PERIYAR UNIVERSITY

SALEM– 636011

SYLLABUS FOR

B.Sc. Food Technology

CHOICE BASED CREDIT SYSTEMOUTCOME BASED EDUCATION

(For Candidates admitted in the Colleges affiliated to Periyar University from 2023 - 2024 onwards)

1. Preamble:

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

2. Eligibility for Admission

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

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

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

3. Eligibility for the Award of the Degree

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

4. Examinations

Semester pattern is adopted for examinations. Candidates failing in any course will be permitted to appear for such failed course at subsequent examinations. Examinations for I, III and V semesters will be held in November/ December and for II, IV and VI semesters will be held in April / May month of every year. **Requirement to appear for the examination** A candidate shall be permitted to appear for the university examinations for any semester (practical/theory) if he / she secure not less than 75% of attendance in the number of working days during the semester.

5. Passing Minimum

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

examination in the course (Theory or Practical).

6. Classification of Successful Candidates

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

7. Maximum Duration for the completion of the programme: The maximum duration for completion of the UG Programme shall not exceed twelve semesters (6 years).

8. Commencement of this Regulation:

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

9. Pattern of Question Paper (All Courses)

Time : 3 Hours Maximum:75 Marks

Part A : 15 x1 =15 (Multiple Choice) (Three questions from each unit) Part B :2 x 5 = 10 (Any Two questions) (One question from each unit) Part C :5 x 10 = 50 (One question from each unit with internal choice)

10. Evaluation Pattern for Continuous Internal Assessment(CIA)

External Assessment (EA)	Internal Assessment (IA)
75 Marks	25 Marks

Component	Time	Total Marks	IA marks
Test I	2 hours	50	10
Test II	2 hours	50	10
Assignment (minimum 2)/Seminar/Problem based Activity		10	05
		Total	**25**

PASS PERCENTAGE(THEORY)

Passing minimum (Internal Assessment) 40%	**10 marks**
Passing minimum (External Assessment) 40%	**30 marks**
Total	**40 marks**

B. PRACTICALS

External Assessment (EA)	Internal Assessment (IA)
60 Marks	40 Marks

Component	Time	Total Marks	IA marks
Practical Test I	3 hours	50	15
Practical Test II	3 hours	50	15
Record / Filled in Manual			05
Attendance / Performance Evaluation of the Experiments during the Conduct of the Course			05
Total			40

PROJECT EVALUATION

External Assessment (EA)	Internal Assessment (IA)
60 Marks	40 Marks

PASS PERCENTAGE(practical &project)

Passing minimum (Internal Assessment) 40%	**16 marks**
Passing minimum (External Assessment) 40%	**24 marks**
Total	**40 marks**

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME	
Programme:	**B.Sc.Food Technology**
Programme Code:	**UFT**
Duration:	**3 years [UG]**
Program Outcomes:	**O1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study **O2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. **O3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and

	theories by following scientific approach to knowledge development. **O4: Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. **O5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **O6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation **O7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society. **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. **PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability toembrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstratingthe ability to identify ethical issues related to one‟s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.

	PO 14: Leadership readiness/qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. **PO 15: Lifelong learning:** Ability 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, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.
Programme Specific Outcomes:	**PSO1 – Placement:** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions. **PSO 2 - Entrepreneur:** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations **PSO3 – Research and Development:** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development. **PSO4 – Contribution to Business World:** To produce employable, ethical and innovative professionals to sustain in the dynamic business world. **PSO 5 – Contribution to the Society:** To contribute to the development of the society by collaborating with stakeholders for mutual benefit

Credit Distribution for UG Programmes

Sem I	Credit	H	Sem II	Credit	H	Sem III	Credit	H	Sem IV	Credit	H	Sem V	Credit	H	Sem VI	Credit	H
Part 1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	5.1 Core Course – \CC IX	4	5	6.1 Core Course – CC XIII	4	6
Part.2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	5.2 Core Course – CC X	4	5	6.2 Core Course – CC XIV	4	6
1.3 Core Course – CC I	5	5	2..3 Core Course – CC III	5	5	3.3 Core Course – CC V	5	5	4.3 Core Course – CC VII Core Industry Module	5	5	5. 3.Core Course CC -XI	4	5	6.3 Core Course – CC XV	4	6
1.4 Core Course – CC II	5	5	2.4 Core Course – CC IV	5	5	3.4 Core Course – CC VI	5	5	4.4 Core Course – CC VIII	5	5	5. 4.Core Course –/ Project with viva- voce CC -XII	4	5	6.4 Elective - VII Generic/ Discipline Specific	3	5
1.5 Elective I Generic/ Discipline Specific	3	4	2.5 Elective II Generic/ Discipline Specific	3	4	3.5 Elective III Generic/ Discipline Specific	3	4	4.5 Elective IV Generic/ Discipline Specific	3	3	5.5 Elective V Generic/ Discipline Specific	3	4	6.5 Elective VIII Generic/ Discipline Specific	3	5
1.6 Skill Enhancement Course SEC-1	2	2	2.6 Skill Enhancement Course SEC-2	2	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	1	4.6 Skill Enhancement Course SEC-6	2	2	5.6 Elective VI Generic/ Discipline Specific	3	4	6.6 ExtensionActivity	1	-
1.7 Skill Enhancement - (Foundation Course)	2	2	2.7 Skill Enhancement Course – SEC-3	2	2	3.7 Skill Enhancement Course SEC-5	2	2	4.7 Skill Enhancement Course SEC-7	2	2	5.7 Value Education	2	2	6.7 Professional Competency Skill	2	2
						3.8 E.V.S.	-	1	4.8 E.V.S	2	1	5.8 Summer Internship /Industrial Training	2				
	23	**30**		**23**	**30**		**22**	**30**		**25**	**30**		**26**	**30**		**21**	**30**
Total – 140 Credits																	

Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credit and Hours Distribution System for all UG courses including Lab Hours

First Year – Semester-I

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses [in Total]	13	14
Part-4	Skill Enhancement Course SEC-1	2	2
	Foundation Course	2	2
		23	**30**

Semester-II

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	14
Part-4	Skill Enhancement Course -SEC-2	2	2
	Skill Enhancement Course -SEC-3 (Discipline / Subject Specific)	2	2
		23	**30**

Second Year – Semester-III

Part	List of Courses	Credit	No. of Hours
Part-1	Language - Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	14
Part-4	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific)	2	2
	E.V.S	-	1
		22	**30**

Semester-IV

Part	List of Courses	Credit	No. of Hours
Part-1	Language - Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	13
Part-4	Skill Enhancement Course -SEC-6 (Discipline / Subject Specific)	2	2
	Skill Enhancement Course -SEC-7 (Discipline / Subject Specific)	2	2
	E.V.S	2	1
		25	**30**

Third Year

Semester-V

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Project / Elective Based	22	26
Part-4	Value Education	2	2
	Internship / Industrial Visit / Field Visit	2	2
		26	**30**

Semester-VI

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Project / Elective Based & LAB	18	28
Part-4	Extension Activity	1	-
	Professional Competency Skill	2	2
		21	**30**

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	13	13	13	13	22	18	92
Part IV	4	4	3	6	4	2	23
Part V	-	-	-	-	-	1	01
Total	23	23	22	25	26	21	**140**

Part I. II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.

B.Sc. Food Technology (Semester Wise Structure)

FIRST YEAR

Part	Semester I	Course Name	Credit	Hours	Internal	External	Total
I	Language	Tamil/ /Other Languages	3	6	25	75	100
II	Language	English	3	6	25	75	100
III	Core Course1	Fundamentals of Food science and chemistry	5	5	25	75	100
III	Core Course 2	Fundamentals of Food science and chemistry Practical	4	3	40	60	100
III	Allied1	Chemistry for Biological Sciences I	3	4	25	75	100
III	Allied 2	Chemistry Practical I	1	2	40	60	100
IV	NMEC	Food Preservation (other departments)	2	2	25	75	100
IV	FC	Foundation of Entrepreneurship	2	2	25	75	100
			23	**30**	**230**	**570**	**800**

Part	Semester II	Course Name	Credit	Hours	Internal	External	Total
I	Language	Tamil/ Other Languages	3	6	25	75	100
II	Language	English	3	4	25	75	100
IV	NMSDC	Overview of English Language Communication	2	2	-	-	-
III	Core Course 3	Fundamental of Food Technology	5	4	25	75	100
III	Core Course 4	Fundamental of Food Technology Practical	3	2	40	60	100
III	Allied 3	Chemistry for Biological Sciences II	3	4	25	75	100
III	Allied 4	Chemistry Practical II	1	2	40	60	100
IV	NMEC	Food Packaging Technology (other departments)	2	2	25	75	100
IV	SEC1	Food Additives	2	2	25	75	100
IV		Disaster Management	1	2	25	75	100
			25	**30**	**230**	**570**	**800**

SECOND YEAR

Part	Semester III	Course Name	Credit	Hours	Internal	External	Total
I	Language	Tamil/ Other Languages	3	6	25	75	100
II	Language	English	3	6	25	75	100
III	Core Course 5	Technology of Food Preservation	4	4	25	75	100
III	Core Course 6	Technology of Food Preservation Practical	3	3	40	60	100
III	Allied 5	Food Microbiology	3	3	25	75	100
III	Allied 6	Food Microbiology Practical	2	3	40	60	100
IV	SEC 2	Bakery and Confectionery	1	2	25	75	100
IV	**NMSDC**	**Digital Skills for Employability**	**2**	**2**	**40**	**60**	**100**
IV	E.V.S	Environmental Studies	-	1	-	-	-
		Health and Wellness	1				
			22	**30**	**245**	**555**	**800**

Part	Semester IV	Course Name	Credit	Hours	Internal	External	Total
I	Language	Tamil/ Other Languages	3	6	25	75	100
II	Language	English	3	6	25	75	100
III	Core Course 7	Post-Harvest Engineering	4	4	25	75	100
III	Core Course 8	Post-Harvest Engineering Practical	3	3	40	60	100
III	Allied 7	Food and Nutrition	3	3	25	75	100
III	Allied 8	Food and Nutrition Practical	2	3	40	60	100
IV	NMSDC	Food Processing & Preservation Techniques	2	2	25	75	100
IV	SEC 5	Food Product Development Practical	2	2	40	60	100
IV	E.V.S	Environmental Studies	2	1	25	75	100
			24	**30**	**270**	**630**	**900**

*Internship -15 days (summer vacation)

THIRD YEAR

Part	Semester V	Course Name	Credit	Hours	Internal	External	Total
III	Core Course 9	Processing Technology of Legumes and Oilseeds	4	4	25	75	100
III	Core Course 10	Processing Technology of Cereals	4	5	25	75	100
III	Core Course 11	Processing Technology of Cereals Practical	3	3	40	60	100
III	Core Course 12	Food Plant Sanitation	4	5	25	75	100
III	Project	Project Viva-Voce	4	4	40	60	100
III	Elective Course1	Nutraceuticals and Functional Foods	3	5	25	75	100
IV	Internship	Summer vacation at the end of IV semester activity	2	-	-	-	-
IV	VE	Value Education	2	2	25	75	100
IV	**NMSDC**	**Advanced Technology for Employability in Life Science Botany & Food Science, Nutrition**	**2**	**2**	**25**	**75**	**100**
			28	**30**	**245**	**555**	**800**

