Programme Structure

BACHELOR OF SCIENCE (Hons.) IN. FOOD SCIENCE TECHNOLOGY

BACHELOR OF SCIENCE (Hons. with Research) IN. FOOD SCIENCE TECHNOLOGY

Course Code: SBR0411

Department of Life Sciences

School of Basic Sciences & Research

Sharda University

(Batch - 2023-2027)

Programme Structure

Sharda School of Basic Sciences and Research

Programme: B.Sc. Food Science Technology Hons. /B.Sc. Food Science Technology Hons. with Research

Batch: 2023-27

Term: I

S.No.	Subject Code	Subjects	Teaching Load			Credits	Type of Course
			L	T	P		
Theory Courses							
1	FST111	Basics of Food Technology	4	0	0	4	Major
2	FST112 Or BBI 102	Introduction to Food Biomolecules Or Application of Biomolecules	4 4	0 0	0 0	4 Or 4	Multidisplinary
3	CHE 112	Chemistry III/Minor	3	0	0	3	Minor/Open elective
4	ARP101	Communicative English-1	1	0	2	2	Ability Enhancement Course
5	VAC 103	Environmental Management (VAC 1)	3	0	0	3	Value Added Course
Practical Courses							
6	FBP121	Principles of Food Technology Lab	0	0	2	1	Major
7	VOL101	Essential techniques in Life Sciences	0	0	6	3	Skill Enhancement Course
		TOTAL CREDITS				**20**	

Programme Structure

Sharda School of Basic Sciences and Research

Programme: B.Sc. Food Science Technology Hons. /B.Sc. Food Science Technology Hons. with Research

Batch: 2023-27

Term: II

S.No.	Subject Code	Subjects	Teaching Load			Credits	Type of Course
			L	T	P		
Theory Courses							
1	FST113	Cereals and Legumes Technology	4	0	0	4	Major
2	FST122	Principles of Fruits and Vegetables processing	3	0	0	3	Major
3	PHR101	Introduction to Renewable Energy and Management/Minor	3	0	0	3	Minor (Open Elective)
4	ARP102	Communicative English-2	1	0	2	2	Ability Enhancement Course
5	VAC110	Yoga for Holistic Development	3	0	0	3	Value Added Course
Practical Courses							
6	FBP122	Principles of Fruits and Vegetables processing Lab	0	0	2	1	Major
7	FBP123	Processing of Cereals and Legumes Lab	0	0	2	1	Major
8	VOL102	Essential Techniques in Life Sciences	0	0	6	3	Skill Enhancement Course
TOTAL CREDITS						**20**	

Programme Structure

Sharda School of Basic Sciences and Research

Programme: B.Sc. Food Science Technology Hons. /B.Sc. Food Science Technology Hons. with Research

Batch: 2023-27

Term: III

S.No.	Subject Code	Subjects	Teaching Load			Credits	Type of Course
			L	T	P		
Theory Course							
1	FST211	Chemistry of Food	4	0	0	4	Major
2	FST216	Food Process and Engineering	3	0	0	3	Major
3	BBT211 OR BBI 203	Biophysics OR Physical and Chemical aspects of Biological Sciences	4 4	0 0	0 0	4 OR 4	Multidisciplinary
4	PHR 201	Renewable Energy Resources/Minor	3	0	0	3	Minor (Open Elective)
5	ARP 207	Logical Skill Building and Soft Skill	2	0	0	2	Ability Enhancement Course
Practical Course							
6	FBP216	Food Process Engineering Lab	0	0	2	1	Major
7	FBP217	Food Biochemistry Lab	0	0	2	1	Major
8	VOL201	Essential Techniques in Life Sciences-III	0	0	6	3	Skill Enhancement Course
9	RBL001	Research Based Learning (RBL)-1	0	0	0	0	Major (Project)
TOTAL CREDITS						**21**	

Programme Structure
Sharda School of Basic Sciences and Research
Programme: B.Sc. Food Science Technology Hons. /B.Sc. Food Science Technology Hons. with Research
Batch: 2023-27
Term: IV

S.No.	Subject Code	Subjects	Teaching Load			Credits	Type of Course
			L	T	P		
Theory Course							
1	FST213	Fundamentals of Dairy Technology	4	0	0	4	Major
2	FST217	Basics of Nutrition Science	3	0	0	3	Major
3	FST218 Or BBI214	Meat, Poultry and Marine Food Processing Or Introduction to Human Physiology	3 5	0 0	0 0	3 Or 5	Multidisciplinary
4	CHE 113	Chemistry IV/Minor	3	0	0	3	Minor (Open Elective)
5	ARP305	Personality Development and Decision Making	2	0	0	2	Ability Enhancement Course
Practical Course							
6	FBP218	Processing of Dairy Products Lab	0	0	2	1	Major
7	FBP219	Basics of Nutrition Science Lab	0	0	2	1	Major
8	FBP214	Animal Food Lab*	0	0	4	2	Multidisciplinary
.9	RBL002	Research Based Learning (RBL)- 2	0	0	0	0	Major (Project)
		TOTAL CREDITS				**19**	

*** Animal Food Lab (FBP 214) is a part of Meat, Poultry and Marine Food Processing (FST 218)**

Programme Structure

Sharda School of Basic Sciences and Research

Programme: B.Sc. Food Science Technology Hons. /B.Sc. Food Science Technology Hons. with Research

Batch: 2023-27

Term: V

S.No.	Subject Code	Subjects	Teaching Load			Credits	Type of Course
			L	T	P		
Theory Courses							
1	FST312	Principles and Process of Food Preservation	3	0	0	3	Major
2	FST311	Principles of Food Microbiology	3	0	0	3	Major
3	FST313	Sensory Evaluation of Food	4	0	0	4	Major
4	FST314 Or BMB303	Food Waste Management Or Modern Industrial Microbiology	3 3	0 0	0 0	3 OR 3	Multidisciplinary
Practical Courses							
5	FBP312	Principles and Process of Food Preservation Lab	0	0	4	2	Major
6	FBP311	Basics of Food Microbiology Lab	0	0	4	2	Major
7	INC001	Industry Connect	0	0	4	2	Value Added Course (Survey)
8	RBL 003	Research Based Learning (RBL-3)	0	0	2	1	Major (Project)
TOTAL CREDITS						**20**	

