high pressure technology, ohmic heating, microwave heating, hurdle technology, Ultrasound, Radio Frequency Pasteurization, Cold plasma, Ozone Technology

UNIT-V Recent Advances in Food Processing (10 hrs)

Classification of Food according to processing - Unprocessed or minimally processed foods, Processed culinary ingredients: Processed foods, Ultra-processed foods (UPFs). Real foods vs Processed foods and Ultra-processed foods.

Food Concentration- purpose, methods of concentration, changes during concentration, Intermediate moisture foods (IMF) and Plant based meat alternatives

Text Book

S.No.	Authors	Title of the Book	Publishers	Year of Publication and Edition
1	William C Frazier & Dennis C Westhoff	Food Microbiology	Tata McGraw Hill Publications	2013, 5th edition
2	Ramaswamy, H. S., and Marcotte, M.	Food Processing: Principles and Applications	CRC Press	2022, 5th edition
3	Norman W Desrosier James N Desrosier	The Technology of Food Preservation	CBS Publishers	2006, 4th edition
4	B. Sivasankar P	Food Processing and Preservation	PHI Learning Pvt. Ltd	2002, 1st edition
5	Fellows, P. J.	Food Processing Technology: Principles and Practice	Woodhead Publishing	2023, 5th edition

Reference Book

S. No	Authors	Title of the Book	Publishers	Year of Publication and Edition
1	Stewart GP and Amerine MA	Introduction to Food Science and Technology	Elsevier	2012, 2nd edition
2	Vickie AV	Essentials of Food Science	Springer Science & Business Media	2012, 4th edition
3	James M Jay	Modern Food Microbiology	Springer	2012, 5th edition
4	Chris van Tulleken	Ultra-Processed People: The Science Behind Food That Isn't Food	W. W. Norton & Company	2023, 1st edition

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

Course Designers:

1. **Dr.N.Deepa Sathish**
2. **Ms. Santhiya**

COURSE CODE	COURSE NAME	Category	L	T	P	Credit
BF23CP4	Food Preservation Practical	Core	-	-	45	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

CLO	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6
CLO1	S	S	S	S	S	S
CLO2	S	S	S	S	S	S
CLO3	S	S	S	S	S	S

S : Strong

Food Preservation Practical- BF23CP4 (45 hrs)

Syllabus

1. Drying of fruits and vegetables
2. Freezing of fruits and vegetables
3. Preparation of jam
4. Preparation of jelly
5. Preparation of marmalade
6. Preparation of syrups
7. Preparation of squashes
8. Preparation of pickles- salt based, oil based, vinegar based.
9. Preparation of sauces/ketchup and chutneys and chutney powders
10. Industrial visit to Food preservation and processing unit

Pedagogy: Demonstration and hands on practical

Text Books

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

Reference Books

S. No	Authors	Title of the Book	Publishers	Year of Publication and Edition
1	Sivasankar B.	Food Processing and Preservation	Prentice Hall of India Pvt. Ltd.	2005, 1st edition
2	P. Fellows	Food Processing Technology: Principles and Practice	CRC Press,	2000, 2nd edition
3	Shafiur Rahman M.	Handbook of Food Preservation	CRC Press	2007, 2nd edition
4	Ranganna S.	Handbook of Analysis and Quality Control for and Vegetable Products.	Tata-McGraw-Hill.	2001, 7th edition

Course Designers:

1. Dr.N.Deepa Sathish

2. Ms. Santhiya R

COURSE CODE	COURSE NAME	Category	L	T	P	Credit
BF23C09	Principles of Marketing	Theory	58	2	-	3

Preamble

- To understand the concepts of marketing in the business world.
- To assess the importance of marketing mix, market segmentation, branding, pricing, product mix, product life cycle.
- To analyze and select marketing channels of distribution in food business
- To adopt the latest marketing practices in modern business.
- To understand the importance of marketing analytics.