Part	Semester VI	Course Name	Credit	Hours	Internal	External	Total
III	Core Course 13	Processing Technology f Spices, Fruits and Vegetables	4	5	25	75	100
III	Core Course 14	Processing Technology of Dairy and Sea food	4	6	25	75	100
III	Core Course 15	Processing Technology of Dairy and Sea food Practical	1	3	40	60	100
III	Core Course 16	Processing Technology of meat, poultry and eggs	3	5	25	75	100
III	Elective Course2	Food Safety and Quality	3	4	25	75	100
III	Elective Course3	Marketing Management	3	4	25	75	100
IV	SEC 6	Basics in Research Methodology	2	3	25	75	100
V	EA	Extension activity	1	-	-	-	-
			21	**30**	**190**	**510**	**700**
		Total	**143**				

Syllabus for B.Sc. Food Technology

SEMESTER I

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

Unit/Module	Intended Learning Chapters	CO(s) Mapped
I	a. Concept of food and nutrients *b.* Colloidal System in foods- *Types & Properties, Sols, Gels, Emulsion and Foams –nature and factors influencing its formation and stability, application of colloidal chemistry to food preparation* *c.* Cooking of food - *cooking methods and principles and effect of cooking on constituents of food*	CO1
II	*a.* Water – *chemistry, physical properties, free, bound and entrapped water, water activity in food, moisture sorption isotherm of a food, water quality for food processing- drinking water, mineral water and potable water* *b.* Carbohydrates – *types of carbohydrates in food, chemical structure, physio-chemical and functional properties, types of starch, resistant starch; role of food carbohydrate/starch in cookery*	CO2
III	*a.* Proteins – *classification/types, chemistry and nature of proteins in food,physio-chemical and functional properties of food proteins, role of food proteins in cookery* *b.* Lipids –*classification/types of lipids, types of fats and oils in food, chemistry and nature of fats and oils in food, physio-chemical and functional properties of fats and oils in food, role of fats and oils in cookery*	CO3
IV	*a.* Vitamins - *classification/types, chemistry and nature of vitamins in food, physio-chemical and functional properties of vitamins in food, effect of cooking on vitamins, pseudo vitamins in food* *b.* Minerals - *classification/types, chemistry and nature of minerals in food, physio-chemical and functional properties of minerals in food, effect of cooking on minerals in food*	CO4
V	*a.* Colours/Pigments - *classification/types, chemistry and nature of colours/pigments in food,effect of cooking on colours/pigments in food* *b.* Flavours - *classification/types, chemistry and nature of flavours in food,effect of cooking on flavours in food* *c.* Enzymes - *classification/types, chemistry and nature of enzymes in food,effect of cooking on enzymes in food, enzymatic and non-enzymatic browning reaction in food* *d.* Phytochemicals - *classification/types, chemistry and nature of phytochemicals in food,effect of cooking on phytochemicals in food*	CO5

COURSE OUTCOMES

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

REFENCES

TEXTBOOKS	
1	John M. deMan., John W. Finley., W. Jeffrey Hurst., Chang Yong Lee., (auth.) (2018), Principles of Food Chemistry, 4thEd., AN ASPEN Publications, Maryland, Springer
2	Fennema, Owen R. (1996), Food Chemistry, 3rd Ed., Marcel Dekker, New York
3	Norman N. Potter and Joseph H. Hotchkiss, (1998), Food Science, 5th Ed., Springer
4	H.-D. Belitz., W. Grosch., P. Schieberle., (2009), Food Chemistry, 4th and revised Ed., Springer-VerlagBerlinHeidelberg
5	Jan Velisek, (2014), The Chemistry of Food, Wiley Blackwell
REFERENCE BOOKS	
1	Joseph J. Provost., Keri L.Colabroy., Brenda S. Kelly., Mark A. Wallert. (2016), The Science of Cooking: Understanding the Biology and Chemistry behind Food and Cooking, Wiley Blackwell
4	Peter Chi Keung Cheung &Bhavbhuti M. Mehta (eds.). (2015), Handbook of Food Chemistry, Springer Reference

5	B.Sunitha and R.Aruna, Food Chemistry of Macronutrients, Department of Food Chemistry and Nutrition Study Material, Acharya NGRanga Agricultural University College of Food Science &Technology, Bapatla
6	Y. H. Hui and Associate Editors, (2006), Handbook of Food Science, Technology and Engineering, Vol.I to IV, Taylor and Francis (CRC)
JOURNALS AND DOCUMENTS	
1	Food Chemistry, Springer
2	Cereal Chemistry, Springer
3	The Journal of Food Science and Technology, Springer

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

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

COURSE OUTCOMES

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

REFERENCES

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

Part IV NME –Food preservation(other majors)

Unit/Module	Intended Learning Chapters	CO(s) Mapped
I	**Introduction to Food Preservation** **Food Spoilage** - Definition, causes, microorganisms involved in spoilage of bread, fruits and vegetables, meat, fish, egg, milk, juices andpickles. Classification of foods based on shelf life **Food preservation** - Definition, principles and importance,classification – bactericidal and bacteriostatic methods.	CO1
II	**Preservation by high temperature** Methods used- blanching, pasteurization, sterilization, UHT processing, canning, extraction cooking, dielectric heating, Dehydration.	CO2
III	**Preservation by low temperature** Methods commonly used- refrigeration,freezing, dehydro-freezing-advantages and limitations	CO3
IV	**Preservation by drying and non- thermal treatments** Preservation by drying, concentration and evaporation: Sun drying, tray or tunnel drying, spray drying, drum drying, freeze drying, fluidized bed drying; advantages anddisadvantages.	CO4
V	**Preservation by other methods and Food packaging** Preservation by addition of sugar, salt,chemicals, smoking. irradiationFood additives used in preservation: Definition, types and functions, and safety aspects; permissible limits of preservatives in fruit andvegetable products. Food packaging- types, advantages and disadvantages; ;Food labeling- types and nutritional information	CO5

COURSE OUTCOMES

After successful completion of the course the student will be able to:

CO's	Description
CO1	Describe the role of microorganisms in food spoilage, principles and importance of food preservation.
CO2	Classify the different food preservation methods and foods based on shelf life
CO3	Apply the various techniques of food preservation to preserve different foods and increase the shelf life
CO4	Evaluate the uses of various food preservation methods andexplain the role of packaging in food processing
CO5	Justify the use of various preservation techniques, natural and chemical food additives used for preservation ,food labeling and food packaging materials

REFERENCES:

1. Arthey D and Ashurst, P.R (1996), Fruit processing, Blackie academic andprofessional. London.
2. Fellows, P.J (2016): Food Processing Technology: Principles and Practice,2nd edition, CRC Wood head publishing Ltd, Cambridge.
3. Gould. G.W (1995), New methods of food preservation. Blackie academicand professional. London.
4. Manay S and Shadaksharaswamy M (2008) Food Facts and Principles, New AgeInternational Publishers, New Delhi.

5. Rahman M S (2020) Handbook of Food Preservation CRC Press, USA
6. Srilakshmi B (2017) Food Science, New Age International Publications, New Delhi.
7. Suganthi.V and Subaratinam.R (2021) Textbook on Food preservation, DiptiPress(OPC) Pvt. Ltd, Chennai.

e- learning resources

- https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/food- spoilage.
- http://ecoursesonline.iasri.res.in/mod/page/view.php?id=111436
- http://ecoursesonline.iasri.res.in/mod/page/view.php?id=111435
- http://www.homepreservingbible.com/2247-an-introduction-to-the-drying-food-preservation-method/
- https://egyankosh.ac.in/bitstream/123456789/12397/1/Unit-15.pdf

Part IV FC – Foundations of Entrepreneurship

Unit/Module	Intended Learning Exercises	CO(s) Mapped
I	**Entrepreneur and Entrepreneurship -** Concept of entrepreneurship,Definition of entrepreneur and entrepreneurship, Objectives of entrepreneurship, Characteristics of entrepreneurship, Qualities of an entrepreneur, Functions of an entrepreneur, Types of entrepreneurs, Problems of an entrepreneur especially women.	CO1
II	**Small enterprises -** Definition, characteristics, Relationship betweensmall and large units. Role of Small enterprises in economic development, and problems of small-scale industries. Subsidies and incentives. Role of MSMEs	CO2
III	Entrepreneurs as problem solvers Innovations and Entrepreneurial Ventures – Global and Indian Role of Technology – E-commerce and Social Media Social Entrepreneurship – Concept	CO3
IV	**Project report-** Meaning, significance, Elements of project formulation, planning, commission, guidelines for project report.Formulation of proje **Creating and Starting the Venture** Sources of new Ideas, Methods of generating ideas, creating problem solving, product planning and development process	CO4
V	**Institutional Finance to Entrepreneurs -** Commercial Banks, OtherFinancial Institutions-SIDBI, SISI, SIPCOT, IFCI, ICICI, IRBI, DIC,SFCs and NABARD	CO5

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO's	Description
CO1	Describe the concept of entrepreneur and entrepreneurship
CO2	Understand the problems of entrepreneurs.
CO3	Analyze the role of small enterprises in economic development
CO4	Identify and compare the financial institutions offering finance to entrepreneurs
CO5	Create project report for starting a small-scale enterprise

REFERENCES

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

E-LEARNING RESOURCES

- http://www.simplynotes.in/e-notes/mbabba/entrepreneurship-development/
- https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_Entrepreneurial_Development_NOTES.pdf
- https://ncert.nic.in/ncerts/l/lebs213.pdf
- https://www.researchgate.net/publication/344413560_Small_Scale_Industries_in_Entrepreneurship_Development_of_India_References
- https://egyankosh.ac.in/bitstream/123456789/52149/1/Unit-1.pdf

Semester II Syllabus

Title of the Course		FUNDAMENTALS OF FOODTECHNOLOGY				
PART III	Year	Credits	Hours	Marks		
	I			CIA	External	Total
	Semester					
Core course2	II	5	5	25	75	100

Learning Objectives

To enable the students to:

- To understand the history and evolution of food processing.
- To study the structure, composition, nutritional quality and post harvest changes of various plant foods.
- To study the structure and composition of various animal foods.

UNIT I

Introduction, Historical evolution of food processing technology.

Cereals and Millets -Structure and composition of cereals

Wheat-structure and composition, types (hard, soft/strong, weak) Diagrammatic representation of longitudinal structure of wheat grain.

Malting, gelatinization of starch, types of browning- Maillard & caramelization.

Rice-structure and composition, parboiling of rice- advantages and disadvantages.

UNIT II

Pulses

Structure and composition of pulses, toxic constituents in pulses, processing of pulses-soaking, germination, decortications, cooking and fermentation.

Fats and Oils

Classification of lipids, types of fatty acids - saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans fatty acids.

