ROYAL GLOBAL UNIVERSITY
GUWAHATI

ROYAL SCHOOL OF BIOSCIENCES (RSBSC)

DEPARTMENT OF FOOD TECHNOLOGY

COURSE STRUCTURE & SYLLABUS

(BASED ON NATIONAL EDUCATION POLICY 2020)

FOR

B.Sc. IN FOOD TECHNOLOGY
(4 YEARS SINGLE MAJOR)

W.E.F

AY - 2023 – 24

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1. Preamble

The National Education Policy (NEP) 2020 conceives a new vision for India's higher education system. It recognizes that higher education plays an extremely important role in promoting equity, human as well as societal well-being and in developing India as envisioned in its Constitution. It is desired that higher education will significantly contribute towards sustainable livelihoods and economic development of the nation as India moves towards becoming a knowledge economy and society.

If we focus on the 21st century requirements, the higher education framework of the nation must aim to develop good, thoughtful, well-rounded, and creative individuals and must enable an individual to study one or more specialized areas of interest at a deep level, and also develop character, ethical and Constitutional values, intellectual curiosity, scientific temper, creativity, spirit of service, and twenty-first-century capabilities across a range of disciplines including sciences, social sciences, arts, humanities, languages, as well as professional, technical, and vocational subjects. A quality higher education should be capable enough to enable personal accomplishment and enlightenment, constructive public engagement, and productive contribution to the society. Overall, it should focus on preparing students for more meaningful and satisfying lives and work roles and enable economic independence.

Towards the attainment of holistic and multidisciplinary education, the flexible curricula of the University will include credit-based courses, projects in the areas of community engagement and service, environmental education, and value-based education. As part of holistic education, students will also be provided with opportunities for internships with local industries, businesses, artists, crafts persons, and so on, as well as research internships with faculty and researchers at the University, so that students may actively engage with the practical aspects of their learning and thereby improve their employability.

The undergraduate curriculums are diverse and have varied subjects to be covered to meet the needs of the programs. As per the recommendations from the UGC, introduction of courses related to Indian Knowledge System (IKS) is being incorporated in the curriculum structure which encompasses all of the systematized disciplines of Knowledge which were developed to a high degree of sophistication in India from ancient times and all of the traditions and practises that the various communities of India—including the tribal communities—have evolved, refined and preserved over generations, like for example Vedic Mathematics, Vedangas, Indian Astronomy, Fine Arts, Metallurgy, etc.

At RGU, we are committed that at the societal level, higher education will enable each student to develop themselves to be an enlightened, socially conscious, knowledgeable, and skilled citizen who can find and implement robust solutions to its own problems. For the students at the University, Higher education is expected to form the basis for knowledge creation and innovation thereby contributing to a more vibrant, socially engaged, cooperative community leading towards a happier, cohesive, cultured, productive, innovative, progressive, and prosperous nation."

1.1 INTRODUCTION

The National Education Policy (NEP) 2020 clearly indicates that higher education plays an extremely important role in promoting human as well as societal well-being in India. As envisioned in the 21st-century requirements, quality higher education must aim to develop good, thoughtful, well-rounded, and creative individuals. According to the new education policy, assessments of educational approaches in undergraduate education will integrate the humanities and arts with Science, Technology, Engineering and Mathematics (STEM) that will lead to positive learning outcomes. This will lead to develop creativity and innovation, critical thinking and higher-order thinking capacities, problem-solving abilities, teamwork, communication skills, more in-depth learning, and mastery of curricula across fields, increases in social and moral awareness, etc., besides general engagement and enjoyment of learning. and more in-depth learning.

The NEP highlights that the following fundamental principles that have a direct bearing on the curricula would guide the education system at large, viz.

- Recognizing, identifying, and fostering the unique capabilities of each student to promote her/his holistic development.
- Flexibility, so that learners can select their learning trajectories and programmes, and thereby choose their own paths in life according to their talents and interests.
- Multidisciplinary and holistic education across the sciences, social sciences, arts, humanities, and sports for a multidisciplinary world.
- Emphasis on conceptual understanding rather than rote learning, critical thinking to encourage logical decision-making and innovation; ethics and human & constitutional values, and life skills such as communication, teamwork, leadership, and resilience.
- Extensive use of technology in teaching and learning, removing language barriers, increasing access for Divyang students, and educational planning and management.
- Respect for diversity and respect for the local context in all curricula, pedagogy,and policy.
- Equity and inclusion as the cornerstone of all educational decisions to ensure that all students can thrive in the education system and the institutional environment are responsive to differences to ensure that high-quality education is available for all.
- Rootedness and pride in India, and its rich, diverse, ancient, and modern culture, languages, knowledge systems, and traditions.

1.2 Learning Outcomes-Based Approach to Curricular Planning:

The learning outcomes-based curriculum framework is based on the premise that every student and graduate is unique. Each student or graduate has his/her own characteristics in terms of previous learning levels and experiences, life experiences, learning styles and approaches to future career- 2 related actions. The quality, depth and breadth of the learning experiences made available to the students while at the higher education institutions help develop their characteristic attributes.

The key objectives that underpin curriculum planning and development at the undergraduate level include Programme Learning Outcomes, and Course Learning Outcomes. For the B.Sc. (H) Food Technology course it includes:

- To demonstrate comprehensive knowledge and understanding of the food technology curriculum.

- To apply the principles of food science to preserve, process and package to assure the quality and safety of food products.

- To understand that the real-world problems in the food industry requires continuous acquisition of knowledge and its application to improve the safety and quality of a given food or process.

- To analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

- To acquire knowledge and skills, including "learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

- To use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources.

- To acquire professional competency and entrepreneurial skills for economic empowerment.

- To demonstrate the ability to acquire, analyze, interpret and appropriately present laboratory data

2. Award of Degree

The structure and duration of undergraduate programmes of study offered by the University as per NEP 2020 include:

2.1. Undergraduate programmes of either 3 or 4-year duration with Single Major, with multiple entry and exit options, with appropriate certifications:

2.1.1. UG Certificate: Students who opt to exit after completion of the first year and have secured 40 credits will be awarded a UG certificate if, in addition, they complete one vocational course of 4 credits during the summer vacation of the first year. These students are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

2.1.2. UG Diploma: Students who opt to exit after completion of the second year and have secured 80 credits will be awarded the UG diploma if, in addition, they complete one vocational course of 4 credits during the summer vacation of the second year. These students are allowed to re-enter within a period of three years and complete the degree programme within the maximum period of seven years.

2.1.3. 3-year UG Degree: Students who will undergo a 3-year UG programme will be awarded UG Degree in the Major discipline after successful completion of three years, securing 120 credits and satisfying the minimum credit requirement.

2.1.4. 4-year UG Degree (Honours): A four-year UG Honours degree in the major discipline will be awarded to those who complete a four-year degree programme with 160 credits and have satisfied the credit requirements as given in Table 6 in Section 5.

2.1.5. 4-year UG Degree (Honours with Research): Students who secure 75% marks and above in the first six semesters and wish to undertake research at the undergraduate level can choose a research stream in the fourth year. They should do a research project or dissertation under the guidance of a Faculty Member of the University. The research project/dissertation will be in the major discipline. The students who secure 160 credits, including 12 credits from a research project/dissertation, will be awarded UG Degree (Honours with Research).

Table: 1: Award of Degree and Credit Structure with ME-ME

Award	Year	Credits to earn	Additional Credits	Re-entry allowed within (yrs)	Years to Complete
UG Certificate	1	40	4	3	7
UG Diploma	2	80	4	3	7
3-year UG Degree (Major)	3	120	x	x	x
4-year UG Degree (Honours)	4	160	x	x	x
4-year UG Degree (Honors with Research):	4	160	Students who secure cumulative 75% marks and above in the first six semesters		

3. Graduate Attributes:

Table: 2: The Learning Outcomes Descriptors and Graduate Attributes

Sl. No.	Graduate Attribute	The Learning Outcomes Descriptors (The graduates should be able to demonstrate the capability to:)
GA1	Disciplinary Knowledge	acquire knowledge and coherent understanding of the chosen disciplinary/interdisciplinary areas of study.
GA 2	Complex problem solving	solve different kinds of problems in familiar and non-familiar contexts and apply learning to real-life situations.
GA 3	Analytical & Critical thinking	apply analytical thought including the analysis and evaluation of policies, and practices. Able to identify relevant assumptions or implications. Identify logical flaws and holes in the arguments of others. Analyse and synthesize data from a variety of sources and draw valid conclusions and support them with evidence and examples.
GA 4	Creativity	create, perform, or think in different and diverse ways about the same objects or scenarios and deal with problems and situations that do not have simple solutions. Think ‘out of the box’ and generate solutions to complex problems in unfamiliar contexts by adopting innovative, imaginative, lateral thinking, interpersonal skills, and emotional intelligence.
GA 5	Communication Skills	listen carefully, read texts and research papers analytically, and present complex information in a clear and concise manner to different groups/audiences. Express thoughts and ideas effectively in writing and orally and communicate with others using appropriate media.

GA 6	Research-related skills	develop a keen sense of observation, inquiry, and capability for asking relevant/ appropriate questions. Should acquire the ability to problematize, synthesize and articulate issues and design research proposals, define problems, formulate appropriate and relevant research questions, formulate hypotheses, test hypotheses using quantitative and qualitative data, establish hypotheses, make inferences based on the analysis and interpretation of data, and predict cause-and-effect relationships. Should develop the ability to acquire the understanding of basic research ethics and skills in practicing/doing ethics in the field/ in personal research work.
GA 7	Collaboration	work effectively and respectfully with diverse teams in the interests of a common cause and work efficiently as a member of a team.
GA 8	Leadership readiness/qualities	plan the tasks of a team or an organization and setting direction by formulating an inspiring vision and building a team that can help achieve the vision.
GA 9	Digital and technological skills	use ICT in a variety of learning and work situations. Access, evaluate, and use a variety of relevant information sources and use appropriate software for analysis of data.
GA 10	Environmental awareness and action	mitigate the effects of environmental degradation, climate change, and pollution. Should develop the technique of effective waste management, conservation of biological diversity, management of biological resources and biodiversity, forest and wildlife conservation, and sustainable development and living.

4. Programme Learning Outcomes relating to B. Sc (Honours) degree programme in Food Technology

Students graduating with the degree B.Sc. (Food technology) will be able to achieve the following:

PLO1: Knowledge of Food Technology: Students are able to demonstrate comprehensive knowledge and understanding of one or more disciplines such as chemistry, bio-chemistry, mathematics, statistics, microbiology, engineering, management; regulations with support of different allied subjects of Life Science; Physical Science

PLO2: Develop the ability to solve complex problems Develop: Identify, formulate, review research literature, and analyze complex. Food Technology/applications problems and Design solutions for complex problems and design system components or processes that meet the specified needs with appropriate consideration for the food sustainability

PLO3: **Develop Critical thinking and analytical reasoning ability:** Recognize the need for, and have the preparation and ability to engage in independent/as an entrepreneur and life-long learning in the broadest context of technological change logical reasoning and capability of recognizing and distinguishing the various aspects of real-life problems.

PLO4: Develop the ability to create: Recognize new skills, ideas and technologies and its implementation in new product developments**.**

PLO5: Communication Skills: Communicate effectively and write effective reports and design documentation, make effective presentation through seminars, project dissertations

PLO6: Develop Research related skills: Acquire the practical knowledge and demonstrate the ability to design, conduct/trouble shoot experiments and analyze data in the field of food technology

PLO7: Develop the skills for collaborative work and team building: Work effectively with food industries, laboratories and production processing team to build the technical and practical learning aspects.

PLO8: **Develop Leadership qualities:** Work effectively with the team work and building capabilities and leadership qualities for achieving the vision**.**

PLO9: Develop Digital and technological skills: The completion of this programme will enable the learner to use appropriate software's to apply for bulk scale/industrial production of technology-based food products.

PLO10: Develop Environmental awareness and imbibe skills for addressing the problems: Examining the role of health consciousness, environmental awareness and intention on purchase of organic food.

5. B.Sc. Food Technology Programme Specific Outcomes

The programme specific outcomes of the course are-

PSO 1: Knowledge of various areas related to Food science and technology,

PSO 2: Understanding of the food composition and its physico-chemical, nutritional, microbiological and sensory aspects,

PSO 3: Knowledge of processing and preservation techniques of pulses, oilseeds, spices, fruits and vegetables, meat, fish, poultry, milk & milk products,

PSO 4: Relevance and significance of food safety, food quality, food plant sanitation, food laws and regulations, food engineering and packaging in food industry.

6. Teaching Learning Process

Teaching and learning in this programme involve classroom lectures as well as tutorial and remedial classes.

Tutorial classes: Tutorials allow closer interaction between students and teacher as each student gets individual attention. The tutorials are conducted for students who are unable to achieve average grades in their weekly assessments. Tutorials are divided into three categories, viz. discussion-based tutorials (focusing on deeper exploration of course content through discussions and debates), problem-solving tutorials (focusing on problem solving processes and quantitative reasoning), and Q&A tutorials (students ask questions about course content and assignments and consolidate their learning in the guiding presence of the tutor).

Remedial classes: The remedial classes are conducted for students who achieve average and above average grades in their weekly assessments. The focus is laid to equip the students to perform better in the exams/assessments. The students are divided into small groups to provide dedicated learning support. Tutors are assigned to provide extra time and resources to help them understand concepts with advanced nuances. Small groups allow tutors to address their specific needs and monitor them. Following methods are adopted for tutorial and remedial classes:

- Written assignments and projects submitted by students
- Project-based learning
- Group discussions
- Home assignments

- Class tests, quizzes, debates organised in the department
- PPT (Presentation), Seminars and conferences
- Extra-curricular activities like cultural activities, community outreach programmes etc.
- Industrial tour / field visit

7. Assessment Methods

	Component of Evaluation	Marks	Frequency	Code	Weightage (%)
A	**Continuous Evaluation**				
I	Analysis/Class test	Combination of any three from (i) to (v)with 5 marks each	1-3	C	25%
II	Home Assignment		1-3	H	
III	Project		1	P	
IV	Seminar		1-2	S	
V	Viva-Voce/Presentation		1-2	V	
VI	MSE	MSE shallbe of 10 Marks	1-3	Q/CT	
VII	Attendance	Attendance shall be of 5 marks	100%	A	5%
B	**Semester End Examination**		1	SEE	70%
	Project				100%

Course Structure
B.Sc. in Food Technology

1st SEMESTER					
COMPONENT	**COURSE CODE**	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
Major (Core)	FTC152M101	Principles of Food Processing and Preservation	100	3	3-0-0
	FTC152M111	Practical on Principles of Food Processing and Preservation	100	3	0-0-6
Minor	FTC152N101	Basic Food Science	100	3	3-0-0
IKS	IKS 1	IKS I (Introduction to Indian Knowledge System- I)		3	3-0-0
Ability Enhancement course (AEC)	AEC982A101	Communicative English		1	1-0-0
	BHS982A102	Behavioral Science –I		1	1-0-0
Skill Enhancement Course (SEC)	FTC152S111	Fruits and Vegetables Processing		3	0-0-6
Value Added Course (VAC)	VAC 1	Basket Course		3	3-0-0
*Swayam/MOOCs	Swayam/MOOCs 1	*Swayam/MOOCs course will be identified by the dept. from the list of courses available on the MOOCs/Swayam portal	100	3	
TOTAL CREDIT FOR 1st SEMESTER				**23**	
2nd SEMESTER					
COMPONENT	**COURSE CODE**	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
Major (Core)	FTC152M201	Fruits and Vegetables Product Technology	100	3	3-0-0
	FTC152M211	Practical on Fruits and Vegetables Product Technology	100	3	0-0-6
Minor	FTC152N201	Food Microbiology	100	3	3-0-0
IKS	IKS	IKS II (Introduction to Indian Knowledge System- II)		3	3-0-0
AEC	AEC982A201	Communicative English		1	1-0-0
	BHS982A202	Behavioral Science –II		1	1-0-0
SEC	FTC152S211	Waste and By-product Utilization		3	0-0-6
VAC	VAC 2	Basket Course		3	3-0-0
*Swayam/MOOCs	Swayam/MOOCs 1	*Swayam/MOOCs course will be identified by the dept. from the list of courses available on the MOOCs/Swayam portal	100	3	
TOTAL CREDIT FOR 2nd SEMESTER				**23**	
3rd SEMESTER					
COMPONENT	**COURSE CODE**	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
Major (Core)	FTC152M301	Food Chemistry	200	4	4-0-0
	FTC152M311	Practical on Food Chemistry	200	4	0-0-8
Minor	FTC152N301	Food Ingredients and Additives	200	4	4-0-0