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 concepts of marketing, buyer behavior, branding, packaging, channel distribution and ethics in marketing	K1
CLO2	Recognize the importance of market segmentation, branding, pricing, product mix, product life cycle and its implications.	K2
CLO3	Apply the concepts of marketing mix, market segmentation, marketing channels, branding, pricing, packaging, labeling according to the recent trends.	K3
CLO4	Analyze the marketing mix, market segmentation, market channels and adopt latest E-marketing tools to enhance marketing decisions with paramount importance towards adopting ethics in marketing for the food products.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	M	S	S	S	S
CLO2	S	M	S	S	S
CLO3	S	S	S	S	S
CLO4	M	S	M	M	S

S-Strong; M-Medium

Principles of Marketing - BF23C09 **(58 Hours)**

Syllabus

UNIT – I **(12 Hours)**

Introduction to Marketing: Meaning and Nature of Marketing - Market – Objectives and Characteristics- Marketing Functions- ***Marketing Management- Elements of Marketing- mix*** -Ethical Marketing and Strategic Insights from Indian Knowledge System- Consumer Behaviour- Factors influencing Buyer Behaviour. Customer Relationship Management: ***** **Definition-Need, Importance*** & Types.

UNIT – II **(12 Hours)**

Market segmentation –Effective market segmentation strategy -Product: Definition, Characteristics, product mix - Product Classification- ***Product Life Cycle** *-New Product Development. Pricing: ***Pricing Objectives- Pricing Methods*.**

UNIT – III **(12 Hours)**

Branding and Packaging –***Brand identity*-** Brand image – Brand Loyalty -Types of brands, Brand vs Branding. Trade Mark. Packaging -***Definition and functions*** of food packaging-– Methods and materials used for packaging - Safety considerations in food packaging – Labelling: ***Purpose and function of Labelling***.

UNIT – IV **(11 Hours)**

Channel of Distribution: ***Channel Objectives-Channel Functions- Types of Channel***-Channel Selection- Factors affecting Selections of Marketing Channel for food industry -Marketing channel decisions. AI in Channel of Distribution.

UNIT – V **(11 Hours)**

Latest trend in marketing - E Marketing- Tele Marketing- Marketing Technology (MarTech) - Social media marketing- green marketing, AI powered chatbots - Marketing Analytics- Content Marketing- AR & VR intervention in food product marketing - Seasonal marketing for food products - Rural and Agricultural Marketing in India. ***Marketing Ethics in food industry***.

Note: * Highlighted Text offered in blended mode. (Links Provided)

Text Books:

SI. No.	Author(s)	Title of the Book	Publisher	Year & Edition
1.	Kotler-i & Mukharjee	Essentials of Modern Marketing	Vikas Publishing House	2024 1st edition
2.	C.N.Sontaki	Marketing Management	Kalyani Publishers	2022 7th edition
3.	Tapan K Panda	Marketing Management	Taxmann	2022 3rd edition

Reference Books:

SI. No.	Author(s)	Title of the Book	Publisher	Year & Edition
1.	Philip Kotlerand Kevin Lane Keller	Marketing Management	Pearson Education, New Delhi	2022 16th edition
2.	Seema Gupta	Digital Marketing	McGraw Hill	2022 3rd edition
3.	Ramasamy and S. Namakumari	Marketing Management	Saga Publication India Pvt Ltd	2018 6th edition
4	Rajan Nair	Marketing Management	Sultan Chand and SonsNew	2018 1st edition

Blended Learning Links

Sl. No.	Units	Topics	Links
1.	Unit-I	Marketing Management	https://www.youtube.com/watch?v=TL0K0AhI7kE
2.		Elements of Marketing mix	https://www.youtube.com/watch?v=dV1LbZg0if4 https://www.youtube.com/watch?v=018ywRj7WF8&feature=emb_imp_woyt
			NPTEL Video: http://www.digimat.in/nptel/co

3.		Customer relationship Management: Definition, Need, Importance.	urses/video/110105145/L01.ht ml https://www.youtube.com/watc h?v=9S9proEmevU
4.	Unit- II	Product life cycle, Pricing: Objectives and methods	https://www.youtube.com/watc h?v=zUTmwdGX4Sg https://www.youtube.com/watc h?v=LX8VMdFwxro
5.	Unit – III	Packaging: Definition and functions Labelling: Purpose and function	https://www.youtube.com/watc h?v=HYkHVX_g_7w
6.		Brand identity	https://www.marketing91.com/ brand-identity/ https://www.youtube.com/watc h?v=uq8hlvuFA54&featur e=emb_imp_woyt https://www.youtube.com/watc h?v=aucfhUZhMMk
7.	Unit-IV	Channel Objectives, Functions and Types of Channels	https://youtu.be/TnMzqaX_5Uw? si=PGT5DHxy0cWvtyCs
8.	Unit -V	Marketing Ethics	https://www.youtube.com/watc h?v=G0K9HpIPlR8