Programme Structure

Sharda School of Basic Sciences and Research

Programme: B.Sc. Food Science Technology Hons. /B.Sc. Food Science Technology Hons. with Research

Batch: 2023-27

Term: VI

S.No.	Subject Code	Subjects	Teaching Load			Credits	Type of Course
			L	T	P		
Theory Courses							
1	FST315	Food Biotechnology	3	0	0	3	Major
2	FST316	Principles of Enzyme Technology	5	0	0	5	Major
3	FST317	Food Safety and Regulatory Aspects	4	0	0	4	Major
4	CHE 111	Chemistry II /Minor/MOOC	3	0	0	3	Minor (Open Elective)
Practical Courses							
5	FBP315	Biotechnology in Food Industry Lab	0	0	4	2	Major
6	CCU108	Community Connect	0	0	4	2	Value Added Course (Survey)
7	RBL 004	Research Based Learning (RBL)- 4	0	0	2	1	Major (Project)
TOTAL CREDITS						**20**	

Programme Structure

Sharda School of Basic Sciences and Research

Programme: B.Sc. Food Science Technology Hons. /B.Sc. Food Science Technology Hons. with Research

Batch: 2023-27

Term: VII

S.No.	Subject Code	Subjects	Teaching Load			Credits	Type of Course
			L	T	P		
Theory Courses							
1	FST411	Bakery and Confectionary Technology	4	0	0	4	Major
2	FST412	Fundamentals of Biostatistics, Bioethics and IPR	4	0	0	4	Major
3	FST413 OR BBI402	Functional Food and Nutraceuticals OR Introduction to Nanotoxicology	4 3	0 0	0 0	4 OR 3	Multidisciplinary
4	FST414	Food Quality Analysis	3	0	0	3	Multidisciplinary
5	CHE 101	Fundamentals of Chemistry/Minor/MOOC	4	0	0	4	Minor (Open Elective)
Practical Courses							
6	BBI404	Introduction to Nanotoxicology Lab*	0	0	2	1	Multidisciplinary
7	FBP414	Food Quality Analysis Lab	0	0	2	1	Multidisciplinary
		TOTAL CREDITS				**20**	

***Introduction to Nanotoxicology Lab (BBI 404) is a part of Introduction to Nanotoxicology (BBI 402)**

Programme Structure
Sharda School of Basic Sciences and Research
Programme: B.Sc. Food Science Technology Hons. /B.Sc. Food Science Technology Hons. with Research
Batch: 2023-27
Term: VIII

S.No.	Subject Code	Subjects	Teaching Load			Credits	Type of Course
			L	T	P		
Theory Courses							
1	FST417	Food Packaging Technology	4	0	0	4	Major
2	FST416	Food Additives	4	0	0	4	Major
3	FST415	Processing of Edible Oils and Fats	4	0	0	4	Major
4	FST418 OR BMB413	Food Toxicity and Safety Regulations OR Bioreactors and Downstream Processing	3 4	0 0	0 0	3 OR 4	Multidisciplinary
5	-	Mooc/Minor	4	0	0	4	Minor (OE)
Practical Courses							
6	FBP418	Food Toxicity and Safety Regulations Lab*	0	0	2	1	Multidisciplinary
					TOTAL CREDITS	**20**	

***Food Toxicity and Safety Regulations Lab (FBP 418) is a part of Food Toxicity and Safety Regulations Theory (FST 418)**

Programme Structure
Sharda School of Basic Sciences and Research
Programme: B.Sc. Food Science Technology Hons. /B.Sc. Food Science Technology Hons. with Research
Batch: 2023-27
Term: VII

S.No.	Subject Code	Subjects	Teaching Load			Credits	Type of Course
			L	T	P		
Theory Courses							
1	FST411	Bakery and Confectionary Technology	4	0	0	4	Major
2	FST 412	Fundamentals of Biostatistics, Bioethics and IPR	4	0	0	4	Major
3	FST413	Functional Food and Nutraceuticals	4	0	0	4	Major
4	FST414	Food Quality Analysis	3	0	0	3	Major
5	CHE 101	Fundamentals of Chemistry/Minor/MOOC	4	0	0	4	Minor (Minor Elective)
Practical Courses							
6	FBP414	Food Quality Analysis Lab	0	0	2	1	Major
7	FSP401	Research Project	0	0	6	3	Value Added Course
TOTAL CREDITS						**23**	

Programme Structure

Sharda School of Basic Sciences and Research

Programme: B.Sc. Food Science Technology Hons. /B.Sc. Food Science Technology Hons. with Research

Batch: 2023-27

Term: VIII

S.No.	Subject Code	Subjects	Teaching Load			Credits	Type of Course
			L	T	P		
1	FST419	Basic concepts of Research Design and Methodology	4	0	0	4	Major
2	-	MOOC/Minor	4	0	0	4	Minor (Open Elective)
3	FSP402	Research Project	0	0	18	9	Value Added Course
TOTAL CREDITS						**17**	

