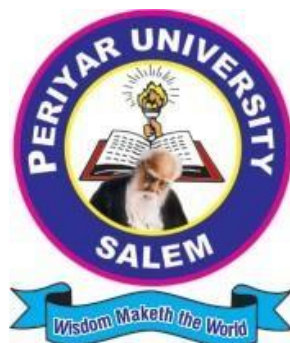


PERIYAR UNIVERSITY

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 2022 - 2023 onwards)

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Sem.	Paper Code	Title of the paper	Page No.
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ALLIED COURSES (FOOD TECHNOLOGY ONLY)			
III		Allied Course II Food Safety and Microbiology I	
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NON-MAJOR ELECTIVE COURSES (For Other Major)			
III		<i>NMEC I</i> Food Preservation	
IV		<i>NMEC II</i> Food Safety Initiatives	

REGULATIONS

1. Preamble:

B.Sc. Food Technology curriculum has been structured in compliance with UGC Model curriculum and TANSCHÉ 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 x 1 = 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	3	3	25	75	100	3
II	Language (English)	English I – Communicative English	3	3	25	75	100	3
III	Core I	Fundamentals of Food Science and Chemistry	5	3	25	75	100	5
	Core Practical I	Fundamentals of Food Science and Chemistry Practical	6	-	-	-	-	-
	Allied I	Chemistry I	4	3	25	75	100	4
	Allied Practical I	Chemistry I Practical	3	-	-	-	-	-
IV	Add-on Course	Professional English I	4	3	25	75	100	4
	Value Education	Food Culture and Ethics in Literature	2	3	25	75	100	2
Total			30	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	3	3	25	75	100	3
II	Language	English II- Communicative English	3	3	25	75	100	3
II	NMSDC	Effective English	2	2	25	75	100	2
III	Core II	Principles of Food Processing and Preservation	5	3	25	75	100	5
	Core Practical II	Principles of Food Processing and Preservation Practical	6	3	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	-	3	40	60	100	3
IV	Add-on course	Professional English II	4	4	25	75	100	4
Total			30	26	265	630	900	29
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	5	3	25	75	100	3
	Core Practical III	Fundamentals of Food Engineering Practical	2	-	-	-	-	-
IV	Allied II	Food Safety and Microbiology I	2	3	25	75	100	4
	Allied Practical II	Food Safety and Microbiology Practical I	2	-	-	-	-	-

IV	SBEC I	Food Product Innovation	3	3	25	75	100	3
	NMEC I	Food Preservation	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	3	3	25	75	100	3
II	Language	English IV- Communicative English	3	3	25	75	100	3
III	Core IV	Technology of Cereals, Pulses and Oilseeds	5	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	4	3	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	SBEC	Digital Skill for Employability – Office Fundamentals	2	2	25	75	100	2
IV	SBEC II	Food Additives	3	3	25	75	100	3
	NMEC II	Food Safety Initiatives	3	3	25	75	100	3
Total			30	29	295	705	100	31
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	4	-	-	-	-	-
	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 Practical	Food Plant Layout	3	3	25	75	100	2
	SBEC IV Practical	Food Plant Hygiene and Sanitation	3	3	40	60	100	2
IV	NMSDC	Advanced Technology for Employability – International Regulatory Requirement in Clinical Trial & Data Management	2	3	25	75	100	2
Total			30	21	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	Institutional Training	6	3	40	60	100	2
	Core VIII	Technology of Egg and Dairy	4	3	25	75	100	4
	Core IX	Technology of Fleshy	4	3	25	75	100	4

		Foods, Spices and Condiments						
	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 Biotechnology	4	3	25	75	100	4
IV	SBEC V Practical	Food Quality Assurance	3	3	40	60	100	2
	SBEC VI Capstone Project	Food Entrepreneurship	3	3	40	60	100	2
	Add On Course	NMSDC Employability Readiness	-	-	-	-	-	-
V	Extension Activities	NSS/NCC/YRC/Extracurricular Activities						
	Total		30	24	275	525	800	24