Pedagogy:

Chalk & Talk, lecture, Seminar, PPT, Group Discussion and Case Study. (Case Study – Internal evaluation only)

COURSE CODE	COURSE NAME	Category	L	T	P	Credit
BF23A04	Bakery and Confectionery Technology	Theory	73	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 and to describe and plan to set up a bakery unit	K4

Mapping with Programme Learning Outcomes

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

S - Strong; M-Medium

Bakery and Confectionery technology (BF23A04) **(73Hrs)**

Syllabus

Unit I Classification of Bakery Product (12 hrs)

Introduction to Indigenous and Modern 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 and tools used for manufacturing of bakery products. Bakery layout and design.

Demonstration of pastry products

Unit II Manufacturing of Bread and Cakes (16 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. Icing. Cake faults and remedies.

Demonstration of breads and cakes

Unit III Manufacturing of Biscuit and Cookies (16 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.

Demonstration of biscuits and cookies

Unit IV Confectionery and its types (16 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).

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

Demonstration of confectionaries

Unit V Manufacturing of Chocolates (13hrs)

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.

Demonstration of chocolates

Text Book

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication and Edition
1	Wang, H., and Xu, Y.	Handbook of Bakery and Confectionery Technology	CRC Press	2023, 2nd edition
2	Galli, M., and Rosell, C. M.	Bakery Products: Science and Technology	Wiley-Blackwell	2022, 3rd edition
4	Ferenc A. Mohos	Confectionery and Chocolate Engineering: Principles and Applications	Wiley Blackwell	2010, 2nd edition

Reference Books

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

Pedagogy

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

Course Designers:

1.Dr.N.Deepa Sathish

2.Ms. Santhiya R

SEMESTER V

COURSE CODE	COURSE TITLE	Category	L	T	P	Credit
BF23C10	Food Biotechnology	Theory	73	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.
- 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

CLO Number	CLO Statement	Knowledge Level
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 and applying different applications of biotechnology in food processing and production	K4

Mapping with Programme Learning Outcomes

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

S- Strong; M-Medium

FOOD BIOTECHNOLOGY (BF23C10) **73 Hours**

Syllabus

UNIT I: **Recombinant DNA Technology** **16 Hours**

Introduction of recombinant DNA, DNA modifying enzymes: Restriction enzymes and other modifying enzymes, Cloning vectors, Steps in gene cloning, Application of rDNA technology in food processing GMOs - current guidelines for the production, labelling and traceability; trade related aspects.

UNIT II: **Biotechnology in food Processing** **13 Hours**

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

UNIT III: Prebiotics and Probiotics **15 Hours**

Prebiotics - Definition, types of prebiotic, bifidogenic effects, health effects of prebiotics and probiotics, synbiotics. Bacterial food additives and dietary supplements.

Probiotics – Definition, potential benefits, Specific strains, advantages and disadvantages.

Bioactive peptides – Definition, Production, types & function

UNIT IV: Enzymes in Food Production **14 Hours**

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

UNIT V: Fermenters **16 Hours**

Design of a Fermenter: Construction and working principle – Temperature controls, Aeration and agitation systems, Stirrer glands and bearings, Baffles, Valves and steam traps, Pressure-control valves.