Refining of oils, types-steam refining, alkali refining, bleaching, steam deodorization, hydrogenation.

Rancidity–Types- hydrolytic and oxidative rancidity and its prevention.

UNIT III

Fruits and Vegetables

Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments, Dietary fibre.

Postharvest 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.

UNIT IV

Meat, Fish, Poultry

Meat - Definition of carcass, concept of red meat and white meat, composition of meat, marbling, post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat.

Fish - Classification of fish (fresh water and marine), aquaculture , composition of

fish, characteristics of fresh fish, spoilage of fish- microbiological, physiological, biochemical.

Poultry - Structure of hen's egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality, difference between broiler and layers.

UNIT V

Milk and Milk Products

Definition of milk, chemical composition of milk, its constituents, processing of milk, pasteurization, homogenization. Factors Affecting the Composition of Milk, Flavours and off- Flavours related to milk ,types of market milk and milk products.

REFERENCES

1. Bawa.A.S,O.PChauhanetal.FoodScience.NewIndiaPublishing agency,2013
2. Roday,S .Food Science,Oxford publication,2011.
3. B.Srilakshmi,Foodscience,NewAgePublishers,2002
4. Meyer,FoodChemistry,NewAge,2004
5. DeSukumar.,Outlines ofDairy Technology,Oxford UniversityPress,2007

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

CO	**Course Outcomes**
CO1	To outline the various processing techniques in the development of cereal and cereal products
CO2	To recognise the structure, nutritional composition, procurement techniques, processing operations of pulses and oil
CO3	To outline the various processing techniques in the development of fruits and vegetables
CO4	To determine the various processing techniques in the preparation of different dairy and meat products baked and sugar related goods.
CO5	To identify the role of raw materials in the production of dairy

MAPPING (CO/PSO):

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	2	3	3
CO2	3	3	2	3	3
CO3	3	3	2	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3
Average	3	3	2	3	3

Title of the Course		FUNDAMENTALS OF FOOD TECHNOLOGY PRACTICAL				
PART III	Year I Semester	Credits	Hours	Marks		
				CIA	External	Total
Core course3	II	3	3	40	60	100

1. Study different types of browning reactions :enzymatic and nonenzymatic.
2. To study gelatinization behavior of various starches
3. To study the concept of gluten formation of various flours.
4. To study malting and germination.
5. To study dextrinization in foods.
6. Identification of pigments in fruits and vegetables and influence of pH on them.
7. Quality inspection of animal foods.
8. Estimation of reducing sugar by Fehlings procedure
9. Estimation of salt content in brine
10. Estimation of salt content in butter
11. Preparation of brix solution and checking by hand refractometer
12. Determination of acidity of water
13. Determination of alkalinity/hardness of water

REFERENCES

1. Bawa.A.S,O.PChauhanetal.FoodScience.NewIndiaPublishingagency,2013
2. Roday,S.FoodScience,Oxfordpublication,2011.
3. B.Srilakshmi,Foodscience,NewAgePublishers,2002
4. Meyer,FoodChemistry,NewAge,2004
5. DeSukumar.,Outlines ofDairy Technology,Oxford UniversityPress,2007

Title of the Course		FOOD PACKAGING TECHNOLOGY				
PART IV	Year I Semester	Credits	Hours	Marks		
				CIA	External	Total
*NMEC2	II	2	2	25	75	100

*other departments

Learning Objectives

To enable the students to:

- Describe the functions of packaging along with the influence of various factors on food.
- Explain the various factors of different packaging materials include metallic cans andglass
- State the types, production and applications of paper, paperboards and polymers in foodpackaging

UNIT I

Introduction to Food Packaging

Functions of packaging, Effect of environmental factors - light, Oxygen, Moisture, Temperature, mechanical forces and biological factors on quality of food. Estimation of shelf life. General Approach, analysis of storage requirement, accelerated storage studies: Vacuum and Inert Gas Packaging: Tests on packaging materials, Mechanical strength (Tension, notch and tearing strengths), Gas and water vapour transmission rates.

UNIT II

Metal cans as Packaging

Metallic can types - Tin cans and Aluminum cans. Specialty of Open top sanitary cans, Lacquers and their use, Three piece cans and Two piece cans, Aerosol Cans, Basics of Canning operations – Can Reformer, Flanger, Seaming, Can closures. Glass jars and Bottles in food packaging, Design features and applications, Sterilization of bottles.

UNIT III

Flexible Films Packaging

Formation of Films and pouches, Plastics used and their Specific applications - Polyethylene (LDPE and HDPE), Cellulose, Polypropylene (PP), Polyesters, Poyvinylidene Chloride (PVDC - Diofan, Ixan and Saran), Polyvinyl chloride, Copolymers their applications. Co-extruded films and Laminates. Rigid and Semi rigid plastic packaging – fabrication methods

– Thermo forming, Blow moulding, Injection moulding, Extrusion – Retort pouch packaging. Laminated Paper board Cartons, Fibre Board and Corrugated Card Board packaging and their applications.

UNIT IV

Filling and sealing operations for various types ofpackages

Closing and sealing of rigid plastic containers. Filling and sealing of Flexible plastic containers, Seal types-Bead seals, Lap Seals and Fin seals –Differences and advantages, Hot wiresealing, hot bar sealing and impulse sealing – differences and relative advantages, Form fill Seal equipment: Printing on packages, Bar codes, Nutrition labeling and legislative requirements. Filling and Sealing of pouches,

pouch from fill seal machines.

UNIT V

Innovations in food packaging

Aseptic Packaging. Active packaging, Moisture control, CO2 and Oxygen scavenging. Modified atmosphere packaging – principles, applications. Permeability of gases in packs. Antimicrobial Packaging, Edible packaging films and coating. Packaging for non-thermal food processing. Intelligent Packaging – Time-temperature indicators, RFID, Tamper evident packaging.

REFERENCES

1. Coles R and Kirwan J. Food and Beverage Packaging Technology. Wiley-BlackwellPublishing. 2nd Edition, 2011.
2. Coles, R., Dowell, D.M., Kirwan, J. Food Packaging Technology, Black Well PublishingLtd, 2009.
3. Gordon L. Robertson. Food Packaging Principles & Practice. CRC Press, 2016.
4. Kit L Yam and Dong Sun Lee. Emerging Food Packaging Technologies: Principles andPractice. Wood head Publishing Ltd, 2012.
5. Jung H. Han. Innovations in Food Packaging. Biogreen Elsevier India, 2nd Edition, 2016.

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

CO No.	CO Statement
CO1	Discuss the need and functions of packaging as a solution to various factors affectingfood.
CO2	Estimate the shelf life of food packed in different types of packaging materials
CO3	Explain the different packaging materials, their manufacturing process and equipmentinvolved
CO4	Compile the various closures and sealing mechanisms for different packaging materials
CO5	Select the different printing and labeling methods with legislative requirements

MAPPING (CO/PSO):

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	2	3
CO2	3	3	2	3	2	3
CO3	3	3	2	3	2	3
CO4	3	3	2	3	2	3
CO5	3	3	2	3	2	3
Average	**3**	**3**	**2**	**3**	**2**	**3**

Title of the Course		FOOD ADDITIVES				
PART IV	Year	Credits	Hours	Marks		
	I			CIA	External	Total
	Semester					
SECI	II	2	2	25	75	100

Learning Objectives

To enable the students to:

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

REFERENCES:

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

New Delhi.
3. Food colours, Flavours and Additives Technology Handbook NIIR Board of Consultants and Engineers Natonal Institute of Industrial Research, Kamla Nagar, Delhi
4. Food chemistry H.D. Belitz, W. Grosh and P. Schieberle 4 th Revised & Extemded Edition, Springer.

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

CO No.	CO Statement
CO1	To understand and recall the definitions and principles of food additives.
CO2	To analyse the presence of food preservatives, food colours, emulsifiers, food additives and toxic compoundspresent in food.
CO3	To illustrate the characteristics of food preservatives, flavouring agents, flavour enhancers and their impacts during processing.
CO4	To outline the importance and toxicity of preservatives,
CO5	To explain the role of food additives, chelating agents,leavening agents, and food adulterants.

MAPPING (CO/PSO):

CO/PSO	PSO 1	PSO 2	PSO 3	PSO4	PSO5
CO1	3	3	2	3	2
CO2	3	3	2	3	2
CO3	3	3	2	3	2
CO4	3	3	2	3	2
CO5	3	3	2	3	2
Average	**3**	**3**	**2**	**3**	**2**

SECOND YEAR -SESESTER III

Title of the Course		TECHNOLOGY OF FOOD PRESERVATION				
PART III	Year II Semester	Credits	Hours	Marks		
				CIA	External	Total
Core Course 5	III	4	4	25	75	100

Learning Objectives

To enable the students to:

- To learn science behind various preservation/processing technologies.
- Technological application of concepts on conventional Indian foods.

UNIT I

Introduction

Principles of Food Preservation, microorganisms associated with foods- bacteria, yeast and mold, Importance of bacteria, yeast and molds in foods. Classification of microorganisms based on temperature, pH, water activity, nutrient and oxygen requirements, typical growth curve of micro-organisms. Classification of food based on pH, Food infection, food intoxication, definition of shelf life, perishable foods, semi perishable foods, shelf stable foods.

UNIT II

Food Preservation by Low temperature

Freezing and Refrigeration: Introduction to refrigeration, cool storage and freezing, definition, principle of freezing, freezing curve, changes occurring during freezing, types of freezing i.e. slow freezing, quick freezing, introduction to thawing, changes during thawing and its effect on food.

UNIT III

Food Preservation by high temperature

Thermal Processing- Commercial heat preservation methods: Sterilization, commercial sterilization, Pasteurization, and blanching.

UNIT IV

Food Preservation by Moisture control

Drying and Dehydration - Definition, drying as a means of preservation, differences between sun drying and dehydration (i.e. mechanical drying), heat and mass transfer, factors affecting rate of drying, normal drying curve, names of types of driers used in the food industry.

Evaporation – Definition, factors affecting evaporation, names of evaporators used in food industry, evaporation equipment's- Batch/Pan evaporator ,rising film evaporator, falling film evaporator, natural circulation and forced circulation evaporator, scraped surface evaporator and vacuum pan evaporator ,application of evaporation in food industry

UNIT V

Food Preservation by Irradiation

Introduction, units of radiation, kinds of ionizing radiations used in food irradiation, mechanism of action, uses of radiation processing in food industry, concept of cold sterilization

REFERENCES

1. Banwart, G. (2012). *Basic Food Microbiology*. Springer Science & Business Media.
2. Garbutt, John. (1997). *Essentials of Food Microbiology*, Arnold, London.
3. Potter, N. N., & Hotchkiss, J. H. (2012). *Food Science*. Springer Science & Business Media.
4. Fellows, P. J. (2009). *Food Processing Technology: Principles and Practice*. Elsevier.
5. Frazier, W.C. & Westhoff, D.C.*Food Microbiology*. TMH Publication, New Delhi, 2004
6. Rao, D.G.*Fundamentals of Food Engineering*, PHI Learning Pvt Ltd, New Delhi, 2010

On completion of this course, students will be able to

CO	Course Outcomes
CO1	Describe the role of microorganisms in food spoilage, principles and importance of food preservation.
CO2	Classify the different food preservation methods and foods based on shelf life
CO3	Apply the various techniques of food preservation to preserve different foods and increase the shelf life
CO4	Evaluate the uses of various food preservation methods
CO5	Justify the use of various preservation techniques.