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	24
Total	30	4300	145

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- <i>Types & Properties, Sols, Gels, Emulsion and Foams –nature and factors influencing its formation and stability, application of colloidal chemistry to food preparation</i> c. Cooking of food - <i>cooking methods and principles and effect of cooking on constituents of food</i>	CO1
II	a. Water – <i>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</i> b. Carbohydrates – <i>types of carbohydrates in food, chemical structure, physio-chemical and functional properties, types of starch, resistant starch; role of food carbohydrate/starch in cookery</i>	CO2
III	a. Proteins – <i>classification/types, chemistry and nature of proteins in food, physio-chemical and functional properties of food proteins, role of food proteins in cookery</i> b. Lipids – <i>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</i>	CO3
IV	a. Vitamins - <i>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</i> b. Minerals - <i>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</i>	CO4

V	a. Colours/Pigments - <i>classification/types, chemistry and nature of colours/pigments in food, effect of cooking on colours/pigments in food</i> b. Flavours - <i>classification/types, chemistry and nature of flavours in food, effect of cooking on flavours in food</i> c. Enzymes - <i>classification/types, chemistry and nature of enzymes in food, effect of cooking on enzymes in food, enzymatic and non-enzymatic browning reaction in food</i> d. Phytochemicals - <i>classification/types, chemistry and nature of phytochemicals in food, effect of cooking on phytochemicals in food</i>	CO5
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2	Fennema, Owen R. (1996), Food Chemistry, 3 rd Ed., Marcel Dekker, New York
3	Norman N. Potter and Joseph H. Hotchkiss, (1998), Food Science, 5 th Ed., Springer
4	H.-D. Belitz., W. Grosch., P. Schieberle., (2009), Food Chemistry, 4 th 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	To characterise the nature of functional components (colours/pigments,	2+16+6 = 24

Phytonutrients	flavours, enzymes and phytochemicals) in food on cooking/ripening/processing	
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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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 using soxhlet apparatus 6. Determine the FFA, Iodine number and saponification value of fresh fats and oils and RUCO 	CO3
IV	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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 its nature of browning 4. Identify the presence or absence of phytochemicals in food on cooking/processing 	CO5

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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.
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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.
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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: <i>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</i> b. Food Preservation: <i>Principles, methods and importance of food preservation</i>	CO1
II	a. Packaging and Bottling - <i>metal containers, glass containers, plastic containers, retortable Pouches, artificial and intelligent packages and methods of packaging – ordinary, controlled and modified atmosphere, vacuum packaging</i> b. Pasteurization and Sterilization - <i>Definition, time-temperature combination and equipments</i> c. Blanching and Canning - <i>Definition, time-temperature combination and equipments, adequacy in blanching and canning</i>	CO2
III	a. Cold storage – <i>Refrigeration, cold storage methods, advantages and disadvantages</i> b. Freezing - <i>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</i>	CO3
IV	a. Drying: <i>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</i> b. Dehydration: <i>Water activity, moisture sorption isotherm, osmotic dehydration using salt and sugar</i>	CO4

V	<p>a. Membrane Technology - <i>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</i></p> <p>b. Preservation by using preservatives - <i>Food additives - Definition, types, Class I and Class II preservatives</i></p> <p>c. Hurdle Technology - <i>concept and its application</i></p>	CO5
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REFERENCE BOOKS	
1	J. Scott Smith, Y. H. Hui, (2004), Food Processing, Principles and Applications, 1 st Edition, Blackwell Publishing Ltd, UK
2	M.Shafiur Rahman, (2007), Handbook of Food Preservation, 2 nd 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, 2 nd 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.

REFERENCES

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 Institute 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 products and canned foods..

REFERENC

1. Siddappa, 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****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 and organization.

UNIT II

Basic principles & concept of food product development. Cultural approach to development of dietary pattern of various groups- linguistic, regional, religious(ethnic). 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 new products.

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****UNIT I**

Fundamentals of Food Preservation -Concept - Importance of food preservation - Principles of food 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 -Natural preservatives -Synthetic preservatives

UNIT IV

Irradiation - Concept, definition -Principles of irradiation. - Types -Application. Preservation by drying -Concept, history -Types of drying and dryers. -Treatments prior to 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 by low 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.3 McWillims and Paine : Modern Food Preservation , Surjeet Publication.
- 4 Fellows, P and Ellis H. 1990 Food Processing Technology: Principal and Practicals,New York.
- 5 NPCS Board, Modern Technology on Food Preservation 6) B. Sivasankar; Food Processing and Preservation.