IDC	IDC 3	Basic Food Processing		3	3-0-0
AEC	AEC982A301 BHS982A302	Communicative English Behavioral Science –III		1 1	1-0-0 1-0-0
SEC	FTC152S311	Basic techniques in bakery		3	0-0-6
*Swayam/MOOCs	Swayam/MOOCs 1	*Swayam/MOOCs course will be identified by the dept. from the list of courses available on the MOOCs/Swayam portal	100	3	
TOTAL CREDIT FOR 3rd SEMESTER				**23**	
4th SEMESTER					
COMPONENT	**COURSE CODE**	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
Major (Core)	FTC152M401 FTC152M402 FTC152M411	Cereals, Pulses and Oilseeds Product Technology Traditional Knowledge of Indian Foods Practical Cereals, Pulses and Oilseeds Product Technology and Traditional Knowledge of Indian Foods	200 200 200	4 4 4	4-0-0 4-0-0 0-0-8
Minor	FTC152N401 FTC152N402	Food Product Development Sugar Confectionary and Chocolate Processing	200 200	3 3	3-0-0 3-0-0
AEC	AEC982A401 BHS982A402	Communicative English Behavioral Science –IV		1 1	1-0-0 1-0-0
*Swayam/MOOCs	Swayam/MOOCs 1	*Swayam/MOOCs course will be identified by the dept. from the list of courses available on the MOOCs/Swayam portal	100	3	
TOTAL CREDIT FOR 4th SEMESTER				**23**	
5th SEMESTER					
COMPONENT	**COURSE CODE**	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
Major (Core)	FTC152M501 FTC152M502 FTC152M511	Dairy Technology Animal Product Technology Practical on Dairy and Animal Product Technology	300 300 300	4 4 4	4-0-0 4-0-0 0-0-8
Minor	FTC152N501	Basic of Food Processing and Preservation	200	4	4-0-0
Internship	FTC152M521	Internship		4	
TOTAL CREDIT FOR 5th SEMESTER				**20**	
6th SEMESTER					
COMPONENT	**COURSE CODE**	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**

Major (Core)	FTC152M601	Unit Operations in food processing	300	4	4-0-0
	FTC152M602	Food Packaging Technology	300	4	4-0-0
	FTC152M603	Food Safety and Quality Management	300	4	4-0-0
	FTC152M611	Practical on Unit operation, packaging and quality management	300	4	0-0-8
Minor	FTC152N601	Extrusion Technology	200	4	4-0-0
		TOTAL CREDIT FOR 6th SEMESTER		**20**	
		7th SEMESTER			
COMPONENT	**COURSE CODE**	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
Major (Core)	FTC152M701	Food Plant Sanitation	400	4	4-0-0
	FTC152M702	Concepts of Food Engineering	400	4	4-0-0
	FTC152M703	Fermentation Technology	400	4	4-0-0
	FTC152M711	Practical on Food Plant Sanitation and Fermentation Technology	400	4	0-0-8
Minor	FTC152N701	Food Business Management	300	4	0-0-4
		TOTAL CREDIT FOR 7th SEMESTER		**20**	
		8th SEMESTER			
COMPONENT	**COURSE CODE**	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
Major (Core)	FTC152M801	Nutraceutical and Functional Foods	400	4	4-0-0
Minor	FTC152N801	Research Methodology	300	4	4-0-0
Project / Dissertation	FTC152M821	Research Project		12	
		OR			
	FTC152M802	Food Quality and Sensory Evaluation	400	4	4-0-0
	FTC152M803	Food Adulteration and Additives	400	4	4-0-0
	FTC152M804	Technology of Spices, Condiments and Plantation Crops	400	4	4-0-0
		TOTAL CREDIT FOR 8th SEMESTER		**20**	

Semester I

Course: Major **Scheme of Evaluation(T)**
Level of Course:100
Title of Paper: Principles of Food Processing and Preservation
Subject Code: FTC152M101
L-T-P-C: 3-0-0-3 **Total credits:3**

Course Objectives

To train the students with various types of processing techniques used in food industry and to understand how processing can lead to increase in food shelf life and palatability.

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms TaxonomyLevel**
CO 1	**Relate** the principle of food processing techniques, its function and application	**BT 1**
CO 2	**Explain** different techniques of freezing in food processing	**BT 2**
CO 3	**Develop** an insight into the different techniques of food	**BT 3**
CO 4	**Analyse** the novel techniques of food preservation	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I.	**Food processing and preservation principles:** Method of preservation: pasteurization (definition, time-temperature combination and equipment's) sterilization (definition, time-temperature combination and equipment's), blanching (definition, time-temperature combination and equipment's, adequacy in blanching), canning (definition, time-temperature combination and equipment's), packaging (Introduction, Metal Containers, Glass Containers, Rigid Plastic Containers, Retortable Pouches).	**15**
II.	**Food Concentration:** Definition of drying and dehydration, Factors affecting drying, types of dryers. Definition of evaporation, types of evaporators. Freeze concentration and food freezing and thawing and the general principles of crystallization and nucleation of ice. Water Activity, free water, bound water and its role in preservation	**15**
III.	**Basic unit operations in food processing:** Cleaning, sorting, grading, blanching, cutting, dicing, mincing, slicing, chopping, grating, sieving, soaking, coating, germination and fermentation, filtration techniques	**15**
IV.	**Introduction to Novel Food Preservation Techniques:** Basics of Ohmic Heating, irradiation, pulsed electric field, pulsed light, high pressure processing, cold plasma	**15**
	TOTAL	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning:

- Group Discussion
- Seminar/presentation on any of the relevant topics
- Case Studies

Textbooks:

- 1.Potter NH,5th edition, Food Science, CBS Publication, New Delhi.
- 2.RamSaswamy H and Marcotte M,1st edition, Food Processing Principles and Applications CRCPress

Reference books:

- 1.Manay NS and Shadaksharaswamy M,Latest edition, Food-Facts and Principles, New AgeInternational (P) Ltd. Publishers, New Delhi.
- 2.Sivasankar B. Latest edition. *Food Processing and Preservation*. First Edition. PHI Learning.

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Semester I

Course: Major **Scheme of Evaluation: (P)**
Level of Course: 100
Title of Paper: Practical on Principles of Food Processing and Preservation
Subject Code: FTC152M111
L-T-P-C: 0-0-6-3 **Total credits: 3**

Course Objectives
Understanding the application of various laboratory equipment's used in food technology in terms of food processing and food safety

Course Outcome

CO Level	On successful completion of the course the students will be able to:	Blooms Taxonomy Level
CO 1	**Define** basic food technology laboratory equipment's and appliances	**BT 1**
CO 2	**Classify** different food groups, determination of moisture content of different food samples	**BT 2**
CO 3	**Construct** the procedures for drying and packaging of fruits and vegetables	**BT 3**
CO 4	**Analyse** the process of malting from cereals, millets and pulses	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	1. Introduction to basic laboratory facilities-tools and appliances 2. Introduction to basic food processing equipment. 3. Care and maintenance of laboratory tools, appliances and equipment.	**20**
II	1. Identification of foods under different food groups 2. Determination of moisture content of different food groups like fruits, vegetables, green leafy vegetables, cereals and pulses 3. Brix analysis by refractometer for different food samples like fruit juices, jam, jelly. 4. Determination of pH of different food products like pickles, fruit juice and sauces.	**25**
III	1. Drying of fruits and vegetables 2. Drying of green leafy vegetables 3. Fruit/vegetable puree making 4. Packaging of prepared food products	**20**
IV	1. Rice flour making from waxy and non-waxy rice 2. Waxy rice products 3. Non waxy rice products 4. Preparation of products from different food groups 5. Preparation of cereal, millet, pulse malts	**25**
	TOTAL	**90**
	Pedagogy: Lectures, Experiments, Laboratory sessions	

Textbooks:

- 1.Potter NH,5th edition, Food Science, CBS Publication, New Delhi.
- 2.RamSaswamy H and Marcotte M,1st edition, Food Processing Principles and Applications CRCPress

Semester I

Course: SEC 1 **Scheme of Evaluation: (P)**
Title of Paper: Fruits and Vegetables Processing
Subject Code: FTC152S111
L-T-P-C: 0-0-6-3 **Total credits: 3**

Course Objectives

Understanding the physiological parameters for fruits and vegetables processing.

Course Outcome

CO Level	On successful completion of the course the students will be able to:	Blooms Taxonomy Level
CO 1	**Define** basic fruits and vegetable varieties and identify their maturity indices	BT 1
CO 2	**Classify** the TSS and acidity of different fruits and vegetables	BT 2
CO 3	**Construct** the process for identification of spices and additives in different fruits and vegetables	BT 3
CO 4	**Analyse** and planning of project for setting up of food processing units	BT 4

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I.	1. Identification of various fruit and vegetable varieties 2. Determination of maturity indices of fruits and vegetables: Days from full bloom (DFFB), firmness. 3. Determination of Starch-iodine ratio, Brix-acid ratio 4. Dehydration and rehydration of fruits and vegetables	20
II	1.Determination of moisture content of different food products 2.Determination of TSS of different food products 3.Determination of acidity of fruits and vegetables	25
III	1. Identification of spices and condiments in fruits and vegetables. 2. Preparation of jam, jelly and marmalade 3. Preparation of pickles	30
IV	1. Project planning on food processing unit	15
	TOTAL	90
	Pedagogy: Lectures, Experiments, Laboratory sessions	

Textbooks:

- Potter NH,5th edition, Food Science, CBS Publication, New Delhi.
- RamSaswamy H and Marcotte M,1st edition, Food Processing Principles and Applications CRCPress

Reference books:

- Manay NS and Shadaksharaswamy M,Latest edition, Food-Facts and Principles, New Age International (P) Ltd. Publishers, New Delhi.
- Sivasankar B. Latest edition. *Food Processing and Preservation*. First Edition. PHI Learning.

Semester I

Course: Minor **Scheme of Evaluation: (T)**
Level of Course: 100
Title of Paper: Basic Food Science
Subject Code: FTC152N101
L-T-P-C: 3-0-0-3 **Total credits: 3**

Course Objectives To train the students with introductory knowledge of food science, scope of food science and its applications in food industries

Course Outcomes

CO Level	On successful completion of the course the students will be able to:	Blooms Taxonomy Level
CO 1	**Relate** the principle of food science, and food constituents- its properties and functions	**BT 1**
CO 2	**Explain** the basic preservation techniques used in food science	**BT2**
CO 3	**Develop** different types of non-thermal processing techniques used in food Industry	**BT 3**
CO 4	**Analyse** the different advantages and disadvantages of different preservation techniques in terms of increasing shelf life	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I.	**Introduction:** Introduction to Food Science, Different kinds of Food Industries, Components of Food industries. Scope of food processing and technology. **Food constituents:** Carbohydrates, lipids, proteins, vitamins and minerals, water. Nutritional and chemical properties of food constituents and its function.	**15**
II.	**Introduction to Food preservation techniques:** Pasteurization, Sterilization, Ultra High temperature, Blanching, etc. Low temperature preservation techniques: Cooling, Evaporation, refrigeration and freezing, Drying and their importance in the food processing.	**15**
III.	**Introduction to non-thermal food preservation techniques:** Introduction to new techniques in preservation of food like High Pressure Processing, Ohmic heating, Pulse electric field processing, Irradiation etc.	**15**
IV.	**Basic introduction**: Unit operations in Food Processing, Cleaning, dry cleaning methods, wet cleaning methods, peeling, grading, sorting.	**15**
	TOTAL	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning:

- Group Discussion
- Seminar/presentation on any of the relevant topics
- Case Studies

Textbooks:

- Food Science by Norman N Potter and Joseph H. Hotchkiss, CBS Publishers and Distributors.

- Advanced Textbook on Food and Nutrition by Dr. M. Swaminathan Vol: I & II, The Bangalore Printing and Publishing Co. Ltd.

Reference books:

- 1.Fellows PJ, 2016. Food Processing Technology, Principles and Practice. Fourth Edition. Woodhead Publishing
- 2.Sivasankar B. Latest edition. *Food Processing and Preservation*. First Edition. PHI Learning

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Semester I

Course: AEC **Scheme of Evaluation: (T)**
Level of Course: 100
Title of Paper: Introduction to Effective Communication
Subject Code: CEN982A101
L-T-P-C: 1-0-0-1 **Total credits: 1**

Course Objective: To understand the four major aspects of communication by closely examining the processes and outlining the most effective ways to communicate with interactive activities.

Course Outcome

CO Level	On successful completion of the course the students will be able to	Blooms Taxonomy Level
CO 1	**List** the elements and processes that make for successful communication and recognize everyday activities that deserve closer attention in order to improve communication skills	**BT 1**
CO 2	**Contrast** situations that create barriers to effective communication and **relate** them to methods that are consciously devised to overcome such hindrance	**BT 2**
CO 3	**Apply** language, gestures, and para-language effectively to avoid miscommunication and **articulate** one's thought and build arguments more effectively	**BT 3**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	Introduction to Effective Communication • Listening Skills o The Art of Listening o Factors that affect Listening o Characteristics of Effective Listening o Guidelines for improving Listening skills	**5**
II	• Speaking Skills o The Art of Speaking o Styles of Speaking o Guidelines for improving Speaking skills o Oral Communication: importance, guidelines, and barriers	**5**
III	• Reading Skills o The Art of Reading o Styles of Reading: skimming, surveying, scanning o Guidelines for developing Reading skills	**5**
IV	• Writing Skills o The Art of Writing o Purpose and Clarity in Writing o Principles of Effective Writing	**5**

Texts:

- Rizvi, M. Ashraf. (2017). *Effective Technical Communication*. McGraw-Hill.
- Chaturvedi, P. D. and Chaturvedi, Mukesh. (2014). *Business Communication.* Pearson.
- Raman, Meenakshi and Sharma, Sangeeta. (2011). *Technical Communication:*

Principles and Practice (2nd Edition): Oxford University Press.

Credit Distribution		
Lecture/Tutorial	**Practicum**	**Experiential Learning**
15 hours	-	10 hours - Movie/ Documentary /Podcasts screening - Peer teaching

Semester I

Course: BHS **Scheme of Evaluation: (T)**
Level of Course: 100
Title of Paper: Behavioural Sciences -1
Subject Code: BHS982A101
L-T-P-C: 1-0-0-1 **Total credits: 1**

Course objectives: To increase one's ability to draw conclusions and develop inferences about attitudes and behaviour, when confronted with different situations that are common in modern organizations.

Course Outcome

CO Level	On successful completion of the course the students will be able to	Blooms Taxonomy Level
CO 1	Understand self & process of self-exploration	BT 1
CO 2	Learn about strategies for development of a healthy self-esteem CO3: Apply the concepts to build emotional competencies	BT 2
CO 3	Apply the concepts to build emotional competencies.	BT 3

Course Outline

Modules	Course Contents	Periods
I	**Introduction to Behavioral Science** Definition and need of Behavioral Science, Self: Definition components, Importance of knowing self, Identity Crisis, Gender and Identity, Peer Pressure, Self-image: Self Esteem, Johari Window, Erikson's model.	4
II	**Foundations of individual behavior** Personality- structure, determinants, types of personalities. Perception: Attribution, Errors in perception. Learning- Theories of learning: Classical, Operant and Social	4
III	**Behaviour and communication.** Defining Communication, types of communication, barriers to communication, ways to overcome barriers to Communication, Importance of Non-Verbal Communication/Kinesics, Understanding Kinesics, Relation between behaviour and communication.	4
IV	**Time and Stress Management** Time management: Introduction-the 80:20, sense of time management, Secrets of time management, Effective scheduling. Stress management: effects of stress, kinds of stress-sources of stress, Coping Mechanisms. Relation between Time and Stress.	4
TOTAL		**16**

Text books

- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management; Pfeiffer &Company
- Blair J. Kolasa, Introduction to Behavioural Science for Business, John Wiley & Sons Inc
- K.Alex, Soft skills; S.Chand.

Semester I

Course: IKS **Scheme of Evaluation: (T)**
Level of Course: 100
Title of Paper: Introduction to Indian Knowledge System - I
Subject Code: IKS992I101
L-T-P-C: 2-1-0-3 **Total credits: 1**

Course objectives:

This Foundation course is designed to present an overall introduction to all the streams of IKS relevant to the UG program. It would enable students to explore the most fundamental ideas that have haped Indian Knowledge Traditions over the centuries.