COURSE MODULE

SEMESTER - I

Course code: FST111 Course Title: Basics of Food Technology

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2023-2024**	
Branch: Food Science and Technology		**SEMESTER: 1st**	
1	Course Code	FST111	
2	Course Title	Basics of Food Technology	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	• To understand the processing methods of plant and animal derived products. • To understand the different physical and chemical method for preservation of food. • To understand the application of Microorganisms in food sector. • To study about the packaging methods and Material	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Define historical development of food science, technology, and the effects of processing on foods. CO2: Explain the processing of cereals, pulses, milk, and meat products. CO3: Demonstrate the thermal and non-thermal methods of food processing. CO4: Examine the potential applications of processing and preservation in Food Technology. CO5: Select the use of microbes in food industries. CO6: Develop the processing, nutritional values, and packaging of food product	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**General Introduction**	CO1, CO6
	A	Historical development of Food Science and Technology	
	B	Importance of food preservation Evolution of Food Processing	
	C	Principles of food preservation Introduction to various branches of Food Science and Technology	
	Unit 2	**Introduction to Plant and Animal derived foods**	CO2, CO6
	A	Classification, processing, and nutritional value: Plant derived: Cereals, pulses, fruits, vegetables	
	B	Importance of microbes in Food industry, Classification, processing, and nutritional value: fats and oils; Animal derived: Meat, poultry, fish, milk andmilk products	
	C	Beneficial microbes in Food	
	Unit 3	**Introduction to Food processing and preservation**	CO3, CO6
	A	Minimal processing of foods with thermal and non-thermal methods; Ohmic heating and High-Pressure processing; Freezing, drying and dehydration and irradiation procedures	
	B	Safety criteria in minimally processed foods	

	C	Minimal processing in practice fruits and vegetables,seafood-effect on quality, Future developments	
	Unit 4	**Introduction to Food packaging**	CO4, CO6
	A	Thermal Techniques- High Temperature preservation Objectives of packaging	
	B	Flexible packaging	
	C	Brief description of packaging of frozen products, driedproducts, fats and oils and thermally processed foods	
	Unit 5	**Properties of the packaging materials**	CO5, CO6
	A	Use of low-density polyethylene, ethylene acrylic acid, ethylene methacrylic acid, ionomers	
	B	High density polyethylene, polypropylene, polyvinyl chloride, polyvinylidene chloride, ethylene vinyl alcohol, polystyrene Polyethylene terephthalate or nylon, ethylene vinylacetate for food packaging	
	C	Polyethylene terephthalate or nylon, ethylene vinylacetate for food packaging	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	75%
	Text book/s*	1.Manay, S. & Shadaksharaswami, M., Foods: Facts and Principles, NewAge Publishers, 2004 2.B. Srilakshmi, Food science, New AgePublishers,2002 3. Marriott, Norman G. Principles of Food Sanitation, AVI, New York, 1985	
	Other References	**1.** Essentials of Food & Nutrition by Swaminathan, Vol.1 & 2 (2012)	

CO-PO-PSO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	2	1	-	1	2	1	1
CO2	2	3	0	2	1	1	3	1	2	-	2	2	3
CO3	3	2	1	2	1	2	1	2	2	1	3	2	2
CO4	3	3	1	1	1	1	3	2	1	1	1	2	3
CO5	3	1	1	2	1	1	1	1	2	1	1	1	2
CO6	3	3	1	2	1	2	3	2	2	1	1	2	3
Avg	2.67	2.17	0.83	1.67	1.00	1.33	2.17	1.50	1.80	1.00	1.67	1.67	2.33

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: FST 112 Course Title: Introduction to Food Biomolecules

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc/		**Current Academic Year: 2023-2024**	
Branch: Food Science and Technology		**SEMESTER: 1st**	
1	Course Code	FST112	
2	Course Title	Introduction to Food Biomolecules	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Multidisplinary	
5	Course Objective	**Course Objectives:** • To understand the classification, structure and the significance of carbohydrates, proteins, DNA and other macromolecules.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Define the structure, classification and significance of carbohydrates CO2: Explain the structure and properties of amino acids and proteins CO3: Demonstrate the structural chemistry and general properties of lipids CO4: Analyze the structure of nucleosides and nucleotides and stability of DNA backbone CO5: Evaluate the biosynthesis of purines and pyrimidines and structure aswell as properties of DNA and RNA CO6: Elaborate the structure, properties and significance of biological macromolecules.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Carbohydrates**	CO1, CO6
	A	Carbohydrate classification, Monosaccharides; D- and L-designation, Open chain, and cyclic structures	
	B	Structure and biological importance of disaccharides	
	C	Structural polysaccharides and storage polysaccharides	
	Unit 2	**Proteins**	CO2, CO6
	A	Amino Acids- Classification	
	B	Classification, Structure and Properties; Proteins: Primary, Secondary structure	
	C	Tertiary and Quaternary Structure; Biological functions of proteins	
	Unit 3	**Lipids**	CO3, CO6
	A	Structure and chemistry of fatty acids	
	B	Saturated and unsaturated fatty acids	
	C	General properties and structures of phospholipids, sphingolipids and cholesterol	
	Unit 4	**Nucleic Acids**	CO4, CO6

	A	Nature of nucleic acids, Structure of purines and pyrimidines	
	B	Nucleosides and Nucleotides	
	C	Stability and formation of phosphodiester linkage	
	Unit 5	**Structure of DNA**	CO5, CO6
	A	Biosynthesis of purines and pyrimidines	
	B	Structure of DNA and RNA	
	C	Watson-Crick model, Types of DNA	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. Nelson D.L., and Cox M.M., *Lehninger Principles of Biochemistry, 6th Edition.* W. H. Freeman (2012).	
	Other References	1. Berg J.M., Tymoczko J.L., and Stryer L., *Biochemistry, 7th Edition.* W. H. Freeman (2010).	