Types of fermenters – batch and continuous, Airlift, Packed Bed, Fluidized Bed, Membrane, Bubble Column

Biosensors: Classification and application in food industry

Textbooks

S. No	Name of the Authors	Title of the Book	Publishers	Year and Edition
1	H. J. Peppler, D.Perlman	Microbial Technology: Fermentation Technology.	Academic Press.	2018,2nd Edn
2	S.C. Bhatia.	**Food Biotechnology**	Springer	2019, 2nd Edn
3	Kalidas Shetty and Dipayan Sarkar	**Functional Foods and Biotechnology: Biotransformation and Analysis of Functional Foods and Ingredients**	CRC Press	2020, 1st Edn
4	Robert J. Whitehurst and Maarten van Oort	Enzymes in food Technology	Wiley - Blackwell	2010, 1st Edn

Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year and Edn
1	Chetan Sharma, Ajay Kumar, and Ramesh C. Ray.	**Frontiers in Food Biotechnology**	Elsevier	2023, 1st Edn
2	Celeste M. Todaro, Henry C. Vogel.	Fermentation and Biochemical Engineering Handbook.	William Andrew Press.	2022, 2nd Edn

Blended learning links:

S. No.	Unit	Topics	Links
1.	I	Recombinant DNA Technology	https://youtu.be/5ffl-0OYVQU?si=kX7RrE-_d5I7tj4r
2.	II	Biotechnology in food Processing	https://youtu.be/NWdJQQP_zHM?si=1fQUQO1pibyD4usQ
3.	III	Prebiotics, Probiotics, Symbiotics & synbiotics	https://youtu.be/wYi0b5js2Fg?si=qqpEbG-HF32Gb_CZ
4.	IV	Enzymes in Food Production	https://youtu.be/577TUF51FAY?si=BUdJt-JUfxr4F1Bs
5.	V	Fermentors	https://youtu.be/azdVSr7DBlg?si=SjpaJteg7I80fCSc
			http://ecoursesonline.iasri.res.in/mod/page/view.php?id=51

Pedagogy

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

Course Designers:

1. **Ms Santhiya R**

COURSE CODE	COURSE TITLE	Category	L	T	P	Credit
BF23C11	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 and evaluating the behavior of market segment and end user	K3
CLO4	Apply the principles in food product development and design and develop entrepreneurial skills	K4

Mapping with Programme Learning Outcomes

CLOS	PLO1	PL O2	PLO 3	PL O4	PLO 5	PLO 6
CLO1	S	S	S	S	S	S
CLO2	S	S	S	S	S	M
CLO3	S	S	S	S	S	S
CLO4	S	S	S	S	M	S

S - Strong, M-Medium

FOOD PRODUCT DEVELOPMENT (BF23C11) 58 Hours

Syllabus

Unit I- Food consumption pattern and Consumer behavior 10 Hours

Trends in Food Consumption pattern. Economical, Psychological and Sociological Dimension of Food Consumption patterns. Trends in Social Change as a Base for New Product Development**.** Need of new product development

Consumer behaviour- Meaning, understanding consumer behavior, Models of consumer behavior, Determinants and Factors influencing of Consumer Behavior: consumer and food relationship, Consumer satisfaction

UNIT II New Product Development 11 Hours

Food Components, Types of Food Processing, Status of Food Processing Industry in India and Scope of Growth in Future

Defining new food products, classification and characterization of New Food Products. Principles and Purpose and Steps in New Product Development, Product Design and Specifications.

UNIT III Standardization and Evaluation of New Product 12 Hours

Standardization, Portion size, Portion Control, Quantity Cooking Evaluation of new product - Nutritional, Sensory, (types of sensory tests – Analytical tests, Affective tests (preference and Acceptance tests) Development of score card), Shelf life, Cost calculation and SWOT Analysis

Unit IV Different types of foods in Market and Packaging 14 Hours

Traditional Foods, Weaning Foods, Convenience Foods, RTE, RTS, Extruded foods, IMF Foods, Speciality Products, Nutritional Supplements, Functional Foods, Nutraceuticals and Designer Foods, Sports Foods, Foods for Defence and Space foods. Suitable Packaging Materials for Different Foods-Types, Selection evaluation

UNIT V Funding Agencies, Marketing and Legal specifications 11 Hours

Institutional Support (Training and Finance) for Entrepreneurship Development. Financial Institutions (Central and State Government) banks/Funding Agencies; Marketing Strategies, Market Research, and Product sales and Advertising Methods.

Product License, Intellectual Property Rights (IPR), Copy Right, Patent and Trademark : - Definition, types and registration.