Course Outcome

CO Level	On completion of this course students will be able to –	BT Level
CO1	**Recall** the rich heritage of Indian knowledge systems	BT level 1
CO2	**Describe** the contribution of Indian knowledge systems to the world	BT level 2
CO3	**Demonstrate** knowledge of sociocultural and ethnolinguistic diversity that constitutes the soul of Bharatvarsha	BT level 2
CO4	**Apply** traditional knowledge and techniques in day-to-day life	BT level 3
CO5	**Distinguish** knowledge traditions that originated in the Indian subcontinent	BT level 3

Course Outline

Module	Topics (if applicable) & Course Contents	Periods
I	**Introduction to Indian Knowledge Systems (IKS):** -What is the Indian Knowledge System? -Definition of Indigenous/ Traditional Knowledge -Scope, and Importance of Traditional Knowledge. **Ancient India- Bharat Varsha:** -People of Ancient Bharat Varsha -Our great natural heritage: The great Himalayas and the rivers. - The civilizations of the Sindhu-Ganga valley, and the Brahmaputra valley. -Our coastal plains. -Our Nature: Forests and Minerals -Ancient Indian Traditional Knowledge and Wisdom about nature and climate.	15

II	**<u>Indian Heritage of Knowledge</u>:** -Ancient Indian Knowledge: The *Vedas* and its components-the *Vedangas* -Ancient Indian books and treaties: The *Sastras.* -The Great Indian Epics: The Ramayana and The Mahabharata,	15
	-Epics and religious treaties of ancient Assam: Introduction to Madhav Kandali's *Ramayan* and Srimanta Sankardev's *Dasam Skandha Bhagavat* of the Puranas. -Ancient Traditional Knowledge-The *Agamas* -The ancient Buddhist knowledge: *Tripitaka: Vinaya, Sutta* and *Abhidhamma Pitaka* **<u>Languages and language studies in India</u>**: -What is linguistics? -Script and Language -Alphabet of the Indian languages *Varnamala:* Origin, Evolution, and phonetic features. -Languages of India -Important texts of Indian languages: Skills *Siksha,* Expression/Prounciation-*Nirukta,* Grammer-*Vyakarana,* Poetic rhythm-*Chandas.* -Paninian Grammar: A Brief Introduction **<u>Introduction to Fine Arts and Performing Arts of India:</u>** -Ancient Indian classical music and dance forms: The Science of Dramas-*Natyasastra* and the Science of Music-*Gandharva-Veda.* -Aesthetics in Indian Art and Culture. -Folk music and traditional dance forms of the Northeast.	

III	**<u>Indian Science & Technology</u>** -Ancient India's contribution to Mathematics- Number System. Algebra and Arithmetic, Geometry and Trigonometry. -Origin of Decimal system in India; nomenclature of numbers in the Vedas. Zero and Infinity. Sulba-sutras. Contribution of Brahmagupta and Sridhar Acharya to Mathematics. Important texts of Indian mathematics. • **<u>Indian Astronomy</u>:** Planetary System. Motion of the Planets. Velocity of Light. Eclipse. Astronomy. Navagrahas. Important works in Indian Astronomy. Aryabhata and Nilakantha: Contribution to Astronomical Studies • **<u>Indian Metal Works</u>:** Mining Techniques. Types of Metals. Tools & Techniques for Metal Smelting with examples. Metalworks in pre-modern India: Special reference to NE India.	15
IV	**<u>Contribution of Ancient India to Health Sciences</u>:** -Traditional Indigenous systems of medicines in India: - *Ayurveda* and *Yoga:* Elements of *Ayurveda: Gunas* and *Doshas*, *Pancha Mahabhuta* and *Sapta-dhatu*. -Concept of disease in Ayurveda -Ayurvedic lifestyle practices: *Dinacharya* and *Ritucharya.* -Important Ayurvedic Texts -Hospitals in Ancient India • -*Ayurveda*: Gift of India to the modern world.	15
EL	The experiential learning sessions may include: • Field Visits: Organizing visits to historical sites, museums, traditional craft centers, and other places relevant to Indian knowledge systems. • Interactive Sessions: Engaging students in discussions with experts and practitioners in various fields of Indian knowledge systems to gain insights and practical knowledge. • Online Lecture Series: Providing the students with online lectures by distinguished experts in the field of the Indian Knowledge System. • Hands-on Activities: Providing opportunities for students to participate in activities related to traditional arts, crafts, music, dance, agriculture, etc., to understand the practical aspects of Indian knowledge systems. Practical Demonstrations: Conducting workshops or sessions to demonstrate traditional practices, such as yoga, Ayurveda, Vastu Shastra, etc., for the students.	30
	TOTAL	90

Textbooks:

- Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavan RN. (2022), *Introduction to Indian Knowledge System: Concepts and Applications.* PHI Learning Privat Private Ltd.
- Mukul Chandra Bora*, Foundations of Bharatiya Knowledge System.* Khanna Book Publishing

Reference Books:

- Baladev Upadhyaya, *Samskrta Śāstrom ka Itihās*, Chowkhambha, Varanasi, 2010.
- D. M. Bose, S. N. Sen and B. V. Subbarayappa, Eds., *A Concise History of Science in India*, 2nd Ed., Universities Press, Hyderabad, 2010.
- Astāngahrdaya, Vol. I, *Sūtrasthāna and Śarīrasthāna*, Translated by K. R. Srikantha Murthy, Vol. I, Krishnadas Academy, Varanasi, 1991.
- Dharampal, *The Beautiful Tree: Indian Indigenous Education in the Eighteenth Century*, Dharampal Classics Series, Rashtrotthana Sahitya, Bengaluru, 2021.
- J. K. Bajaj and M. D. Srinivas, *Indian Economy, and Polity in Eighteenth-century Chengalpattu*, in J. K. Bajaj ed., Indian Economy and Polity, Centre for Policy
    - Studies, Chennai, 1995, pp. 63-84.

Semester II

Course: Major **Scheme of Evaluation(T)**
Level of Course: 100
Title of Paper: Fruits and Vegetables Product Technology
Subject Code: FTC152M201
L-T-P-C: 3-0-0-3 **Total credits: 3**

Course Objectives

To understand the processing of fruits and vegetables, maturity indices and canning of fruits and vegetables

Course Outcome

CO Level	On successful completion of the course the students will be able to	Blooms TaxonomyLevel
CO 1	**Explain** the causes and effects of different post-harvest changes in fruits andvegetables	BT 1
CO 2	**Identify** the processing and preservation techniques of different fruits and vegetable products (Jam, Jelly and Marmalade)	BT 2
CO 3	**Apply** different pickling and dehydration processes in fruits and vegetables,their packaging and storage methods	BT 3
CO 4	**Analyse** the processing flowchart for canning of fruits and vegetables	BT 4

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I.	**Fruits and Vegetables:** Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments, Dietary fibre. Post-harvest changes in fruits and vegetables – Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes, pathological changes during the storage of fruits and vegetables.	15
II.	**Fruits beverages:** Introduction, Processing of fruit juices, preservation of fruit juices, processing of squashes, cordials, nectars, concentrates and powder. Jams, jellies and marmalades: Jam: Constituents, selection of fruits, processing & technology, Jelly: Essential constituents (Role of pectin, ratio), Theory of jelly formation, Processing & technology, defects in jelly, Marmalade: Types, processing & technology, defects	15
III.	**Pickles, chutneys and sauces:** processing, types, causes of spoilage pickling. 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 methods	15

IV	**Canning**: Introduction, can manufacture, canning process - selection of fruits and vegetables, grading, washing, peeling, cutting, blanching, cooling, filling, exhausting, sealing, processing, cooling and storage; types of canning- pressure canning and water bath canning, common causes of spoilage in canning of foods.	**15**
	TOTAL	**60**
Pedagogy: Lectures, Assignments, Seminars		

Experiential Learning:

- Group Discussion
- Seminar/presentation on any of the relevant topics
- Case Studies

Textbooks:

- Manay, S. &Shadaksharaswami, M.2013. Foods: Facts and Principles, New Age Publishers
- Srivastava, R.P. and Kumar, S. 2006. Fruits and Vegetables Preservation- Principles and Practices. 3rd Ed. International Book DistributingCo

Reference books:

- Girdharilal, Siddappaa, G.S and Tandon, G.L.latest edition. Preservation of fruits & vegetables, ICAR, NewDelhi
- Ranganna S.latest edition. Handbook of analysis and quality control for fruits and vegetable products, Tata McGraw-Hill publishing company limited, Second edition.

Credit Distribution		
Theory	**Practicum**	**Experiential Learning**
60	**-**	**30**

Semester II

Course: Major **Scheme of Evaluation: (P)**

Level of Course: 100

Title of Paper: Practical on Fruits and Vegetables Product Technology

Subject Code: FTC152M211

L-T-P-C: 0-0-6-3 **Total credits: 3**

Course Objectives

Understanding the application of various laboratory equipment's used in terms of fruits and vegetables product technology

Course Outcomes

CO Level	On successful completion of the course the students will be able to:	Blooms Taxonomy Level
CO 1	**Define** the manufacturing process of chutneys, sauces and fruit leather preparation	**BT 1**
CO 2	**Classify** the various preparation techniques of dips, spreads and mayonnaise	**BT 2**
CO 3	**Construct** the preparation methods on pickles, jam and jellies	**BT 3**
CO 4	**Analyse** the different dehydration and rehydration techniques of fruits and vegetables	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I.	1. Osmotic drying of fruits 2. Candied fruits from different sources 3. Fruit leather preparation 4. Preparation of chutneys and sauces	**25**
II	1. Preparation of mayonnaise 2. Preparation of dips 3. Preparation of spreads 4. Preparation of salad dressings	**20**
III	1. Quantity production of jam and jellies 2. Quantity production of squash and RTS 3. Quantity production of ketchups 4. Quantity production of pickles	**25**
IV	1.Preparation of concentrates 2.Preparation of chips 3.Preparation of papads and khakras	**20**
	Total	**90**
	Pedagogy: Lectures, Experiments, Laboratory sessions	

Textbooks:

- Manay, S. &Shadaksharaswami, M.2013. Foods: Facts and Principles, New Age Publishers
- Srivastava, R.P. and Kumar, S. 2006. Fruits and Vegetables Preservation- Principles and Practices. 3rd Ed. International Book DistributingCo

Reference books:

- Girdharilal, Siddappaa, G.S and Tandon, G.L.latest edition. Preservation of fruits & vegetables, ICAR, NewDelhi
- Ranganna S.latest edition. Handbook of analysis and quality control for fruits and vegetable products, Tata McGraw-Hill publishing company limited, Second edition.

Semester II

Course: SEC 2

Scheme of Evaluation: (P)

Title of Paper: Waste and By- Product Utilization

Subject Code: FTC152S211

L-T-P-C: 0-0-6-3 **Total credits: 3**

Course Objectives

Understanding the various waste product utilization techniques in food industries for development of new products

Course Outcomes

Course Outcome	On successful completion of the course the students will be able to:	Blooms Taxonomy Level
CO 1	**Define** the different cereals waste products for product development and waste utilization	**BT 1**
CO 2	**Classify** the different pulses waste products for product development and waste utilization	**BT 2**
CO 3	**Construct** the different fruit waste products for product development and waste utilization	**BT 3**
CO 4	**Analyse** the different vegetables waste products for product development and waste utilization	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Content	Periods
I.	1.Utilization of cereal by products for food/ product development/functional ingredients	**25**
II	1.Utilization of pulses by products for food/ product development/functional ingredients	**20**
III	1. Utilization of fruit by product for food/ product development/functional ingredients	**25**
IV	1. Utilization of vegetables by product for food/ product development/functional ingredients	**20**
	Total	**90**
	Pedagogy: Lectures, Experiments, Laboratory sessions	

Textbooks:

- Manay, S. &Shadaksharaswami, M.2013. Foods: Facts and Principles, New Age Publishers
- Srivastava, R.P. and Kumar, S. 2006. Fruits and Vegetables Preservation- Principles and Practices. 3rd Ed. International Book DistributingCo

Reference books:

- Girdharilal, Siddappaa, G.S and Tandon, G.L.latest edition. Preservation of fruits & vegetables, ICAR, NewDelhi
- Ranganna S.latest edition. Handbook of analysis and quality control for fruits and vegetable products, Tata McGraw-Hill publishing company limited, Second edition.

Semester II

Course: Minor **Scheme of Evaluation: (T)**

Level of Course: 100

Title of Paper: Food Microbiology

Subject Code: FTC152N201

L-T-P-C: 3-0-0-3 **Total credits: 3**

Course Objectives

To train the students with various microbial growth control techniques in food preparation

Course Outcome

CO Level	On successful completion of the course the students will be able to:	Blooms TaxonomyLevel
CO 1	**Relate** the scope, importance, basic techniques of microbiology	BT 1
CO 2	**Explain** the various sterilization- both physical and chemical methods	BT 2
CO 3	**Develop** the different methods for isolation and preservation of food microbes	BT 3
CO 4	**Analyse** the application of food microbiology and its comparison to the industrial fields of microbiology	BT 4

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I.	**History and scope of Microbiology**: discovery, importance and relevance of microorganisms. Microscopy: basic techniques of Microscopy optical and electron techniques of microscopy staining and its types.	15
II.	**Microorganisms in fermentation:** dairy and plant-based fermentation, probiotics.	15
III.	**Isolation and preservation** of pure cultures, pour plate method, streak plate spread plate and single cell isolation, microbial enzymes in food processing.	15
IV.	**Industrial applications –** microbial processes for food ingredient and enzyme production.	15
	TOTAL	48
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning:

- Group Discussion
- Seminar/presentation on any of the relevant topics
- Case Studies

Textbooks:

- Microbiology (5th Ed) by M. J. Pelczar, E. C. S. Chan and Noel R. Krieg. Tata McGraw-Hill.
- Microbiology by R. P. Singh Kalyani Publishers.

Reference books:

- Fellows PJ, 2016. Food Processing Technology, Principles and Practice. Fourth Edition. Woodhead Publishing.
- Sivasankar B. Latest edition. *Food Processing and Preservation*. First Edition. PHI Learning

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Semester II

Course: AEC **Scheme of Evaluation: (T)**

Level of Course: 100

Title of Paper: Approaches to Verbal and Non-Verbal Communication

Subject Code: CEN982A201

L-T-P-C: 1-0-0-1 **Total credits: 1**

Course Objectives

To introduce the students to the various forms of technical communication and enhance their knowledge in the application of both verbal and non-verbal skills in communicative processes.

Course Outcome

CO Level	On successful completion of the course the students will be able to:	Blooms Taxonomy Level
CO 1	**List** the different types of technical communication, their characteristics, their advantages and disadvantages.	**BT 1**
CO 2	**Explain** the barriers to communication and ways to overcome them.	**BT 2**
CO 3	**Identify** the means to enhance conversation skills.	**BT 3**
CO 4	**Determine** the different types of non-verbal communication and their significance.	**BT 4**

Modules	Topics (if applicable) & Course Contents	Periods
I	**Technology Enabled Communication** Communicating about technical or specialized topics, Different forms of technology-enabled communication tools used in organizations Telephone, Teleconferencing, Fax, Email, Instant messaging, Blog, Podcast, Videos, videoconferencing, social media	**4**
II	**Communication Barriers** Types of barriers: Semantic, Psychological, Organizational, Cultural, Physical, Physiological, Methods to overcome barriers to communication.	**4**
III	**Conversation skills/Verbal Communication** Conversation – Types of Conversation, Strategies for Effectiveness, Conversation Practice, Persuasive Functions in Conversation, Telephonic Conversation and Etiquette Dialogue Writing, Conversation Control.	**4**
IV	**Non-verbal Communication** Body language- Personal Appearance, Postures, Gestures, Eye Contact, Facial expressions Paralinguistic Features-Rate, Pause, Volume, Pitch/Intonation/ Voice/Modulation, Proxemics, Haptics, Artifacts, Chronemics,	**4**
	Total	**16**

Texts:

- Rizvi, M. Ashraf. (2017). *Effective Technical Communication*. McGraw-Hill.
- Chaturvedi, P. D. and Chaturvedi, Mukesh. (2014). *Business Communication.* Pearson.
- Raman, Meenakshi and Sharma, Sangeeta. (2011). *Technical Communication: Principles and Practice* (2nd Edition): Oxford University Press.

Credit Distribution		
Lecture/Tutorial	**Practicum**	**Experiential Learning**
15 hours	-	10 hours - Movie/ Documentary /Podcasts screening - Peer teaching

Semester II

Course: BHS-II **Scheme of Evaluation: (T)**

Level of Course: 100

Title of Paper: Behavioral Sciences-II

Subject Code: BHS982A202

L-T-P-C: 1-0-0-1 **Total credits: 1**

Course objectives: To increase one's ability to draw conclusions and develop inferences about attitudes and behaviours, when confronted with different situations that are common in modern organizations.

Course Outcome

CO Level	On successful completion of the course the students will be able to:	Blooms Taxonomy Level
CO 1	**Develop** an elementary level of understanding of culture and its implications on personality of people	**BT 1**
CO 2	**Understand** the concept of leadership spirit and to know its impact on performance of employees	**BT 2**
CO 3	**Understand** and apply the concept of Motivation in real life	**BT 3**

Modules	Course Contents	Periods
I	**Culture and Personality** Culture: Definition, Effect, relation with Personality, Cultural Iceberg, Overview of Hofstede's Framework, Discussion of the four dimensions of Hofstede's Framework.	**4**
II	**Attitudes and Values** Attitude's definition: changing our own attitudes, Process of cognitive dissonance Types of Values, Value conflicts, Merging personal and Organisational values	**4**
III	**Motivation** Definition of motivation with example, Theories of Motivation (Maslow, McClelland's theory& Theory X and Y)	**4**
IV	**Leadership** Definition of leadership, Leadership continuum, types of leadership, Importance of Leadership, New age leaderships: Transformational & transactional Leadership, Leaders as role models.	**4**
TOTAL		**16**

Text books:

- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management; Pfeiffer &Company
- Blair J. Kolasa, Introduction to Behavioural Science for Business, John Wiley & Sons Inc.
- Organizational Behaviour by Kavita Singh (Vikas publishers, 3rd Edition).