CO-PO-PSO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	-	-	**1**	**1**	**1**	-	**1**	**1**	-	**1**	**3**	**3**	**1**
CO2	-	-	**1**	**1**	**1**	-	**1**	**1**	-	**1**	**3**	**3**	**1**
CO3	-	-	**1**	**2**	**1**	-	**1**	**2**	**1**	**1**	**3**	**3**	**2**
CO4	-	-	**1**	-	-	**1**	**2**	**2**	**1**	**1**	**3**	-	-
CO5	-	-	**1**	-	-	**1**	**2**	**2**	**1**	**1**	**3**	-	-
CO6	**1**	**1**	**2**	**1**	**1**	**2**	**3**	**3**	**1**	**2**	**3**	**3**	**3**
Avg	1.00	1.00	1.17	1.25	1.00	1.33	1.67	1.83	1.00	1.17	3.00	3.00	1.75

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2023-24**	
Branch: Food Science and Technology		**SEMESTER: 1st**	
1	Course Code	BBI102	
2	Course Title	Application of Biomolecules	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Multidisplinary	
5	Course Objective	1. To study the structure and function of macromolecules present in biological systems 2. Understanding the general properties of biomolecules 3. To learn the structure and function of tertiary and quaternary proteins	
6	Course Outcomes	The students at the completion of the course will be able to: CO1: to Understand the concept of solutions in biological solutions CO2: Identify the different biomolecules in a given mixture. CO3: Demonstrate the concept and structures of amino acids and protein CO4: Differentiate between tertiary and quaternary structure of protein. CO5: Explain the concept of the basic techniques used in Biotechnology. CO6: Investigate the basic concepts of biomolecules and use those concepts to understand the structure and basic functions of cell membrane.	
7	Course Description	Student must be able to understand when and how to use which technique of a given biological problems. Also, to understand and interpret the result obtained from various techniques	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction to Chemistry	CO1,CO6
	A	Understand the concept of pH and acid base	
	B	Molarity, Molality, Normality (concept and numerical problems)	
	C	Understanding the concept of buffers, serial dilutions (numerical problems)	
	Unit 2	To learn the various test for identification of	CO2, CO6
	A	Carbohydrates	

	B	Proteins	
	C	Lipids	
	Unit 3	Amino acids	CO3, CO6
	A	Structure and properties of amino acids	
	B	Introduction to Ramachandran plot	
	C	Tertiary and Quaternary structure of protein- Hemoglobin; difference between myoglobin and hemoglobin	
	Unit 4	Spectrophotometer	CO4, CO6
	A	Principle of spectrophotometer, the Lamber Beer's law: working, advantages, uses, limitations	
	B	UV/VIS absorption spectroscopy: Principle, working, advantages, uses, limitations	
	C	Theoretically plot absorption spectrum of DNA and protein using BSA/Egg Albumin and find λmax	
	Unit 5	Electrophoresis	CO5, CO6
	A	Polarimetry: Determination of the percentage composition of optically active solution	
	B	Introduction to Electrophoresis: Principle, working, advantages, uses, limitations	
	C	Types of Electrophoresis: PAGE and Native gel Electrophoresis: Principle, working, advantages, uses, limitations	
	Mode of examination	Theory	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	75%
	Text book/s*	Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 4th Edition, W.H. Freeman and Company, New York, USA.	
	Other References	S Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman Buchanan, B., Gruissem, W. and Jones, R. (2000) Biochemistry and Molecular Biology of Plants.American Society of Plant Biologists. Swayam - Government of India, https://swayam.gov.in/	

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	-	1	1	-	1	-	-
CO2	-	-	-	-	-	1	-	1	1	-	1	-	-
CO3	-	-	-	-	-	1	-	1	1	-	1	-	-
CO4	-	-	-	-	-	1	-	1	1	-	1	-	-
CO5	-	-	-	-	-	1	-	1	1	-	1	-	-
CO6	-	-	-	-	-	1	-	1	1	-	1	-	-
Avg	0	0	0	0	0	1	0	1	1	0	1	0	0

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: ARP101 Course Title: Communicative English-1

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2023-2024**	
Branch: Food Science and Technology		**SEMESTER: 1st**	
1	Course Code	**ARP101**	
2	Course Title	**Communicative English-1**	
3	Credits	2	
4	Contact Hours (L-T-P)	1-0-2	
	Course Status	Compulsory	
5	Course Objective	• To minimize the linguistic barriers that emerges in varied socio-linguistic environments using English. Help students to understand different accents and standardize their existing English. Guide the students to hone the basic communication skills - listening, speaking, reading and writing while also uplifting their perception of themselves, giving them self-confidence and building positive attitude.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1 Develop a better understanding of advanced grammar rules and write grammatically correct sentences CO2 Explain wide vocabulary and punctuation rules and learn strategies for error-free communication. CO3 Interpret texts, pictures and improve both reading and writing skills which would help them in their academic as well as professional career CO4 Comprehend language and improve speaking skills in academic and social contexts CO5 Develop, share and maximize new ideas with the concept of brainstorming and the documentation of key critical thoughts articulated towards preparing for a career based on their potentials and availability of opportunities. CO6 Function effectively in multi-disciplinary teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Sentence Structure**	CO1, CO6
	A	Subject Verb Agreement	
	B	Writing well-formed sentences	
	C	Writing well-formed sentences	
	Unit 2	**Vocabulary Building & punctuation**	CO2, CO6
	A	Homonyms/ homophones, Synonyms/Antonyms	
	B	Punctuation/ Spellings (Prefixes-suffixes/Unjumbled Words)	
	C	Conjunctions/Compound Sentences	
	Unit 3	**Writing Skills**	CO3, CO6
	A	Picture Description – Student Group Activity	
	B	Positive Thinking - Dead Poets Society-Full-length feature film -	

		Paragraph Writing inculcating the positive attitude of a learner through the movie | SWOT Analysis – Know yourself	
	C	Story Completion Exercise –Building positive attitude - The Man from Earth (Watching a Full-length Feature Film), Digital Literacy | Effective Use of Social Media	
	Unit 4	**Speaking Skills**	CO4, CO6
	A	Self-introduction/Greeting/Meeting people – Self branding	
	B	Describing people and situations - To Sir With Love (Watching a Full-length Feature Film)	
	C	Dialogues/conversations (Situation based Role Plays)	
	Unit 5	**Professional Skills/ Career Skills/Leadership and Management Skills**	CO5, CO6
	A	Exploring Career Opportunities Brainstorming Techniques & Models	
	B	Social and Cultural Etiquettes Internal Communication	
	C	Managerial Skills Entrepreneurial Skills	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	-	
	Other References	Blum, M. Rosen. How to Build Better Vocabulary. London: Bloomsbury Publication Comfort, Jeremy (et.al). Speaking Effectively. Cambridge University Press	