Text Books

S.No	Name of the Authors	Title of the Book	Publishers	Year and Edition
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 and Edition
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

References:

1. HarryT.Lawless, Hildegarde 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.N.Deepa Sathish**
2. **Ms. Santhiya R**

COURSE CODE	COURSE TITLE	Category	L	T	P	Credit
BF23E01	Convenience Foods	Theory	58	2	-	3

Preamble

To enable the students to

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

Course Learning Outcomes

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	K3
CLO3	Understand the different equipment used in the snack food industry	K4
CLO4	Perceive the microbial, toxicological aspects and safety of convenience foods	K5

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

Mapping with Programme Learning Outcomes

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

S - Strong; M-Medium

ELECTIVE I CONVENIENCE FOODS (BF23E01) 58 Hours

Syllabus

Unit I: Market trends of convenience foods 11 Hours

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 13 Hours

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 12 Hours

Equipment used in manufacturing of RTC and RTE, Heat transfer mechanism, specialized 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., AI based 3D printing in convenience food manufacturing.

Unit IV Extruded Products and it's Technology 12 Hours

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 10 Hours

Food – borne pathogens in convenience foods and its Microbial safety, AI sensors for microbial detection.

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

Text Books

S.No	Name of the Authors	Title of the Book	Publishers	Year and Edition
1.	Gordon Young and Dennis Forte	Food and Feed Extrusion Technology: An Applied Approach to Extrusion Theory	Food Industry Engineering	2021, 2nd Edn
2.	Hari Niwas Mishra, Pradyuman Kumar and Ajay Singh	Recent Advances in Ready-to-Eat Food Technology	CRC Press	2024, 1st Edn
3.	Sergio O. Serna-Saldivar	Snack Foods: Processing, Innovation, and Nutritional Aspects	CRC Press	2022, 1st Edn
4.	Dr. Prerana Shere and Dr. Rinku Agrawal	Extrusion Technology: Transforming Food Processing	B P International	2024, 1st Edn

Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year and Edition
1.	Alagi Parvarti	Convenience Foods Technology	Self Publisher	2023, 1st Edn
2.	Suvendu Bhattacharya	Snack Foods: Processing and Technology	Academic Press Inc	2022 ,1st Edn

E- Resources

- 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://www.globalmediajournal.com/open-access/role-relevance-and-significance-of-convenience-food-a-literature-review-approach.pdf

S. No.	Unit	Topics	Links
1.	I	Classification of convenience foods	https://youtu.be/Y61csMI0h54?si=v8SJ4Khnip_8cXxG
2.	II	Healthy breakfast cereals	https://youtu.be/X3goPrQKE20?si=JDLY7u71P4XbjX0e
3.	III	3D Printed Foods manufacturing	https://youtu.be/uqqB5aTE5kM?si=f7BEEmmsR0_Y3OB7
4.	IV	Extrusion process	https://youtu.be/sod2fxPAS7I?si=5bKU9KQgnrAkNG8t
5.	V	Food borne pathogens	https://youtu.be/-lcad4oaR9w?si=a8hr-2A2qqVP2NYw

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

Course Designers:
1. Dr.N. Deepa Sathish
2. Mrs. Amrutha B. Nair

COURSE CODE	COURSE TITLE	Category	L	T	P	Credit
BF23E02	Food Entrepreneurship	Theory	58	2	-	3

Preamble

To enable the students to

- Acquire knowledge about importance of food business
- Aware of various ventures safety
- Familiarize the methods of developing an entrepreneurial setup

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 entrepreneurs, objectives, ventures	K1
CLO2	To gain knowledge about the systems and organization's involved in entrepreneurial setup	K2
CLO3	Recognize the location significance and the organizations in entrepreneurial development	K3
CLO4	Understand about the market potential , financial, demand and feasibility analysis	K4

Mapping with Programme Learning Outcomes

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

S- Strong; M-Medium

FOOD ENTREPRENEURSHIP (BF23E02) 58 hours

Syllabus

Unit I Introduction to Food Entrepreneurship **12 Hours**

Entrepreneurship: Meaning, definition and concepts, characteristics, functions, entrepreneurial traits. Types of entrepreneurs - Women entrepreneurship, significance, problems

Food Entrepreneurship, role of food entrepreneur in economic development, Challenges and factors affecting food entrepreneurial growth.