Semester II

Course: IKS **Scheme of Evaluation: (T)**

Level of Course: 100

Title of Paper: Introduction to Indian Knowledge System - II

Subject Code: IKS992I201

L-T-P-C: 2-1-0-3 **Total credits: 3**

Course objectives:

This Foundation course is designed to present an overall introduction to all the streams of IKS relevant to the UG program. It would enable students to explore the most fundamental ideas that have shaped Indian Knowledge Traditions over the centuries.

Course Outcomes

CO Level	On completion of this course, students will be expected to	BT Level
CO1	**Recall** traditional Indian knowledge traditions constituting Indian culture	BT level 1
CO2	**Summarize differences** between classical literature in Sanskrit and other Indian languages	BT level 2
CO3	**Compare** knowledge traditions originating in NE India	BT level 2
CO4	**Appreciate** the contribution of Indian Knowledge Systems to the world	BT level 3

Course outline

Module	Course Contents	Periods
I	**Indian Classical Literature** Indian Classical Literature: A Brief Introduction.	15

	- Ancient Indian Spritual Poetics-*Kavya*: Contribution of Kalidasa **Diversity and Indian Culture**: - Diversity and Indian Culture -Indigenous Faith and Religion -Preservation of culture and indigenous knowledge **The Purpose of** Knowledge - Understanding Self-Awareness and Spirituality. -Indian concept and purpose of Knowledge and Education - Understanding Spirituality and Materialism: *Para* and *Apara Vidya*	
II	**Methodology of Indian Knowledge System**: - *Shruti* and *Smriti* traditions. -Intoduction to *Shastras.* -Manuscriptology: The art and science of documenting knowledge. - Repositories of ancient manuscripts with special reference to the Norteast India. **Indian Architecture and Town Planning:** - Introduction ancient Indian architecture. - *Sthapatya-Veda*: An Introduction - Indigenous tools & techniques for town planning & Temple Architecture. Lothal, Mohan Jo Daro. - Temple Art: Lepakshi Temple, Jagannath Puri Temple, Konark Sun Temple. - Vernacular architecture of Assam: Special reference to Brahmaputra Valley	15
III	**Indian Agriculture**: - Agriculture: Significance in Human Civilization. - Sustainable Agriculture. - Historical significance of agriculture and sustainable farming in India. - Step Cultivation of India: Special reference to Northeast India. - Wet rice cultivation of Assam. **Indian Textiles**: What is Textile? - Tradition of cotton and silk textiles in India. - The historical contribution of textile and weaving to the Indian economy.	15

	- Varieties of textiles and dyes developed in different regions of India with special reference to Northeast India	
IV	**<u>Indian Polity and Economy</u>**: - Understanding Kingdom and Chiefdom - Role of a king - The Indian idea of a well-organized polity and flourishing economy. - The *Chakravarti* System: Administrative System of Ancient Bharatvarsha. - Village administrative system: Northeast India. - *Arthashastra*: Brief synopsis **<u>The outreach of Indian Knowledge System across Geographical Boundaries</u>** - Indian Languages. - Scripts. - Linguistics. - Ayurveda. - Yoga and Meditation. - Textile Decimal value place system-based arithmetic, Algebra and Astronomy	15
EL	The experiential learning sessions may include: • Field Visits: Organizing visits to historical sites, museums, • traditional craft centers, and other places relevant to Indian knowledge systems. • Interactive Sessions: Engaging students in discussions with experts and practitioners in various fields of Indian knowledge systems to gain insights and practical knowledge. • Online Lecture Series: Providing the students with online lectures by distinguished experts in the field of the Indian Knowledge System. • Hands-on Activities: Providing opportunities for students to • participate in activities related to traditional arts, crafts, music, dance, agriculture, etc., to understand the practical aspects of Indian • knowledge systems. • Practical Demonstrations: Conducting workshops or sessions to demonstrate traditional practices, such as yoga, Ayurveda, Vastu Shastra, etc., for the students.	30
	TOTAL	90

Textbooks Books:

- Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavan RN. (2022), *Introduction to Indian Knowledge System: Concepts and Applications.* PHI Learning Private Ltd.
- Mukul Chandra Bora*, Foundations of Bharatiya Knowledge System.* Khanna Book Publishing

Reference Books:

- Baladev Upadhyaya, *Samskrta Śāstrom ka Itihās*, Chowkhambha, Varanasi, 2010.
- D. M. Bose, S. N. Sen and B. V. Subbarayappa, Eds., *A Concise History of Science in India*, 2nd Ed., Universities Press, Hyderabad, 2010.
- Astāngahrdaya, Vol. I, *Sūtrasthāna and Śarīrasthāna*, Translated by K. R. Srikantha Murthy, Vol. I, Krishnadas Academy, Varanasi, 1991.
- Dharampal, *The Beautiful Tree: Indian Indigenous Education in the Eighteenth Century*, Dharampal Classics Series, Rashtrotthana Sahitya, Bengaluru, 2021.
- J. K. Bajaj and M. D. Srinivas, *Indian Economy and Polity in Eighteenth century Chengalpattu*, in J. K. Bajaj ed., Indian Economy and Polity, Centre for Policy Studies, Chennai, 1995, pp. 63-84.

Credit Distribution (hours)		
Lecture/Tutorial	**Practicum**	**Experimental Learning**
60	0	30

Level: Semester III

Course: Major **Scheme of Evaluation: (T)**

Title of the Paper: Food Chemistry

Subject Code: FTC152M301

L-T-P-C : 4-0-0-4 **Total credits: 4**

Course Objectives

Understanding the composition of different chemicals present in foods and their relation to its taste and to gain basic knowledge on metabolic roles and functional aspects of food components.

Course Outcomes

On successful completion of the course the students will be able to:		
CO level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**explain** the properties, the composition, structure of nutrients	**BT 2**
CO 2	**identify** the role of food constituents, nutrients, techniques used for estimation	**BT 3**
CO 3	**apply** the knowledge of proteins, carbohydrates, fats	**BT 3**
CO 4	**analyse** the structural and functional properties of lipids, fats and oil,its deficiencies and excess, role of vitamins and minerals and their recommended dietary allowances	**BT 4**

Course Outline:

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I.	**Food And Its Constituents:** Food and Nutrients - Definition, Classification, and Functions: Role of Water in Food and Human Health, Pigments, Phytonutrients, Antioxidants, Flavour Components.	**15**
II.	**Carbohydrates:** Definition, Structure, Properties, Functions, Classification, Dietary Sources, Chemical Reactions **Proteins:** Definition, Structure, Properties, Functions, Classification, Dietary Sources, Chemical Reactions, Deficiencies and Excess, Recommended Dietary Allowances, chemical reactions	**15**

III.	**Fats and oil:** Definition, Structure, Properties, Functions, Classification, Fatty Acid Oxidation, Rancidity of Fats,Emulsions, Chemical Reactions **Vitamins And Minerals:** Classification, Functions, Dietary Sources, Deficiencies and Excess, Recommended Dietary Allowances	**15**
IV	**Enzymes**: general characteristics, enzymes in food processing, immobilization of enzymes, Enzymatic and non-enzymatic browning such as Maillard reactions **Food Additives and its importance:** Need of food additives in food processing and preservation, Characteristics and classification of food additives, major categories of food addit.ives, functions and uses of different types of food additives	**15**
TOTAL		**60**
Pedagogy: Lectures, Assignments, Seminars		

Experiential Learning:

1. Group Discussion
2. Seminar/presentation on any of the relevant topics

Case Studies

Texts:

1. Agarwal A and Udipi SA. 2014. Textbook of Human Nutrition. JaypeeBrothers MedicalPublishers (P) Ltd.
2. Bamji MS, Krishnaswamy K, and Brahmam GNV. 2009. Textbook of Human Nutrition. ThirdEdition. Oxford and IBH Publishing Co. Pvt.Ltd.

References:

1. Belitz H.-D, Grosch W, and Schieberle P. 1st edition. Food Chemistry. FourthEdition. Springer.
2. Civille GV and Carr BT. 2016. Sensory Evaluation Techniques. Fifth Edition.CRC Press.
3. Rodwell VW, Bender DA, Botham KM, Kennelly PJ, Weil PA. 2015.Harper's IllustratedBiochemistry. 30th Edition. McGraw Hill Education.

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester III

Course: Major **Scheme of Evaluation: (P)**

Title of the Paper: Practical on Food Chemistry

Subject Code: FTC152M311

L-T-P-C : 0-0-8-4 **Total credits: 4**

Course Objectives

To gain knowledge about proximate analysis of food samples and their manufacturing techniques

Course Outcomes

On successful completion of the course the students will be able to:		
CO level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**find** the estimation for total protein, lipid, reducing and non-reducing sugar content in food samples	**BT 1**
CO 2	**demonstrate** the ash, moisture, gluten, iodine value determination in foodsamples	**BT 2**
CO 3	**apply** the techniques of dehydration and rehydration of fruits andvegetables and its manufacturing practices	**BT 3**
CO 4	**list** preparation methods for fruits and vegetable samples (Jam,jelly, ketchup, pickles)	**BT 4**

Course Outline

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I.	1 Estimation of Total Protein Content of Food Sample 2. Estimation of Total Lipid Content in Food Sample 3.Estimation of Total Ash 4.Estimation of Moisture Content	**20**
II.	1.Determination of vitamin c. 2 Estimation of Moisture Content 3.Determination of phenolic compound	**25**
III.	1.Determination of saponification value 2.Determination of peroxide value. 3.Determination of acid value	**20**

IV	1.Determination of titratable acidity 2.Determination of total volatile basic nitrogen (TVBN)	**25**
TOTAL		**90**
Pedagogy: Lectures, Experiments, Laboratory sessions		

Texts:

3. Agarwal A and Udipi SA. 2014. Textbook of Human Nutrition. JaypeeBrothers MedicalPublishers (P) Ltd.
4. Bamji MS, Krishnaswamy K, and Brahmam GNV. 2009. Textbook of Human Nutrition. ThirdEdition. Oxford and IBH Publishing Co. Pvt.Ltd.

References:

4. Belitz H.-D, Grosch W, and Schieberle P. 1st edition. Food Chemistry. FourthEdition. Springer.
5. Civille GV and Carr BT. 2016. Sensory Evaluation Techniques. Fifth Edition.CRC Press.
6. Rodwell VW, Bender DA, Botham KM, Kennelly PJ, Weil PA. 2015.Harper's IllustratedBiochemistry. 30th Edition. McGraw Hill Education.

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Level: Semester III

Course: Minor **Scheme of Evaluation: (T)**

Title of the Paper: Food Ingredients and Additives

Subject Code: FTC152N301

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

The students should be well versed with basic knowledge of the type of food, chemistry and microbiology

Course Outcomes

On successful completion of the course the students will be able to:		
CO level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**define** properties of food and various ingredients	**BT 1**
CO 2	**explain** the role of food ingredients in food product	**BT 2**
CO 3	**apply** knowledge with the additives relevant to the processed food industry for shelf-life extension, processing support and sensory appeal	**BT 3**
CO 4	**categorize** the microbial, chemical and natural toxicants and allergens indigenously present and developed during food processing	**BT 4**

Course Outline

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I	**Introduction to Food Ingredients:** Food Additives and its importance, need of food additives in food processing and preservation, Characteristics and classification of food additives, major categories of food additives, functions and uses of different types of food additives	15
II	**Food Preservatives:** Different categories of food preservatives, its properties and uses and its toxic effect, Sorbic Acid, Benzoic Acid, propyl-4-hydroxybenzoate, Sulphur dioxide, Nisin, Sodium nitrate, Acetic acid, Propionic Acid. **Sweeteners**: Introduction, importance, classification-Natural and artificial, toxicity and consideration for choosing sweetening agents	15
III	**Colours and flavours:** Different types of food colours, its	15

	importance and toxicity, classification (Natural and synthetic colours), permitted and non-permitted, synthetic colours Flavouring agents and its importance in the food industry	
IV	**Antioxidants and Emulsifiers:** Antioxidants, emulsifiers, stabilizers, chelating agents, hydrocolloids, thickeners, acidulants, curing agents, government rules and regulations on food additives	15
	TOTAL	**60**
	PEDAGOGY: Lectures, Assignments and Seminars	

Experiential Learning:

- Group Discussion
- Seminar/presentation on any of the relevant topics
- Case Studies

Texts:

1. A Larry Branen, P Michael Davidson and Seppo Salminen, Food Additives: CRC Book Press. USA.
2. S.N. Mahindru, Food Additives: APH Publishing Corporation, Drya Ganj, New Delhi.

References:

1. Food Facts and Principles -N. ShakuntalaManay& M. Shadaksharaswamy, New Age International (P) Limited, New Delhi.
2. Branen AL, Davidson PM &Salminen S. 2001. Food Additives. 2nd Ed.Marcel Dekker.
3. Gerorge AB. 2004. Fenaroli's Handbook of Flavor Ingredients. 5th Ed.CRC Press

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester III

Course: IDC **Scheme of Evaluation: (P)**

Title of the Paper: Basic Food Processing

Subject Code: IDC 3

L-T-P-C: 3-0-0-3 **Total credits: 3**

Course Objectives

The students will acquire basic knowledge of the type of food and processing method.

Course Outcomes

On successful completion of the course the students will be able to:		
CO level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**define** properties of food and various ingredients	**BT 1**
CO 2	**explain** the role of food ingredients in food product	**BT 2**
CO 3	**apply** knowledge with the additives relevant to the processed food industry for shelf-life extension, processing support and sensory appeal	**BT 3**
CO 4	**develop** different food products	**BT 4**

Course Outline

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I	**Introduction to Food Ingredients:** Introduction to Food Science, Different kinds of Food Industries, Components of Food industries. Scope of food processing and technology. Basic introduction to unit operation in Food Processing and define the term Cleaning, dry cleaning methods, wet cleaning methods, peeling, grading, sorting.	15
II	**Food constituents:** Carbohydrates, lipids, proteins, vitamins and minerals, water. Nutritional and chemical properties of food constituents and its function.	15
III	**Introduction to Food preservation techniques:** Define: Pasteurization, Sterilization, Ultra High temperature, Blanching, etc. Low temperature preservation techniques: Cooling, Evaporation, refrigeration and freezing.	15
IV	**Introduction to new techniques in preservation**: High Pressure Processing, Ohmic heating, . Basic introduction to unit	15

	operation in Food Processing and define the term Cleaning, dry cleaning methods, wet cleaning methods, peeling, grading, sorting.. Drying and their importance in the food processing.	
	TOTAL	**60**
	PEDAGOGY: Lectures, Assignments and Seminars	

Experiential Learning:

- Group Discussion
- Seminar/presentation on any of the relevant topics
- Case Studies

Texts:

3. A Larry Branen, P Michael Davidson and Seppo Salminen, Food Additives: CRC Book Press. USA.
4. S.N. Mahindru, Food Additives: APH Publishing Corporation, Drya Ganj, New Delhi.

References:

4. Food Facts and Principles -N. ShakuntalaManay& M. Shadaksharaswamy, New Age International (P) Limited, New Delhi.

Level: Semester III

Type of Course: AEC **(w.e.f. 2023-24) UG Programme**

Course Code: CEN982A301

Course Title: CEN III – Fundamentals of Business Communication

Course level: 200 **Total Credits:** 1, **L-T-P-C**: 1-0-0

Scheme of Evaluation: Theory and Practical

Course Objective: The aim of the course is to develop essential business communication skills, including effective writing, speaking, and interpersonal communication, to enhance professional interactions, collaboration, and successful communication strategies within diverse corporate environments.

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

CO Level	Course Outcome	Blooms Taxonomy Level
CO 1	**Define and list** business documents using appropriate formats and styles, demonstrating proficiency in written communication for various business contexts.	**BT 1**
CO 2	**Demonstrate** confident verbal communication skills through persuasive presentations, active listening, and clear articulation to engage and influence diverse stakeholders.	**BT 2**
CO 3	**Apply** effective interpersonal communication strategies, including conflict resolution and active teamwork, to foster positive relationships and contribute to successful organizational communication dynamics	**BT 3**

Detailed Syllabus		
Units	**Course Contents**	**Periods**
I	**Business Communication: Spoken and Written** • The Role of Business Communication • Classification and Purpose of Business Communication • The Importance of Communication in Management • Communication Training for Managers • Communication Structures in Organizations • Information to be Communicated at the Workplace • Writing Business Letters, Notice, Agenda and Minutes	**5**

II	**Negotiation Skills in Business Communication**
	• The Nature and Need for Negotiation
	  o Situations requiring and not requiring negotiations
	• Factors Affecting Negotiation
	  o Location, Timing, Subjective Factors
	• Stages in the Negotiation Process
	  o Preparation, Negotiation, Implementation
	• Negotiation Strategies
		5

III	**Ethics in Business Communication** • Ethical Communication • Values, Ethics and Communication • Ethical Dilemmas Facing Managers • A Strategic Approach to Business Ethics • Ethical Communication on the Internet • Ethics in Advertising	**5**
IV	**Business Etiquettes and Professionalism** • Introduction to Business Etiquette • Interview Etiquette • Social Etiquette • Workplace Etiquette • Netiquette	**5**

Texts:

1. *Business Communication* by Shalini Verma
2. *Business Communication* by P.D. Chaturvedi and Mukesh Chaturvedi
3. *Technical Communication* by Meenakshi Raman and Sangeeta Sharma

Level: Semester-III

Course Title: Behavioural Sciences -III

Course code: BHS982A302

Credit: 1

Course objectives: To increase one's ability to draw conclusions and develop inferences about attitudes and behaviour, when confronted with different situations that are common in modern organizations. To enable students to understand the process of problem-solving and creative thinking.