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PSO 1	PSO 2	PSO 3
ARP101.1	-	-	-	-	-	-	-	-	1	3	-	-	-
ARP101.2	-	-	-	-	-	-	-	-	1	3	-	-	-
ARP101.3	-	-	-	-	-	-	-	-	1	3	-	-	-
ARP101.4	-	-	-	-	-	-	-	-	1	2	-	-	-
ARP101.5	-	-	-	-	-	-	-	-	1	2	-	-	-
ARP101.6	-	-	-	-	-	-	-	-	1	2	-	-	-
Avg	-	-	-	-	-	-	-	-	1	2.5	-	-	-

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course Code: VAC 103 **Course Title: Environmental Management**

School: SET | SOL | SMFE | SBS-BBA | SBSR | SOE | SAP		**Batch: 2023-2027**
Programme: All		**Current Academic Year: 2023-24**
Branch: All		**Semester: I**
1	Course Code	VAC 103
2	Course Title	Environment Management (VAC 1)
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	• Enable students to learn the concepts, principles and importance of environmental science • Provide students an insight of various causes of natural resource depletion and its conservation • Provide detailed knowledge of causes, effects and control of different types of environmental pollution and its effect on climate change, global warming and ozone layer depletion. • Provide knowledge of different methods of water conservation • Provide and enrich the students about sustainable practices and environmental management
6	Course Outcomes	After successful completion of this course students will be able to: CO1.Develop a better understanding of the principles and scope of environmental science CO2. Acquire to learn various pollution causes, effects and control and solid waste management. CO3. Interpret the effect of global warming and ozone layer depletion CO4. Comprehend about various types of natural resources and its conservation CO5. Develop a better understanding about sustainable practices and environmental management CO6. Function effectively an overall understanding of various environmental components, its protection and management.
7	Course Description	Environmental Science emphasises on various factors as 1. Importance and scope of environmental science 2. Natural resource conservation 3. Pollution causes, effects and control methods 4. Sustainable and Environmental environment

8	Outline syllabus		CO Mapping
	Unit 1	**Natural resource management**	
	A	Introduction to Natural Resources	CO1/CO6
	B	Management of Land and Forest Resources	CO1/CO6
	C	Water and Energy resource Management	CO1/CO6
	Unit 2	**Environmental Pollution Management**	
	A	Air pollution Control and Water Pollution treatment Methods	CO2/CO6
	B	Soil and Noise Pollution Management	CO2/CO6
	C	Solid waste management	CO2/CO6

	Unit 3	**Climate Change Mitigation**		
	A	Concept of Global Warming and greenhouse effect		CO3/CO6
	B	Ozone layer Depletion and its consequences		CO3/CO6
	C	Climate change, its effect on ecosystem and its mitigation. Kyoto protocol and IPCC concerns on changing climate.		CO3/CO6
	Unit 4	**Natural resource conservation and management**		
	A	Hot spots, Endangered and endemic species of India		CO4/CO6
	B	Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions		CO4/CO6
	C	Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.		CO4/CO6
	Unit 5	**Sustainable practices and environmental management**		
	A	Sustainable development and sustainable consumption		CO4/CO6
	B	Environmental Issues and Management in India		CO4/CO6
	C	Environmental Management System (EMS)		CO4/CO6
	Mode of examination	Theory		
	Weightage Distribution	Internal (CA+MSE)	External (ESE)	
		25%	75%	
	Text book/s*	Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha, Pub: Orient Blackswan Pvt Ltd		
	Other References	Environmental Science by G. Tyler Miller, JR. and Scott E. Spoolman; Broks/Cole.		

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	2	1	3	3	1	1	3	1	1	-	-
CO2	3	2	1	-	1	3	1	3	3	-	1	-	2
CO3	2	1	1	-	1	3	-	-	3	-	-	-	-
CO4	2	1	-	-	-	3	-	-	1	-	-	-	2
CO5	1	2	1	-	-	3	1	1	1	1	-	-	2
CO6	2	2	3	2	2	3	2	2	2	2	-	-	-
Avg	2	1.5	1.6	1.5	1.75	3	1.25	2	1.5	1.6	1.5	1.75	1

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: FBP121 Course Title: Principles of Food Technology Lab

School: SSBR		**Batch: 2023-2027**
Programme: B.Sc		**Current Academic Year: 2023-2024**
Branch: Food Science and Technology		**Semester: 1st**
1	Course Code	FBP121
2	Course Title	Principles of Food Technology Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	• To understand the techniques for testing of food and quality check. • To understand the importance of various methods of preservation.
6	Course Outcomes	After successful completion of this course, students will be able to: CO1: Demonstrate common food testing techniques. CO2: Explain the importance of testing procedures for cereal and related products. CO3: Analyze and evaluate the quality assessment of milk. CO4: Explain the importance of various chemicals preservatives in preservation. CO5: Discuss the macronutrient constituents of food products. CO6: Analyze the nutritional constituents of different food products.
7	Course Description	In depth understanding of the methods applied for quality check of processes food.

8	**Outline syllabus**	**CO Mapping**
Unit 1	Practical based on effect of heat and pH on color and texture of green vegetables	CO1, CO6
Unit 2	Practical related to estimation of gluten content (wet and dry Basis) present in a different sample	CO2, CO6
Unit 3	Practical related to evaluation of milk products	CO3, CO6
Unit 4	To study the structure of an animal cell	CO4, CO6
Unit 5	Practical related to development of different types of fruit and vegetable- b a s e d products (Jam, Jelly and tomato-based products)	CO5, CO6
Unit 6	Practical related to estimation of carbohydrates in different food samples.	CO6, CO6
Mode of examination	Practical/Viva	

Weightage Distribution	CA	CE	ESE	
	25%	25%	50%	
Other References	FSSAI Manual for Analysis for Food Products.			