Unit II Entrepreneurship Development Program **11 Hours**

Objectives, Steps, Need for training- target group- Contents of the training program. Special Agencies for Entrepreneurial Development and Training

Unit III Entrepreneurial Plan **12 Hours**

Project Meaning, Features, Classification, Project identification, Stages in project identification, Project Life Cycle, Project formulation- Elements, Feasibility Analysis- Economic, Marketing, Financial and Technical, Demand Analysis, Market Potential Measurement, use of artificial intelligence in market research.

Unit IV: Setting up of micro small and medium food enterprises **12 Hours**

Setting up of micro small and medium enterprises, Selection of factory location, location significance, Green channel, Bridge capital, Seed capital assistance, Margin money scheme, Causes, Remedies.

Unit V: Role of institutions in food entrepreneurial development **11 Hours**

Institutional support for new ventures- Supporting organizations, Incentives and facilities, Financial institutions and small scale industries, Government Policies, IPR, Patent, Copyright and Trademark

Text Books

S.No	Name of the Authors	Title of the Book	Publishers	Year and Edition
1.	K P Sudheer, V. Indira	Entrepreneurship Development in Food Processing	CRC Press	2021,1st Edn
2.	Dr Bhaskar Bora	Culinary Entrepreneurship: Starting and Managing Food Businesses	IP publishers	2024, 1st Edn

Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year and Edition
1.	Michael Politz	The Food and Beverage Magazine Guide to Restaurant Success-The Proven Process for Starting Any Restaurant Business From Scratch to Success	Wiley	2020, 1st Edn
2.	Douglas Raggio and Heidi Scott	So You Wanna: Start a Food or Beverage Business	Simon And Schuster Group USA	2022, 23rd Edn

S. No.	Unit	Topics	Links
1.	I	How to Become a Food Entrepreneur	https://youtu.be/2gY2Svhjbfg?si=QU6DbtP6iJ9rWQpw
2.	II	Entrepreneurial Development Programme	https://youtu.be/HGds1_uViU0?si=r3vRpbVyHgk6XrzI
3.	III	Artificial intelligence in market research	https://youtu.be/1PghNoTfTaI?si=bf78iCk7e57T_xzx
4.	IV	Micro, Small & Medium Enterprises	https://youtu.be/ESWj2bDLZJo?si=nYZoUkk1DsUVanTl
5.	V	Role of institutions for financial support to entrepreneurs	https://youtu.be/_bN9plcE1Jw?si=2cxSS9T4ZI5NOl__

Pedagogy

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

Course Designers

1. **Dr.N.Deepa Sathish**
2. **Ms. Santhiya R**

\

COURSE CODE	COURSE TITLE	Category	L	T	P	Credit
BF22CP5	Food Processing and Food Bioprocessing Practical	Theory	-	-	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

CLO Number	CLO Statement	Knowledge Level
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 and access the characteristics of microorganisms	K4
CLO4	Apply the processing techniques in developing bioprocessed foods	K4

Mapping with Programme Learning Outcomes

CLOs	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6
CLO1	S	S	S	S	S	S
CLO2	S	S	S	S	S	S
CLO3	S	S	S	S	S	S
CLO4	S	S	S	S	S	S

S- Strong

CORE PRACTICAL- V

Food Processing and Food Bioprocessing practical (BF22CP5)

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 yoghurt
   b) Kefir
   c) Bulgarian buttermilk
   d)Cheese
4. Studies on Minimal Processing of fruits and vegetables.
5. Preparation and calculation of overrun percentage of ice cream.
6. Experiment on osmotic dehydration characteristic of food materials (fruit preserves)
7. Studies on Textural Profile Analysis of Baked goods.
8. Preparation & sensory analysis oriental fermented products:-
   a)Tempeh b) Tofu
9. 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)
10. Qualitative assessment of Extracellular activities of microorganisms- amylase, gelatinase, lipase, caseinase (Demonstration)
11. Isolation of Plasmid DNA and Analysis by Agarose Gel Electrophoresis (Demonstration)
12. 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 and Edition
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 CODE	COURSE TITLE	Category	L	T	P	Credit
BF23CP6	**Food Product Development and Marketing Practical**	**Practical**			**60**	**3**