Course outcomes:

CO level	Course Outcome	Blooms Taxonomy Level
CO 1	Understand the process of problem solving and creative thinking.	**BT 1**
CO 2	Develop and enhance of skills required for decision-making	**BT 2**

Modules	Course Contents	Periods
I	Problem Solving Process Defining problem, the process of problem solving, Barriers to problem solving(Perception, Expression, Emotions, Intellect,surrounding environment)	4
II	Thinking as a tool for Problem Solving What is thinking: The Mind/Brain/Behaviour Critical Thinking and Learning: -Making Predictions and Reasoning. -Memory and Critical Thinking. -Emotions and Critical Thinking.	4
III	Creative Thinking - Definition and meaning of creativity, - The nature of creative thinking :Convergent and Divergent thinking, - Idea generation and evaluation (Brain Storming) - Image generation and evaluation. - The six-phase model of Creative Thinking: ICEDIP model	4
IV	Building Emotional Competence Emotional Intelligence – Meaning, components, Importance and Relevance Positive and Negative emotions Healthy and Unhealthy expression of emotions	4
Total		**16**

Text books:

- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management; Pfeiffer &Company
- Blair J. Kolasa, Introduction to Behavioural Science for Business, John Wiley & Sons Inc

Level: Semester III

Course: SEC **Scheme of Evaluation: (P)**

Title of the Paper: Basics techniques in bakery.

Subject Code: FTC152S311

L-T-P-C: 0-0-6-3 **Total credits: 3**

Course Objectives

Apply techniques of baking and preparing various types of bakery preparations.
Develop art of modifying, decorating bakery foods to enhance aesthetic appeal.

Course Outcomes

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**define** equipment's and explain their use in bakery.	**BT 1**
CO 2	**explain** ingredients and their specifications for various baked items.	**BT 2**
CO 3	**apply** knowledge for basic techniques for the preparation of bakery products.	**BT 3**
CO 4	**categorize** the different varieties of cakes, brownies and muffins	**BT 4**

Course Outline

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I	**Introduction to Bakery**, History of baking, Cookery terms, Bakery equipment, Ingredients	**20**
II	**Yeast products**: Different methods and steps in bread making. Role of ingredients used in bread	**25**
III	**Pastry and cakes**: role of ingredients, basic techniques and preparation of different varieties of pastry and cakes, factors affecting qualities of pastry and cakes.	**20**
IV	**Biscuits and cookies**: role of ingredients, basic techniques and preparation of different varieties of biscuits and cookies, factors affecting qualities of biscuits and cookies.	**25**
	TOTAL	**90**
	PEDAGOGY: Lectures, Assignments and Seminars	

Texts:

5. Agarwal A and Udipi SA. 2014. Textbook of Human Nutrition. JaypeeBrothers MedicalPublishers (P) Ltd.
6. Bamji MS, Krishnaswamy K, and Brahmam GNV. 2009. Textbook of Human Nutrition. ThirdEdition. Oxford and IBH Publishing Co. Pvt.Ltd.

References:

7. Belitz H.-D, Grosch W, and Schieberle P. 1st edition. Food Chemistry. FourthEdition. Springer.
8. Civille GV and Carr BT. 2016. Sensory Evaluation Techniques. Fifth Edition.CRC Press.
9. Rodwell VW, Bender DA, Botham KM, Kennelly PJ, Weil PA. 2015.Harper's IllustratedBiochemistry. 30th Edition. McGraw Hill Education.

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Level: Semester IV

Course: Major **Scheme of Evaluation: (T)**

Title of the Paper: Cereals, Pulses and Oilseeds Product Technology

Subject Code: FTC152M401

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

To understand the technology of milling of various cereals and processing of pulses and oilseeds. To gain knowledge on the importance and processing of protein-rich products and to introduce concepts of manufacturing alcoholic beverages

Course Outcomes

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**define** the milling techniques for wheat, flour treatments, types of flour etc.	**BT 2**
CO 2	**explain** the processing of rice, corn, barley and other cereal crops.	**BT 3**
CO 3	**explain** the processing of pulses, milling procedures, and anti-nutritional factors	**BT 3**
CO 4	**apply** the knowledge of the processing of oilseeds (Soybean, Coconut), refining fats and oil, concepts of protein isolates, their sources, properties, and uses	**BT 4**

Course Outline:

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I.	**Wheat technology**: Wheat-Types, milling, flour grade, flour treatments (bleaching, maturing), flour for various purposes, Products and By- products.	**15**
II.	**Rice and other cereal crop technology** – Physicochemical properties, milling (mechanical & solvent extraction), parboiling, rice aging, and byproducts utilization. Corn–Milling (wet & dry), cornflakes, corn flour. Barley- Milling (pearl barley, barley flakes & flour) Oats–Milling (oatmeal, oat flour & oat flakes) Sorghum and millets – Traditional & commercial milling (dry &wet)	**15**
III	**Pulse technology:** Processing- Soaking, Germination, Decortication, Cooking and Fermentation. Changes during germination, Milling-decortication, and splitting (dry and wet milling). Antinutritional factors, Factors affecting cooking time	**15**
IV	**Oilseeds technology:** Sources, Composition, Processing of oil seeds – Soya bean, coconut. Hydrogenation. Refining of fats & oils, bleaching, deodorizing, hydroxylation, Protein isolates, Sources of protein (defatted flour,	**15**

	protein concentrates, and isolates), properties and uses, protein texturization, fibre spinning	
	TOTAL	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning:

- Group Discussion
- Seminar/presentation on any of the relevant topics
- Case Studies

Texts:

1. Chakraverty. 2019. Post-Harvest Technology of Cereals, Pulses and Oilseeds, revised Ed., Oxford &IBH Publishing Co. Pvt Ltd.

2. Manay, S. and Sharaswamy, M. 2004. Food Facts and Priniciples. Wiley Eastern Limited

References:

1. Kent, N.L. 2003. Technology of Cereal, 5th Ed. Pergamon Press.

2. Marshall, Rice Science and Technology. 1st edition,. Wadsworth Ed., Marcel Dekker, New York

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Semester IV

Course: IKS **Scheme of Evaluation: (T)**

Title of Paper: Traditional Knowledge of Indian Foods

Subject Code: FTC152M402

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

To train the students on various aspect of traditional foods of India

Course Outcomes

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**relate** the history and cultural aspect of Indian traditional food	**BT 1**
CO 2	**identify** the traditional food items from different regions of India	**BT 2**
CO 3	**explain** the food processing principles involved in the traditional Indian food preparation/processing	**BT 3**
CO 4	**learn** the traditional methods of preparation/processing of the Indian food items	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I.	**Historical and cultural perspectives:** Food as source of physical sustenance, food as religious and cultural symbols; Importance of food in understanding human culture - variability, diversity, from basic ingredients to food preparation; Impact of customs and traditions on food habits, heterogeneity within cultures (social groups) and specific social contexts - festive occasions, specific religious festivals, mourning etc. Kosher, Halal foods; foods for religious and other fasts.	**15**
II.	**Traditional methods of food processing:** Traditional methods of milling grains – rice, wheat and corn – equipment's and processes as compared to modern methods; Equipment's and processes for edible oil extraction, paneer, butter and ghee manufacture; Comparison of traditional and modern methods; Traditional methods of food preservation – sun-drying, osmotic drying, brining, pickling and smoking.	**15**
III.	**Traditional food patterns:** Typical breakfast, meal and snack foods of different regions of India; Popular regional foods; Regional foods that have gone Pan Indian / Global; Traditional fermented foods, , beverages, snacks, desserts and sweets, street foods;	**15**

IV.	**Traditional food of Northeast India –** Traditional food consumption pattern in North East India**:** Traditional food products of Northeast India- Cereal based-,Fruits and Vegetable food product Milk based-, Fish and meat based food products; Probiotic food; Commercialization opportunity	**15**
	TOTAL	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning:

- Group Discussion
- Seminar/presentation on any of the relevant topics
- Case Studies

Texts:

1. Taylor, S. C., 2005, Food Culture in India. Greenwood Press.
2. Ruth, N. D., 2001, Indian Food Science: A Health and Nutrition Guide to Traditional Recipes. East West Books.

References:

1. Tamang JP (2010). Himalayan fermented foods: microbiology, nutrition and ethnic value. New York: CRC Press, Taylor and Francis Group
2. Boon-Lung, N. (1986). Traditional Foods: Some Products and Technologies. Central Food Technological Research Institute, 114-133.

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**-**

Level: Semester IV

Course: Major **Scheme of Evaluation: (P)**

Title of the Paper: Practical on Cereals, Pulses and Oilseeds Product and Traditional Knowledge of Indian Foods

Subject Code: FTC152M411

L-T-P-C: 0-0-8-4 **Total credits: 4**

Course Objectives

To gain knowledge about the proximate analysis of food samples and their manufacturing techniques

Course Outcomes

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**define** the basic microbiological laboratory practices and equipment with their functioning.	**BT 1**
CO 2	**explain** the different staining and plating techniques used for detection of microbes in food samples, detailed study on morphological study on bacteria and fungi using permanent slides, preparation of various fermented food products and beverages	**BT 2**
CO 3	**develop** malt from cereals and millets	**BT 3**
CO 4	**analyse** the proximate and cooking characteristics of wheat and rice	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I.	1. Introduction to the basic laboratory practices and equipment's handling 2. Cleaning and sterilization of glassware	**20**
II.	1. Study of different food groups 2. Preparation of traditional snacks 3. Preparation of traditional beverages	**25**
III.	1. Physical parameters of wheat 2. Determination of moisture content of the given sample of wheat flour. 3. Determination of gluten percentage in wheat flour 4. Determination of ash content of wheat flour	**20**
IV	1. Measurement of Physical parameters of rice 2. Determination of Milling quality of rice (head rice yield, broken rice yield) 3. Determination of cooking quality of rice (alkali test, cooking time/glass slide method)	**25**

	4. Preparation of malt from cereals	
	TOTAL	**90**
Pedagogy: Lectures, Assignments, Seminars		

Texts:

3. Chakraverty. 2019. Post-Harvest Technology of Cereals, Pulses and Oilseeds, revised Ed., Oxford &IBH Publishing Co. Pvt Ltd.

4. Manay, S. and Sharaswamy, M. 2004. Food Facts and Priniciples. Wiley Eastern Limited

References:

3. Kent, N.L. 2003. Technology of Cereal, 5th Ed. Pergamon Press.

4. Marshall, Rice Science and Technology. 1st edition,. Wadsworth Ed., Marcel Dekker, New York

Level: Semester IV

Course: Minor **Scheme of Evaluation: (T)**

Title of the Paper: Food Product Development

Subject Code: FTC152N401

L-T-P-C: 0-0-6-3 **Total credits: 3**

Course Objectives

To gain knowledge about proximate analysis of food samples and their manufacturing techniques

Course Outcomes

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**define** the Opportunities in the marketplace for new product development, technological advances driving new product development, government's role in new product development .	**BT 1**
CO 2	**Explain** the scope of new product development and modification of traditional methods.	**BT 2**
CO 3	**Develop** the design for production and sensory evaluation.	BT 3
CO 4	**Analyse** the development of food products from commercially available ingredients.	**BT 4**

Course Outline

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I.	**New product development:** Introduction- new products, customers and consumers, value addition, and market, marketing characteristics of new products- product life cycle and profit picture, opportunities in the marketplace for new product development technological advances driving new product development, government's role in new product development.	**15**
II.	**Designing new products:** New Food Product Development (NPD) process and activities; recipe development; use of traditional recipe and modification; selection of materials/ingredients for specific purposes; modifications for production on large scale, cost-effectiveness, nutritional needs or uniqueness; use of novel food ingredients and novel processing technologies	**15**

III.	**Standardization & large-scale production:** Process design; Sensory evaluation; Food testing lab requirements, different techniques and tests; statistical quality control; comparison of market samples	**15**
IV	**New Food product development using locally available ingredients.** Sensory-based evaluation of the developed food products and comparison with the commercially available products (as reference products) and its analysis using novel consumer acceptance techniques such as fuzzy logic approaches.	15
	TOTAL	**60**
Pedagogy: Lectures, Assignments, Seminars		

Experiential Learning:

- Group Discussion
- Seminar/presentation on any of the relevant topics
- Case Studies

Texts:

1.Moskowitz, H.R., Saguy,S. and Straus,T. An Integrated Approach to New Food Product Development, CRC Press, 2006 .

References:

1.Gordon W Fuller, "New Food Product Development: From Concept to Marketplace", 3rd Edition, CRC press, Taylor and Francis Group, UK, 2016.
2. Catherine Side., "Food Product Development: Based on Experience", 2nd Edition, Iowa State Press, Blackwell publications, 2008

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester IV

Course: Minor **Scheme of Evaluation: (T)**

Title of the Paper: Sugar Confectionery and Chocolate Processing

Subject Code: FTC152N402

L-T-P-C: 0-0-6-3 **Total credits: 3**

Course Objectives

To acquaint students with production and processing technologies for product development and value addition of various bakery and confectionery products.

Course Outcomes

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**define** the basic principles of baking and introduce the tools and equipment, along with their uses.	**BT 1**
CO 2	**explain**. knowledge of the Principles of Confectionery and its manufacture. and their Role	**BT 2**
CO 3	**develop** the ability to understand chemistry of dough, chemistry and rheological testing	**BT 3**
CO 4	**analyse t**he chocolate manufacturing, chewing gum and pan coating basics	**BT 4**

Course Outline

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I.	**Principles of Baking Raw Material and their Role** – flour, leavening agents, sugars, fats, additives, spice, Types of Bakery Products and Technology for their Manufacture – dough and batters; cakes, pies, pastries, bread, biscuits Icings and Fillings.	**15**
II.	**Principles of Confectionery Manufacture.** Raw Material and their Role – interfering agents, inversion of sugars, etc. Types of Confectionery Products and Technology for their Manufacture. Quality Parameters of Confectionery Products. Nutrient and other Losses in Confectionery Products. Sanitation and Hygiene in a Confectionery Unit. Equipment used in the Confectionery Industry.	**15**
III.	**Sugar-** Manufacturing of sugar, types of sugar, byproducts, jaggery, honey. Additional ingredients: colours, flavors, gums, pectin and gelatin, chocolate processing. Types: imitation chocolate, milk chocolate. Crystalline and non-crystalline candies.	**15**

IV	**Chocolate** – raw material, types, and manufacture, Ingredients of chocolate **sugar substitutes**-sucrose, invert sugars, corn syrup, non-nutritive sweeteners, **Chewing Gum** - raw material, types, and manufacture **Pan Coating** – hard and soft panning; problems in coating; glazing, polishing, and tableting Nutritional Value, Quality Parameters	**15**
	TOTAL	**60**
Pedagogy: Lectures, Assignments, Seminars		

Experiential Learning:

- Group Discussion
- Seminar/presentation on any of the relevant topics
- Case Studies

Texts:

1.Samuel, A.M.(1996) " The Chemistry and Technology of Cereals as Food and Feed ", CBS Publisher & Distribution, New Delhi. Jay, James M. Modern Food Microbiology, CBS Publication, New Delhi, 2000.

2. Pomeranz, Y.(1998) " Wheat : Chemistry and Technology", Vol 1,3" Am. Assoc.Cereal Chemists. St. Paul, MN, USA.

References:

1. Dubey SC. 2002. Basic Baking. The Society of Indian Bakers, New Delhi
2. Pomeranz, Y. (1993) "Advances in Cereal Science and Technology", Am. AssocCereal Chemists St.Paul, MN, USA

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester IV

Type of Course: AEC **(w.e.f. 2023-24) UG Programme**

Course Code: CEN982A401

Course Title: CEN IV: Business Communication: Concepts and Skills

Course level: 200, **Total Credits:** 1, **L-T-P-C**: 1-0-0

Scheme of Evaluation: Theory and Practical

Course Objectives: This course is designed to enhance employability and maximize the students' potential by introducing them to the principles that determine personal and professional success, thereby helping them acquire the skills needed to apply these principles in their lives and careers.

