PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR
SALEM - 636 011

SYLLABUS FOR

B.Sc. Food Technology

CHOICE BASED CREDIT SYSTEM
OUTCOME BASED EDUCATION

(For Candidates admitted in the Colleges affiliated to Periyar University from 2021 - 2022 onwards)

CONTENTS

		Microbiology Practical	
NON-MAJOR ELECTIVE COURSES (For Other Major)			
III		***NMEC I*** Food Preservation	
IV		***NMEC II*** Food Safety Initiatives	

REGULATIONS

1. Preamble:

B.Sc. Food Technology curriculum has been structured in compliance with UGC Model curriculum and TANSCHE guidelines. Core courses addresses the science of food, food chemistry, food engineering, food processing and food preservation, food safety and quality assurance, food innovation, food packaging, technology of cereals, pulses, oilseeds, fruits, vegetables, egg, milk, fleshy foods, spices and condiments and food entrepreneurship. The programme empowers the capacity of the students as per the job role specific requirements of food industries.

2. Eligibility for Admission

Candidates for admission to the first year of the Degree of B.Sc. Food Technology shall be required to have passed the Higher Secondary Examinations conducted by the Government of Tamil Nadu or any other equivalent examination.

As per Government Order (2020-2021) G.O.(1D) No.110, Higher Education (G1) Department, dated 18.07.2020.

- **General Stream:** Chemistry with Science subjects like Biology/Home Science/Botany and Zoology/Computer Science/Computer Applications/Microbiology/Food Service Management/Nutrition and Dietetics
- **Vocational Stream:** Agriculture/Home Science/Engineering and Technology

3. Eligibility for the Award of the Degree

A candidate shall be eligible for the award of the Degree only if she has undergone the prescribed course of study for a period of not less than three academic years, passed the examinations of all the six semesters prescribed.

4. Course of Study

The main streams of study for B.Sc. Food Technology shall consist of the following:

PART-I: Tamil / Other languages

PART-II: English

PART -III: Core Courses, Elective Courses and Allied Courses
PART-IV: SBEC*/ NMEC**/Add-on course / EVS***/ Value Education
PART-V: **Extension Activities:** NSS / NCC / Sports / YRC and other Extracurricular activities offered under part V of the programmes

*Skilled Based Elective Course
** Non Major Elective Course
*** Environmental Science

Non major elective course may be chosen by other stream students of the respective colleges and the same must be communicated to the University.

5. Examinations

Semester pattern is adopted for examinations. Candidates failing in any course will be permitted to appear for such failed course at subsequent examinations. Examinations for I, III and V semesters will be held in November/ December and for II, IV and VI semesters will be held in April / May month of every year.

Requirement to appear for the examination A candidate shall be permitted to appear for the university examinations for any semester (practical/theory) if he / she secure not less than 75% of attendance in the number of working days during the semester.

6. Passing Minimum

A candidate who secures not less than 40% in the End Semester Examination (ESE) and 40% marks in the ESE and Continuous Internal Assessment (CIA) put together in any course of Part I, II, III & IV shall be declared to have passed the examination in the course (Theory or Practical).

7. Classification of Successful Candidates

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in First Class. All other successful candidates shall be declared to have passed in the Second Class. Candidates who obtain 75% of the marks in the aggregate shall be declared to have passed the examination in First Class with Distinction provided they pass all the examinations prescribed for the course at the first appearance. Candidates who pass all the examinations (Part I, II, III & IV) prescribed for the course in the **FIRST APPEARANCE ITSELF ALONE** is eligible for ranking.

8. Maximum Duration for the completion of the programme:

The maximum duration for completion of the UG Programme shall not exceed twelve semesters (6 years).

9. Commencement of this Regulation:

These regulations shall take effect from the academic year 2022-2023, i.e. for students who are to be admitted to the first year of the B.Sc.Food Technology programme during the academic year 2022-2023 and thereafter.

10. Pattern of Question Paper (All Courses)

Time : 3 Hours Maximum:75 Marks

Part A : 15 x1 =15 (Multiple Choice) (Three questions from each unit)

Part B : 2 x 5 = 10 (Any Two questions) (One question from each unit)

Part C : 5 x 10 = 50 (One question from each unit with internal choice)

11. Evaluation Pattern for Continuous Internal Assessment (CIA)

11A. THEORY COURSES

Component	Time	Appearing marks	CIA marks	Minimum Pass
Test I	2 hours	50	5	40 %
Test II	2 hours	50	5	40 %
Assignment (minimum 2) Assignment 1 - Problem Based Activities Assignment 2 - Field/Industrial Visit Reports		10	10	40 %
Student Seminar with power point presentation		5	5	40 %
Total Marks for CIA		115	25	10
Total Marks for ESE		75	75	30
Minimum attendance for each theory course to appear for ESE				75%

11B. PRACTICALS

Component	Appearing marks (Average)	CIA marks	Minimum Pass
Performance in each experiment	10x5 = 50	20	40 %
Internal Practical Test 1	60	10	40 %

Internal Practical Test 2	60	10	40 %
Total Marks for CIA	170	40	16
Total Marks for ESE	60	60	24
Minimum attendance for each practical course to appear for ESE			75%

Programme Specific Outcomes

PO1. KNOWLEDGE

Students will be able to

- define and disseminate the updated food technology related information to the society
- recognize the traditional practices, cultural beliefs and ethos in food production, processing and supply to the market

PO2. SKILLS

Students will be able to

- address the skill gap in the divisions of food industrial sector and food business operations
- apply the scientific methods and techniques, as well as quality management processes related to food technology.
- Innovate unique solution to solve the problems in the food industries and food supply chain management
- administer the SDGs and food related societal issues using sustainable models
- naturalizes the food plant layout and design, manufacturing protocol, HACCP implementation and complete quality assurance of food business operation

PO3. COMPETENCIES

Students will be able to

- guide and supervise effectively the entire process of food manufacturing unit with coordination
- train and empower the food handlers with good attitude and ethos
- apply technical knowledge acquired in the field of food technology in his career platforms confidently with professional ethics.

SEMESTER WISE CURRICULUM FRAMEWORK AND SCHEME OF EXAMINATION

Semester I								
Part	Course Type	Course Title	TL Hrs. /week	Examination				Credits
				Hrs.	CIA marks	ESE marks	Total marks	
I	Language	Tamil I or Other language	6	3	25	75	100	3
II	Language (English)	English I - Communicative English	6	3	25	75	100	3
III	Core I	Fundamentals of Food Science and Chemistry	6	3	25	75	100	5
	Core Practical I	Fundamentals of Food Science and Chemistry Practical	3	-	-	-	-	-
	Allied I	Chemistry I	4	3	25	75	100	4
	Allied Practical I	Chemistry I Practical	3	-	-	-	-	-
IV	Add-on Course	Professional English I	6	3	25	75	100	4
	Value Education	Value Education	2	3	25	75	100	2
	Total		36	18	150	450	600	21

Semester II								
Part	Course Type	Course Title	Hrs. /week	Examination				Credits
				Hrs.	CIA marks	ESE marks	Total marks	
I	Language	Tamil II or other language	6	3	25	75	100	3
II	Language	English II- Communicative English	6	3	25	75	100	3
III	Core II	Principles of Food Processing and Preservation	4	3	25	75	100	5
	Core Practical II	Principles of Food Processing and Preservation Practical	3	6	40	60	100	3
	Allied I	Chemistry II	4	3	25	75	100	4
	Allied Practical I	Chemistry I and II Practical	3	3	40	60	100	2
	Core Practical I	Fundamentals of Food Science and Chemistry Practical	-	6	40	60	100	3
IV	Add-on course	Professional English II	6	3	25	75	100	4
		Environmental Studies	2	3	25	75	100	
	Total		30	30	245	555	800	28

Semester III								
Part	Course Type	Course Title	Hrs. /week	Examination				Credits
				Hrs.	CIA marks	ESE marks	Total marks	
I	Language	Tamil III or other language	6	3	25	75	100	3
II	Language	English III- Communicative English	6	3	25	75	100	3
III	Core III	Fundamentals of Food Engineering	4	3	25	75	100	5
	Core Practical III	Fundamentals of Food Engineering Practical	3	-	-	-	-	-
	Allied II	Food Safety and Microbiology I	4	3	25	75	100	4
	Allied Practical II	Food Safety and Microbiology Practical I	3	-	-	-	-	-
IV	SBEC I	Food Product Innovation	2	3	25	75	100	3
	NMEC I	Food Preservation(offered by other major course)	2	3	25	75	100	3
IV	NMSDC	Digital Skill for Employability- Microsoft Office Essentials	2	3	25	75	100	2
	Total		30	18	150	450	600	20

Semester IV								
Part	Course Type	Course Title	Hrs. /week	Examination				Credits
				Hrs.	CIA marks	ESE marks	Total marks	
I	Language	Tamil IV or other language	6	3	25	75	100	3
II	Language	English IV- Communicative English	6	3	25	75	100	3
III	Core IV	Technology of Cereals, Pulses and Oilseeds	4	3	25	75	100	5
	Core Practical III	Fundamentals of Food Engineering Practical	-	3	40	60	100	3
	Core Practical IV	Technology of Cereals, Pulses and Oilseeds Practical	3	6	40	60	100	3
	Allied II	Food Safety and Microbiology II	4	3	25	75	100	4
	Allied Practical II	Food Safety and Microbiology Practical I and II	3	3	40	60	100	2
IV	NMSDC	Employability Skills- Microsoft	2	2	25	75	100	2
IV	SBEC II	Food Additives	2	3	25	75	100	3
	NMEC II	Food Safety Initiatives(offered by other major course)	2	3	25	75	100	3
	Total		30	30	270	630	900	29

Semester V								
Part	**Course Type**	**Course Title**	**Hrs. /week**	**Examination**				**Credits**
				Hrs.	**CIA marks**	**ESE marks**	**Total marks**	
III	Core V	Technology of Fruits, Vegetables and Plantation Crops	5	3	25	75	100	5
	Core VI	Technology of Sugar, Salt and Beverages	5	3	25	75	100	5
	Core Practical V	Technology of Fruits, Vegetables and Plantation Crops Practical	6	-	-	-	-	-
	Elective I	Food Quality Control	4	3	25	75	100	4
	Elective II	Food Storage and Packaging	4	3	25	75	100	4
IV	**NMSDC**	**Advanced Technology for Employability – Food Analysis Food Processing & Preservation**	**2**	**3**	**25**	**75**	**100**	**2**
	SBEC IV	Food Plant Hygiene and Sanitation	3	3	25	75	100	2
	Total		30	18	165	435	600	23