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	1	1	1	2	2	3	2	2	3	3	3
CO2	1	3	1	-	1	1	1	2	2	1	3	3	3
CO3	1	3	1	1	1	1	2	3	2	2	3	3	3
CO4	3	1	1	-	1	1	1	1	2	1	3	3	3
CO5	1	1	0	0	0	0	1	2	2	1	3	3	3
CO6	1	3	0	1	1	1	3	3	2	2	3	3	3
Avg	1.50	2.33	0.67	0.75	0.83	1.00	1.67	1.50	2.33	0.67	0.75	0.83	1.00

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course Code: VOL101 Course code: Essential Techniques in Life Sciences

School: SSBR		**Batch: 2023-2027**
Programme: B.Sc		**Current Academic Year: 2023-2024**
Branch: Food Science and Technology		**Semester: 1st**
1	Course Code	**VOL101**
2	Course Title	Essential Techniques in Life Sciences
3	Credits	3
4	Contact Hours (L-T-P)	0-0-6
	Course Status	Compulsory
5	Course Objective	• Develop knowledge of a specific area of specialization. • Develop research skills especially in biological experiments, project writing oral presentation.
6	Course Outcomes	After successful completion of this course students will be able to: CO 1: Identify the methods of finding concentration of protein and carbohydrates. CO 2: Illustrate the effect of temperature and pH on the growth of bacteria CO 3: Compare the growth of bacteria in different carbon sources CO 4: Differentiate between bacteria on the basis of biochemical test CO 5: Deduct the presence of DNA through isolation and electrophoresis CO 6: Discuss the biomolecules and the growth of bacteria.
7	Course Description	The goal is to provide concise but thorough introductory guides to various scientific techniques. Vocational education is concerned with the training on vocation. It is related to productivity. Vocational education prepares individuals for jobs. It has adequate employment potentialities. It helps in broadening of horizon. It leads to dignity of labour. It is helpful in the maximum utilisation of the material resources of the country.

8	**Outline syllabus**	**CO Mapping**
Unit 1	**Biomolecules test**	
A	To estimate the protein concentration using Lowry method.	CO1, CO6
B	To calculate the carbohydrate concentration using Molisch Test.	CO1,CO6
C	Iodine test for lipids	CO1,CO6
Unit 2	**Culturing of Bacteria**	
A	Culture bacterial cells using nutrient broth	CO2, CO6
B	To study the bacterial growth curve at different pH	CO2, CO6
C	To study the bacterial growth curve at different temperature	CO2, CO6
Unit 3	**Characterization of the bacteria**	
A	To study the bacterial growth at different carbon sources- glucose, lactose	CO3, CO6
B	Study the effect of antibiotics on the growth of bacteria	CO3, CO6
C	To prepare glycerol stock of bacterial cells	
Unit 4	**Characterization of the bacteria-2**	

A	Antibiotic Test	CO4, CO6
B	Oxidase Test	CO4, CO6
C	Catalase Test	CO4, CO6
Unit 5	**Bacterial DNA**	
A	To isolate DNA from bacterial cells	CO5, CO6
B	To run the DNA on an agarose gel electrophoresis.	CO5, CO6
C	To estimate the DNA concentration using spectrophotometry method.	CO5, CO6

Mode of examination	Continuous Assessment (CA): 25 Marks Viva-Voce (on the basis of weekly Viva performance): 25 Marks ETE: 50 marks (Quiz for 15 marks; Lab Work for 15 Marks; Viva for 10 Marks and Lab record for 10 marks)			
Weightage Distribution	CA	CE	ESE	
	25%	25%	50%	
Text books	1. Practical manual of Biotechnology by Ritu Mahajan, Jitendar Sharma, RK Mahajan, Vayu Education of India			
Reference books	-			

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	1	1	-	2	1	2	1	2
CO2	2	2	1	1	-	2	1	-	3	2	2	2	1
CO3	3	2	2	1	-	2	1	-	3	2	2	1	2
CO4	3	2	1	2	1	-	1	-	2	1	1	2	2
CO5	3	1	2	1	-	1	-	-	2	1	2	1	1
CO6	3	2	3	1	2	2	2	-	2	2	2	2	1
Avg	2.83	1.83	1.67	1.33	1.33	1.60	1.20	0	2.33	1.50	1.83	1.50	1.50

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: CHE112 **Course Title: Chemistry III**

School: SSBSR		**Batch: 2023-2027**
Programme: B.Sc		**Current Academic Year: 2023-2024**
Branch: Food Science and Technology		**Semester Ist**
1	Course Code	CHE112
2	Course Title	Chemistry III
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Minor
5	Course Objective	1. To discuss importance of clean water and water treatment. 2. To explain the method to determine hardness and alkalinity in water sample and discussion on boiler trouble at industrial scale using different suitable technology 3. To describe the basic concepts of spectroscopy to apply in various engineering applications. 4. To provide an introduction to the basic concepts in Electrochemistry and apply them to understand corrosion. 5. To equip the students with the knowledge of chemistry and its various applications.
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Realize the importance of clean and healthy water by giving knowledge about water quality parameters and cleaning measures. CO2: Explain various kind of boiler troubles, water desalination, softening and treatment method. CO3: Discuss the chemistry of various type of Cement, Ceramics and Refractories and its industrial importance. CO4: Illustrate the chemical properties of material by having the knowledge of spectroscopic techniques. CO5: Describe the basics of electrochemistry and apply it to understand the corrosion of a metals. CO6: Have a thorough grounding in water technology, cement chemistry, basic spectroscopic techniques and electrochemistry to solve the contemporary issues.
7	Course Description	The course includes the water technology, Electrochemistry and corrosion, chemistry of cement, ceramic and refractories, basic spectroscopic techniques.
8	Outline syllabus	CO Mapping
	Unit 1	**Water Technology I**