MAPPING(CO/PSO):

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	2
CO4	3	3	3	2	3
CO5	3	3	3	3	3
Average	**3**	**3**	**3**	**2.6**	**2.6**

Title of the Course		TECHNOLOGY OF FOOD PRESERVATION PRACTICAL				
PART III	Year	Credits	Hours	Marks		
	II			CIA	External	Total
	Semester					
Core Course 6	III	3	3	40	60	100

1. Concept of shelf life of different foods
2. Blanching of selected food items
3. Preservation of food by heat treatment- pasteurization
4. Study quality characteristics of foods preserved by drying/ dehydration/ freezing
5. Determination of pH of different foods using pH meter Food adulteration tests for common food.
6. Visit to food processing industry

Title of the Course		FOOD MICROBIOLOGY				
PART III	Year	Credits	Hours	Marks		
	II			CIA	External	Total
	Semester					
Allied 5	III	3	3	25	75	100

Learning Objectives

To enable the students to:

- Understand the interaction between micro-organisms and food
- Discuss the factors that favor or inhibit the growth of microbes
- Understand the role of microbes in fermentation, spoilage and food borne diseases.

UNIT-I

Importance and significance of microbes in food science

Sources of microorganisms in foods andtheir effective control

Factors affecting growth and survival of microorganisms in foods:

Intrinsic factors i.e., pH, water activity, nutrients, redox potential, oxygen etc.,
Extrinsic factors: Relative humidity, temperature, gaseous atmosphere etc.

UNIT-II

Normal Microbiological quality of Foods and its significance:

milk and milk products, fruits and vegetables, cereals and cereal products,
meat and meat products, fish and other sea foods, poultry and eggs;
sugar and sugar products, slats and spices and canned foods

UNIT-III

Chemical changes caused by microorganisms:

Changes in nitrogenous organic compounds,non-nitrogenous organic compounds,
organic acids, other compounds,lipids, pectic substances

Shelf life:

Calculation of shelf life, Shelf life requirements,
deteriorative reactions, accelerated testing;

UNIT-IV

Shelf life-Simulations of product: Package environment interaction, shelf life simulation for moisture, oxygen, and light sensitive products;

Microbial toxins:

Bacterial toxins,
fungal toxins,
algal toxins and mushroom toxins

UNIT-V

Food borne intoxications and infections:

types of food involved, toxicity and symptoms,
chemical properties, environmental conditions

Food borne viruses: types of food involved, nor viruses, rota viruses, prion diseases, toxicity and symptoms

REFERENCES

1. Bibek Ray and Arun Bhunia. 2008. Fundamental Food Microbiology, 4th Ed., CRC press, Taylor and Francis Group, USA.
2. Martin R. Adams and Maurice O. Moss. 2008. Food Microbiology, 3rd Ed., The Royal Society of Chemistry, Cambridge, UK.
3. James M. Jay. 2000. Modern Food Microbiology, 6th Ed. Aspen Publishers, Inc., Gaithersburg, Maryland, USA.
4. George J. Banwart. 1989. Basic Food Microbiology, 2nd Ed. Chapman & Hall, New York, USA.
5. William C. Frazier and & Dennis C. Westfoff. 1987. Food Microbiology, 4th Ed. Tata McGraw-Hill Education, New Delhi.

On completion of this course, students will be able to

CO	Course Outcomes
CO1	Understand the interaction between micro-organisms and food
CO2	Obtain a basic understanding of the microbial phenomena occurring in food products and factors affecting the growth of microbes
CO3	Recognize the microbes causing food spoilage and food borne illnesses.
CO4	Explain sources of contamination, principles of preservation and types of spoilage of different foods
CO5	Evaluate the role of microorganisms in food safety

MAPPING(CO/PSO):

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	**3**	**3**	**3**	**3**	**3**

Title of the Course		FOOD MICROBIOLOGY PRACTICAL				
PART III	Year	Credits	Hours	Marks		
	II			CIA	External	Total
	Semester					
Allied 6	III	2	3	40	60	100

1. Isolation of bacteria and molds from foods; vegetable and fruits/meat and meat products/fish and other sea foods/ eggs and poultry/ milk and milk products/ sugar, salts and spices/Fermented foods
2. Isolation of bacteria and molds from foods; vegetable and fruits/meat and meat products/fish and other sea foods/ eggs and poultry/ milk and milk products/ sugar, salts and spices/Fermented foods
3. Microbial examination of cereal and cereal products
4. Microbial examination of vegetable and fruits
5. Microbial examination of milk
6. Microbial examination of sugar, salts and spices
7. Determination and enumeration of pathogenic and indicator organisms in foods (Coliform/Enterococcus)
8. Detection of Salmonella from food sample
9. Detection of coliforms from milk by MPN method
10. Detection of *Staphylococcus aureus* from food sample

Title of the Course		BAKERY AND CONFECTIONERY				
PART IV	Year II Semester	Credits	Hours	Marks		
				CIA	External	Total
SEC 2	III	1	2	25	75	100

Learning Objectives

To enable the students to:

- Identify and explain baking terms, ingredients, equipment and tools.
- Employ safe food handling practices using contemporary guidelines

UNIT-I

Current status and growth rate of bakery industry. Economic importance in India. Classification of Baked Foods, Product Types, Nutritional Quality and Safety of Products, Storage and Packaging Materials, Basic baking principles

UNIT-II

Baking--Ingredients uses- liquid and flours (cereals types and flour quality) Guidelines to follow the standards & regulations.

Forming the dough. Mixing and Gluten Development: Blending the ingredients, adding liquid to hydrate flour proteins , developing gluten

Processes that occur during Mixing-Air cell formation, Hydration, Gluten development

UNIT-III

The Baking Process- Melting of fats, leavening, Formation and expansion of gases, Killing of yeast and microorganisms,

Bread formulation: quality of materials like flour, shortening, yeast, chemical leaveners, flour improvers, preparing bread formula on the basis of the role of ingredients

Bread processing.

UNIT-IV

Cake

mixing methods, Types of cakes-Butter Cake, Sponge Cake and Eggless Cake

Hands on experience: Preparation and evaluation of cakes

Different types and techniques of Cake Decoration -icings and fillings.

Methods, types and techniques, equipments used for the preparation of Biscuits, Cookies macaroons and muffins

UNIT-V

Confectionery

Processing of Cocoa and Chocolate

Role of ingredients and Processing methods

Equipments Used, Product Development – Quality Characteristics, Sensory Evaluation of Products;

Types – Hard – Boiled Candies, Crystalline and Non-Crystalline Candies,

REFERENCES

1. Dubey, S.C. (2017). *Basic Baking*, 5th Edition, ChanakyaMudrakPvt. Ltd., New Delhi.
2. Rainact, AL. (2013). *Basic Food Preparation – Complete Manual*, 3rd Edition, Orient Longman Pvt Ltd., Mumbai
3. Manay, S &Shanaksharaswami, M. (2014).*Foods : Facts and Principles*, New Age Publishers, New Delhi
4. Samuel A, Martz (2004). *Bakery Technology and Engineering*, PAN-TECHI International IncorporatedP.Ltd, Madras Faridi, F (2004). *Dough Rheology and Baked Product Texture,* CBS Publication, New Delhi
5. E.B. Jackson. 1995. Sugar Confectionery Manufacture, 2nd Ed. Springer-Verlag, US.
6. B.W. Minife. 1989. Chocolate, Cocoa, and Confectinery – Science and Technology, 3rd Ed. Chapman and Hall,Inc., New York, USA.

On completion of this course, students will be able to

CO	Course Outcomes
CO1	Resize recipes to meet production needs and equipment capacities
CO2	Demonstrate proper storage techniques for all baked products
CO3	Gain skills to plan, prepare and present recipes
CO4	Prepare product finishes such as icings and fillings
CO5	Enhance entrepreneurial skills in bakery and confectionery

MAPPING(CO/PSO):

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	**3**	**3**	**3**	**3**	**3**

Title of the Course		BAKERY AND CONFECTIONERY PRACTICAL				
PART IV	Year II Semester	Credits	Hours	Marks		
				CIA	External	Total
SEC 3	III	2	2	40	60	100

1. Determination of dough raising capacity of the dough
2. Preparation of gluten-free baked product
3. Preparation of cakes(any three methods)
4. Preparation of cookies cakes(any three)
5. Preparation of biscuits(any types)
6. Preparation of icing(any three design)
7. Preparation of puff (veg.and non veg.)
8. Preparation of toffees
9. Preparation of fudge
10. Preparation of fondant
11. Preparation of chocolate.
12. Visit or baking and confectionery unit.

SEMESTER IV

Title of the Course		POST-HARVEST ENGINEERING				
PART III	Year / Semester: II / IV	Credits: 4	Hours: 4	Marks: CIA 25	External 75	Total 100
Core Course 7						

Learning Objectives

To enable the students to:

Knowledge about Post-harvest technology.

Understand the different method for processing technique.

UNIT-I

Overview of Post-Harvest Technology

Concept and science, Introduction to different agricultural crops, their cropping pattern, production, harvesting and post-harvest losses, reasons for losses, importance of loss reduction, Post-Harvest Handling operations

Water Activity

Water binding and its effect on enzymatic and non-enzymatic reactions and food texture, control of water activity and moisture

UNIT-II

Engineering Properties of Food Materials

physical, thermal, aerodynamic, optical, mechanical, rheological and electromagnetic properties and their measurement

Cleaning

Cleaning of grains, washing of fruits and vegetables, types of cleaners, screens, types of screens, rotary screens, vibrating screens, machinery for cleaning of fruits and vegetables (air cleaners, washers), cleaning efficiency, care and maintenance; Peeling

UNIT-III

Sorting and Grading

Sorting, grading, methods of grading; Grading- Size grading, colour grading, specific gravity grading; screening, equipment for grading of fruits and vegetables, grading efficiency, care and maintenance

Separation

Magnetic separator, destoners, electrostatic separators, pneumatic separator

UNIT-IV

Decorticating and Shelling

Principles of working, design and constructional details, operating parameters, maintenance, etc. of various decorticators/dehullers/shellers, description of groundnut decorticators, maize shellers, etc.