Semester VI								
Part	**Course Type**	**Course Title**	**Hrs. /week**	**Examination**				**Credits**
				Hrs.	**CIA marks**	**ESE marks**	**Total marks**	
III	Core VII	Food and Nutrition	6	3	40	60	100	4
	Core VIII	Technology of Egg and Dairy	4	3	25	75	100	4
	Core IX	Technology of Fleshy Foods, Spices and Condiments	4	3	25	75	100	4
	Core Practical V	Technology of Fruits, Vegetables and Plantation Crops Practical	-	3	40	60	100	3
	Core Practical VI	Technology of Egg, Dairy and Fleshy Foods Practical	6	3	40	60	100	3
	Elective III	Food Product Development	4	3	25	75	100	4
IV	SBEC V	Bakery	3	3	40	60	100	2
	SBEC VI	Entrepreneurship Development	3	3	40	60	100	2
V	Extension Activities	NSS/NCC/YRC/Extracurricular Activities						
	Total		30	30	275	525	800	26

OVERALL PROGRAMME GRADE AND CREDITS

Semester	Hrs./Week	Total Marks	Credits
Semester I	30	600	21
Semester II	30	800	28
Semester III	30	600	20
Semester IV	30	900	29
Semester V	30	600	23
Semester VI	30	800	26
Total	**30**	**4300**	**147**

Syllabus for B.Sc. Food Technology
SEMESTER I
Part III: CORE I – Fundamentals of Food Science and Chemistry

Course Name	Fundamentals of Food Science and Chemistry	**Programme Name**	B.Sc. Food Technology
Course Code	2022BFTC01	**Academic Year Introduced**	2022 - 23
Type of Course	Theory	**Semester**	I

COURSE OUTCOMES

On completion of the course, the students will be able to	
CO1	Define the chemical constituents and colloidal nature of food
CO2	Explain the nature of water and carbohydrates in food
CO3	Enshrine the scientific principles of food proteins and lipids
CO4	Appraise the nature of vitamins and pseudo vitamins in food
CO5	Enumerate the chemistry and types of macro and micro minerals in food

COURSE OBJECTIVES AND HOURS OF INSTRUCTION

Unit/Module	Objectives	Hours of Instruction TL+A+As=To
Colloidal Nature of Food	To impart learning on types and application of colloidal system and methods of cooking	12+3+2 = 17
Water and Carbohydrates	To illustrate the types and chemical nature of water and carbohydrates in food	12+3+2 = 17
Proteins and Lipids	To differentiate the chemical nature and types of proteins and lipids in food	13+4+2 = 19
Vitamins and Pseudo Vitamins	To picturize the chemistry and retention of vitamins and minerals in food	14+3+2 = 19
Minerals and Phytonutrients	To exhibit the types, nature and role of functional components (colours/pigments, flavours, enzymes and phytochemicals) in food	13+3+2 = 18
Total Hours of Instruction		90 (18x5)

TL-Teaching and Learning, A-Activities, As-Assessment, To-Total Hours

COURSE PLAN

Unit/Module	Intended Learning Chapters	CO(s) Mapped
I	a. Concept of food and nutrients *b.* Colloidal System in foods- *Types & Properties, Sols, Gels, Emulsion and Foams –nature and factors influencing its formation and stability, application of colloidal chemistry to food preparation* *c.* Cooking of food - *cooking methods and principles and effect of cooking on constituents of food*	CO1
II	*a.* Water – *chemistry, physical properties, free, bound and entrapped water, water activity in food, moisture sorption isotherm of a food, water quality for food processing- drinking water, mineral water and potable water* *b.* Carbohydrates – *types of carbohydrates in food, chemical structure, physio-chemical and functional properties, types of starch, resistant starch; role of food carbohydrate/starch in cookery*	CO2
III	*a.* Proteins – *classification/types, chemistry and nature of proteins in food, physio-chemical and functional properties of food proteins, role of food proteins in cookery* *b.* Lipids – *classification/types of lipids, types of fats and oils in food, chemistry and nature of fats and oils in food, physio-chemical and functional properties of fats and oils in food, role of fats and oils in cookery*	CO3
IV	*a.* Vitamins - *classification/types, chemistry and nature of vitamins in food, physio-chemical and functional properties of vitamins in food, effect of cooking on vitamins, pseudo vitamins in food* *b.* Minerals - *classification/types, chemistry and nature of minerals in food, physio-chemical and functional properties of minerals in food, effect of cooking on minerals in food*	CO4

V	*a.* Colours/Pigments - *classification/types, chemistry and nature of colours/pigments in food, effect of cooking on colours/pigments in food* *b.* Flavours - *classification/types, chemistry and nature of flavours in food, effect of cooking on flavours in food* *c.* Enzymes - *classification/types, chemistry and nature of enzymes in food, effect of cooking on enzymes in food, enzymatic and non-enzymatic browning reaction in food* *d.* Phytochemicals - *classification/types, chemistry and nature of phytochemicals in food, effect of cooking on phytochemicals in food*	CO5

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TEXTBOOKS	
1	John M. deMan., John W. Finley., W. Jeffrey Hurst., Chang Yong Lee., (auth.) (2018), Principles of Food Chemistry, 4th Ed., AN ASPEN Publications, Maryland, Springer
2	Fennema, Owen R. (1996), Food Chemistry, 3rd Ed., Marcel Dekker, New York
3	Norman N. Potter and Joseph H. Hotchkiss, (1998), Food Science, 5th Ed., Springer
4	H.-D. Belitz., W. Grosch., P. Schieberle., (2009), Food Chemistry, 4th and revised Ed., Springer-Verlag Berlin Heidelberg
5	Jan Velisek, (2014), The Chemistry of Food, Wiley Blackwell
REFERENCE BOOKS	
1	Joseph J. Provost., Keri L. Colabroy., Brenda S. Kelly., Mark A. Wallert. (2016), The Science of Cooking: Understanding the Biology and Chemistry behind Food and Cooking, Wiley Blackwell
4	Peter Chi Keung Cheung & Bhavbhuti M. Mehta (eds.). (2015), Handbook of Food Chemistry, Springer Reference
5	B.Sunitha and R.Aruna, Food Chemistry of Macronutrients, Department of Food Chemistry and Nutrition Study Material, Acharya NG Ranga Agricultural University College of Food Science & Technology, Bapatla
6	Y. H. Hui and Associate Editors, (2006), Handbook of Food Science, Technology and Engineering, Vol.I to IV, Taylor and Francis (CRC)
JOURNALS AND DOCUMENTS	
1	Food Chemistry, Springer
2	Cereal Chemistry, Springer
3	The Journal of Food Science and Technology, Springer

Part III: CORE I PRACTICAL – Fundamentals of Food Science and Chemistry Practical

Course Name	Fundamentals of Food Science and Chemistry Practical	**Programme Name**	B.Sc. Food Technology
Course Code	2022BFTC01	**Academic Year Introduced**	2022 - 23
Type of Course	Theory	**Semester**	I

COURSE OUTCOMES

On completion of the course, the students will be able to	
CO1	Differentiate different types of solution and methods of cooking food
CO2	Analyse the role of water and carbohydrates in cooking and processing of food
CO3	Determine the type and role of protein and lipid in raw and cooked food
CO4	Evaluate the nature of vitamins and pseudo vitamins in raw and cooked food
CO5	Catalogue the chemistry and types of macro and micro minerals in raw and cooked food

COURSE OBJECTIVES AND HOURS OF INSTRUCTION

Unit/Module	Objectives	Hours of Instruction TL+A+As=To
Colloidal Nature of Food	To impart practical learning on types and application of colloidal system and methods of cooking	2+10+3 = 15
Water and Carbohydrates	To illustrate the role of water and carbohydrates in cooking and processing of food	2+10+3 = 15
Proteins and Lipids	To determine the chemical nature and role of proteins and lipids in cooked and processed food	2+22+6 = 30
Vitamins and Pseudo Vitamins	To study the types and level of retention of vitamins and minerals in food on cooking/processing	2+16+6 = 24

Minerals and Phytonutrients	To characterise the nature of functional components (colours/pigments, flavours, enzymes and phytochemicals) in food on cooking/ripening/processing	2+16+6 = 24
Total Hours of Instruction		108 (18x6)

TL-Teaching and Learning, A-Activities, As-Assessment, To-Total Hours

COURSE PLAN

Unit/Module	Intended Learning Exercises	CO(s) Mapped
I	1. Identify the type of colloidal solution and describe on it 2. Tabulate the SOP for different cooking methods by integrating nature of ingredients, technique and method	CO1
II	1. Differentiate the type of water as per quality parameter 2. Identify the type of starch and sugar through qualitative tests and microscopic examination in various food	CO2
III	1. Tabulate the name, type and biological value of protein in ten foods through evidence based database 2. Determine the protein content of food by micro kjeldahl method 3. Experiment the nature of protein denaturation on cooking and processing of milk and egg 4. Tabulate the name, type and nature of fatty acids in ten foods through evidence based database 5. Determine the total fat content of food suing soxhlet apparatus 6. Determine the FFA, Iodine number and saponification value of fresh fats and oils and RUCO	CO3
IV	1. Tabulate the name, type and chemical nature of vitamins in ten foods through evidence based database 2. Determine the Beta Carotene and vitamin C content of the fresh and processed fruits and vegetables 3. Tabulate the name, type and chemical nature of minerals in ten foods through evidence based database 4. Determine the calcium and iron content of the fresh and processed fruits and vegetables	CO4
V	1. Demonstrate the effect of cooking on colours/pigments in food 2. Determine the sensory quality changes on cooking of food in terms of descriptive sensory profile 3. Determine the browning index of fruits and vegetables and define it nature of browning 4. Identify the presence or absence of phytochemicals in food on cooking/processing	CO5

REFERENCES

TEXTBOOKS	
1	Connie M. Weaver and James R. Daniel, (2003), The Food Chemistry Laboratory: A Manual for Experimental Foods, Dietetics, and Food Scientists, Second Edition (Contemporary Food Science), Second Edition, CRC Press.
2	Shalini Sehgal, (2016), A Laboratory Manual of Food Analysis, ikbooks.com.
3	Mohini Sethi and Eram S. Rao, (2020), e-book edition, Food Science: Experiments and Applications, CBS Publishers and Distributors Pvt. Ltd.
REFERENCE BOOKS	
1	Joseph J. Provost., Keri L. Colabroy., Brenda S. Kelly., Mark A. Wallert. (2016), The Science of Cooking: Understanding the Biology and Chemistry behind Food and Cooking, Wiley Blackwell.
2	M.S.Swaminathan, (1987), Food Science, Chemistry and Experimental Foods, Second edition, Bangalore Print. & Pub. Co., Bangalore.
3	Mississippi State University Extension, (2019), Revised by Courtney Crist, M. W. Schilling, Viodelda Jackson, and J.B. Williams, Experiments in Food Science Laboratory Manual.
JOURNALS AND DOCUMENTS	
1	Food Chemistry, Springer
2	Cereal Chemistry, Springer
3	The Journal of Food Science and Technology, Springer