Preamble

To enable the students to

- Identify suitable food groups for developing products
- Understand the steps involved new food product development with standardization
- Learn marketing techniques and launch the developed products

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Categorize appropriate food groups for the development of innovative food products and preservation techniques based on nutritional value, consumer demand, and functional characteristics	K1
CLO2	Demonstrate the process of food product development, from ideation and formulation to preparation and sensory evaluation	K2
CLO3	Apply principles of food packaging, labeling, and cost analysis to enhance shelf life, appeal, and regulatory compliance.	K3
CLO4	Design and implement a marketing strategy for a developed food product, including branding, promotion, and pricing.	K4

Mapping with Programme Learning Outcomes

CLOS	PLO1	PL O2	PLO 3	PL O4	PLO 5	PLO 6
CLO1	S	S	S	S	S	S
CLO2	S	S	S	S	S	M
CLO3	S	S	S	S	S	S
CLO4	S	S	S	S	M	S

S - Strong, M-Medium

Food Product Development and Marketing Practical (BF23CP6) 58 Hours

Syllabus

A. Product Development and Standardization

1. Cereal Based Foods
2. Pulse Based Foods
3. Fruit Juices, Squash, Jams and Preserves
4. Pickles, Ketchup, Sauce
5. Weaning Foods
6. Health Foods and Nutritional Supplements
7. Convenience foods, RTS and RTE foods

B. Marketing of a product

1. Selection of a product, preparation, standardization, and quality cooking
2. Selection of packaging material, labeling, cost calculation and marketing
3. Presentation of report

Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year and Edition
1	Naik, H.R., & Amin, T.	Food Processing and Preservation	CRC Press. https://doi.org/10.1201/9781003243250	2021,1st Edn
2	Carpenter Lyon & Hasdell	Guidelines for Sensory Analysis in Food Product Development and Quality Control	Springer	2000
3	Earle, M. D., Earle, R.L.& Anderson,A.M	Food product development	Boca Raton, Fla: CRC Press	2001
4	Gordon L Robertson	Food Packaging: Principles and Practice	2nd Ed. CRC Press	2006
5	V.K. Joshi	Sensory science- Principles and Applications in Food Evaluation	Agrotech Publishing Academy, Udaipur	2006
6	Harper J.M.	Extrusion of Foods Vol. 1 & 2	Boca Raton, Aorida, CRC Press, Inc	1991
E Resources: https://iastate.pressbooks.pub/foodproductdevelopment				

Course Designers:
Dr. N. Deepa Sathish

COURSE CODE	COURSE TITLE	Category	L	T	P	Credit
BF23SBP1	Food Analysis Practical	Theory	-	-	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

CLO Number	CLO Statement	Knowledge Level
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

CLOs	PLO1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6
CLO1	S	S	S	S	S	S
CLO2	S	S	S	S	S	S
CLO3	S	S	S	S	S	S
CLO4	S	S	S	S	S	S

S- Strong

SKILL BASED SUBJECT – Food Analysis Practical (BF23SBP1)

Total hours: 45 **Credits :3**

1. Determination of pH of food samples using pH meter
2. Determination of moisture content
3. Determination of total ash in food samples.
4. Estimation of vitamin A in food samples.
5. Estimation of Ascorbic acid in food samples.
6. Estimation of calcium in food samples
7. Estimation of iron
8. Estimation of phosphorus
9. Determination of total phenols
10. Determination of total antioxidant capacity
11. Hands on Training/Short term course/Certificate course in Institution/Industry

Text Books

S.No	Name of the Authors	Title of the Book	Publishers	Year and Edition
1	A.Y.Sathe`	A first course in food Analysis	New Age International Publishers	2016, 2nd Edn
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	2011, 9th Edn
3.	S. Suzzane Neilsen	Introduction to the chemical analysis of foods	CBS	2010, 2nd Edn