	A	Drinking water standards, Water quality parameters, hardness: definition and expression, estimation of hardness by EDTA method. Turbidity,	CO1, CO6
	B	Alkalinity and acidity – determination by titrimetry, Dissolved Oxygen (DO). Ill effects of fluoride, nutrients (N, P, etc.) and dissolved metals.	CO1, CO6
	C	Biological oxygen demand (BOD), Chemical oxygen demand (COD)Determination of chloride present in water (by Mohr's method),	CO1, CO6
	Unit 2	**Water Technology II**	
	A	Boiler Troubles: Carry Over, Priming, Foaming, Scale, Sludge, Corrosion, Caustic Embrittlement.	CO2, CO6
	B	Desalination of water; Softening of water: Ion exchange process, Zeolite process.	CO2, CO6
	C	Municipal Water treatment process - screening, sedimentation, flocculation; Coagulation, Filtration (slow sand and rapid sand), disinfection-chlorination (break-point chlorination).	CO2, CO6
	Unit 3	**Cement, Ceramics and Refractories**	
	A	Cement: Raw material, composition, manufacturing process and application of Portland cement, Chemistry of setting of cement	CO3, CO6
	B	Ceramics and Refractories: Introduction, classification	CO3, CO6
	C	Properties, raw materials, manufacturing and applications	CO3, CO6
	Unit 4	**Spectroscopy**	
	A	Introduction of UV-Vis spectroscopy, Lamberts Beer's law. Different type of electronic transitions Chromophore, auxochrome, effect of conjugation on chromophore and applications.	CO4, CO6
	B	Introduction of Atomic Absorption Spectroscopy (AAS), Principle of AAS, Instrumentation.	CO4, CO6
	C	Detection Limit and Sensitivity, Application of AAS	CO4, CO6
	Unit 5	**Electrochemistry and corrosion**	
	A	Electrochemistry: Redox reactions, Nernst Equation, Electrochemical cells-Galvanic cells and Concentration cell.	CO5, CO6
	B	Electrode potentials and its relevance to oxidation and reduction, measurement of EMF under standard conditions, determination of pH using Hydrogen electrode.	CO5, CO6

	C	Types of corrosion, mechanism of Electrochemical corrosion, galvanic corrosion and protection against electrochemical corrosion	CO5, CO6
	Mode of examination	Theory	
	Text book/s*	i. Puri, B.R., Sharma, L.R., and Pathania, M.S., "Principles of Physical Chemistry", Vishal publishing company. ii. Engineering Chemistry by Jain & Jain.	
	Other References	i. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan.	

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	2	1	2	1	1	2	-	-
CO2	1	3	1	-	1	2	1	-	1	-	1	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	1	-	-	1	-	1	1	3	-	-
CO5	1	2	1	2	-	2	-	1	1	1	2	-	-
CO6	1	1	1	1	1	1	-	2	2	2	2	-	-
Avg	1.4	2	1	1.25	1	1.75	1	1.66	1.2	1.25	2	0	0

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

SEMESTER - II

Course code: FST 113 Course Title: Cereals and Legumes Technology

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2023-2024**	
Branch: Food Science and Technology		**SEMESTER: 2nd**	
1	Course Code	FST113	
2	Course Title	Cereals and Legumes Technology	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	• Students will get exposure to various technologies in cereal and pulse processing and milling. Also, they will acquire knowledge about storage structures for grains.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Define the structural, nutritional and processing importance of wheat grain. CO2: Explain physicochemical properties of rice grain and importance of parboiling based on its advantages and disadvantages. CO3: Identify the other important cereals and their processing aspects CO4: Compare the processing of various pulses CO5: Explain about oilseeds as well as processing of vegetable oils and fats. CO6: Discuss the nutritional composition and processing of cereals, legumes and oilseeds.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Wheat**	CO1, CO6
	A	Introduction, Structure and composition to cereals.	
	B	Wheat types, physicochemical characteristics, milling of wheat, quality of flour and flour treatment.	
	C	Additives used in bakery products -bleaching agents and flour improvers. Bakery products: bread, biscuits, cakes, extruded products (noodles and pasta)	
	Unit 2	**Rice**	CO2, CO6
	A	Physicochemical characteristics, Rice Milling; Parboiling of rice-traditional methods and their drawbacks. CFTRI process of parboiling.	
	B	Properties of parboiled rice. Changes during parboiling. Advantages and disadvantages of parboiling.	
	C	By- products of rice milling. Rice aging and rice based processed products.	
	Unit 3	**Minor cereals**	CO3, CO6

	A	Barley, Oats, Sorghum and Millets processing and their important products.	
	B	Corn milling wet and dry method;	
	C	Corn products: corn starch, flakes, and hydrolyzed syrups, corn flour, corn oil and baby corn.	
	Unit 4	**Pulses**	CO4, CO6
	A	Types and processing of Legumes (Pulses)	
	B	Storage and cooking losses, sprouting of legumes for nutritional benefits.	
	C	Antinutritional factors in legumes and methods of removal.	
	Unit 5	**Oilseeds**	CO5, CO6
	A	Processing- oil extraction/expression and solvent extraction. Refining of crude oil- degumming, bleaching, deodorizations.	
	B	Preparation of protein concentrates and isolates and their use in high protein foods.	
	C	Hydrogenation and Interesterification, Shortening-introduction, manufacturing and uses of shortening, types of shortening. Margarine.	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. Chakraverty, A. 1988. Postharvest Technology of Cereals, Pulses and oilseeds. Oxford and IBH, New Delhi. **2.** Kent, N.L. 1983. Technology of Cereals. 3rd Edn. Pergamon Press, Oxford, UK.	
	Other References	1. Salunkhe, D. and Despande, S.S(2001) Foods of Plant origin: Production, Technology & Human 2. Nutrition An AVI Publications, New York. 3. Pomeranz, Y. 1987. Modern Cereal Science and Technology. VCH Pub., New York	

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	2	-	1	2	1	3	1	1
CO2	2	1	-	-	-	2	1	1	1	1	3	1	1
CO3	2	1	-	-	-	2	1	1	1	1	3	1	2
CO4	2	1	-	-	-	2	-	1	2	1	3	3	1
CO5	2	1	-	-	-	2	-	1	2	2	3	3	1
CO6	2	1	-	-	-	2	-	1	2	2	3	3	1
Avg	2.00	1.17	0	0	0	2.00	1.00	1.00	1.67	1.33	3.00	2.00	1.17