SEMESTER II

Part III: CORE II – Principles of Food Processing and Preservation

Course Name	Principles of Food Processing and Preservation	**Programme Name**	B.Sc. Food Technology
Course Code		**Academic Year Introduced**	2022 - 23
Type of Course	Theory	**Semester**	II

COURSE OUTCOMES

On completion of the course, the students will be able to	
CO1	Comprehend the scope, principles and methods of food processing and preservation
CO2	Define the role of packaging in preservation and apply the method of high temperature processing
CO3	Specify the suitable low temperature processing and preservation method to store the food
CO4	Apply the suitable drying and dehydration technique to preserve the food
CO5	Explicate the membrane technology, use of preservatives and hurdle technology in food preservation

COURSE OBJECTIVES AND HOURS OF INSTRUCTION

Unit/Module	Objectives	Hours of Instruction TL+A+As=To
Introduction to food processing and preservation	To impart knowledge on scope, principles and methods of food processing and preservation	14+3+2 = 19
Packaging and High temperature processing	To enlighten the principles and methods of packaging the preserved foods and high temperature processing and preservation	14+3+2 = 19
Low temperature processing	To educate the principles and methods of low temperature processing and preservation	12+3+2 = 17
Drying and Dehydration	To impart technical knowledge on drying and dehydration of foods	13+3+2 = 18
Other methods of preservation	To illustrate the principles and technology behind the membrane filtration, application of food preservatives and hurdle technology	12+3+2 = 17
Total Hours of Instruction		90 (18x5)

TL-Teaching and Learning, A-Activities, As-Assessment, To-Total Hours

COURSE PLAN

Unit/Module	Intended Learning Chapters	CO(s) Mapped
I	*a.* Food Processing*: Introduction, Scope and Importance, Goals and Objectives of food processing, Historical developments in food processing, Principles of food processing, merits and demerits - minimal processing - removal of moisture, removal of air, low temperature, high temperature, milling, fermentation and irradiation processing; advanced processing - extrusion cooking, hydrostatic pressure cooking, dielectric heating, microwave and ultrasound processing* *b.* Food Preservation*: Principles, methods and importance of food preservation*	CO1
II	*a.* Packaging and Bottling - *metal containers, glass containers, plastic containers, retortable Pouches, artificial and intelligent packages and methods of packaging – ordinary, controlled and modified atmosphere, vacuum packaging* *b.* Pasteurization and Sterilization - *Definition, time-temperature combination and equipments* *c.* Blanching and Canning - *Definition, time-temperature combination and equipments, adequacy in blanching and canning*	CO2
III	*a.* Cold storage – *Refrigeration, cold storage methods, advantages and disadvantages* *b.* Freezing - *direct and indirect, freezing curve, freezer selection - still air sharp freezer, blast freezer, fluidized freezer, plate freezer, spiral freezer and cryogenic freezing, advantages and disadvantages of freezing, changes in food during freezing and storage in frozen condition*	CO3
IV	*a.* Drying*: Utilities of drying, thermal properties, Equilibrium Moisture Content (EMC), drying theories, drying rate, methods of drying - contact drying, convective drying, freeze drying, radiation drying, superheated steam drying, types of dryers - Deep bed, Flat bed, Continuous, Recirculating, LSU, Fluidized bed, Rotary, Tray, Tunnel and Solar* *b.* Dehydration: *Water activity, moisture sorption isotherm, osmotic dehydration using*	CO4

	salt and sugar	
V	*a.* Membrane Technology - *Introduction to pressure activated membrane processes- Micro filtration, ultra-filtration, nano filtration and Reverse Osmosis and its industrial application, membrane performance, and limitation of membrane processes* *b.* Preservation by using preservatives - *Food additives - Definition, types, Class I and Class II preservatives* *c.* Hurdle Technology - *concept and its application*	CO5

REFERENCES

TEXTBOOKS	
1	G Subbulakshmi, Shobha A Udipi, Padmini S Ghurge (2021), Food Processing and Preservation, Second Edition, New Age International Publishers, New Delhi
2	P. Fellows, (2000), Food Processing Technology, Principles and Practice, 2nd Edition, Woodhead Publishing Limited and CRC Press LLC in North and South America
3	Paine FA and Paine HY, (1992), Handbook of Food Packaging, Second Edition, Published under the authority of The Institute of Packaging, Springer-Science+Business Media, BV
4	Khetarpal Neelam, (2005), Food Processing and Preservation, Daya Publishing House, New Delhi
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1	J. Scott Smith, Y. H. Hui, (2004), Food Processing, Principles and Applications, 1st Edition, Blackwell Publishing Ltd, UK
2	M.Shafiur Rahman, (2007), Handbook of Food Preservation, 2nd Edition, CRC Press, Taylor & Francis group, London, New York
3	Theodoros Varzakas, Constantina Tzia, (2016), Handbook of Food Processing, Food Preservation, CRC Press, Taylor & Francis group, London, New York
4	Stephanie Clark, Stephanie Jung and BuddhiLamsal, (2014), Food Processing Principles and Application, 2nd Edition, John Wiley & Sons, Ltd., UK
5	Geoffrey Campbell-Platt, (2009), Food Science and Technology, Blackwell Publishing Ltd, UK
6	Karnal, Marcus and D.B. Lund, (2003), Physical Principles of Food Preservation, Marcel Dekker, Inc. USA
JOURNALS AND DOCUMENTS	
1	Journal of Food Processing and Preservation, Wiley Periodicals Inc.
2	Food Production, Processing and Nutrition, Springer
3	Food Packaging and Shelf Life, Springer

Part III: CORE II PRACTICAL – Principles of Food Processing and Preservation Practical

Course Name	Principles of Food Processing and Preservation Practical	**Programme Name**	B.Sc. Food Technology
Course Code		**Academic Year Introduced**	2022 - 23
Type of Course	Practical	**Semester**	II

COURSE OUTCOMES

On completion of the course, the students will be able to	
CO1	Practice the GFLP and preserve the food using suitable packaging
CO2	Sterilize/pasteurize/bottle/can the food and preserve using high temperature
CO3	Store the food in effective cold temperature and preserve its quality
CO4	Dry and dehydrate the food to improve its shelf life
CO5	Preserve the food using suggested food preservative, hurdle technology and define the water quality using TDS

COURSE OBJECTIVES AND HOURS OF INSTRUCTION

Unit/Module	Objectives	Hours of Instruction TL+A+As=To
GFLP and Food packaging	To illustrate the GFLP and impact of packaging on preserving the sensory quality of foods	3+3+3 = 9
High temperature preservation	To educate on method of sterilization/pasteurization/bottling/canning of food	3+9+3 = 15

Low temperature preservation	To analyze the role of refrigeration and freezing in preserving the fruits/vegetables and fleshy foods	3+15+6 = 24
Drying and Dehydration	To understand the drying of foods by using different types of dryers and osmotic dehydration technique	3+15+6 = 24
Hurdle technology preservation	To prepare pickles, jam and jelly and marmalades using preservatives, hurdle technology and membrane filtration	6+24+6 = 36
Total Hours of Instruction		108 (18x6)

TL-Teaching and Learning, A-Activities, As-Assessment, To-Total Hours

COURSE PLAN

Unit/Module	Intended Learning Exercises	CO(s) Mapped
I	*a. Good Food Laboratory Practice defined by FSSAI* *b. Compare the sensory quality of any one food packed by different methods of packaging*	CO1
II	*a. Experiment the sterilization or pasteurization of foods (laboratory or at Industry)* *b. Experiment the bottling/canning of foods (laboratory or at Industry)*	CO2
III	*a. Refrigerate fruits and vegetables and evaluate its sensory quality* *b. Deep freeze the non-vegetarian food and evaluate its sensory quality* *c. Visit cold storage and freezing facility existing in the industry and report*	CO3
IV	*a. Dry the food using tray drier or hot air drier and observe the drying characteristics* *b. Apply the osmotic dehydration to any one fruit or vegetable and observe its characteristic changes* *c. Dry the food using sun drier or hot air drier and observe the drying characteristics*	CO4
V	*a. Prepare the pickle using raw mango, garlic & lemon and evaluate its sensory profile* *b. Prepare the jam & jelly using any five pectin rich fruits and evaluate its sensory profile* *c. Prepare the marmalade using orange and evaluate its sensory profile* *d. Check the TDS of the water filtered by different methods and report its suitability for consumption*	CO5

REFERENCES

TEXTBOOKS	
1	https://fssai.gov.in/upload/uploadfiles/files/Manual_GFLP_06_09_2018.pdf
2	https://www.studocu.com/my/document/universiti-teknologi-mara/food-analysis/fst528-lab-manual/10347126
3	https://egyankosh.ac.in/handle/123456789/1166
4	https://www.scribd.com/document/556561814/3-3-PFPP-Lab-Manual-converted
5	http://14.139.185.57:8080/jspui/bitstream/123456789/10752/1/810084-practical%20manual.pdf
6	https://www.doctorfresh.in/blog/11/how-to-check-tds-of-water
REFERENCE BOOKS	
1	https://www.nios.ac.in/media/documents/srsec321newE/pracmanual321.pdf
2	https://iastate.pressbooks.pub/foodproductdevelopment/open/download?type=pdf
3	http://www.rpaulsingh.com/learning/virtual/virtual.html
JOURNALS AND DOCUMENTS	
1	Journal of Food Processing and Preservation, Hindawi
2	Food Production, Processing and Nutrition, Springer
3	Food Packaging and Shelf Life, Springer

SEMESTER III

Core Paper III Fundamentals of Food Engineering 4hrs/week

UNIT I

Units and dimensions, basic principles of mass and energy balances, classifications of processes and unit operations, Significance of Engineering, properties of food materials: physical, thermal, aerodynamic, mechanical, optical and electromagnetic properties.

UNIT II

Food processing as a manufacturing process, status of food processing industries in India and abroad: sector wise food processing, import and export of food commodities/processed foods, Underutilized food commodities. Food material transportation, supply (value addition) chain, scale-up and plant layout (equipment and utilities).