Milling

Milling, polishing, grinding, milling equipment, dehuskers, polishers (abrasion, friction, water jet), flour milling machines, pulse milling machines, grinders, cutting machines, oil expellers, machine efficiency and power

requirement

UNIT-V

Materials Handling

Introduction to different conveying equipment used for handling of grains, fruits and vegetables; Scope and importance of material handling devices

Belt conveyor: Principle, characteristics, design, relationship between belt speed and width, capacity, inclined belt conveyors, idler spacing, belt tension, drive tension, belt tripper

REFERENCES

1. Chakraverty. 2008. Post Harvest Technology of Cereals, Pulses and Oilseeds, 3rd Ed. Oxford andIBH Publishing Co. Pvt. Ltd., New Delhi.
2. Amalendu Chakraverty and R. Paul Singh. 2014. Post Harvest Technology and Food ProcessEngineering. CRC Press, Boca Raton, FL, USA.
3. James G. Brennan. 2006. Food Processing Handbook. Wiley-VCH Verlag GmbH & Co. KGaA,Weinheim, Germany.
4. K.M. Sahay and K.K. singh. 2001. Unit Operations of Agricultural Processing. Vikas PublishingHouse Pvt. Ltd., Noida, UP.
5. Mohsenin, Nuri N. 1980. Thermal Properties of Foods and Agricultural Materials. Gordon and BreachScience Publishers, New York.
6. Mohsenin, Nuri N. 1984. Electromagnetic Radiation Properties of Foods and Agricultural Products.Gordon and Breach Science Publishers, New York.
7. Mohsenin, Nuri N. 1986. Physical Properties of Plant and Animal Materials : Structure, PhysicalCharacteristics and Mechanical properties, 2nd Ed. Gordon and Breach Science Publishers, NY.

On completion of this course, students will be able to

CO	Course Outcomes
CO1	Understand the importance of post harvest processing
CO2	Perform grading of agricultural products
CO3	Recognize the working principles of grain cleaning and sorting
CO4	Enhance the working principles of milling
CO5	understanding the processes of setting up and managing viable businessventures.

MAPPING(CO/PSO):

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	**3**	**3**	**3**	**3**	**3**

SEMESTER IV

Title of the Course		POST-HARVEST ENGINEERING PRACTICAL				
PART III	Year II Semester	Credits	Hours	Marks		
				CIA	External	Total
Core Course 8	IV	3	3	40	60	100

1. Determination of shape and size of food materials
2. Determination of densities, porosity and specific gravity of solid/powder materials
3. Determination of terminal velocity and angle of repose of grain sample
4. Determine co-efficient of external and internal friction of different crops
5. Study of Thermal and rheological properties of food materials
6. Study of Optical properties measurement equipment/instruments
7. Study of cleaners and washers for agricultural produces
8. Study of graders for agricultural produces
9. Study of decorticators
10. Study of Maize shellers
11. Study of crop dryers
12. Study of rice milling machines
13. Study of pulse milling machines
14. Study of different components of flour mill
15. Study of oil expeller
16. Study of different materials handling equipment

Title of the Course		FOOD AND NUTRITION				
PART III	Year	Credits	Hours	Marks		
	II			CIA	External	Total
	Semester					
Allied 7	IV	3	3	25	75	100

Learning Objectives

To enable the students to:

- To understand the relationship between food, nutrition and health.
- To understand digestion, absorption, functions and food sources of various nutrients

UNIT I

Introduction to Food and Nutrition 10

Basic terms used in study of food and nutrition
Methods of assessment of nutritional status
Functions of food-physiological, psychological and social
Understanding relationship between food, nutrition and health

UNIT II

Nutrients

Classification, digestion, absorption, functions, dietary sources, RDA, clinical manifestations of deficiency and excess of the following in brief:
Energy
Carbohydrates, lipids and proteins
Fat soluble vitamins-A, D, E and K
Water soluble vitamins – thiamine, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C
Minerals – calcium, iron, iodine, fluorine, copper and zinc

UNIT III

Planning Balanced Meals and Selection of Healthy Foods

Food Groups
Concept of Balanced Diets
Healthy and Fad Diets
Factors affecting meal planning
Understanding specific considerations for planning meal for different groups of people.
Understanding Nutrition labelling on foods, FSSAI regulations, Codex guidelines for health and nutrition claims

UNIT IV

Methods of Cooking and Nutrient Retention 8

Dry, moist, frying and microwave cooking - Advantages, disadvantages
Effect of various methods of cooking on foods and nutrients.
Preventing nutrient losses

REFERENCES

1. Byrd-Bredbenner, C., Moe, G., Beshgetoor, D. & Berning, J. (2013). *Wardlaw's*
2. *Perspectives in Nutrition*, International Edition, 9th edition, New York: McGraw- Hill
3. Chadha, R. and Mathur, P. eds. (2015). *Nutrition: A Lifecycle Approach*. Hyderabad: Orient Blackswan.
4. Longvah, T., Ananthan, R., Bhaskarachary, K. and Venkaiah, K. (2017). *Indian Food*
5. *Composition Tables*. Hyderabad: National Institute of Nutrition, Indian Council of Medical Research, Department of Health Research, Ministry of Health and Family

Welfare, Government of India.
6. Seth, V., Singh, K. & Mathur, P. (2018). *Diet Planning Through the Lifecycle Part I:*
7. *Normal Nutrition- A Practical Manual*. 6th Edition. Delhi: Elite Publishing House.
8. Bamji, M.S., Krishnaswamy, K. & Brahmam, G.N.V. (2016). *Textbook of Human*
9. *Nutrition*,4thedition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.
10. Srilakshmi, B. (2017). *Nutrition Science*. 6th edition. Delhi: New Age International

On completion of this course, students will be able to

CO	Course Outcomes
CO1	Appreciate the relationship between food, nutrition and health
CO2	Explain digestion, absorption, functions and food sources of various nutrients
CO3	Understand the concept of balanced diets and menu planning.
CO4	Describe different methods of cooking and ways to prevent nutrient losses
CO5	Plan and prepare meals and nutritious dishes for various age groups.

MAPPING (CO/PSO):

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	**3**	**3**	**3**	**3**	**3**

Title of the Course		FOOD AND NUTRITION PRACTICAL				
PART III	Year II Semester	Credits	Hours	Marks		
				CIA	External	Total
Allied 8	IV	2	3	40	60	100

1. Identification of food sources for various nutrients using food composition tables.
2. Record diet of self, using 24-hour dietary recall.
3. Introduction to meal planning, concept of food exchange system.
4. Planning of meals for adults of different activity levels for various income groups.
5. Planning of nutritious snacks for different age and income groups.
6. Preparation of nutritious snacks using various methods of cooking.
7. Critical analysis of nutritional labeling of food products.
8. Measurement and interpretation of Weight, Height and Waist circumference of adults.

Title of the Course		FOOD PRODUCT DEVELOPMENT				
PART IV	Year	Credits	Hours	Marks		
	II			CIA	External	Total
	Semester					
SEC 4	IV	2	2	25	75	100

Learning Objectives

To enable the students to:

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

UNIT-I

Introduction to New food products & food product development

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

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

UNIT-II

Stages in food product development Idea generation

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

UNIT-III

Concepts in sensory evaluation of foods

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

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

UNIT-IV

Subjective evaluation methods

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

UNIT-V

Objective and instrumental evaluation methods

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

REFERENCES

1. Carpenter Lyon & Hasdell, "Guidelines for Sensory Analysis in Food Product Development and Quality Control", Springer, 2000
2. Earle, M. D., Earle, R. L., & Anderson, A. M. (2001). Food product development. Boca Raton, Fla: CRC Press.
3. Gordon L Robertson. 2006. Food Packaging: Principles and Practice. 2nd Ed. CRC Press
4. Harper J.M. Extrusion of Foods. Vol. 1 & 2 (1991) CRC Press, Inc.) Boca Raton, Aorida
5. Naik, H.R., & Amin, T. (2021). Food Processing and Preservation (1st ed.). CRC Press. https://doi.org/10.1201/9781003243250
6. V.K. Joshi (2006) Sensory science- Principles and Applications in Food Evaluation,Agrotech Publishing Academy, Udaipur.

On completion of this course, students will be able to

CO	Course Outcomes
CO1	Recall, categorize, and analyze major trends in product development .
CO2	Identify the processes & stages for new product development from conception to commercialization.
CO3	Understand the role of sensory and objective evaluation in product development, quality control, and research in the food and otherconsumer industries.
CO4	Explain the theoretical background and practical understanding of sensory evaluation of food.
CO5	Develop a new food product from concept to prototype or pilot-scale production with the inclusion of a critical analysis of the quality,safety, shelf-life, packaging, labeling, and cost of the product.

MAPPING(CO/PSO):

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	**3**	**3**	**3**	**3**	**3**

Title of the Course		FOOD PRODUCT DEVELOPMENT PRACTICAL				
PART IV	Year	Credits	Hours	Marks		
	II			CIA	External	Total
	Semester					
SEC 4	IV	2	2	40	60	100

1. Evaluate food products by sensory perceptions using sensory evaluation - Difference test, Attribute difference test ,Analytical descriptive test , Preference test
2. Tests with sweetness, saltiness, sourness, bitterness and astringency using different concentration series.
3. Formulation of different Ready To Cook (RTC) and Ready To Service (RTE)
4. Preparation of different premixes – Rice mix, soup mix, fortified weaning foods using malts.
5. Formulation of foods with Pectin-Jam, Jelly
6. Preparation of pickles
7. Preparation of syrup
8. Formulation of value-added extruded products – Incorporation of fiber/sprouts/vegetable extract.

THIRD YEAR-SEMESTER V

Title of the Course		PROCESSING TECHNOLOGY OF LEGUMES AND OIL SEEDS				
PART III	Year	Credits	Hours	Marks		
	III			CIA	External	Total
	Semester					
Core Course 9	V	4	6	25	75	100

Learning Objectives

To enable the students to:

- To learn about the processing of legumes and oil seeds.
- To gain knowledge about value added products.

UNIT I

Pulse Classification and Processing Present status and future prospects of legumes - Current trends in area, production and yield – Technology Mission on Oil seeds and Pulses (TMOP).