Reference Books

S.No.	Authors	Title of the Book	Publishers	Year and Edition
1.	Pomrenz Y & Meloan CE	Food Analysis- Theory and Practice.	CBS	2007 ,3rd Edn
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	2020 ,2nd Edn
3.	David T Plummer	An Introduction to Practical Biochemistry	Tata McGraw Hill	2019 ,4th Edn

E References

https://nptel.ac.in/content/storage2/courses/122101001/downloads/le c-38.pdf
http://www.egyankosh.ac.in/bitstream/123458789/15897/1/Experimen t-12.p

Course Designers

1. **Ms Santhiya R**

COURSE CODE	COURSE TITLE	Category	L	T	P	Credit
BF23AC1	Environmental Issues in Food Industry	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

CLO 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	Summarize the methods of used in treatment of food industry waste and waste water treatment	K3
CLO4	Recognize the methods of utilizing wastes to make value added products	K4

Mapping with Programme Learning Outcomes

CLOS	PLO 1	PLO 2	PLO 3	PL O4	PLO 5	PLO 6
CLO1	S	S	S	S	S	S
CLO2	S	S	S	S	S	M
CLO3	S	S	S	S	S	S
CLO4	S	S	S	S	M	S

S- Strong; M- Medium

ALC I Environmental Issues in Food Industry (BF23AC1)

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; **Indoor Air Quality (IAQ);** 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. **Advanced Treatment Methods- membrane bioreactors (MBR), constructed wetlands,** and **advanced oxidation processes (AOP)**

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, Vermicomposting 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 and Edition
1.	H. Panda	The complete book on managing food processing industry waste	Asia Pacific Business Press Inc.	2020,2nd Edn
2.	Roday, S	Hygiene and Sanitation in Food Industry	Tata McGraw – Hill Publishing	2012, 2nd Edn
3.	Moorthy, C.K.	Principles and Practices of Contamination Control and Clean rooms	Book Syndicate	2014, 2nd Edn
4.	Potter, N. and Hotchkiss, J.H.	Food Science	CBS	2008, 5th Edn

Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year and Edition
1.	Wilson, C.L.	Microbial Food Contamination	CRC Press	2016, 2nd Edn
2.	Hester, R.E. and Harrison, R.M.	Food Safety and Food Quality", (Issues in Environmental Science and Technology),	RSC	2016, 2nd Edn
3.	V.K. Joshi and S.K. Sharma	Food Processing Waste Management : Treatment and Utilization Technology	New India Publishing Agency	2011, 1st Edn

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

Course Designers:

1. Ms. Santhiya R

COURSE CODE	COURSE TITLE	Category	L	T	P	Credit
BF23AC2	**Food Supply Chain**	**Theory**	**-**	**-**	**-**	**5***

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 and understand the application of supply chain management in various sectors and the quality standards	K4

Mapping with Programme Learning Outcomes

CLos	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6
CLO1	S	S	S	M	S	S
CLO2	S	S	S	M	S	S
CLO3	S	S	S	M	S	S
CLO4	S	S	S	M	M	M

S- Strong; M-Medium

Food Supply Chain (BF23AC2)

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, **Agriculture 4.0**: Digital Transformation in Agriculture 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

Globalization vs. Local Sourcing. International food supply chains, Factors affecting the future of International food systems, Managing challenges in International food supply chains, global supply chain disruptions on 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 and Edition
1	Chopra, S., and Meindl, P.	Supply Chain Management Strategy, Planning and Operation	Pearson Education	2023, 7th Edn
2	Pullman, M., and Wu, Z.	Food Supply Chain Management: Economic, Social and Environmental Perspectives	Taylor & Francis Group	2011, 1st Edn
3	Raghuram, G.,and Rangaraj, N.	Logistics and Supply Chain Management: Cases and Concepts	Macmillan	2015, 2nd Edn
4	Simchi, L.D., Kaminski. P., and Simchi, L.E.	Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies	Irwin/McGraw- Hill	2014, 3rd Edn

Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year and Edition
1	Janat, S.	Supply Chain Management: Text and Cases	Pearson Education	2015, 2nd Edn
2	Sanders N R	Supply chain management: A global perspective	Wiley publications	2016 ,2nd Edn

Pedagogy

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

Course Designers:
Ms. Santhiya R