UNIT III

Food materials science and engineering- An overview: Introduction: Molecular basis of food materials, Benefits, classification, determination and designation of the fineness of ground material, sieve/screen analysis, principle and mechanisms, observation of materials at various size ranges and size-property relationship, amorphous and crystalline structures of materials, interfacial properties of the food materials, application of materials science in food design and development of engineered food materials.

UNIT IV

Food manufacturing as industrial practice: Food processing as a manufacturing process, status of food processing industries in India and abroad: sector wise food processing, import and export of food commodities/processed foods, Underutilized food commodities. Food material transportation, supply (value addition) chain, scale-up and plant layout (equipment and utilities).

UNIT V

Sustainable food processing systems: Water activity of food and its significance in food preservation; dehydration and drying of food items; IMF; Low temperature preservation: cold storage, cold chain, freezing Environmental impact of food processing, packaging and handling.

REFERENCS

1. R.L.Earle, . Unit Operations in Food Processing, NZIFST (Inc.)
2. ZekiBerk, Food Process Engineering and Technology, ELSEVIER
3. J.G.Brennan, . Food Processing Handbook, WILEY-VCH Verlag GmbH & Co.
4. Farrall A.W, Engineering for dairy and food product, John Wiley and Sons
5. 5.Fellows, P.J. (2009). Food Processing Technology: Principles and Practice. 3rd Edition,Woodhead Publishing, Oxford.
6. Potter, N.N. and Hotchkiss, J.H. (2007). Food Science. CBS Publishers & Distributors, New Delhi.
7. R.L. Earle. 2004. Unit Operations in Food Processing. The New Zealand Intitute of Food Science & Technology, Nz. Warren L. McCabe, Julian Smith, Peter Harriott. 2004.
8. Unit Operations of Chemical Engineering, 7th Ed. McGraw-Hill, Inc., NY, USA. Christie John Geankoplis. 2003.
9. Transport Processes and Separation Process Principles (Includes Unit Operations), 4th Ed. Prentice-Hall, NY, USA.
10. George D. Saravacos and Athanasios E. Kostaropoulos. 2002. Handbook of Food Processing Equipment. Springer Science+Business Media, New York, USA.
11. J. F. Richardson, J. H. Harker and J. R. Backhurst. 2002. Coulson & Richardson's Chemical Engineering, Vol. 2, Particle Technology and Separation Processes, 5th Ed.

Core Practical III **Fundamentals of Food Engineering** **3 hrs/week**

1. Comparison of conventional and microwave processing of food.
2. Determination of pH of different foods using pH meter.
3. Study quality characteristics of foods preserved by drying/dehydration/ freezing.
4. Drying of food using Tray dryer/other dryers
5. Preservation of food by canning(Fruit/Vegetable/meat).
6. To perform blanching of different plant foods.
7. Osmotic dehydration.
8. To study gelatinization behavior of various starches.
9. Concept of shelf life of different foods.
10. To study the concept of gluten formation of various flours.
11. Plant layout design.
12. Determination of viscosity

Allied Paper II Food Safety and Microbiology I 4hrs/week

UNIT I

Standardization of Foods; Definition, Standards of Quality, for cereals, starchy foods, spices and condiments, sweetening agents, meat and meat products, vinegar, sugar and confectionary, beverages-alcoholic and non alcoholic , carbonated water etc., Milk and milk products , oils and fats , Canned foods , fruits and vegetables products.

UNIT II

Food laws and regulation: Mandatory and voluntary food laws, International quality systems and standards like ISO and Food Codex, BRC; International trades & federal agencies, Indian act-Food Safety and Standards Act, 2006.

UNIT III

Various food acts- PFA, FPO, AGMARK, MMPO, MFPO, edible oil acts, standard weight acts. HACCP AND WTO (briefly)

UNIT-IV

Microorganisms important in food microbiology – Mold, Fungi, Algae, Bacteria and Virus – general characteristics. Contamination of foods – green plants and fruits, animals, sewage, soil, water, air during handling and processing. Spoilage – cause, classification, factors affecting kinds and numbers of microorganisms in food.

UNIT-V

Spoilage of different groups of foods – cereal and cereal products, vegetables and fruits, meats and meat products, fish and other sea foods, eggs, poultry, milk and milk productsand canned foods..

REFERENCS

1. Siddappaa, G. S., Girdhari Lal and Tandon, G.L. 1998..Preservation of Fruits and Vegetables. ICAR, New Delhi
2. Sivasankar, B. 2002. Food Processing and Preservation. PHI Learning Pvt. Ltd. Delhi
3. Srilakshmi. 2010. Food Science. New age International 978-81-224- 2724-0.
4. Srivastava, R. P. & Sanjeev Kumar. 2002. Fruits and vegetable Preservation – Principles and Practice. International Book Distributing Co., Lucknow.
5. Swaminathan, M. 1988. Hand book of Food Science & Experimental Foods. Bappco publishers, Bangalore
6. U.D. Chavan and J.V. Patil. 2013. Industrial Processing of fruits and vegetables. Astral International Pvt Ltd. New Delhi.
7. Vijay, K. 2001. Text Book of Food Sciences and Technology. ICAR, New Delhi.
8. Adams M.R., Moss M.O., Food Microbiology, New age international publishers, New Delhi, 2015.
9. William C Frazier., Dennis C Westhoff., Food Microbiology, McGraw Hill education private limited, New delhi, 2014.
10. Sivasankar., Food Processing and Preservation, PHI Learning private limited New delhi, 2015.
11. Branen A.L. and Davidson, P.M.. Antimicrobials in Foods. Marcel Dekker, New Delhi, 1983.
12. Jay J.M., Modern Food Microbiology. 3rd Edn. VNR, New York.utta. 1980 9th Edition, Prism Books Pvt. Ltd.,1986

Allied Practical II **Food Safety and Microbiology I** **3hrs/week**

1. Introduction to the Basic Microbiology Laboratory Practices and Equipments
2. Functioning and use of compound microscope
3. Cleaning and sterilization of glassware
4. Preparation and sterilization of nutrient broth
5. Cultivation and sub-culturing of microbes
6. Preparation of slant, stab and plates using nutrient agar
7. Morphological study of bacteria and fungi using permanent slides
8. Simple staining
9. Gram's staining
10. Standard Plate Count Method
11. Identification of Molds by lacto phenol blue staining
12. Negative Staining
13. Microbiological Examination of food
14. Bacteriological Analysis of Water by MPN method
15. Assessment of surface sanitation by swab and rinse method
16. Assessment of personal hygiene

SBEC I Food Product Innovation 2hrs/week

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UNIT-I

Food product development tool: Organoleptic testing panels- export profile panels, primary sensory panels and secondary sensory panels; Research guidance panels- purpose, panel organization, utility of results. Inter locking activities of people andorganization.

UNIT II

Basic principles & concept of food product development. Cultural approach to development of dietary pattern of various groups- linguistic, regional, religious(ethic). Factors involved in food habit alteration, availability, importance & role of different research & development departments in food production industry.

UNIT-III

Types of new products: Completely new product; new product for company existing competitor product-idea sources, "must have"- "would like" specifications; some minor new technology for existing factory; new entry using existing technology in existing factory; steps in the development of new product-concept testing, prototype product, process development, public health clearance, packaged product storage studies, finalize specifications, develop advertising claims, pre production runs, market research, timing.

UNIT IV

Steps in product development –material resources based on market demand, standardization methods involved in product development. Portion size & portion control, Calculation of nutritive value & cost of production, Shelf life & storage stability evaluation procedure of developed food products.

UNIT III

Formulation of new food products for infants, preschool children, adolescents, pregnant & nursing mothers, old age, sports persons. Selection & training of judges, Development of score card analysis of data. Role of advertisement & technologies in promotion of newproducts.

REFERENCES :

1. Sivarama prasad.A, 1985,Agricultural Marketing in India-Mittal Publications,NewDelhi.
2. Acharya.S.S,and N.L.Agarwal,1992,Agricultural Marketing in India- Oxford and IBH Publishing Pvt., Ltd., New Delhi.
3. Developing New Food Products For a Changing Market Place, 2nd Edition, 2005,Aaron, L.Brody,John B.Lord.
4. New Food Product Development, 2004,Gordon W.Fuller. 5. John Kao , Creativity & Entrepreneurship package Compatibility, toxicity, tainting and corrosion. Packaging and environment.

NMEC I **Food Preservation** **2hrs/week**

(offered to other major course)

UNIT I
Fundamentals of Food Preservation -Concept - Importance of food preservation - Principles offood preservation -Techniques of food preservation.

UNIT II Microorganisms in food -Introduction -Types of Microorganisms -Conditionsfor growth. -Food spoilage & their control .

UNIT III Preservation by preservatives -Concept and definition -Types -Naturalpreservatives - Synthetic preservatives

UNIT IV
Irradiation - Concept, definition -Principles of irradiation. - Types -Application. Preservation bydrying - Concept, history -Types of drying and dryers. -Treatments priorto drying.

UNIT V
Preservation by use of high temperature. -Concept and importance -Various methods used- pasteurization, Boiling, Canning -Effect of high temperature on food. Unit III - Preservation by Low Temperature - Concept, History -Types of Preservation methods bylow temperature -Different equipments used for preservation by low temperature - Treatments Prior to freezing

REFERENCES:

1 Prakash Triveni : Food Preservation, Aadi publication, Delhi.
2 M . Shafiur Rahman : Hard Book Of Food Preservation, Marcel Dekker Inc, New York. 3McWillims and Paine : Modern Food Preservation , Surjeet Publication.
4 Fellows, P and Ellis H. 1990 Food Processing Technology: Principal and Practicals, NewYork.
5 NPCS Board, Modern Technology on Food Preservation 6) B. Sivasankar; FoodProcessing and Preservation.

SEMESTER IV

Core paper IV Technology of cereals, Pulses and oilseeds 4/week

Objectives

- To teach technology of milling of various cereals
- To impart technical knowhow of pulses and oilseeds refining

UNIT:I

Paddy processing and rice milling: Conventional milling, modern milling, milling operations, milling machines, milling efficiency; Quality characteristics influencing final milled product; parboiling, ageing of rice, utilization of by products.

UNIT:II

Wheat milling: Break system, purification system and reduction system; extraction rate and its effect on flour composition; quality characteristics of flour and their suitability for baking; Corn milling: Dry and wet milling of corn, starch and gluten separation, milling fractions and modified starches.

UNIT:III

Barley: Malting and milling; Oat/Rye: Processing, milling; Sorghum: Milling, malting, pearling; Millets (Pearl millets, finger millets): Processing of millets for food uses; Secondary and tertiary products processing of cereals and millets; By-products processing of cereals and millets; Processing of infant foods from cereals and millets; Breakfast cereal foods: Flaked, puffed, expanded, extruded and shredded.