Course Outcomes: After the successful completion of the course, the students will be able to

CO Level	Course Outcome	Blooms Taxonomy Level
CO 1	**Demonstrate** understanding the importance of verbal and non-verbal skills while delivering an effective presentation.	**BT 2**
CO 2	**Develop** professional documents to meet the objectives of the workplace	**BT 3**
CO 3	**Identify** different life skills and internet competencies required in personal and professional life.	**BT 3**

Detailed Syllabus		
Units	**Course Contents**	**Periods**
I	**Presentation Skills** Importance of presentation skills, Essential characteristics of a good presentation, Stages of a presentation, Visual aids in presentation, Effective delivery of a presentation	**5**
II	**Business Writing** Report writing: Importance of reports, Types of reports, Format of reports, Structure of formal reports Proposal writing: Importance of proposal, Types of proposal, structure of formal proposals Technical articles: Types and structure	**5**

III	**Preparing for jobs** Employability and Unemployability, Bridging the Industry-Academia Gap Knowing the four- step employment process, writing resumes, Guidelines for a good resume, Writing cover letters Interviews: Types of interview, what does a job interview assess, strategies of success at interviews, participating in group discussions.	**5**
IV	**Digital Literacy and Life Skills** **Digital literacy:** Digital skills for the '21st century', College students and technology, information management using Webspace, Dropbox, directory, and folder renaming conventions. Social Media Technology and Safety, Web 2.0. **Life Skills**: Overview of Life Skills: Meaning and significance of life skills, Life skills identified by WHO: self-awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem-solving, Effective communication, interpersonal relationship, coping with stress, coping with emotion. Application of life skills: opening and operating bank accounts, applying for PAN, Passport, online bill payments, ticket booking, gas booking	**5**

Texts:

1. *Business Communication* by Shalini Verma References:
2. *Technical Communication* by Meenakshi Raman and Sangeeta Sharma

Credit Distribution		
Lecture/Tutorial	**Practicum**	**Experiential Learning**
15 hours	-	10 hours - Movie/ Documentary screening - Field visits - Peer teaching - Seminars - Library visits

Level Semester IV

Course title: Behavioural Sciences -IV
Course code: BHS982A402
Credit: 1
Course objectives: To increase one's ability to draw conclusions and develop inferences about attitudes and behaviour, when confronted with different situations that are common in modern organizations.
Course outcomes:

CO Level	Course Outcome	Blooms Taxonomy Level
CO1	Understand the importance of individual differences	**BT1**
CO2	Develop a better understanding of self in relation to society and nation	**BT2**
CO3	Facilitation for a meaningful existence and adjustment in society	**BT3**

Modules	Course Contents	Periods
I	Managing Personal Effectiveness	4
	Setting goals to maintain focus, Dimensions of personal effectiveness (self disclosure, openness to feedback and perceptiveness), Integration of personal and organizational vision for effectiveness, A healthy balance of work and play, Defining Criticism: Types of Criticism, Destructive vs Constructive Criticism, Handling criticism and interruptions.	
II	Positive Personal Growth	4
	Understanding & Developing positive emotionsPositive approach towards future, Impact of positive thinking, Importance of discipline and hard work, Integrity and accountability, Importance of ethics in achieving personal growth.	
III	Handling Diversity	4
	Defining Diversity, Affirmation Action and Managing Diversity, Increasing Diversity in Work Force, Barriers and Challenges in Managing Diversity.	
IV	Developing Negotiation Skills	4

Modules	Course Contents	Periods
	Meaning and Negotiation approaches (Traditional and Contemporary) Process and strategies of negotiations. Negotiation and interpersonal communication. Rapport Building – NLP.	
Total		**16**

Text books:

- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management; Pfeiffer &Company
- Blair J. Kolasa, Introduction to Behavioural Science for Business, John Wiley & Sons Inc.

Key details preserved:

- All course codes, credits, objectives, and outcomes
- Module-wise syllabus content with periods
- Textbook references
- Original structure of tables and headings
- Page-wise semester segregation

Level: Semester V

Course: Major **Scheme of Evaluation: T**

Level of Course: 300

Title of the Paper: Dairy Technology

Subject Code: FTC152M501

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

To acquaint students with production and processing technologies for product development and value addition of various dairy based products.

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Define** the basic composition of milk, physical and chemical properties and various grades of milk.	**BT 1**
CO 2	**Explain** the processing techniques of marketed milk, pasteurization methods of milk.	**BT 2**
CO 3	**Develop** the ability to understand various types of milk and their properties.	**BT 3**
CO 4	**Analyse** the manufacturing methods of fermented and indigenous milk products.	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	**Introduction:** Definition, sources, and composition of milk; Factors effecting composition of milk; Physiochemical properties of milk; Grading of milk: definition and types of grades; Collection and transportation of milk.	**15**
II	**Processing of market milk:** Flowchart of milk processing; Different types of cooling systems; Clarification and filtration process; Standardization: Pearson's square method; Pasteurization: LTLT, HTST and UHT; Sterilisation and homogenisation; Cream separation: centrifugal cream separator; Bactofugation.	**15**
III	**Special Milk:** Skim milk; Evaporated milk; Condensed milk; Standardized milk; Toned milk; Double toned milk; Flavoured milk; Reconstituted milk; Spray drying system: dried milk, whole milk and skim milk powder; Instantization of milk.	**15**
IV	**Indigenous and fermented milk products:** Methods for manufacture: butter; cheese; ice cream; khoa; channa; paneer; shrikhand; ghee.	**15**
	Total	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning

- Group discussion
- Seminar/presentation on any of the relevant topics
- Case studies

Textbooks

- Dairy Technology: Principles of Milk Properties and Processing, P. Walstra, T.J. Geurts, A. Noomen, and J.S. Van Boekel, Marcel Dekker, Illustrated Edition, 1999.
- Outlines of Dairy Technology, Sukumar De, Oxford University Press, 3rd Edition, 2006.
- Food Engineering and Dairy Technology, HG Kessler, Verlag- A Kessler publication, 1981.

Reference Books

- Dairy Processing and Quality Assurance, Chandan RC, Kilara A and Shah NP, Blackwell Publishing, 2008.
- Milk Processing and Quality Management, Tamime AY, Blackwell Publishing, 2009.

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester V

Course: Major **Scheme of Evaluation: T**

Level of Course: 300

Title of the Paper: Animal Product Technology

Subject Code: FTC152M502

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

To acquaint students with production and processing technologies for product development and value addition of various animal and egg products.

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Define** the basic composition and classification of poultry meat.	**BT 1**
CO 2	**Explain** the slaughtering methods of various categories of animals.	**BT 2**
CO 3	**Develop** the ability to understand the classification of various grades of animals	**BT 3**
CO 4	**Analyse** the processing methods of eggs and egg products.	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	**Introduction:** Classification, composition and nutritional value of poultry meat; Effects of feed, breed and stress on production of meat and their quality; Meat quality: colour, flavor, texture, water holding capacity, emulsification capacity.	**15**
II	**Slaughtering of animals:** Buffalo, sheep/goat, poultry, pig; Antemortem and post-mortem examination of meat; Post-mortem changes of meat; Grading; Importance of by-products: utilization, classification and uses; Refrigeration and freezing; Thermal processing: canning, retort pouch, dehydration, irradiation, meat curing; Sausages: processing, types and defects; Packaging of meat.	**15**
III	**Freshwater and marine fish:** Composition, storage and transport; Preservation: drying, smoking, curing, freezing, salting and canning; Surimi: introduction, surimi process, comparison of surimi and fish mince products; Fish protein concentrates; Fish protein extracts; Fish protein hydrolysis; Flowchart of indigenous products: fish sauce and paste.	**15**
IV	**Eggs:** Structure, composition and nutritional value; Factors affecting egg quality and measures of egg quality; Egg processing and manufacturing of egg powder; Egg coatings; Processing of lecithin.	**15**

	Total	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning

- Group discussion
- Seminar/presentation on any of the relevant topics
- Case studies

Textbooks

- Stadelman, W. J., Newkirk, D., & Newby, L., Egg Science and Technology. 4th ed. New Delhi: CBS Publication, 2002.
- Pearson, A. M., & Gillett, T. A., Processed Meats. 3rd ed. New Delhi, CBS Publication, 1997.
- Sen, D.P., Advances in Fish Processing Technology. Allied Publishers Pvt.Limited, 2005.

Reference Books

- Shai, Barbut., Poultry Products Processing. CRC Press, 2005.
- Parkhurst, C., &Mountney, G. J., Poultry Meat and Egg Production. New Delhi: CBS Publishers, 2004.

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester V

Course: Major **Scheme of Evaluation: P**

Level of Course: 300

Title of the Paper: Practical on Dairy and Animal Product Technology

Subject Code: FTC152M511

L-T-P-C: 0-0-8-4 **Total credits: 4**

Course Objectives

To acquaint students with production and processing technologies for product development and value addition of various milk, animal and egg products.

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Define** the basic laboratory equipment's and their handling practices.	**BT 1**
CO 2	**Explain** the methods for estimation of moisture and protein content in milk and meat.	**BT 2**
CO 3	**Develop** the methods to study the shelf life of eggs and evaluate the quality of eggs.	**BT 3**
CO 4	**Analyse** evaluation methods for various fish categories.	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	Introduction to glassware and equipment Quality analysis of milk Milk processing techniques Milk product formulations	**20**
II	Quality evaluation of meat Cut out analysis of canned meats/retort pouches Meat product formulations Analysis of frozen meat/meat emulsion products	**25**
III	Quality evaluation of fish/prawn Cut out examination of canned fish. (Sardine, Mackerel, Tuna) Analysis of frozen meat/meat emulsion products Fish product formulations	**20**
IV	To study shelf-life of eggs by different methods of preservation. Evaluation of eggs for quality parameters (market eggs, branded eggs)	**25**

	To perform freezing of yolk/albumen Egg product formulations	
	Total	**90**
	Pedagogy: Lectures, Assignments, Seminars	

Textbooks

- Dairy Technology: Principles of Milk Properties and Processing, P. Walstra, T.J. Geurts, A. Noomen, and J.S. Van Boekel, Marcel Dekker, Illustrated Edition, 1999.
- Outlines of Dairy Technology, Sukumar De, Oxford University Press, 3rd Edition, 2006
- Stadelman, W. J., Newkirk, D., & Newby, L., Egg Science and Technology. 4th ed. New Delhi: CBS Publication, 2002.
- Pearson, A. M., & Gillett, T. A., Processed Meats. 3rd ed. New Delhi, CBS Publication, 1997.
- Sen, D.P., Advances in Fish Processing Technology. Allied Publishers Pvt.Limited, 2005.

Reference Books

- Shai, Barbut., Poultry Products Processing. CRC Press, 2005.
- Parkhurst, C., &Mountney, G. J., Poultry Meat and Egg Production. New Delhi: CBS Publishers, 2004.
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Level: Semester V

Course: Minor **Scheme of Evaluation: T**

Level of Course: 200

Title of the Paper: Basic of Food Processing and Preservation

Subject Code: FTC152N501

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

To acquaint students with contaminants and toxins associated with food processing.

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Define** the basic terms of food toxicology and classifications.	**BT 1**
CO 2	**Explain** the concepts of carcinogenesis, mutagenesis, teratogenesis.	**BT 2**
CO 3	**Develop** the knowledge to identify the naturally occurring toxicants and food contaminants.	**BT 3**
CO 4	**Analyse** the different types of food additives as toxicants.	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	**Introduction:** Principles of Food Preservation; Water Activity and its significance in food preservation; Overview of the Traditional Methods of Food Preservation; Natural and Chemical Food Preservatives.	**15**
II	**Preservation:** Blanching; Pasteurization; Sterilization; Canning; Extrusion Cooking; Baking; Roasting; Grilling; Dehydration; Concentration; Evaporation; Refrigeration; Freezing; Intermediate Moisture Foods.	**15**
III	**Food processing:** Definition and Difference between food processing and food preservation; Functions; Benefits and Drawbacks of Food Processing; Primary Processing Techniques; Novel Food Processing.	**15**
IV	**Performance parameters for food processing:** Hygiene, Energy efficiency, Minimization of waste, labour; Overview of the types of food processing industries; Shelf life, Perishable foods, Semi perishable foods, Shelf stable foods.	**15**
	Total	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning

- Group discussion
- Seminar/presentation on any of the relevant topics
- Case studies

Textbooks

- Potter NH., Food Science, 5th edition, CBS Publication, New Delhi, 2009.
- Manay NS and Shadaksharaswamy M, Food-Facts and Principles, New Age International (P) Ltd. Publishers, New Delhi, 2014.
- Fellows PJ. 2016. Food Processing Technology Principles and Practice. Fourth Edition. Woodhead Publishing, 2016.

Reference Books

- Sivasankar B. Food Processing and Preservation. First Edition. PHI Learning, 2000.
- Ramsaswamy H and Marcotte M, Food Processing Principles and Applications CRC Press, 2002.

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester V

Course: SEC 4 **Scheme of Evaluation: P**

Title of the Paper: Sugar Confectionary and Chocolate Processing

Subject Code: FTC152S511

L-T-P-C: 0-0-6-3 **Total credits: 3**

Course Objectives

To acquaint students with production and processing technologies for product development and value addition of sugar confectionary and chocolate processing.

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Define** the basic laboratory equipment's and their handling practices.	**BT 1**
CO 2	**Explain** the methods for quality analysis of sugar and chocolate products.	**BT 2**
CO 3	**Develop** the methods to study the shelf life of sugar and chocolate products.	**BT 3**
CO 4	**Analyse** methods for various of sugar and chocolate products formulations.	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	Introduction to glassware and equipment Hard candy formulation Soft candy formulation Jellies, gummies, licorices	**20**
II	Caramel, fudge, toffee Aerated confections Fondant formulation Sugar and sugar free panned confections	**25**
III	Chewing gum Chocolate tempering Chocolate coatings Chocolate panning	**20**
IV	Fat estimation in chocolate Moisture estimation in chocolate Chocolate tasting Chocolate bars	**25**
	Total	**90**
	Pedagogy: Lectures, Assignments, Seminars	

Textbooks

- Lees, R. (2012). *Sugar confectionery and chocolate manufacture*. Springer Science & Business 2012
- Ranken, M. D., Kill, R. C., & Baker, C.. Sugar and chocolate confectionery. In *Food Industries Manual* (pp. 406-443). Boston, MA: Springer US. 1997

Reference Books

- Sivasankar B. Food Processing and Preservation. First Edition. PHI Learning, 2000.
- Ramsaswamy H and Marcotte M, Food Processing Principles and Applications CRC Press, 2002.

Level: Semester VI

Course: Major **Scheme of Evaluation: T**

Level of Course: 300

Title of the Paper: Unit Operation in Food Processing

Subject Code: FTC152M601

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

To acquaint students with knowledge of types of operation techniques used in the food processing industry.

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Define** the types of operations and their principle.	**BT 1**
CO 2	**Explain** the types of separators and their operations.	**BT 2**
CO 3	**Develop** the knowledge to identify the size reduction methods.	**BT 3**
CO 4	**Analyse** the different techniques of drying.	**BT 4**

Course Outline

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I	**Screening:** Types of screens: grizzly, revolving screen, shaking screen, rotary screen, vibratory screen, horizontal screen, perforated metal screens, wire mesh screen; Ideal and Actual screen; Effectiveness of screen; Air screen cleaners.	**15**
II	**Separation:** Types of Separators: disk, indented cylinder, spiral, specific gravity, destoner, inclined draper, velvet roll, pneumatic and aspirator; Separation-based fluidization technique; Magnetic and cyclone separator.	**15**
III	**Size reduction procedures:** Crushing; Impact; Shearing; Cutting; Cereal grinding; Degree of grinding; Size reduction machinery: crusher, grinder, attrition mills, hammer mill, ball mills, rietz mill; Oil expression and extractions: hydraulic press, screw press.	**15**
IV	**Utilities of drying:** Thermal properties: equilibrium moisture content, drying theories, drying rate period; Methods of drying: contact drying, convective drying, freeze drying, radiation drying, superheated steam; Types of dryers: deep bed, flat bed, continuous, recirculating, fluidized bed, rotary, tray, tunnel and solar.	**15**

	Total	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning

- Group discussion
- Seminar/presentation on any of the relevant topics
- Case studies

Textbooks

- Sahay K.M & Singh K.K., Unit Operation of Agricultural Processing. Vikash Publication House, 1994.
- Potter NN & Hochkiss, Food Science 5th Ed. CBS, 1994.
- Earle, R. L. Unit Operations in Food Processing, Elsevier. 2013.

Reference Books

- Fellows, P. J. Food Processing Technology: Principles and Practice. Woodhead publishing, 2022.
- Saravacos, G. D., & Maroulis, Z. B. Food Process Engineering Operations. CRC Press, 2011.

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester VI

Course: Major **Scheme of Evaluation: T**

Level of Course: 300

Title of the Paper: Food Packaging Technology

Subject Code: FTC152M602

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

To provide knowledge about trends and development in food packaging technologies and materials.