Morphological description of pulses. Classification and types of legumes Processing of legumes - Milling, Soaking, Germination, Fermentation, Roasting and Parching, Extrusion, Parboiling and Agglomeration. Physical and chemical changes during the processing of legumes

UNITII

Milling of Pulses Dehulling of pulses - Advantages - Methods of dehulling - Traditional and modern methods of dehulling. Dehulling pretreatments - wet treatment, soaking, chemical treatment, dry treatment, oil treatment and heattreatment. Seed characteristics that affect dehulling - Nature of seed coat and physical characteristics of grains.Storage of pulses - Insect control measures in pulses. Milling of pulses - Wet milling and dry milling- Commercial milling of pulses by traditional methods. Dry milling of , Black gram, Bengal gram, Modern CFTRI method of pulse milling

UNIT III

Pulse's Value Added Product Dhal milling equipment and effect on quality - Principal products. Fermented products of legumes - Idli, Dosa,Soya curd(Tofu), Textured Vegetable Protein (TVP), Soya sauce, Tempeh, Natto and Miso. Cooking quality of dhal - Factors affecting cooking quality of dhal and Legumes – Processed legume products - Puffed chick pea and Peas, Canned dry pea. Quick cooking dhal and instant dhal - Uses of pulses - Role of pulses in cookery –Medicinal value of pulses. Present status and future prospects of oil seeds - Annual oil crops, Perennial oil seed plants and Minor oil seeds

UNIT IV

Post-Harvest Technology of Oil Seeds Post-Harvest Technology of oil seeds - Handling- Drying and Storage - Grading – Pretreatments - Cleaning -Dehulling - Size reduction - Flaking - Heat treatment. Oil extraction - Rendering - Traditional methods - Ghani -Power ghanis - Hydraulic Press- Expellers - Principle and structural design of expeller. Solvent extraction process - Principle - Pretreatment - Breaking - Cracking - Flaking - Extraction principles - Factors affecting

theextraction process - Desolventisation. Processing of oil seeds - Production and refining of cotton seed oil -Mechanical expression of cotton seed oil - Refining of crude cotton seed oil. Solvent extraction of soya bean oil- Sunflower oil - Palm oil - Coconut oil. Utilization of rice bran - Stabilization of rice bran - Dry heat treatment - Wet heat treatment. Extraction of rice bran oil - Solvent extraction - batch and continuous methods

UNIT V

Refining of Oils Refining of oils - Degumming - Neutralization - Bleaching - Filtration – Deodorization - Winterization -Principles and process controls. Refining of crude bran oil into edible oil - Uses of bran and bran oil. Hydrogenation - Products based on hydrogenated fats -Margarine - Shortenings – Salad oils - Vanaspati – Salad dressings .

New technologies in oil seed processing. Utilization of oil seed meals for different food uses. High protein products - Protein concentrates - Protein isolates

REFERENCES

1. Karleskind, "Oils and Fats manual", 1st Edition, Lavoisier Publisher, Paris, 1996.
2. R.H. Mathews, Marcel Dekker, "Legumes: Chemistry, Technology and Human Nutrition", 1st Edition, 1989.
3. D. Swer, "Bailey's Industrial Oil & Fat Products", 5 th Edition, John Wiley & Sons, 2005.
4. Achhayya K.T. Oil seeds and Oil Milling in India. Oxford and IBH Publishing Co., New Delhi, 1999
5. Barid and Hamson. Hand Book of Solvent Extraction.
6. Chakraverty A, Majumdar A.S, VijayaRaghavan G.S and Ramaswamy H.S. Hand Book of PostHarvest Technology. Marcel Dekker Inc., New York. Basel.
7. Guriqbal Singh, Harbhajan Singh Sekhon and Jaspinder Singh Kolar. Pulses. Agrotech
8. Publishing Academy, Udaipur.
9. Jaswanth Singh and Shukla B.D. Post Harvest Technology of Oil Seeds. Central Institute ofAgricultural Engineering, Bhopal

On completion of this course, students will be able to

CO	Course Outcomes
CO1	Know about different pulses processing aspects
CO2	Skill the knowledge preparation of products and value added products
CO3	Knowledge on milling of legumes and oil seeds
CO4	Need of refining and other processes like hydrogenation etc.
CO5	Importance of protein derivatives from oilseeds.

MAPPING (CO/PSO):

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	**3**	**3**	**3**	**3**	**3**

Title of the Course		PROCESSING TECHNOLOGY OF CEREALS				
PART III	Year	Credits	Hours	Marks		
	III			CIA	External	Total
	Semester					
Core Course 10	V	4	5	25	75	100

Learning Objectives

To enable the students to:

- Learn about the processing of major cereals.
- Gain knowledge about grain structure and Physico-chemical properties

UNIT-I

Present status and future prospects of cereals and millets.
Current trends in area, production and yield.
Structure of cereals - Wheat, Corn, Rice, Barley, Oat, Rye and Sorghum.
Physico-chemical properties of cereals, major and minor millets

UNIT-II

Paddy processing and rice milling: Conventional milling, modern milling Milling operations, milling machines, milling efficiency; Quality characteristics influencing final milled product
Parboiling; Rice bran stabilization and its methods
Ageing of rice; Enrichment of rice – methods of enrichment; Rice fortification

UNIT-III

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

UNIT-IV

Barley: Malting and milling
Oat/Rye: Processing, milling
Sorghum: Milling, malting, pearling
Millets (Pearl millets, finger millets): Processing of millets for food uses

UNIT-V

Secondary and tertiary products processing of cereals and millets
By-products processing of cereals and millets
Processing of infant foods from cereals and millets
Breakfast cereal foods: Flaked, puffed, expanded, extruded and shredded

REFERENCES

1. Chakraverty, A. and Singh, R. P. 2014. Post Harvest Technology and Food Process Engineering. CRC Press,Boca Raton, FL, USA.
2. Khan, K. and Shewry, P. R. 2009. Wheat: Chemistry and Technology, 4th Ed., AACC International, Inc., St.Paul, MN, USA.
3. Wrigley, C. 2004. Encyclopedia of Grain Science. Academic Press, London, UK.
4. Champagne, E. T. 2004. Rice: Chemistry and Technology, 3rd Ed., AACC International, Inc., St. Paul, MN,USA.
5. Chakraverty, A., Mujumdar, A.S., Vijaya Raghavan G.S. and Ramaswamy, H. S. 2003. Handbook of Post Harvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices. Marcel Dekker, Inc., NY, USA.

6. White, P. J. and Johnson. L. Lawrence A. 2003. Corn: Chemistry and Technology, 2nd Ed., AACCInternational, Inc., St. Paul, MN, USA.
7. David A.V. Dendy and Bogdan J. Dobraszczyk. 2001. Cereal and Cereal Products: Technology and Chemistry. Springer-Verlag, US.

On completion of this course, students will be able to

CO	Course Outcomes
CO1	Know about different cereals and millets and their processing aspects
CO2	Knowledge of milling and parboiling of paddy and other processing methods
CO3	Importance of quality assessment related to rice and rice products
CO4	Description of quality parameters
CO5	Acquaint with knowledge of other cereals

MAPPING (CO/PSO):

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	**3**	**3**	**3**	**3**	**3**

Title of the Course		PROCESSING TECHNOLOGY OF CEREALS PRACTICAL				
PART III	Year	Credits	Hours	Marks		
	III			CIA	External	Total
	Semester					
Core Course 11	V	3	3	40	60	100

1. Study of morphological characteristics of cereals–
2. Determination of physical properties of cereals
3. Determination of chemical properties of cereals
4. Determination of colour of cereals
5. Determination of moisture content of cereals
6. Experiment on parboiling of paddy
7. Cooking quality studies of rice
8. Determination of gelatinization temperature using DSC and other methods.
9. Processing of value added products from millets.
10. Experiments on rice shelling
11. Experiments on rice polishing
12. Visit to rice bran oil extraction industry
13. Visit to a commercial cereal processing unit

Title of the Course		FOOD PLANT SANITATION				
PART III	Year	Credits	Hours	Marks		
	III			CIA	External	Total
	Semester					
Core Course 12	V	4	5	25	75	100

Learning Objectives

To enable the students to:

- To obtain knowledge of design of food plant and food processing equipments.
- To understand basic principles of safe and hygeinic storage of foods

UNIT-I

Food Plant Layout and Equipment Design

General principles of food plant Design and layout

Design of food processing equipments: Size Reduction, Mixing, Separation, Extraction, Extrusion, Drying ,Freezing, Filtration, Centrifugation, Distillation, Gas absorption equipments

UNIT-II

Sanitation and food industry: Sanitation, sanitation laws, regulations, and guidelines, establishment of sanitary Practices.

Foodborne bioterrorism: Potential risks and protection measures for bioterrorism

The Relationship of microorganisms to sanitation: Microbial growth in relation to spoilage and food borne out breaks and its control measures

UNIT-III

The Relationship of allergens to sanitation: Food allergens and its control measures

Food contamination sources: Sources of contamination, contamination of foods, protection against contamination

Personal hygiene and sanitary food handling: Personal hygiene, employee hygiene, sanitary food handling, role of employee supervision, employee responsibility

UNIT-IV

Cleaning compounds and sanitizers: Classification, selection of cleaning compounds and sanitizers, handling and storage, precautions

Pest and Rodent Control: Insect infestation, cockroaches, insect destruction, rodents, birds, use of pesticides, integrated pest management

UNIT-V

Sanitary design and construction for food processing: Site selection, site preparation, building construction considerations, processing and design considerations, pest control design

Waste product handling: solid waste and liquid waste management

Role of HACCP in sanitation: Good manufacturing practices, current good manufacturing practices; Standard operating procedures, good laboratory practices

REFERENCES

1. Hui, Y.H., Bruinsma, B., Gorham, R., Nip, W.-K. (2003). *Food Plant Sanitation*. NewYork: Marcel Dekker.
2. Norman, G. Marriott. and Robert, B. Gravani. (2006). *Principles of Food Sanitation*,5th edition.82
3. Rao, D. G. (2010). *Fundamentals of Food Engineering*. PHI learning Private Ltd.
4. Fellows, P. (2000). *Food Processing Technology*, 2nd Edition. Woodhead Publishing Limited and CRC Press LLC.
5. Food and Agriculture Organization of the United Nations& International Institute of
6. Refrigeration.(1984).*Design and operation of cold stores in developing countries, FAOagricultural services bulletin.*Food and Agriculture Organization of the United Nations.ISBN:925101373X, 9789251013731
7. Forsythe, S.J. and Hayes, P.R. (1998). *Food Hygiene, Microbiology and HACCP*. Gaitersburg, Maryland: Aspen.
8. James, A. (2013) *The supply chain handbook*.Distribution group.
9. Rees, N. and D. Watson. (2000). *International Standards for Food Safety*. Gaitersburg,Maryland: Aspen

On completion of this course, students will be able to

CO	Course Outcomes
CO1	Gaining detailed knowledge of design of food plant and food processing equipments.
CO2	Basic knowledge of food contamination and treatment
CO3	Knowledge of hygeine and sanitation principles and practices in food industry.
CO4	Understanding principles of solid waste menagement
CO5	Basic understanding of mode of action of detergents and sanitizers

MAPPING (CO/PSO):

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	**3**	**3**	**3**	**3**	**3**

Title of the Course		PROJECT VIVA-VOCE				
PART III	Year	Credits	Hours	Marks		
	III			CIA	External	Total
	Semester					
Project	V	4	4	40	60	100

COURSE OBJECTIVES

- To develop a research design on a topic relevant to their field
- To understand the concept of a systematic literature review and report writing

COURSE LEARNING OUTCOMES

- Demonstrate knowledge of scientific writing method and styles
- Develop a research design on a topic relevant to their field
- Prepare a systematic literature review
- Understand the basic concept of report writing

I Project based on the any one subject related to the syllabus

((for group project-5-10 students may be included)

- Submission of Project Report
- Presentation of project report
- Viva – Voice

Title of the Course		NUTRACEUTICALS AND FUNCTIONAL FOODS				
PART III	Year	Credits	Hours	Marks		
	III			CIA	External	Total
	Semester					
Elective Course 1	V	3	5	25	75	100

Learning Objectives

To enable the students to:

- To understand the types of nutraceuticals and functional foods
- To understand the potential of various nutraceuticals and functional foods in promoting human health

UNIT I

Introduction

Definitions and history

Difference between nutraceuticals and functional foods

Current status of nutraceuticals and functional foods in India

Market trends of nutraceuticals and functional food

UNIT II

Nutraceuticals

Types of nutraceuticals: phytochemicals- isoprenoids, polyphenolics, phytosterols; carbohydrates- (dietary fibers, oligosaccharides and resistant starch); proteins and peptides, lipids- conjugated linoleic Acid, omega-3 fatty acids, fat replacers; vitamins and minerals; microbial- probiotics, probiotics and synbiotic; sources and stability of nutraceuticals

UNIT-III

Health benefits- cardiovascular diseases, cancer, diabetes, cholesterol management, obesity, joint pain, immune enhancement, age-related macular degeneration, endurance performance and mood disorders – compounds and their mechanisms of action

UNIT III

Functional Foods

Types of functional foods - Cereal and cereal products, milk and milk products, egg, oils,meat and products, sea foods, nuts and oilseeds, functional fruits and vegetables, herbs and spices, beverages (tea, wine), fermented foods

UNIT IV

Potential health benefits and role in cardiovascular diseases, hypertension and diabetes

Development, formulation and fabrication of functional foods

Legal Aspects

Safety

Consumer acceptance

Assessment of health claims

Labeling, marketing and regulatory issues

Future prospects

.