UNIT:IV

Pulse milling: home scale, cottage scale and modern milling methods, machines, milling quality, milling efficiency, factors affecting milling quality and quantity; Problems in dhal milling industry; Nutritional changes during soaking and sprouting of pulses; Cooking quality of dhal, methods, factors affecting cooking of dhal; Quick cooking dhal, instant dhal; Soybean milk processing and value addition.

UNIT:V

Problems in oil milling industry; Desolventization; Refining of oils: Degumming, neutralization, bleaching, filtration, deodorization, their principles and process controls.

Hydrogenation of oils; New technologies in oilseed processing; Utilization of oil seed meals for different food uses: High protein products like protein concentrates and isolates; By-products of pulse and oil milling and their value addition.

REFERENCES:

1. Kent,N.L.2003.Technology ofCereal,5thEd.Pergamon Press.
2. Chakraverty.1988.PostHarvestTechnologyofCereals,PulsesandOilseeds,revisedEd., Oxford & IBH Publishing Co. Pvt Ltd.
3. Marshall,RiceScienceandTechnology.1994.WadsworthEd.,MarcelDekker,New York.
4. Manay,S. and Sharaswamy,M. 1987. Food Factsand Priniciples.Wiley Eastern Limited.
5. Amalendu Chakraverty and R. Paul Singh. 2014. Post Harvest Technology and Food Process Engineering. CRC Press, Boca Raton, FL, USA.
6. Elaine T. Champagne. 2004. Rice: Chemistry and Technology, 3rd Ed., AACC

International, Inc., St. Paul, MN, USA.
7. Amalendu Chakraverty, Arun S. Mujumdar, G.S. Vijaya Raghavan and Hosahalli S. Ramaswamy. 2003. Handbook of Post Harvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices. Marcel Dekker, Inc., NY, USA.

Core practical IV Technology of cereals, Pulses and oilseeds 3hrs/week

1. Observations of morphological characteristics of cereals
2. Determination of physical properties of cereals
3. Determination of chemical properties of cereals
4. Determination of cooking quality characteristics of rice
5. Experiment on production of puffed rice,
6. Experiment on production of popcorns
7. Experiment on production of noodles
8. Determination of gelatinization temperature by amylograph
9. Experiment on preparation of value added products from millets
10. Determination of physical properties of legumes and oilseeds
11. Determination of proximate composition of selected pulses and oil seed
12. Removal of anti-nutritional compounds from selected pulses and oilseeds
13. Experiment study of cooking quality of dhal
14. Experiment on preparation of value added products legume products

Allied Paper II Food Safety and Microbiology II 4hrs/week

Objectives

1. To gain an understanding on the food safety/quality aspects for food industries.
2. To apply the principles of safety and quality systems to control food risks/hazards And assure the quality of food products.

UNIT I

Food safety -Definition and terms Safety in food procurement, handling, preparation storage and distribution.

Food Adulteration- IPC provisions on food adulteration. Food allergens and its management. FoodBio security, Food defense, Food bioterrorism and protection measures.

UNIT II

Scope of food quality and food safety activities-Food safety as part of food quality.

Food quality attributes -Quality assessment of food materials during andafter processing.

Role of Quality Control and Quality assurance in the food industries.Quality plan, Quality manuals.

Quality improvement -Total Quality Management-Principle and implementation, Quality improvementtools, customer focus, cost implications of quality systems.

UNIT III

Factors Affecting Food Safety

Physical Hazards, Biological, Hazards, Chemical Hazards, Microorganisms in Foods, Bacteria, Fungi, Yeasts, Moulds, Viruses, Parasites, Recent Concerns of Food Safety Prions, Concern of Genetically Modified Foods. Concern of Dioxin-Contaminated Foods. HACCP system and food safety used in controlling microbiological hazards.

UNIT IV

Food Fermentations

Fermentation–definition and types

Microorganisms used in food fermentations

Dairy Fermentations-starter cultures and their types , concept of probiotics,

FermentatedFoods-types,methodsofmanufactureforvinegar,sauerkraut,tempeh, miso , soya sauce ,beer,wine and traditional indian foods

UNIT V

Sanitation and Food industry

Sanitation guidelines-Definition and regulationof food sanitation.

Cleaning and sanitation of food establishment, equipment, cleaning compounds and sanitizers, safety limits of sanitizers. Food Filtration, Chlorination, Ozonation,Disinfection, CIP and COP.

Importance of personal hygiene of foodhandlers.

Planning andimplementation of Training programme.

Relationship of microorganisms to sanitation Sewage and waste product handling and treatment.

Control of infestation, Integrated Pestmanagement

Food sanitation control and inspection.

REFERENCE:

1. Atlas, M.Ronald (1995) Principles of Microbiology, 1st Edition, Mosby-Year Book, inco,Missouri, U.S.A.
2. Frazier, W.C. (1998) Food Microbiology, Mc Graw Hill Inc, 4thEdition.
3. Roday. S. (1999) Food Hygiene and Sanitation, 1st Edition, Tata Mc Graw Hill, New Delhi.
4. 4.Joshua A.K.2000 Microbiology. Popular Book Depot,Madras.
5.Adams & Moss 2000, Food Microbiology, Panima Publishing corporation, New Delhi. 6.Anandhanarayan. R & C.K.J. Panicker, 2003, Textbook of Microbiology, Orient long manpublications, Chennai.

Allied Practical II **Food Safety and Microbiology II** **3hrs/week**

1. PFA, FPO, Agmark, BIS and HACCP for common foods: Cereals and flours, Pulses, nuts and oilseeds, Fruits and vegetables, Oil, butter, ghee, vanaspati and other fats, Milk and milk products, Sugar, jaggery and miscellaneous foods, Meat, fish and poultry, Eggs
2. Physical and chemical methods/techniques for assessment of food quality
3. Quality evaluation of processed foods with cereal, pulse, vegetable, fruit, milk, milk products, meat, fish and poultry as main component by chemical and sensory methods.
4. Market survey of processed foods with reference to food labeling.
5. Visit to Consumer Forum/Food Quality Laboratory .
6. Food adulteration tests for different foods.

SBEC II Food Additives 2hrs/week

Objectives

- To teach various types of food additives
- To recognize the type of additive added to a food by reading the label on the packaging of the food.

UNIT I

Introduction: Introduction to Food Additives; Scope of food additives; Functions and uses of Food Additives; Classification- Intentional & Unintentional Food additives; Types of food additives Toxicology and Safety Evaluation of Food Additives: Effects of Food Additives; Food Additives generally recognized as safe (GRAS); Tolerance levels & Toxic levels in Foods; Legal safeguard; Risks of food additives.

UNIT II

Naturally occurring food additives: Classification; Health Implications; Role in Foods Acidulants: Introduction; Different acidulants; Role in food processing Food colorants: Introduction; Natural & Synthetic food colorants; Classification of Food colorants; Chemical nature; Impact on health.

UNIT III

Pigments: Importance; Classification: Utilization as food colour .Food Preservatives : Introduction; Classification- Natural & chemical preservatives, Mode of action.

UNIT IV

Antioxidants & chelating agents: Introduction; Role in foods; Types of antioxidants -natural & synthetic; Mode of action of antioxidants in foods; Chelating agents- Naturally & synthetic; Mode of action of chelating agents; Applications of antioxidants and chelating .

UNIT V

Sweeteners: Introduction; Classification- Artificial sweeteners & Nonnutritive sweeteners. Classification of flavors- natural & synthetic; Flavor enhancer/ Potentatior; Importance of taste and flavours; Role of flavoring agents in food processing.

REFERENCES:

1. Food Additives A Larry Branen, P Michael Davidson and Seppo Salminen CRC Book Press. USA.
2. Food Additives S.N. Mahindru APH Publishing Corporation, Drya Ganj, New Delhi.
3. Food colours, Flavours and Additives Technology Handbook NIIR Board of Consultants and Engineers Natonal Institute of Industrial Research, Kamla Nagar, Delhi
4. Food chemistry H.D. Belitz, W. Grosh and P. Schieberle 4 th Revised & Extemded Edition, Springer.

NMEC II Food Safety Initiatives 2hrs/week

(Offered to other major course)

Objectives

- To understand the safety and hygiene
- To learn the types of hazards associated with food

UNITI

Introduction to Food Safety, Definition, Types of hazards, biological, chemical,physical hazards, Factors affecting Food Safety, Importance of Safe Foods, Impact on health,Control measures.

UNIT II

Management of hazards-Need, Control of parameters, Temperature control, Food Storage, Hygiene and Sanitation in Food Service Establishments- Introduction, Sources of Contamination, control methods using physical and chemical agents

UNIT III

Food Safety Management Tools- Basic concept, Prerequisites- GHPs ,GMPs, HACCP, ISO series, TQM-concept and need for quality, components of TQM, Kaizen. Risk Analysis, Accreditation and Auditing.

UNIT IV

Microbiological criteria- Microbiological standards and limits, Sampling Basic steps in detection of food borne pathogens, Water Analysis.

UNIT V

Food laws and Standards, Indian Food Regulatory Regime, Global Scenario, Other laws and standards related to food.

REFERENCES

1. Lawley,R.,CurtisL.andDavis,J.TheFoodSafetyHazardGuidebook,RSC publishing, 2004
2. DeVries.FoodSafetyandToxicity,CRC,NewYork,1997
3. Marriott,NormanG.PrinciplesofFoodSanitation,AVI,NewYork,1985
4. Forsythe,SJ.MicrobiologyofSafeFood,BlackwellScience,Oxford,2000
5. Forsythe,S.J.TheMicrobiologyofSafeFood,secondedition,Willey-Blackwell,U.K.,2010
6. MortimoreS.andWallaceC.HACCP,Apracticalapproach,Chapmanand Hill,London,1995
7. BlackburnCDWandMcClureP.J.Foodbornepathogens.Hazards,riskanalysis& control.CRC Press,Washington,U.S.A, 2005

SEMESTER V

Part	Course Type	Course Title	Hrs. /week	Examination				Credits
				Hrs.	CIA marks	ESE marks	Total marks	
III	Core V	Technology of Fruits, Vegetables and Plantation Crops	5	3	25	75	100	5
	Core VI	Technology of Sugar, Salt and Beverages	5	3	25	75	100	5
	Core Practical V	Technology of Fruits, Vegetables and Plantation Crops Practical	6	-	-	-	-	-
	Elective I	Food Quality Control	4	3	25	75	100	4
	Elective II	Food Storage and Packaging	4	3	25	75	100	4
IV	SBEC III	Food Plant Layout	3	3	25	75	100	2
	SBEC IV	Food Plant Hygiene and Sanitation	3	3	25	75	100	2
	Total		30	18	165	435	600	23

Core V	TECHNOLOGY OF FRUITS, VEGETABLES AND PLANTATION CROPS	5Hrs	5Credits

Objectives

1. To impart knowledge of different methods of fruits and vegetable processing.
2. To learn about processing of various spices, tea, coffee and cocoa.