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Define** the functions and basic types of packaging materials.	**BT 1**
CO 2	**Explain** the deteriorative reactions and shelf life of food.	**BT 2**
CO 3	**Develop** the knowledge of packaging materials and their functions.	**BT 3**
CO 4	**Analyse** the different types of special packaging materials.	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	**Introduction to packaging:** Definition; Functions of packaging: containment, protection, preservation, promotion, convenience, communication; Requirements of effective package; Types of food packaging: primary, secondary and tertiary packaging.	**15**
II	**Shelf Life of Food:** Introduction; Deteriorative reactions in food: factors affecting deterioration of foods; physical changes; biological changes; chemical changes. Intrinsic and extrinsic factors controlling the rate of reactions; Shelf-life determination tests.	**15**
III	**Packaging materials:** Rigid containers: glass, wooden boxes, metal cans; Semi rigid containers: paperboard cartons; Flexible packaging: paper, plastic pouches, low density polyethylene, high density polyethylene and polypropylene.	**15**
IV	**Special Packaging:** Aseptic packaging; Active packaging; Intelligent packaging; Modified atmospheric packaging; Controlled atmospheric packaging; Shrink packaging; Stretch packaging; Biodegradable packaging; Edible packaging; Tetra packs.	**15**
	Total	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning

- Group discussion
- Seminar/presentation on any of the relevant topics
- Case studies

Textbooks

- Robertson GL, Food Packaging – Principles and Practice, CRC Press Taylor and Francis Group, 2012.
- Paine FA and Paine HY, A Handbook of Food Packaging, Blackie Academic and 46 Professional, 1992.
- Coles R, McDowell D, Kirwan MJ Food Packaging Technology. Blackwell, 2003.

Reference Books

- Richard C, Derek M, Mark J.K, Food Packaging Technology CRC Press, 2003.
- Sacharwo S and Griffin RC, Principles of Food Packaging AVI Publication, 2013.

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester VI

Course: Major **Scheme of Evaluation: T**

Level of Course: 300

Title of the Paper: Food Safety and Quality Management

Subject Code: FTC152M603

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

To understand the role of various safety measures to be taken in food industries.

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Define** the types of hazards and factors affecting food safety.	**BT 1**
CO 2	**Explain** the different types of food borne pathogens.	**BT 2**
CO 3	**Develop** the knowledge for food certification and prerequisites.	**BT 3**
CO 4	**Analyse** the quality concepts and quality attributes.	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	**Definition of food safety:** Types and examples of hazards: biological, chemical, physical hazards; Factors affecting food safety; Importance of safe foods; Impact of food safety on health; Control measures; Accreditation and auditing.	**15**
II	**Hazards of origin:** Biological: Indicator organisms; Food borne pathogens; Sea food and shellfish poisoning; Methods to detect adulterant of various foods; Basic steps in detection of food borne pathogens; Water analysis; Chemical hazards; Physical Hazards.	**15**
III	**Tools of food safety management:** Food certification; Prerequisites: GHPs, GMPs, SSOPs, HACCP, ISO series; TQM; Codex Alimentarius; Kaizen; Risk Analysis; Objective of food laws; Major food laws and regulations of India; Regulation of food sanitation; FSSAI.	**15**
IV	**Food quality management:** Quality concepts; Quality perception; Quality attributes; Safety; Health; Sensory; Shelf life, Convenience, Extrinsic attributes, Factors affecting food behaviours and quality; Halal; Kosher.	**15**
	Total	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning

- Group discussion
- Seminar/presentation on any of the relevant topics
- Case studies

Textbooks

- Pieternel A, Luning, Willem J. Marcelis, Food Quality Management Technological and Managerial principles and practices, Wageningen, 2009.
- Lawley, R., Curtis L. and Davis,J. The Food Safety Hazard Guidebook, RSC publishing, 2004
- Khan, M. S., & Rahman, M. S., Techniques to Measure Food Safety and Quality. Springer International Publishing, 2021.

Reference Books

- Early, R. Guide to Quality Management Systems for the Food Industry. Springer Science & Business Media, 2012.
- Lelieveld, H. L., & Motarjemi, Y. (Eds.). Food Safety Management: A Practical Guide for the Food Industry. Academic Press, 2013.

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester VI

Course: Major **Scheme of Evaluation: P**

Level of Course: 300

Title of the Paper: Practical on Unit operation, packaging and quality management

Subject Code: FTC152M611

L-T-P-C: 0-0-8-4 **Total credits: 4**

Course Objectives

To understand practical knowledge about food packaging and unit operations skills.

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Define** the identification methods for testing of food packaging materials.	**BT 1**
CO 2	**Explain** the characteristics of different packaging materials and unit operations.	**BT 2**
CO 3	**Develop** competence in process management technique.	**BT 3**
CO 4	**Analyse** processing techniques to ensure food safety and quality.	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	Identification of different types of packaging and packaging materials. Determination of tearing strength of paper. Determination of drop test of food package. Determination of water vapor permeability of packaging material.	**20**
II	Determination of cooking properties of parboiled and raw rice. Experiment on osmotic dehydration of foods. Determination of rehydration ratio of dehydrated foods. Study of separation of cream.	**25**
III	Test food samples for microbial contaminants Measure quality parameters of packaged foods under different storage conditions over time. Evaluate cleaning methods on food contact surfaces through microbial load assessments. Evaluation of food packaging materials.	**20**
IV	Analysis of food packaging labels for regulatory compliance and nutritional information. Conduction of mock food safety audits to assess compliance with safety standards. Scheme for the detection of food borne pathogens. Preparation of plans for implementation of FSMS - HACCP, ISO: 22000.	**25**
	Total	**90**

	Pedagogy: Lectures, Assignments, Seminars	

Textbooks

- Robertson GL, Food Packaging – Principles and Practice, CRC Press Taylor and Francis Group, 2012.
- Paine FA and Paine HY, A Handbook of Food Packaging, Blackie Academic and 46 Professional, 1992.
- Coles R, McDowell D, Kirwan MJ Food Packaging Technology. Blackwell, 2003.

Reference Books

- Richard C, Derek M, Mark J.K, Food Packaging Technology CRC Press, 2003.
- Sacharwo S and Griffin RC, Principles of Food Packaging AVI Publication, 2013.

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Level: Semester VI

Course: Minor **Scheme of Evaluation: T**

Level of Course: 200

Title of the Paper: Extrusion Technology

Subject Code: FTC152N601

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

To understand the role of extrusion processes taken in food industries.

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Define** the extrusion process and its principles.	**BT 1**
CO 2	**Explain** the different types of extrusion equipment.	**BT 2**
CO 3	**Develop** the knowledge for food extrusion and its prerequisites.	**BT 3**
CO 4	**Analyse** the principles and importance of extrusion technology.	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	**Introduction:** Principles of extrusion cooking; Methods of extrusion cooking; Types of extruders: single screw, twin screw, applications, construction and operational characteristics; Model and strategies for computer control of twin screw extruder.	**15**
II	**Design:** Aspect of extruder; Extruder components; extrusion models; extrusion measurement and experiments.	**15**
III	**Food products:** Effect of dependent and independent variables on the product; Extruded products: raw materials, process of manufacture, quality, evaluation, packaging; Properties: chemical changes, sensory, rheology, texture; Nutritional value.	**15**
IV	**Application:** Cold extrusion; Extrusion cooking; New extrusion technology for confectionary; Ready to eat breakfast cereals; Cereals products: vermicelli, spaghetti, pasta, macaroni; Texturized vegetable protein; Other extruded food products.	**15**
	Total	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning

- Group discussion
- Seminar/presentation on any of the relevant topics
- Case studies

Textbooks

- Matza. S., Extruded Foods, Springer, 2000.
- Frame, N.D., Technology of Extrusion Cooking, Springer, 2012.
- Riaz, M. N., Extruders in Food Applications, CRC Press, 2000.

Reference Books

- Maskan and Altan, Advances in Food Extrusion Technology, CRC Press, 2012.
- Harper, J.M., Extrusion of Foods, CRC Press, 1981.

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester VII

Course: Major **Scheme of Evaluation: T**

Level of Course: 400

Title of the Paper: Food Plant Sanitation

Subject Code: FTC152M701

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

Understanding the importance and process of sanitation in food processing facilities and learning of the sanitary processes and practices for production of safe and quality food products.

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms TaxonomyLevel**
CO 1	**Explain** the importance of sanitation in food processing facilities.	**BT 1**
CO 2	**Identify** different contaminants of potential hazards in the food processing plants and equipment	**BT 2**
CO 3	**Apply** the knowledge of hygienic design principles to avoid contaminants	**BT 3**
CO 4	**Analyse** the food processing plants and methods to employ appropriate sanitation protocol and practices	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	**Introduction to Food Plant Sanitation**: Definitions and importance of sanitation, Regulatory standards, Key terminologies (Clean, sanitize, disinfect), Microbial Contamination in Food Processing, Types of contaminants, Common foodborne pathogens, Sources of contamination, Types of soil contaminants- Organic, inorganic soils, Biofilms, Understanding allergens and cross-contamination, Cleaning and Sanitation Methods, Detergents and cleaning agents, Sanitizers, Physical methods.	**15**
II	**Hygienic Layout and equipment design**: Hygienic Design Principles: Layout considerations for sanitation, separation of clean and unclean areas, and hygienic design of walls, floors, ceilings, and drains, Sanitation in Equipment Design: Materials of construction (stainless steel, plastics), clean-in-place (CIP) systems, and proper equipment maintenance, Water and Waste Management: Water quality standards, waste management practices, and environmental impacts.	**15**
III	**Sanitation Protocols and Practices:** Standard Operating Procedures (SOPs), Development, implementation, and monitoring of SOPs for cleaning and sanitation, Employee Hygiene, Personal hygiene practices, training, and compliance, Cleaning and Sanitizing Techniques: Proper use of cleaning agents, allergen control, and verification of sanitation.	**15**
IV	**New methods of sanitation and safety standards:** new cleaning technologies (e.g., UV light, ozone), Simple automation in sanitation: CIP and basic robotics, Sustainability in sanitation: Reducing chemical use and water consumption, GHP- personal and plant, Food Safety Audits: Types of	**15**

	audits (internal, external), audit procedures, and corrective actions, Certification Standards: ISO 22000, FSSC 22000, and SQF certification requirements	
	Total	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning

- Group discussion
- Seminar/presentation on any of the relevant topics
- Case studies

Textbooks

- Roday, S. 1998. Food Hygiene and Sanitation, Tata McGraw-Hill Education.
- Principles of Food Sanitation, 4th ed., Norman G. Marriott, 1999
- Heldman, D. R. latest edition. Food Process Engineering: AVI Publications.

Reference Books

- Sanitation in Food Processing, John A. Troller, 1993. Academic Press
- Food safety management: A practical guide for the food industry. Lelieveld, H. L., & Motarjemi, Y. 2013. Academic Press.

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester VII

Course: Major **Scheme of Evaluation: T**

Level of Course: 400

Title of the Paper: Concepts of Food Engineering

Subject Code: FTC152M702

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

To acquaint students with the fundamentals of food engineering and its process and to understand the basics of designing food plants and systems

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms TaxonomyLevel**
CO 1	**Understand** the basic laws of engineering.	**BT 1**
CO 2	**Explain** heat, mass and momentum transfer	**BT 2**
CO 3	**Apply** transport phenomenon in food processing operations	**BT 3**
CO 4	**Solve** problems related to transport phenomenon	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	**Physical properties of Foods**: Methods of Estimation of Shape-Roundness, sphericity, roundness ratio, size, volume- platform scale method, density, specific gravity-apparatus, porosity and surface area	**15**
II	**Thermal Properties of Foods**: Definitions-Specific heat, enthalpy, conductivity and diffusivity, surface heat transfer coefficient. Measurement of thermal properties like specific heat, thermal conductivity and thermal diffusivity	**15**
III	**Aerodynamic properties and Frictional properties of Foods**: Aerodynamic Property- definition- drag coefficient, terminal velocity- application in handling and separation of food materials. Frictional property- coefficient of friction, angle of repose, angle of internal friction, application in food handling and storage	**15**
IV	**Rheology and texture of Foods**: Rheology-Rheological classification- viscoelasticity-viscometers, Hookean Body, St Venant body and Newtonian Body. Texture of foods-Methods of textural evaluation, Subjective and objective Method-texture profile method	**15**
	Total	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning

- Group discussion
- Seminar/presentation on any of the relevant topics

- Case studies

Textbooks

- Rao, M. A., Rizvi, S. S. H. and Datta A.K. latest edition. Engineering Properties of Foods: CRC Press.
- Heldman, D. R. latest edition. Food Process Engineering: AVI Publications.
- Toledo, R. T. latest edition. Fundamentals of Food Process Engineering (2 ed.): CBS Publications, New Delhi.

Reference Books

- Warren McCabe, Julian Smith, Peter Harriott. Unit Operations of Chemical Engineering. 7th Edition. McGraw Hill.
- R. Paul Singh, Dennis R. Heldman, and Ferruh Erdogdu. Introduction to Food Engineering.Latest Edition. Elsevier Science.

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester VII

Course: Major **Scheme of Evaluation: T**

Level of Course: 400

Title of the Paper: Fermentation Technology

Subject Code: FTC152M703

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

Understanding food processing through fermentation, including microbial biochemistry, fermentation techniques, equipment used, and production methods for various fermented foods

Course Outcomes

CO Level	On successful completion of the course the students will be able to:	Blooms TaxonomyLevel
CO 1	**Explain** the fundamental principles of fermentation, including the role of microorganisms as starter culture and food material as a substrate	**BT 1**
CO 2	**Identify** the role of different microorganism, food materials and environmental conditions in producing fermented food products	**BT 2**
CO 3	**Apply** the principle of microbiology and food processing to understand the production of various types fermented food products	**BT 3**
CO 4	**Analyse** the starter cultures, raw materials, processing parameters to ensure the safe production of high-quality fermented food products	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	**Introduction to fermentation:** History of fermented foods, traditional and modern fermented foods, properties of fermented foods, Micro-organisms in fermented foods (Lactic acid bacteria, Acetobacter, Gluconobacter, Yeast and Molds etc.), Biochemical pathways of metabolic reactions for utilization of carbon sources and formation of different metabolites by microorganisms.	**15**
II	**Types of fermentation**: Different types of fermentation process, Starter cultures (bacterial starter culture, yeast starter culture and fungal starter culture), Media formulation, fermenters and other equipment used during fermentation.	**15**
III	**Fermentation Processes of food products**: Preparation of Fermented Dairy Products (Yogurt and Shrikhand), Traditional Indian Fermented Foods (Idli, Dosa, Dhokla), Cheese Production Processes;	**15**
IV	**Fermentation Processes and Product Quality Control**: Alcoholic Beverages (Wines, Whiskies, Beers, Rum) production process. Monitoring Fermentation Parameters (pH, Temperature, Time), Quality Assurance Techniques for Fermented Products	**15**
	Total	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning

- Group discussion
- Seminar/presentation on any of the relevant topics
- Case studies

Textbooks

- Hutkins, R. W. (2018). Microbiology and Technology of Fermented Foods.
- Mansi EMTEL, Bryce CFA. Fermentation Microbiology and Biotechnology, 2nd Edition, Taylor & Francis Ltd, UK, 2007
- Ray, B., & Joshi, V. K. (2014). Fermented Foods: Part I-Biochemistry and Microbiology.

Reference Books

- Hutkins, R. W. (2018). Microbiology and Technology of Fermented Foods.
- Mansi EMTEL, Bryce CFA. Fermentation Microbiology and Biotechnology, 2nd Edition, Taylor & Francis Ltd, UK, 2007

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester VII

Course: Major **Scheme of Evaluation: P**

Level of Course: 400

Title of the Paper: Practical on Food Plant Sanitation and Fermentation Technology

Subject Code: FTC152M711

L-T-P-C: 0-0-8-4 **Total credits: 4**

Course Objectives

Understanding of food plant sanitation, traditional food processing, and fermentation techniques and applying hygiene practices, conducting microbial analyses, and ensuring quality control in food production

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms TaxonomyLevel**
CO 1	**Define** key concepts related to food plant sanitation, traditional food processing, and fermentation technologies, including hygiene and safety standards	**BT 1**
CO 2	**Classify** various traditional food products and fermentation methods based on their preparation techniques, ingredients, and regional variations	**BT 2**
CO 3	**Construct** practical solutions for enhancing food safety and quality during the production of traditional and fermented foods	**BT 3**
CO 4	**Analyse** the impact of processing techniques on the microbial quality, safety, and nutritional value of traditional and fermented food products	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	Introduction to basic laboratory facilities-tools and appliances Introduction to basic food processing layout design Cleaning and maintenance of the food processing equipment	**20**
II	Assessment of microbial load by swab tests on different food plant surfaces and following standard plating methods Determination of the effectiveness of different sanitizers (chlorine, quaternary ammonium, hydrogen peroxide) on microbial load reduction on equipment surfaces Analysis of water used in food processing for chlorine content Identification of biofilm formation on food plant surfaces and testing the effectiveness of cleaning agents in removing biofilms	**25**
III	Measurement of roundness, sphericity, bulk density, angle of repose, viscosity measurement using viscometer	**20**
IV	Implementation of hygienic protocols during the preparation of fermented foods and assess the reduction in microbial contamination Shelf-life analysis on traditionally processed and fermented foods under controlled and open environments.	**25**

	Preparation of a starter culture for alcoholic beverage production Preparation of acetic acid (vinegar) by fermentation of fruit juice	
	Total	**90**
	Pedagogy: Lectures, Assignments, Seminars	

Textbooks

- Rao, M. A., Rizvi, S. S. H. and Datta A.K. latest edition. Engineering Properties of Foods: CRC Press.
- Heldman, D. R. latest edition. Food Process Engineering: AVI Publications.
- Toledo, R. T. latest edition. Fundamentals of Food Process Engineering (2 ed.): CBS Publications, New Delhi.