REFERENCES

1. Wildman, R.E.C. (2001). *Handbook of Nutraceutical and Functional Foods*. CRC Press
2. Mazza, G. (1988). *Functional foods – biochemical and processing aspects*. USA:Technomic Publ. Lancaster.
3. Pathak, Y.V. (2011). *Handbook of nutraceuticals*. Volume 2, CRC Press.
4. Ranganna, S. (1986). *Handbook of analysis and quality control for fruits and vegetableproducts*. Tata McGraw-Hill publishing company limited, Second edition
5. Various journals of food technology, food science and allied subjects

On completion of this course, students will be able to

CO	Course Outcomes
CO1	Understand the types of nutraceutical and functional foods
CO2	Understand the potential of various nutraceuticals and functional foods in promoting human health
CO3	Understand the safety issues and consumer acceptance of nutraceutical and functional foods
CO4	Understand labeling and marketing issues related to nutraceutical and functional foods
CO5	Understand regulatory issues related to nutraceutical and functional foods

MAPPING (CO/PSO):

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	**3**	**3**	**3**	**3**	**3**

Title of the Course		INTERNSHIP VIVA-VOCE		
PART III	Year	Credits	Hours	EVALUATION
	III			As per university norms
	Semester			
Internship	V	2	-	

FOOD INDUSTRY INTERNSHIP

The students are expected to undergo a food industry internship for 15 days at any reputed industries.
Internship will be carried out during the summer vacation after the fourth semester

SEMESTER VI

Title of the Course		PROCESSING TECHNOLOGY OF SPICES, FRUITS AND VEGETABLES				
PART III	Year	Credits	Hours	Marks		
	III			CIA	External	Total
	Semester					
Core Course 13	VI	4	5	25	75	100

Learning Objectives

To enable the students to:

- To understand processing and preservation of fruits and vegetables
- To understand maturity indices of fruits and vegetables.

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UNIT-I

Major Processed products of spices: Ginger, chilli, turmeric, onion and garlic, pepper, cardamom..

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

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

UNIT I

Introduction

Importance of fruits and vegetable

History and need of preservation, reasons of spoilage

Dehydration of Fruits and Vegetables

Sun drying & mechanical dehydration

Process variation for fruits and vegetables

UNIT II

Canning and Bottling of Fruits and Vegetables

Selection of fruits and vegetables

Process of canning, factors affecting the process- time and temperature

Containers of packing, lacquering

Syrups and brines for canning

Spoilage in canned foods

UNIT III

Fruit Beverages

Introduction, reasons of spoilage

Processing of fruit juices- selection, juice extraction, deaeration, straining, filtration and clarification.

Preservation of fruit juices- pasteurization, chemically preserved with sugars, freezing, drying, tetra-packing, carbonation.

Processing of squashes, cordials, nectars, concentrates and powder.

Packaging of fruit beverages.

UNIT IV

Jams, Jellies and Marmalades

Introduction

Jam: Constituents, selection of fruits, processing & technology**.**

Jelly: Essential constituents, Theory of jelly formation, Processing & technology, defects in jelly**.** Marmalade : Types, processing & technology, defects.

Packaging of jams, jellies and marmalades

UNIT V

Pickles and Tomato Products

Pickles - Processing and Types, Causes of spoilage in pickling.

Tomato products -Selection of tomatoes, pulping & processing of tomato juice.

Tomato puree, paste, ketchup, sauce and soup**.**

Packaging of pickles and tomato products

.**REFERENCES**

1. Girdharilal., Siddappaa, G.S and Tandon, G.L.(1998). *Preservation of fruits &vegetables*. ICAR, New Delhi.
2. Thompson, A.K., (2003). *Fruits and vegetables; Harvesting, handling and storage*.Blackwell Publishing.
3. Crusess, W.B. (2004). *Commercial Unit and Vegetable Products*. W.V. Special Indian Edition. Agrobios India.
4. Manay, S. and Shadaksharaswami, M. (2004). *Foods: Facts and Principles*. New AgePublishers.
5. Ranganna S.(1986). *Handbook of analysis and quality control for fruits and vegetableproducts*. Tata Mc Graw-Hill publishing company limited, Second edition.
6. Srivastava, R.P. and Kumar, S. (2006). *Fruits and Vegetables Preservation- Principlesand Practices*. 3rd Ed. International Book Distributing Co.
7. Somogyi, L.P., Ramaswamy, H.S. and Hui, Y.H. (1996). *Biology, Principles andApplications.* Volume 1. Technomic Publishing Company, Inc.

On completion of this course, students will be able to

CO	Course Outcomes
CO1	Understand maturity indices of spices
CO2	Understand maturity indices of fruits and vegetables
CO3	Understand the concept of quality in relation to fruit and vegetable based products
CO4	Understand the processing and preservation of fruits and vegetables using various techniques.
CO5	Understand processing of plantation crops

MAPPING (CO/PSO):

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	**3**	**3**	**3**	**3**	**3**

Title of the Course		PROCESSING TECHNOLOGY OF DAIRY AND SEA FOOD				
PART III	Year	Credits	Hours	Marks		
	III			CIA	External	Total
	Semester					
Core Course 14	VI	4	6	25	75	100

Learning Objectives

To enable the students to:

- To understand fish preservation and value added fish
- To understand the properties and composition of milk, milk processing, milk products and working of a few dairy equipments.

UNIT I

Introduction, Chilling and Freezing of fish

Status of fishery industry in India. Relationship between chilling and storage life, MAP, general aspects of freezing, freezing systems (air blast freezing, plate or contact freezing spray or immersion freezing, freezing on board, onshore processing, changes in quality in chilled and frozen storage, thawing.

UNIT II

Fish Curing, Smoking and Canning

Drying and salting of fish, water activity and shelf-life , salting process, salting methods (brining, pickling, kench curing, gaspe curing), types of salts, dried and

Salted fish products- pindang, fishwood, dried shrimp. Preservation by smoking, Smoked fish, processing and equipment, pre-smoking processes, smoking process control. Traditional chimney kiln, modern mechanical fish smoking kiln, examples of smoked and dried products. Principles of canning, classification based on pH groupings, effect of heat processing on fish, storage of canned fish, pre-process operations, post process operations, cannery operations for specific canned products.(Tuna, Mackerel, Sardine).Fish protein concentrates (FPC),

UNIT III

Physical properties of milk

Color, taste, pH and buffering capacity, refractive index, viscosity, surface tension, freezing, boiling point, specific heat, OR, electrical conductivity.

UNIT V

Lactose, Milk fat, protein and enzymes

Lactose-Significances of lactose in dairy industry. Milk fat composition and structure, factors affecting melting point, boiling point, solubility and Refractive Index. Chemical reactions of fat..

Protein and Enzymes

Types of casein (acid and rennet), uses of casein.

Enzymes- catalase, alkaline phosphatase, lipases and proteases

UNIT VI

Market milk industry, milk plant equipments and milk products

Systems of collection of milk

Reception, Platform testing Various stages of processing: Filtration, Clarification, Homogenization, Pasteurization

Description and working of clarifier, cream separator, homogenizer and plate heat exchanger.

Flow diagram of following milk products

Butter, ghee, flavored milk, yoghurt, cheese, ice-cream, condensed milk, milk Powder.

REFERENCES

1. De, Sukumar. (2007).*Outlines of Dairy Technology*.Oxford: Oxford University Press.
2. Hall, G.M. (1992). *Fish Processing Technology*. NY: VCH Publishers.38
3. Sen, D.P. (2005).*Advances in Fish Processing Technology*. Allied Publishers Pvt.Limited.
4. Shahidi, F. and Botta, J.R. (1994).*Seafoods: Chemistry, Processing, Technology and*
5. *Quality*. London: Blackie Academic & Professional,.
6. Webb. and Johnson. (1988).*Fundamentals of Dairy Chemistry*, 3rd ed., New Delhi: CBS Publishers.

On completion of this course, students will be able to

CO	Course Outcomes
CO1	Understand the importance fishery industry, the techniques that can be used for preservation of fish
CO2	Understand the manufacturing of various value added fish products
CO3	Understand the various properties and composition of milk
CO4	Understand the technology of manufacturing of various products like butter, ghee etc.,
CO5	Understand market milk industry stages of milk processing and working of a few dairy equipments

MAPPING (CO/PSO):

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	**3**	**3**	**3**	**3**	**3**

Title of the Course		PROCESSING TECHNOLOGY OF DAIRY AND SEA FOOD PRACTICAL				
PART III	Year	Credits	Hours	Marks		
	III			CIA	External	Total
	Semester					
Core Course 15	VI	1	3	40	60	100

1. To perform platform tests in milk.(Acidity, COB, MBRT, specific gravity, SNF)
2. To estimate milk protein by Folin method.
3. To estimate milk fat by Gerber method.
4. Preparation of flavoured milk/. Pasteurization of milk
5. To prepare casein and calculate its yield.
6. Quality evaluation of fish/prawn.
7. Subjective evaluation of Fresh Fish.
8. Cut out examination of canned fish.(Sardine,Mackerel,Tuna)
9. Fish/Milk product formulation

Title of the Course		PROCESSING TECHNOLOGY OF MEAT, POULTRY AND EGGS				
PART III	Year	Credits	Hours	Marks		
	III			CIA	External	Total
	Semester					
Core Course 16	VI	3	5	25	75	100

Learning Objectives

To enable the students to:

- To understand meat quality and slaughter processes for meat animals and poultry.
- To understand the of concept and methods of processing and preservation of meat, poultry and eggs

UNIT I

Introduction

Livestock and poultry population in India, Development of meat and poultry industry in India and its need in nation's economy, Status of meat poultry and Eggs industry in India; Sources and composition and importance of meat, poultry and egg

UNIT II

Structure and composition of muscle, types, classification and composition of fish Pre-slaughter operations and slaughtering operations for animals and poultry. Dressing and evaluation of animal carcasses; Factors affecting post-mortem changes, properties and shelf life of meat;

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

UNIT III

Preservation of meat and poultry by chilling, freezing, pickling, curing, cooking and smoking, canning, dehydration, radiation, chemical and biological preservatives.