UNIT I

Introduction

Importance of fruits and vegetable, history and need of preservation, reasons of spoilage, methodof preservation (short & long term).

Canning and Bottling of Fruits and Vegetables

Selection of fruits and vegetables, process of canning, factors affecting the process- time and temperature, containers of packing, lacquering, syrups and brines for canning, spoilage in canned foods**.**

UNIT II

Fruits Beverages

Introduction, Processing of fruit juices (selection, juice extraction, deaeration, straining, filtrationand clarification), preservation of fruit juices (pasteurization, chemically preserved with sugars, freezing, drying, tetra-packing, carbonation), processing of squashes, cordials, nectars, concentrates and powder.

UNIT III

Jams, Jellies and Marmalades

Introduction**,** Jam: Constituents, selection of fruits, processing & technology**,** Jelly: Essential constituents(Role of pectin, ratio), Theory of jelly formation, Processing & technology, defectsin jelly**,** Marmalade : Types, processing & technology, defects.

Pickles, Chutneys and Sauces

Processing , Types, Causes of spoilage in pickling.

UNIT IV

Tomato Products

Selection of tomatoes, pulping& processing of tomato juice, tomato puree, paste, ketchup, sauce and soup**.**

Dehydration of Foods and Vegetables

Sun drying & mechanical dehydration, process variation for fruits and vegetables, packing and storage**.**

UNIT V

Spices

Processing and properties of major and minor spices, essential oils & oleoresins, adulteration

Tea, Coffee And Cocoa

Processing, Variety and Products

REFERENCES

1. Girdharilal, Siddappaa, G.S and Tandon, G.L.1998. Preservation of fruits & Vegetables, ICAR, New Delhi

2. W B Crusess.2004. Commercial Unit and Vegetable Products, W.V. Special Indian Edition, Pub: Agrobios India

3. Manay, S. & Shadaksharaswami, M.2004. Foods: Facts and Principles, New Age Publishers

4. Ranganna S.1986. Handbook of analysis and quality control for fruits and vegetable products, Tata Mc Graw-Hill publishing company limited, Second edition.

5. Srivastava, R.P. and Kumar, S. 2006 . Fruits and Vegetables Preservation- Principles and Practices. 3rd Ed. International Book Distributing Co.

Core V	TECHNOLOGY OF SUGAR, SALT AND BEVERAGES	5Hrs	5Credits

Objectives

1.To impart knowledge of different methods of sugar, salt and beverages.

2.To understand the processing of sugar and beverages.

UNIT-I

Sugar

Introduction, properties, type of plants-sugar cane, sugar beet, composition of sugar cane and sugar beet, Processing method for sugar, and by products.

UNIT-II

Confectionery Technology:

Different stages of sugar cookery and preparation of indigenous products based on the stages. Preparation of sugar solutions and evaluation using Refractometry and Brix

Preparation and quality evaluation of non-crystalline candies: NonCrystalline candies; Hard candies caramels, toffees and nougats

Preparation and quality evaluation of Crystalline candies: Fondant, fudge and Marshmallow

Preparation of Cocoa, Chocolate and related products

UNIT-III

Salt- Production, properties, processing, types and uses in food processing industry.

UNIT-IV

Processing of beverages: Packaged drinking water, juice based beverages, synthetic beverages, still, carbonated

Low-calorie and dry beverages, isotonic and sports drinks

Dairy based beverages

Alcoholic beverages, fruit beverages, specialty beverages

UNIT-V

FSSAI specifications for beverages

Ingredients, manufacturing and packaging processes and equipment for different Beverages

Sweeteners, colorants, acidulants,

Clouding and clarifying and flavouring agents for beverages

REFERENCES:

1. Lees and Jackson **(1994)** Sugar Confectionery and Chocolate Manufacture by, 1st Ed. London: Chapman & Hall,1973, Reprinted
2. Justin J. Alikonis. Candy Technology **(1979)** AVI publishing company, Inc., Westport, Connecticut
3. Philip R. Ashurt, (2005). Chemistry and technology of Soft drinks and fruit juices, 2nd edition

   Blackwell Publishing Ltd. E book

4. Tammy Foster and Purnendu, C. Vasavada, (2003) Beverage Quality and safety, 2nd edition. CRC Press - E book.
5. Principles of Sugar Technology, Vol 1-3 by Peter Honig, Elsaevier Poh, Co., Newyork
6. Training manual for sugar mills by Mangal Singh, Somaiya Pvt. Ltd. Mumbai.

Core Practical V	TECHNOLOGY OF FRUITS, VEGETABLES AND CROPS PRACTICAL	6Hrs*	3Credits

*(Sem VI Practical)

1. Estimation of total soluble solids (TSS).
2. Estimation of pH and acidity of products.
3. Estimation of brix: acidity ratio
4. Estimation of ascorbic acid and effect of heat treatment on it.
5. To study the steps of can making process.
6. Preparation and evaluation of pectin products.
7. Adulteration of spices.
8. Dehydration of fruits and vegetables.
9. Rehydration of fruits and vegetables.

REFERENCES

1. Girdharilal, Siddappaa, G.S and Tandon, G.L.1998. Preservation of fruits & Vegetables, ICAR, New Delhi

2. W B Crusess.2004. Commercial Unit and Vegetable Products, W.V. Special Indian Edition, Pub: Agrobios India

3. Manay, S. & Shadaksharaswami, M.2004. Foods: Facts and Principles, New Age Publishers

4. Ranganna S.1986. Handbook of analysis and quality control for fruits and vegetable products, Tata Mc Graw-Hill publishing company limited, Second edition.

5. Srivastava, R.P. and Kumar, S. 2006 . Fruits and Vegetables Preservation- Principles and Practices. 3rd Ed. International Book Distributing Co.

Elective I	FOOD QUALITY CONTROL	4Hrs	4Credits

Objectives:

To enable the students

1. To gain knowledge about food laws and standards for food quality
2. To know about food additives and quality control of foods.

UNIT-I

Principles of Quality control of foods –Raw material control, processed food control and finished product inspection. Leavening agents- classification, uses and optimum levels. Food additives - Preservatives, colouring, flavouring, sequestering agents, emulsifiers, antioxidants.

UNIT-II

Standardisation systems for quality control of foods:-National and International standardization system, GMP, GHP. Different types of food grade materials. Food adulteration - Common adulterants in foods and tests to detect common adulterants.

UNIT-III

Standards for foods: Cereals and pulses, milk and milk products, Coffee, tea, sugar and sugar products.

UNIT-IV

Methods for determining quality - Subjective and objective methods. Sensory assessment of food quality-appearance, color, flavour, texture and taste, different methods of sensory analysis, preparation of score card, panel criteria, sensory evaluation room.

UNIT-V

Food safety, Risks and hazards: Food related hazards, Microbial consideration in food safety, HACCP-principles and structured approach. FSSAI

REFERENCES

1.Food science-Norman potter
2.Food Technology-Presscott.S.C.and Procter
3.Food chemistry-Meyer
4.Food science,Chemistry and experimental foods-M.Swaminathan
5.Food chemistry-Lee
6.Food science-Srilakshmi(2001)2nd edition, New age international publishers-(2001)
7.Rerfus.K.Guthrie-Food sanitation –3rd edition –Van Nostrand Reinhold Newyork 1988.
8.Mahirdra-S.N.-Food safety –A techno-legal analysis-Tata McGrawhill publishers 2000.
9.Manoranjan Kalia-Food processing and preservation.
10.Roday-Food hygiene and sanitation.
11.Indian Food industry,2000,Vol19:2

Elective II	FOOD STORAGE AND PACKAGING	4Hrs	4Credits

Objectives:

- To impart comprehensive overview of the scientific and technical aspects of food packaging.
- To instill knowledge on packaging machinery, systems, testing and regulations ofpackaging.

Unit 1:

Food storage

Introduction classification of food based on perish ability, definition of food storage, types of storage, essential features of food storage areas, basic guidelines for food storage, care and maintenance of storage equipment.

Unit 2:

Introduction to Food Packaging

Packaging Functions and Requirements,, Printing of packages .Barcodes & other marking,Labeling Laws

Unit 3:

Food Packaging Materials

Paper and paper-based materials, corrugated fiber board (CFB).

Plastics, formation- Injection molding, Blow molding, Types of plastics, Lamination, Biodegradable plastics, Edible packaging and Bio-composites. Environmental Concerns- recycling and disposal of plastic waste

Metal packaging- Metals: Tinplate, tinning process, components of tinplate, tin free can (TFC) types of can, metallic films, lacquers

Glass: Composition, Properties, Methods of bottle making, Types of closures.

Unit 4:

Package Designing for Foods

Package design for fresh horticultural produce and animal foods, dry and moisture sensitive foods, frozen foods, fats and oils, thermally processed foods and beverages.

Unit 5:

Testing and Regulatory Aspects of Food Packaging(Chapter 22 Robertson, 2012) Testing Procedures for Packaging Materials- thickness, tensile strength, puncture resistance,bursting strength, seal strength, water vapor permeability, CO2 permeability, oxygenpermeability, grease resistance,

Testing Procedures for Packaged Foods - Compatibility and shelf life studies, evaluation of transport worthiness of filled packages.
Food Packaging Laws and Regulations.

REFERENCES

1. Robertson GL, Food Packaging – Principles and Practice, CRC Press Taylor and FrancisGroup, 2012
2. Paine FA and Paine HY, A Handbook of Food Packaging, Blackie Academic andProfessional, 1992
3. Coles R, McDowell D, Kirwan MJ Food Packaging Technology. Blackwell, 2003
4. Mudambi, Sumathi V. and Rajagopal, M.V. 2001. Fundamentals of Foods & Nutrition. New Age International (P) Ltd. Publishers, New Delhi. 405p.
5. Sethi, M. 2008. Institutional Food Management. New Age International (P) Ltd. Publishers, New Delhi. 450p.
6. Sethi, M. and Malhan, S. 1989. Catering Management: An Integrated Approach. New Age International (P) Ltd. Publishers, New Delhi. 450

SBEC III	FOOD PLANT LAYOUT	3Hrs	2Credits

Objective:

1. To impart comprehensive overview of the scientific and technical aspects of food plan layout.

Unit I

Plant Layout-

Introduction Design considerations of processing agricultural and food products. Plant design concepts and general design considerations: Plant layout, plant location, location factors and their interaction with plant location, location theory models, and computer aided selection of the location. Human factors in design, selection of materials of construction and standard component, design standards and testing standards.