Reference Books

- Warren McCabe, Julian Smith, Peter Harriott. Unit Operations of Chemical Engineering. 7th Edition. McGraw Hill.
- R. Paul Singh, Dennis R. Heldman, and Ferruh Erdogdu. Introduction to Food Engineering.Latest Edition. Elsevier Science.

Level: Semester VII

Course: Minor **Scheme of Evaluation: T**

Level of Course: 300

Title of the Paper: Food Business Management

Subject Code: FTC152N701

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

Understanding of the fundamental principles and practices necessary for effectively managing and operating food businesses, with an emphasis on marketing, operations, finance, and entrepreneurship within the food industry

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms TaxonomyLevel**
CO 1	**Explain** the key concepts and principles of food business management, including operational, marketing, and financial strategies	**BT 1**
CO 2	**Identify** the various sectors within the food industry and the specific challenges and opportunities each sector presents for business management	**BT 2**
CO 3	**Apply** effective marketing and operational strategies to real-world food business scenarios to enhance performance and customer satisfaction.	**BT 3**
CO 4	**Analyse** financial statements and performance metrics to assess the viability and profitability of food business ventures	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	**Introduction to Food Business Management**: Importance of the food industry, key sectors in the food business: production, processing, distribution, and retail, business models in the food industry, understanding the food supply chain, legal and regulatory framework (FSSAI, CODEX, etc) for food businesses, ethical considerations in food management,	**15**
II	**Marketing and Consumer Behaviour in the Food Industry:** Fundamentals of food marketing, understanding consumer behaviour and preferences, market research techniques in the food sector, segmentation, targeting, and positioning strategies, branding and product development in food businesses, pricing and promotional strategies; case studies of successful food marketing campaigns.	**15**
III	**Operations and Supply Chain Management in Food Businesses:** Overview of operations management in food production and service, quality management systems in the food industry, supply chain management concepts and practices, inventory management and control techniques, logistics and distribution strategies, sustainability in food supply chains, role of technology in food operations, food safety and traceability in supply chains, case studies on efficient food operations.	**15**

IV	**Financial Management and Entrepreneurship in the Food Industry:** Introduction to financial management principles in food businesses, budgeting and forecasting for food enterprises, financial statement analysis and key performance indicators, sources of funding for food businesses: loans, venture capital, and grants, entrepreneurship in the food sector: starting and managing a food business, business plan development for food ventures, risk management in food businesses, case studies of successful food entrepreneurs, exploring trends and innovations in the food industry.	**15**
	Total	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning

- Group discussion
- Seminar/presentation on any of the relevant topics
- Case studies

Textbooks

- David D and Erickson S. 1987. Principles of Agri Business Management. Mc Graw HillBook Co., New Delhi.
- Acharya S S and Agarwal N L. 1987. Agricultural Marketing in India. Oxford & ISH Publishing Co., New Delhi.
- Phill Kottler .1994. Marketing Management - Prentice Hall of India, New Delhi

Reference Books

- Cundiff Higler. 1993.Marketing in the International Environment, Prentice Hall of India,New Delhi.
- Batra G S & Kumar N. 1994. GAD implications of Denkel proposals - Azmol PublicationsPvt., New Delhi.

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester VIII

Course: Major **Scheme of Evaluation: T**

Level of Course: 400

Title of the Paper: Nutraceuticals and Functional Foods

Subject Code: FTC152M801

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

To understand the Fundamental knowledge of nutraceuticals and functional foods and knowledge about health promoting effect of nutraceuticals and various metabolic disorders and their prevention and treatment by nutraceuticals and processing and storage of functional foods.

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms TaxonomyLevel**
CO 1	**Define** knowledge of nutraceuticals and functional foods	**BT 1**
CO 2	**Explain** the health promoting effect of nutraceuticals.	**BT 2**
CO 3	**Explain** role of functional beverages and herbs and their market aspects	**BT 3**
CO 4	**Apply** the role of functional beverages and herbs and their market aspects	**BT 4**

Course Outline

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I	**Technological Aspects of Nutraceuticals and functional Foods:** Defining nutraceuticals and functional foods, nature, type and scope. Nutraceuticals and functional foods applications and their health benefits, classification based on chemical and biochemical nature with suitable and relevant descriptions.	**15**
II	**Nutraceuticals for Specific Diseases:** Food recommended and restricted in metabolic disorders and disturbances, gastrointestinal disorders; fever and infection; liver, gall, bladder and pancreatic disturbances; blood circulatory and cardiac diseases; urinary and musculoskeletal diseases; allergies.	**15**
III	**Functional Role of Food Components:** Antioxidants, phytochemicals, isoflavones, lycopene, their role in Nutraceutical and functional foods, dietary fibers and complex carbohydrates as functional food ingredients. Proteins as a functional food ingredient, probiotic foods and their functional role.	**15**
IV	**Role of Specific Food Products as a Functional Food** Herbs as functional foods, health promoting activity of common herbs. Cereal products as functional foods- Oats, Wheat bran, rice bran etc. Functional vegetable products, oil seeds and sea foods. Coffee, tea and other beverages as functional foods/ drinks and their protective effects	**15**
	Total	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning

- Group discussion
- Seminar/presentation on any of the relevant topics

Textbooks

- Handbook of Nutraceuticals. Pathak YV, CRC Press, 2009
- Innovations in Healthy and Functional Foods Ghosh D et al., CRC Press,2012
- Functional Foods and Nutraceuticals- Bioactive Components, Formulations and Innovations. Chukwuebuka Egbuna, Genevieve Dable Tupas. Springer Nature. 2020.

Reference Books

- Handbook of Nutraceutical and Functional Foods. Wildman REC
- Anti-angiogenic Functional and Medicinal Foods. Losso JN

Credit Distribution		
Theory	**Practical**	**Experimental Learning**
60	**-**	**30**

Level: Semester VIII

Course: Minor **Scheme of Evaluation: T**

Level of Course: 300

Title of the Paper: Research Methodology

Subject Code: FTC152N801

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

To understand design a research problem by applying appropriate experimental design and statistically analyze the collected data and explain the ethics in research and plagiarism and write research papers, reports and research proposals

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms TaxonomyLevel**
CO 1	**Define** research problem by applying appropriate experimental design	**BT 1**
CO 2	**Explain** statistically analyze the collected data.	**BT 2**
CO 3	**Explain** the ethics in research and plagiarism	**BT 3**
CO 4	**Apply to** write research papers, reports and research proposals	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	**Research:** Types, Research process and steps in it, Hypothesis, Research proposals and aspects; Research Design: Need, Problem Definition, variables, research design concepts, Literature survey and review, Research design process, Errors in research; Research Modeling: Types of Models, Model building and stages, Data consideration and testing, Report Writing: Pre writing considerations, Thesis writing, Formats of report writing and publications in Research journals. Ethical issues, ethical committees Commercialization, Copy right, royalty, Intellectual property rights and patent law, Trade Related aspects of Intellectual Property Rights, Plagiarism, Citation and acknowledgement, Reproducibility and accountability**.**	**15**
II	**Design of Experiments:** Objectives, strategies, Experimental design, Factorial design, Central composite design, Fractional factorial design, Taguchi's approach to design of experiments. Model development: Empirical model development, Validity of predicted equation, Graphic analysis, Adjusted coefficient of determination, F test for lack of fit. Statistical quality control: Introduction-Process control-control charts for variables-X and R, X and s charts control charts for attributes: p chart, np chart, c chart	**15**
III	**Testing of hypothesis**: Introduction - Large sample tests based on normal distribution - Test for single mean, difference between means - proportion, difference between proportions - standard deviation, difference between standard deviation -Chi-square test for goodness of fit - Independence of attributes.	**15**

IV	**Analysis of variance:** Small sample tests based on t and F distribution-Test for, single mean, difference between means, Paired t-test, test for equality of variances. ANOVA one -way classification, Two-way classification	**15**
	Total	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning

- Group discussion
- Seminar/presentation on any of the relevant topics

Textbooks

- Montgomery, D. C. Design and Analysis of Experiments, Wiley India, 2007.
- Montgomery, D.C. and Runger, G.C. Applied Statistics & Probability for Engineers, Wiley India, 2007.
- Ewans W. & Grant G., "Statistical Methods in Bio informatics - An Introduction", Springer, 2nd edition, 2005.

Reference Books

- Kothari, C.K. Research Methodology Methods and Techniques, New Age International, 2004.
- Gupta S.C. & Kapoor V.K., "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, New Delhi, 11th edition, 2007.

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester VIII

Course: Major **Scheme of Evaluation: T**

Level of Course: 400

Title of the Paper: Food Quality and Sensory evaluation

Subject Code: FTC152M802

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

To understand the knowledge of food hygiene, quality control and importance of food safety and quality management system in food industry.

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms TaxonomyLevel**
CO 1	**Define** the concepts of food quality and role of total quality management system in food industry	**BT 1**
CO 2	**explain** the quality of food products using various techniques	**BT 2**
CO 3	**explain** the national & international food laws and regulations for quality of foods	**BT 3**
CO 4	**apply** to different techniques to perform sensory evaluation study of foods	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	**Quality and Assurance:** Definition, scope, importance and difference, Total quality control and (TQC) Total quality management (TQM), Statistical quality control. Definition, importance, scope and difference between food quality and food safety.	**15**
II	**Raw materials & Finished product quality**: Quality parameters and evaluation procedures: appearance, colour, texture, viscosity, consistency, flavour etc. Food safety standards and laws: FSSAI, BIS, FDA	**15**
III	**Quality Certification & Accreditation**: Introduction and procedure Prevention of food adulteration: Act, method of detection, Food additives and legislation; Nutritional labelling Risk and Hazard.	**15**
IV	**Sensory Evaluation:** Selection of panel of judges, Prerequisite for sensory analysis, application of consumer tests; control of factors affecting of sensory verdict, Instrumental measurements of sensory attribute of foods sensory characteristics of foods, types of tests, Texture profile analysis. Correlation between instrumental and Sensory analysis of food quality attributes.	**15**
	Total	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning

- Group discussion
- Seminar/presentation on any of the relevant topics

Textbooks

- Food Quality Assurance: Principles and Practices, I. Ali, CRC Press, 2nd Edition, 2004.
- Quality Assurance in Food Industry: a Practical Approach, J. A. Vasconcellos, CRC Press, 1st Edition, 2003.
- Statistical Quality Control for the Food Industry, M. R. Hubbard, Kluwer Academic/ Plenum Publishers, 3rd Edition, 2003.

Reference Books

- HACCP in Meat, Poultry and Fish Processing, A. M. Pearson and T.R. Dutson, Kluwer Academic Publishers, 2nd Edition, 1999.
- Food Safety Contaminants and Toxins, J. P. F. D'Mello, Oxford University Press, 1st Edition, 2003.
- Quality of Fresh and Processed Foods, F.Shasidi, A.M.Spanier, Chi-Tang Ho and T.Braggins, Kluwer Academics/ Plenum Publishing,3rd Edition, 2004.
- Rapid and On-line Instrumentation for Food Quality Assurance, Jotbill, Woodhead Publishing,2nd Edition, 2003.

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester VIII

Course: Major **Scheme of Evaluation: T**

Level of Course: 400

Title of the Paper: Food Adulteration and Additives

Subject Code: FTC152M803

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

To aware students about basic idea on various foods and about adulteration and know about adulteration of common foods and their adverse impact on health and develop the skills of detecting adulteration of common foods and extend their knowledge for remedial measures for common food adulterants and knowledge of food additives and their applications in food processing.

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms TaxonomyLevel**
CO 1	**Define** on various foods and about adulteration	**BT 1**
CO 2	**Explain** adulteration of common foods and their adverse impact on health	**BT 2**
CO 3	**Explain** the certain detecting adulteration of common foods	**BT 3**
CO 4	**Apply** for food additives and their functions and regulatory aspects of food additives	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	**Common Foods and Adulteration:** subjected to adulteration-Adulteration-Definition-Types, poisonous substance, Foreign Matter, cheap substitutes, spoilers part. Adulteration through food Additives	**15**
II	**Adulteration in common Foods and methods of detection:** Means of adulteration, methods of detection adulteration in the following foods; milk, oil, grains, sugar, spices and condiments, tea and coffee, process foods, fruits and vegetable	**15**
III	**Present Law and Procedures of Adulteration:** Food Safety and standards Authority of India -Rules and Procedures of Local Authorities, International – Concept of C ISO 9000, ISO 22000, ISO 14000. Consumer Protection Act (1986), BIS/IS, Food Safety and standards – 2006, method for detection of food adulteration.	**15**
IV	**Food Additives:** Definitions, sources, uses and functions; nomenclature of food additives, Food additives: Used in fruit and vegetable preservation, food additives and legislation; PFA specification for food products, Nutritional labelling	**15**
	Total	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning

- Group discussion
- Seminar/presentation on any of the relevant topics

Textbooks

- Rapid Detection of Food Adulterants and Contaminants; Theory and Practice by Shyam Narayan Jha; Academic Press, 2016.
- A first course in Food Analysis - A.Y. Sathe, New Age International (P) Ltd., 1999.
- Food Additive Toxicology. Joseph A. Maga, Anthony Y. Tu. Routledge. 1994

Reference Books

- Food adulteration and food fraud by Jonathan Rees, London, Reaktion Books, 2020.
- Fennema's Food Chemistry by Damodaran Parkin Fennema, CRC Press, 2017.

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**

Level: Semester VIII

Course: Major **Scheme of Evaluation: T**

Level of Course: 400

Title of the Paper: Technology of spices, condiments and plantation crops

Subject Code: FTC152M804

L-T-P-C: 4-0-0-4 **Total credits: 4**

Course Objectives

Skill and knowledge required to apply the principles and concepts behind spices, condiments and plantation products processing and Knowledge on post-harvest handling, specific processing technologies, preparing, quality analysis and stabilizing shelf life of spices, condiments and plantation-based products

Course Outcome

On successful completion of the course the students will be able to:		
CO Level	**Course Outcome**	**Blooms TaxonomyLevel**
CO 1	**Define** the scope, processing and production of spices and condiments	**BT 1**
CO 2	**Explain** the processing methods for value addition of spices and condiments	**BT 2**
CO 3	**Explain** the processing of plantation products	**BT 3**
CO 4	**Apply** for standards, adulteration and packaging of spices and condiments	**BT 4**

Course Outline

Modules	Topics (if applicable) & Course Contents	Periods
I	**Spices & Condiments -** Definition and classification and types of spices and condiments, composition, functional properties, flavoring agents, nutritive value; Intermediate Moisture Products. Challenges in production, processing and trade, spice-based food additives, extraction procedure and utilization; global trade scenario	**15**
II	**Plantation Crops** - Description of various types of Plantation crops, viz., coconut, areca nut, coffee, tea, cocoa etc. Differences between plantation crops vs. fruit crops processing and preservation methods. Commercialization of plantations and value-added products shelf- stable products viz., coconut water bottling, desiccated coconut powder, coffee concentrate, instant coffee powder, instant tea powder, cocoa processing, their composition, nutritive value, health benefits.	**15**
III	**Processing of Tea leaves**: Black tea, green tea and Oolong tea. chemistry of tea manufacturing and tea quality; tea aroma precursors; tea flavour; tea grades; storing of tea Instant tea, tea concentrates, decaffeinated tea, flavoured tea; herbal tea.	**15**
IV	**Processing of coffee:** Coffee cherries by wet and dry methods to obtain coffee beans, grinding, storage and preparation of brew, Soluble /Instant coffee, Use of chicory in coffee, decaffeinated coffee	**15**
	Total	**60**
	Pedagogy: Lectures, Assignments, Seminars	

Experiential Learning

- Group discussion
- Seminar/presentation on any of the relevant topics

Textbooks

- Tea Production and Processing. B. Banerjee, Oxford & IBH Pub. Co., 1st Edition, 1993.
- Coffee Technology. M. Sivetz, AVI publishing Co., 1st Edition, 1979.
- Minor Spices and Condiments: Crop Management and Post Harvest Technology. J.S.Purthi, ICAR publication, 1st Edition, 2001.
- Major Spices of India: Crop Management and Post Harvest Technology. J.S.Purthi, ICAR publication, 1st Edition, 2003.

Reference Books

- Handbook of Fruit Science and Technology: Production, Composition, Storage, and Processing. D. K. Salunkhe, S. S. Kadam, CRC Press, 1st Edition, 1995.
- Global Advances in Tea Science. N.K.Jain, Aravali Books International, 1st Edition, 1999.
- Coffee: Botany, Biochemistry and Production of Beans and Beverage. M.N. Clifford and K.C.Willson, AVI publishing Co., 1st Edition, 1985.

Credit Distribution		
Theory	**Practicum**	**Experimental Learning**
60	**-**	**30**