Novel methods: Low dose irradiation; High pressure treatment, hurdle barrier concept for- meat and poultry

Meat tenderization; Meat emulsions

UNIT IV

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

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

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

Problems on mass balancing of ingredients in formulation of value added meat products;

UNIT V

Eggs

Structure, quality characteristics, processing, preservation of eggs

Factors affecting egg quality and measures of egg quality, utilization of by products

Safety standards in meat/ poultry/eggs industry: HACCP/ISO/MFPO/FSSAI/

REFERENCES

1. Lawrie, R. A. (1998). *Lawrie's meat science*. 5th ed. England: Woodhead Publishing Ltd.
2. Stadelman, W. J., Newkirk, D., & Newby, L. (2002). *Egg science and technology*. 4th ed.New Delhi: CBS Publication.
3. Parkhurst, C., &Mountney, G. J. (1997). *Poultry meat and egg production*. New Delhi:CBS Publishers.
4. Pearson, A. M., & Gillett, T. A. (1997). *Processed meats*. 3rd ed.New Delhi: CBS Publication.
5. Shai, Barbut. (2005). *Poultry Products Processing*. CRC Press.

On completion of this course, students will be able to

CO	Course Outcomes
CO1	Understand the need and importance of meat, eggs and poultry industry
CO2	Understand the concept and methods of processing and preservation of animal foods.
CO3	Understand the technology behind preparation of various animal food products
CO4	Understand egg production practices and egg preservation methods
CO5	Understand factors affecting egg quality and measures of egg quality

MAPPING (CO/PSO):

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	**3**	**3**	**3**	**3**	**3**

Title of the Course		FOOD SAFETY AND QUALITY				
PART III	Year	Credits	Hours	Marks		
	III			CIA	External	Total
	Semester					
Elective Course 2	VI	3	4	25	75	100

Learning Objectives

To enable the students to:

- To understand the concept of safe food and types of hazards associated with food.
- To control the potential threats to safety of food.

UNIT I

Food Safety

Definition of safe food, .mode of entry of hazards in food

Types of hazards, Factors affecting Food Safety

Importance of Safe Foods, Role of communication and training in food safety

UNIT II

Food Laws and Standards

Introduction to Standards, Specifications and limits

National Food Regulation-FSSAI, AGMARK, BIS, FPO, Weights and Measures Act and CODEX

International regulatory scenario and role of organizations - Codex, WHO, FAO

UNIT III

Quality attributes

Physical properties: Color, visocisity, size and shape:

Definition, color measurement techniques by spectrophotometer, Muncell color system and Lovibond tintometer; Role of viscosity and consistency in food quality :Size and Shape :Size and shape, weight, volume, weight volume ratio, length, width, diameter, symmetry, curvature, area;

UNIT IV

Quality Defects : Classification, Genetic-physiological defects: Structural, off color, character; Entomological defects: Holes, scars, lesions, off coloring, curled aves, pathological defects; Mechanical defects, extraneous or foreign material defects. Measurement of defects by different techniques

UNIT V

Quality Assessment:

Quality assessment of food materials on the basis of sensory evaluation, Physical, chemical microbiological methods ;

Quality of products during processing and after processing:

Factors influencing the food qualities: Soil, field practices, harvesting practices, procedures, packaging, transportation, storage, conditions, processing conditions, packaging and storage conditions of finished products.

REFERENCES

1. Forsythe,S.J. (2010).*The Microbiology of Safe Food* , 2nd edition. UK: Willey-Blackwell.
2. Lawley, R., Curtis L. and Davis,J.(2012) *The Food Safety Hazard Guidebook*. London:RSC.
3. Mathur, P. (2018). *Food Safety and Quality Control*. Hyderabad: Orient BlackSwan Pvt.Ltd.,
4. Blackburn, C.D.W. and Mc Clure, P.J.(2005).*Food borne pathogens. Hazards,risk analysis & control*.Washington,US: CRC Press.
5. De Vries. (1997).*Food Safety and Toxicity*.New York: CRC.
6. Marriott, Norman G. (1985).*Principles of Food Sanitation*.New York: AVI.

Mortimore S.and Wallace C. (1995).*HACCP-A Practical Approach*. London: Chapmanand Hill

On completion of this course, students will be able to

CO	Course Outcomes
CO1	Understand the concept of food safety ,types of hazards and their control measures
CO2	Identify and prevent potential sources of food contamination
CO3	Comprehend the need of hygiene and sanitation for ensuring food safety
CO4	Knowledge of Food Safety Management tools
CO5	Practical knowledge to detect and quantify microorganisms from various routes of contamination of food

MAPPING (CO/PSO):

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	**3**	**3**	**3**	**3**	**3**

Title of the Course		MARKETING MANAGEMENT				
PART III	Year	Credits	Hours	Marks		
	III			CIA	External	Total
	Semester					
Elective Course 3	VI	3	4	25	75	100

Learning Objectives

To enable the students to:

- To develop an insight of marketing management.
- To gain knowledge and acquired skills for setting up an enterprise and its management.

UNIT I

Concept of marketing, functions of marketing

Concepts of marketing management, scope of marketing management

Marketing management process, Concepts of marketing- mix, elements of marketing- mix,

Concept of market structure, Marketing environment -Micro and macro environments

UNIT II

Consumers buying behaviour, consumerism

Marketing opportunities analysis: marketing research and marketing information systems.

Market measurement- present and future demand, market forecasting

Market segmentation, targeting and positioning

Allocation and marketing resources

UNIT III

Marketing planning process

Product policy and planning : product-mix, product line, product life

Cycle, New product development process ,Product brand, packaging, services decisions,

Marketing channel decisions. Retailing, wholesaling and distribution.

UNIT IV

Pricing decisions

Price determination and pricing policy of milk products in organized and unorganized sectors of dairy industry. Promotion-mix decisions.

Advertising, how advertising works, deciding advertising objectives

Advertising budget ,Advertising message, media planning, personal selling, publicity, sales promotion

International marketing and international trade, salient features of international marketing

UNIT V

Exports- direct exports, indirect exports, Licensing, Joint ventures, Direct investment

Export trends and prospects of food products in India

Government institutions related to international food trade: APEDA, Tea Board, Spice Board, MOFPI, etc.

WTO and world trade agreements related to food business

REFERENCES

1. Acharya, S.S. & Agarwal, N.L. (1987) *Agricultural Marketing in India*. New Delhi: Oxford & ISH Publishing Co.
2. Kottler, P. (1994).*Marketing Management*. New Delhi: Prentice Hall of India Private Limited
3. Philip Kotler, Kevin Lane Keller, Abraham Koshy, Mithileshwar Jha. 2013. Marketing
4. Management: A South Asian Perspective, 14th Ed. Pearson Education.
5. Willium J. Stanton. 1984. Fundamentals of Marketing. Tata McGraw-Hill Publication, New Delhi.
6. C.N. Sontakki. Marketing Management. Kalyani Publishers, New Delhi.
7. John Daniels, Lee Radebaugh, Brigham, Daniel Sullivan. International Business, 15th Ed., PearsonEducation.
8. Aswathappa. International Business. Tata McGraw-Hill Education, New Delhi.
9. Fransis Cherunilam. International Business: Text and Cases, 5th Ed. PHI Learning, New Delhi.

On completion of this course, students will be able to

CO	Course Outcomes
CO1	Develop an insight of marketing function
CO2	Understand the basics of market measurement
CO3	Develop insight for different views of Fund raising.
CO4	Understand the different support system for business development
CO5	Gain knowledge and acquired skills for setting up an enterprise and its management

MAPPING (CO/PSO):

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	**3**	**3**	**3**	**3**	**3**

Title of the Course		BASICS IN RESEARCH METHODOLOGY				
PART IV	Year	Credits	Hours	Marks		
	III			CIA	External	Total
	Semester					
SEC 6	VI	2	3	25	75	100

Learning Objectives

To enable the students to:

- Gain a clear understanding of basic concepts, approaches and methods in conducting research.
- Apply appropriate statistical techniques for data collection, analysis and interpretation in any given study in the field of nutrition and dietetics
- Develop skills to carry out a project and present a report. Acquire skills required in preparing a research proposal.

UNIT-I

Introduction to research

Research- Meaning, objectives, significance.

Research problem- Definition and selection of research problem.Research design –Types of research design

Method of sampling - probability and non-probability sampling – Merits and Demerits, Determining sample size, Deciding Variables

UNIT-II

Data Collection

Primary and secondary data, selection of appropriate method fordata collection. Tools used for data collection- Questionnaire and Interview schedule.

UNIT-III

Coding and tabulation of data

Data entry and computation, Tabulation of data – parts of the tablePresentation of data- use of bar graph and pie chart

UNIT-IV

Basic statistical tools for analysis and interpretation Measures of central tendency – Mean, Median, Mode definition, merits, demerits and basic application Measures of dispersion - range and standard deviation-definition, merits, demerits and basic application

Correlation –Karl Pearson's coefficient of correlation merits, demerits and basic application. Test of significance- Student's t test basic application.

UNIT-V

Report writing

Steps in report writing, Layout of a report.Bibliography-citing references-APA style.

REFERENCES

1. Anderson, David R and et.al. (2013): Statistics for Business and Economics. Delhi, CengageLearning India Pvt Ltd. 11th Ed.
2. Bandarkar, P.L. and Wilkinson T.S. (2000): Methodology and Techniques of Social Research.Himalaya Publishing House, Mumbai.
3. Bell, Judith (2005): Doing your Research Project – A guide for first time researchers in education,health and social science. England, Open

University Press. 4th Ed.
4. Danial, Wayne W and Chad L Cross (2017): Biostatistics – Basic Concepts and Methodology forthe Health Sciences – International Student Version. New Delhi, ArEmm International, 10th Ed.
5. Ranjit Kumar (2011). Research Methodology: a step-by-step guide for beginners, SAGEPublications. 3rd edition.

E.learning resources

- https://mfs.mkcl.org/images/ebook/Fundamental%20of%20Research%20Methodology%20and%20Statistic
- s%20by%20Yogesh%20Kumar%20Singh.pdf
- https://www.statisticssolutions.com/research-methodology/

On completion of this course, students will be able to

CO	Course Outcomes
CO1	Demonstrate knowledge of the scientific method, purpose and approaches toresearch.
CO2	Identify and select appropriate techniques to select samples and tools of measurement for the chosen research problem at hand
CO3	Acquire skills in preparing a research proposal
CO4	Conduct statistical analysis for the given data, interpret the results and depict findings with suitable use of tables and pictorial representations
CO5	Present research data in a scientific manner and discuss the findings obtained.

MAPPING(CO/PSO):

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	**3**	**3**	**3**	**3**	**3**