Unit II

Process Economics of Plant Layout

Feasibility analysis and preparation of feasibility report: plant size, factors affecting plant size and their interactions, estimation of break-even and economic plant size; Product and process design, process selection, process flow charts, Plant utilities, electricity, water, steam, air, raw material requirements and computer aided development of flow charts.

Unit III

Food Processing Plant & Equipment Layout

Plant layout and design of bakery and biscuit industries; fruits and vegetables processing industries including beverages Equipment layout in fruits and vegetables processing industries including beverages food Industries : Basic understanding of equipment layout and. Preparation of flow sheets for material movement and utility consumption in food plants.

Unit IV

Food Processing Plant & Equipment Layout

Plant layout and design of milk and milk products; meat, poultry and fish processing industries. Equipment layout in milk and milk products; meat, poultry and fish processing industries: Basic understanding of equipment layout and. Preparation of flow sheets for material movement and utility consumption in food plants.

Unit V

Project Evaluation and Cost Estimation

Preparation of flow sheets for material movement and utility consumption in food plants; Application of Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) in project planning and monitoring; Cost estimation for a Food Plant; Scale-up. Case Study: Preparation of plant layout and cost estimation for a food processing plant

REFERENCES

1. Maroulis, Z.B. and Saravacos, G.D. . Food Process Design. Marcel Dekker Inc,. 2003.
2. Antonio Lopez-Gomez, Gustavo V. Barbosa-Canovas,“Food Plant Design (Food Science and Technology)”, CRC Press, 2005.
3. Towler, G. and Sinnott, R.K. Chemical Engineering design principles, practice and Economics of Plant and Procese. 2nd Edition. Elsevier.2012.
4. Theunis C. Robberts . Food plant engineering system. II Edition, CRC Press, Washington, 2013.
5. M Moore, Mac Millan, Plant Layout & Design. Lames, New York, 1971.
6. Langley and C. Billy, Refrigeration and Air conditioning, Ed. 3, Engle wood Cliffs (NJ), Prentice

SBEC IV	FOOD PLANT HYGIENE AND SANITATION	3Hrs	2Credits

Objectives:

- Introduction to Food Hygiene and Sanitation and its significance in Food industries.
- Understanding general principles of Food Hygiene in relation to food preparation.

UNIT I

General principle of food hygiene

Hygiene in rural and urban areas in relation to food preparation, personal hygiene and food handling habits. Sanitary aspects of building and processing equipment. Establishing and maintaining sanitary practices in food plants.

UNIT II

Physical and chemical control, Food contamination by microorganisms, effective control of micro-organisms, importance in food sanitation, micro-organisms as indicator of sanitary quality.

UNIT III

Sanitary aspects of water supply:

Source of water, quality of water, water supply and its uses in food industries. Purification and disinfection of water preventing contamination of potable water supply.

UNIT IV

Effective detergency and cleaning practices: Importance of cleaning technology, physical and chemical factors in cleaning, classification and formulation of detergents and sanitizers, cleaning practices. Role of sanitation, general sanitary consideration and sanitary evaluation of food plants.

UNIT V

Food Plant Hygiene and Sanitation

Waste disposal, Control methods using Physical and Chemical Agents, Pest and RodentControl, ETP Design and Layout. Food storage sanitation, transport sanitation and water sanitation.

By-products utilisation obtained from dairy plant, egg& poultry processing industry and meatindustry.

Wastewater and solid waste treatment: - Waste-types-solid and liquid waste characterization, physical, chemical, biological, aerobic, anaerobic, primary, secondary and tertiary (advanced) treatments.

REFERENCES

1. Principles of Food Sanitation by Marriott and Norman, G.
2. Hygiene and Sanitation in Food Industry by S. Roday, TMH
3. Guide to Improve Food Hygiene by Gaston and Tiffney, TMH.
4. Practical Food Microbiology & Technology by Harry H. Weiser, Mountney, J. and Gord, W.W.
5. Food Poisoning and Food Hygiene by Betty C. Hobbs, London publication.
6. Norman G. Marriott and Robert B. Gravani. (2006). Principles of Food Sanitation,5th edition

SEMESTER VI

Part	Course Type	Course Title	Hrs. /week	Examination				Credits
				Hrs.	CIA marks	ESE marks	Total marks	
III	Core VII	Food and Nutrition	6	3	40	60	100	4
	Core VIII	Technology of Egg and Dairy	4	3	25	75	100	4
	Core IX	Technology of Fleshy Foods, Spices and Condiments	4	3	25	75	100	4
	Core Practical V	Technology of Fruits, Vegetables and Plantation Crops Practical	-	3	40	60	100	3
	Core Practical VI	Technology of Egg, Dairy and Fleshy Foods Practical	6	3	40	60	100	3
	Elective III	Food Product Development	4	3	25	75	100	4
IV	SBEC V	Bakery	3	3	40	60	100	2
	SBEC VI	Entrepreneurship Deveoplment	3	3	40	60	100	2
V	Extension Activities	NSS/NCC/YRC/Extracurricular Activities						
	Total		30	30	275	525	800	26

CoreVII	FOOD AND NUTRITION	6Hrs	4Credits

Objectives

- Learn the metabolic pathways of nutritional significance
- Get acquainted with the role of enzymes and coenzymes in metabolism

UNIT-I

Concepts of Food and Nutrition

Functions of food; Basic food groups; nutrients supplied by food; Water and energy balance, water intake and losses, basal metabolism, acid base balance

UNIT-II

Balanced diet

Formulation of diets, classification of balanced diet, preparation of balanced diet for various groups; Recommended dietary allowances for various age groups; Malnutrition; Assessment of nutritional status; Food fad and faddism; Potentially toxic substance in human food

UNIT-III

Mechanism of Enzyme action

Introduction to enzyme and characteristics, coenzymes, kinetics and mechanism of enzyme action.

Minerals

Functions, sources, absorption, deficiency of macro minerals
Functions, sources, absorption, deficiency of micro minerals

UNIT-IV

Nutrients

Functions, sources, digestion, absorption, assimilation, transport of carbohydrates
Functions, sources, digestion, absorption, assimilation, transport of proteins
Functions, sources, digestion, absorption, assimilation, transport of fats

UNIT-V

Vitamins Functions, sources, absorption, deficiency of Vitamins A &D
Functions, sources, absorption, deficiency of Vitamins E & K
Functions, sources, absorption, deficiency of water soluble vitamins.

REFERENCES

1. Albanese, A. (Ed.). (2012). Newer methods of nutritional biochemistry V3: Withapplications and interpretations. Elsevier.
2. Bettelheim, F. A., Brown, W. H., Campbell, M. K., & Farrell, S. O. (2009).General,Organic & Biochemistry. Brooks/Cole Cengage Learning.
3. Champe, P. C., Harvey, R. A., & Ferrier, D. R. (2005). Biochemistry. LippincottWilliams & Wilkins, 6th Edition, Wolters Kluwer, London.
4. Chatterjea M.N. and Shinde R.,2016 -Textbook of Medical Biochemistry, 8th edition –Jaypee Brothers Medical Publishers (P) Ltd. New Delhi.
5. David L.N. and Cox M.M., 2017 – Lehninger Principles of Biochemistry, 7th edition - W. H.Freeman & Co Ltd.
6. Harbans Lal, 2017 - Essentials of Biochemistry for BSc Nursing Students – CBS Publishers& Distributors Pvt. Ltd., New Delhi.
7. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2000): 25th Ed. HarpersBiochemistry.Macmillan worth publishers.
8. Sathyanarayana U and Chakrapani U, 2016 – Biochemistry, 4th Revised Edition – Elsevier(New Delhi) and Books and Allied (p) Ltd., Kolkata.
9. Shanmugham Ambika (1985) Fundamentals of bio-chemistry to medicalstudents. NVABharat Printers, and traders 56, Peters Road, Madras-86.

CoreVIII	TECHNOLOGY OF EGG AND DAIRY	4Hrs	4Credits

Objectives

- To know the need and importance of dairy and egg industry
- To know the compositional and technological aspects of milk and egg.
- To study processed milk and egg products.

UNIT-I

Cream: Basic aspect, Classification, manufacture of different types of cream, processing of cream; Classification of dairy products;

Butter: Definition, composition; processing and production steps, overrun, butter making machines, quality testing of table butter, butter- defects, causes and their prevention, packaging and storage

UNIT-II

Paneer and Cheese: Definition, composition, types, processing steps, process flow diagram, equipment, quality defects, causes and prevention, packaging and storage.

UNIT-III

Ice cream and frozen desserts: Definition, composition, types, Processing steps and flow diagram, equipment, quality testing, defects causes and prevention, packaging and storage.

UNIT-IV

Condensed and Dried milk: Definition, composition, role of milk constituents
in condensed milk, manufacture of condensed milk, types of standards for dried milk

UNIT-V

Eggs: Structure, composition, quality characteristics, processing, preservation of eggs. Factors affecting egg quality and measures of egg quality. By-products of eggs and their utilization

REFERENCES

1. De Sukumar, Outlines of Dairy Technology, Oxford University Press, Oxford.2007.
2. Hall GM, Fish Processing Technology, VCH Publishers Inc., NY, 1992
3. Sen DP, Advances in Fish Processing Technology, Allied Publishers Pvt.Limited2005
4. Shahidi F and Botta JR, Seafoods: Chemistry, Processing, Technology and Quality,Blackie Academic & Professional,London,1994
5. Y.H. Hui. 1993. Dairy Science and Technology Handbook, Vol. I, II and III. Wiley-VCH, USA
6. Webb and Johnson, Fundamentals of Dairy Chemistry
7. Vikas Nanda. 2014. Meat, Egg and Poultry Science & Technology. I.K. International Publishing HousePvt. Ltd., New Delhi.

Core IX	TECHNOLOGY OF FLESHY FOODS, SPICES AND CONDIMENTS	4Hrs	4Credits

Objectives

- To understand need and importance of fleshy food and spices and condiments industries
- To study processing and preservation of fleshy foods.

UNIT-I

Structure and composition of muscle, types, classification and composition of fish

Pre-slaughter operations and slaughtering operations for animals and poultry.

Dressing and evaluation of animal carcasses; Factors affecting post-mortem changes, properties and shelf life of meat;

Mechanical deboning, grading and aging; Eating and cooking quality of meat.

UNIT-II

Meat cutting and handling; Preparation, preservation and equipment for manufacture of smoked meat and its quality evaluation

Preparation, packaging and equipment for manufacture of dehydrated meat products and their quality evaluation;

Preparation, preservation and equipment for manufacture of meat sausages and their quality evaluation.

UNIT-III

Production and processing scenario of spice, flavour and plantation crops and its scope.

Major spices: Post harvest technology, composition

Processed products of spices: Ginger, chilli, turmeric, onion and garlic, pepper,Cardamom

UNIT-IV

Minor spices: Herbs, leaves and spartan seasonings and their processing and utilization;

All spice, Annie seed, sweet basil; Caraway seed, cassia, cinnamon Clove, coriander, cumin, dill seed; Fennel seed, nutmeg, mace, mint marjoram. Rosemary, saffron, sage; Savory, thyme, ajowan; Asafetida, curry leaves

UNIT-V

Flavours of minor spices; Flavour of major spices and condiments

Spice oil and oleoresins: Extraction techniques; Super critical fluid extraction of Spices.

Functional packaging of spices and condiments products

By-products of plantation crops and spices and condiments.

REFERENCES

1. K.G. Shanmugavelu. Spices and Plantation Crops. Oxford & IBH Publishing Co., New Delhi
2. J.W. Purseglave, E.G. Brown, C.L. Green and Robins. Spices, Vol. I and II. SRJ Academic Press,New Delhi.
3. H. Panda. Handbook on Spices and Condiments (Cultivation, Processing and Extraction). AsiaPacific Business Press Inc., New Delhi.
4. S. Gupta. Handbook of Spices and Packaging with Formulae. Engineers India Research Institute,
5. Vikas Nanda. 2014. Meat, Egg and Poultry Science & Technology. I.K. International Publishing HousePvt. Ltd., New Delhi.
6. B.D. Sharma and Kinshuki Sharma. 2011. Outlines of Meat Science and Technology. Jaypee BrothersMedical Publishers Pvt. Ltd., New Delhi.
7. Fidel Toldrá, Y. H. Hui, Iciar Astiasarán, Wai-Kit Nip, Joseph G. Sebranek, Expedito-Tadeu F. Silveira,
8. Louise H. Stahnke, Régine Talon. 2007. Handbook of Fermented Meat and Poultry. BlackwellPublishing Professional, Ames, Iowa, USA.
9. Joseph Kerry, John Kerry and David Ledward. 2005. Meat Processing-Improving Quality. WoodheadPublishing Ltd., Cambridge, England.
10. B.D. Sharma. 1999. Meat and Meat Products Technology Including Poultry Products Technology. JaypeeBrothers Medical Publishers Pvt. Ltd, New Delhi.
11. Alan H. Varnam and Jane P. Sutherland. 1995. Meat and Meat Products: Technology, Chemistry andMicrobiology. Chapman & Hall, London.
12. William J. Stadelman and Owen J. Cotterill. 1995. Egg Science and Technology, 4th Ed. Food ProductsPress, NY, USA.
13. R.A. Lawrie. 1985. Meat Science, 4th Ed. Pergamon Press, Oxford, UK.

Core Practical VI	TECHNOLOGY OF EGG, DAIRY AND FLESHY FOODS PRACTICAL	6Hrs	3Credits

Objectives

- To acquire practical skills in techniques used for processing of meat and dairy product

- To formulate and develop novel products with meat and dairy and understand their marketability in the food industry.

1. Preparation of ghee
2. Preparation of paneer
3. Preparation of ice-cream
4. Preparation of khoa
5. Preparation of whey drink
6. Preparation of halwa/ kheer etc.
7. Determination of selected quality parameters of selected dairy products.
8. Preservation of meat/ fish by curing and pickling
9. Preservation of meat by dehydration
10. Evaluation of quality and grading of raw and boiled eggs
11. Preparation of value added dairy/meat/ egg

REFERENCES

1. Das H. (2005). Food Processing Operations Analysis, Asian Books.
2. De Sukumar, (2007) Outlines of Dairy Technology, Oxford University Press.
3. Ramesh C. Chandan, Arun Kilara Nagendra Shah (Editors) 2008 Dairy Processing and Quality Assurance Hardcover, Wiley Blackwell Publisher
4. Spreer, Edgar, (2005). Milk and Dairy Product Technology, Marcel Dekker.
5. 3.Y.H. Hui (2012)- Handbook of meat and Meat processing, CRC Press

Elective III	FOOD P RODUCT DEVELOPMENT	4Hrs	4Credits

Learning Objectives

To enable the students to:

- Understand the concept of development of a new product
- Discuss the preparation of new products based on special dietary requirements, functionality, convenience
- Employ novel methods to enhance traditional Indian foods.

UNIT-I

Introduction to New food products & food product development

Concepts, definitions & characteristics. Factors to consider for food product development (external and internal factors)

Types of new food products- Line extensions, new-to-world products, innovative/creative products, existing products- repositioned, reformulated, new form, new size, and new package.

UNIT-II

Stages in food product development Idea generation

Internal & external sources; Screening - Course Objectives and criterion; Development of product prototype- market research, concept testing approaches, product formulation and specification, product optimization, process development & optimization, product attributes, scale up requirements; Product prototype testing - consumer testing, packaging testing, shelf life testing, product integrity and conformance to standards; Marketing plans - price structure, place & distribution system, promotional program, market positioning, test marketing,results evaluation

UNIT-III

Concepts in sensory evaluation of foods

Sensory attributes of foods: Chemical senses (olfactory and gustatory);physical, kinesthetic and tactile senses (appearance, color, texture, & overall taste).

Score card development. Role of sensory analysis in product development& quality control.

UNIT-IV

Subjective evaluation methods

Definition, advantages, and disadvantages. Subjective tests: Analytical tests (sensitivity tests, difference tests, ranking tests), descriptive tests, and consumer/ preference tests.

UNIT-V

Objective and instrumental evaluation methods

Objective methods for appearance, size, shape, volume, specific gravity,refractive index, moisture, fat, and others. Instrumental methods for evaluation of color, viscosity, texture & aroma.

TEXT BOOKS

1. Carpenter Lyon & Hasdell, “Guidelines for Sensory Analysis in Food Product Development and Quality Control”, Springer, 2000
2. Earle, M. D., Earle, R. L., & Anderson, A. M. (2001). Food product development. Boca Raton, Fla: CRC Press.

3. Gordon L Robertson. 2006. Food Packaging: Principles and Practice. 2nd Ed. CRC Press
4. Harper J.M. Extrusion of Foods. Vol. 1 & 2 (1991) CRC Press, Inc.) Boca Raton, Aorida
5. Naik, H.R., & Amin, T. (2021). Food Processing and Preservation (1st ed.). CRC Press. https://doi.org/10.1201/9781003243250
6. V.K. Joshi (2006) Sensory science- Principles and Applications in Food Evaluation,Agrotech Publishing Academy, Udaipur.

SBEC V	BAKERY	3Hrs	2Credits

Learning Objectives:

To enable student to

1. Understand the technique of baking.
2. Know the equipments and ingredients used in baking.
3. Understand the production of baked products.

UNIT I: BAKING

a. History of baking, definition, principle, changes that take place during baking, advantages and disadvantages, classification of baked foods.
b. Factors to be considered for setting up a bakery unit.

UNIT II: EQUIPMENTS

a. Major equipment's – description, types, materials and usage.
b. Minor equipment's - description, types, materials and usage.

UNIT III: INGREDIENTS

a. Major ingredients – types, role and usage.
b. Minor ingredients - types, role and usage.
c. Batter and Dough – definition, types, methods of making batter and dough.

UNIT IV: CAKES

a. Cake preparation – ingredients, methods, types.
b. Faults and remedies.
c. Icing – Definition, types.

UNIT V: BISCUITS

a. Biscuit preparation – ingredients, methods, types.
b. Faults and remedies.

TEXT BOOKS

1. YogambalAshokkumar, (2012), Textbook of Bakery and Confectionery, 2nd edition, PHI, New Delhi.
2. Sivasankar, D., (2007), Food Processing and Preservation, Prentice Hall of India, New Delhi.
3. Dubey, S.C., (2012), Basic Baking, 4th Edition, The Society of Indian Bakers, New Delhi.
4. Bakers, (2008), Handbook on Practical Baking, US Wheat Associates, New Delhi.

SBEC VI	ENTREPRENEURSHIP DEVELOPMENT	3Hrs	2Credits

Objectives

- Initiate entrepreneurial motive and impart skills and capabilities for entrepreneurship
- Comprehend nuances of entrepreneurship
- Gain knowledge on Governmental plans and programs

UNIT-I

Entrepreneurship: Importance and growth, characteristics and qualities of entrepreneur

Role of entrepreneurship, ethics and social responsibilities

Entrepreneurship development: Assessing overall business environment in the Indian economy

Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs

UNIT-II

Globalization and the emerging business/entrepreneurial environment

Concept of entrepreneurship

Entrepreneurial and managerial characteristics, managing an enterprise

Motivation and entrepreneurship development, importance of planning, monitoring, evaluation and follow up, managing competition, entrepreneurship development programs

SWOT analysis

Generation, incubation and commercialization of ideas and innovations

UNIT-III

Women entrepreneurship: Role and importance, problems

Planning and evaluation of projects: Growth of firm, project identification and selection, factors inducing growth

UNIT-IV

Project feasibility study: Post planning of project, project planning and control; New venture management; Creativity

Government schemes and incentives for promotion of entrepreneurship; Government policy on small and medium enterprises (SMEs)/SSIs

UNIT-V

Export and import policies relevant to food processing sector; Venture capital; Contract farming and joint ventures, public-private partnerships

Overview of food industry inputs; Characteristics of Indian food processing industries and export

REFERENCES

1. B. Jankiraman, P.V. Raveendra, V.K. Srirama (2010). Role and Challenges of Entrepreneurship Development, Excel Books Publishers
2. Dr.Jayshree Suresh (2012) Entrepreneurial Development, Margham Publications
3. S S Khanka (2011) Entrepreneurial development, S Chand, and company
4. Sunil Gupta, (2018), Small-Scale Industries and Entrepreneurship, ABD Publishers
5. T N Chhabra (2019), Entrepreneurship Development, Sun India Publications
6. Taneja, S. and Gupta, S.L. (1992). Entrepreneurship Development, New Venture Creation, Galgotia Publishing Company, New Delhi.