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: FST122 Course Title: Principles of Fruits and Vegetables Processing

School: SSBSR		**Batch: 2023-27**
Programme: B.Sc		**Current Academic Year: 2023-2024**
Branch: Food Science and Technology		**SEMESTER: 2nd**
1	Course Code	**FST122**
2	Course Title	Principles of Fruits and Vegetables Processing
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	• Understanding the characteristics and composition of different types of fruits and vegetables. • Familiarizing students with various processing methods used in the fruit and vegetable industry, such as canning, freezing, drying, juicing, and fermentation. • Exploring the principles of food preservation and quality control in fruit and vegetable processing. • Studying the factors that affect the nutritional and sensory quality of processed fruits and vegetables. • Examining the principles of packaging, labelling, and storage of processed fruit and vegetable products. • Learning about the technological advancements and innovations in fruit and vegetable processing.
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Define the importance of canning and need of preservation for fruits and vegetables. CO2: Explain the processing and preservation of fruit juices. CO3: Apply the industrial method of making jam, jellies and marmalades. CO4: Analyse the making of pickles, chutneys, sauces with processingof tomatoes and their various products. CO5: Explain the drying and dehydration methods of fruits and vegetables. CO6: Adopt the processing technology of fruits and vegetables.
7	**Outline syllabus**	**CO Mapping**
	Unit 1	**Introduction** CO1, CO6
	A	Importance of fruits and vegetable; history and need of preservation; Reasons of spoilage.
	B	Method of preservation; Canning and bottling of fruitsand vegetables; process of canning; factors affecting the process- time and temperature

	C	Lacquering syrups and brines for canning; spoilage in canned foods, containers of packing.	
	Unit 2	**Fruit Beverages and products**	CO2, CO6
	A	Processing of fruit juices	
	B	Preservation of fruit juices (pasteurization, chemically preserved with sugars, freezing, drying, tetra packing, carbonation)	
	C	Processing of squashes, cordials, nectors, concentrates and powder.	
	Unit 3	**Jams, jellies and marmalades**	CO3, CO6
	A	Jam: Constituents, selection of fruits, processing & Technology	
	B	Jelly: Essential constituents (Role of pectin, ratio); Theory of jelly formation, Processing; defects in jelly	
	C	Marmalade: Types, processing & technology, defects.	
	Unit 4	**Pickles , chutneys and sauces**	CO4, CO6
	A	Processing and types of pickles and chutney; causes of spoilage.	
	B	Tomato products: Selection of tomatoes, pulping	
	C	Processing of tomato juice; tomato puree; paste, ketchup; sauce and soup	
	Unit 5	**Dehydration of foods and vegetables**	CO5, CO6
	A	Sun drying & mechanical dehydration	
	B	Process variation for fruits and vegetables	
	C	Effects of dehydration on fruits and vegetables (Merits /Demerits); packing and storage.	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. Girdharilal, Siddappaa, G.S and Tandon, G.L., Preservation of Fruits & Vegetables, ICAR, New Delhi,1998	
	Other References	1. Manay, S. & Shadaksharaswami, M., Foods: Facts and Principles, New Age Publishers, 2004	

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	-	1	-	1	-	1	2	1	3	1	3
CO2	3	3	-	1	-	2	1	2	2	2	3	3	3
CO3	2	2	-	1	1	2	3	1	2	2	3	3	3
CO4	2	2	-	1	1	2	3	1	2	2	3	3	3
CO5	3	3	-	1	1	2	1	1	2	1	3	2	3
CO6	3	3	-	1	1	2	1	1	2	1	3	2	3
Avg	2.67	2.67	0	1.00	1.00	1.83	1.80	1.17	2.00	1.50	3.00	2.33	3.00

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2023-2024**	
Branch: Food Science and Technology		**SEMESTER: 2nd**	
1	Course Code	**ARP102**	
2	Course Title	**Communicative English-2**	
3	Credits	2	
4	Contact Hours (L-T-P)	1-0-2	
	Course Status	Compulsory	
5	Course Objective	To Develop LSRW skills through audio-visual language acquirement, creative writing, advanced speech et al and MTI Reduction with the aid of certain tools like texts, movies, long and short essays.	
6	Course Outcomes	After completion of this course, students will be able to: CO1 Acquire Vision, Goals and Strategies through Audio-visual Language Texts CO2 Synthesize complex concepts and present them in creative writing CO3 Develop MTI Reduction/Neutral Accent through Classroom Sessions & Practice CO4 Determine their role in achieving team success through defining strategies for effective communication with different people CO5 Realize their potentials as human beings and conduct themselves properly in the ways of world. CO6 Acquire satisfactory competency in use of Quantitative aptitude and Logical Reasoning	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Acquiring Vision, Goals and Strategies through Audio-visual Language Texts**	CO1, CO6
	A	Pursuit of Happiness / Goal Setting & Value Proposition in life	
	B	12 Angry Men / Ethics & Principles	
	C	The King's Speech / Mission statement in life | strategies & Action Plans in Life	
	Unit 2	**Creative Writing**	CO2, CO6
	A	Story Reconstruction - Positive Thinking	
	B	Theme based Story Writing - Positive attitude	
	C	Learning Diary Learning Log – Self-introspection	
	Unit 3	**Writing Skills 1**	CO3, CO6
	A	Precis	
	B	Paraphrasing	
	C	Essays (Simple essays)	

	Unit 4	**MTI Reduction/Neutral Accent through Classroom Sessions & Practice**	CO4, CO6
	A	Vowel, Consonant, sound correction, speech sounds, Monothongs, Dipthongs and Tripthongs	
	B	Vowel Sound drills , Consonant Sound drills, Affricates and Fricative Sounds	
	C	Speech Sounds | Speech Music| Tone | Volume| Diction |Syntax |Intonation | Syllable Stress |	
	Unit 5	**Gauging MTI Reduction Effectiveness through Free Speech**	CO5, CO6
	A	Jam sessions	
	B	Extempore	
	C	Situation-based Role Play	
	Unit 6	**Leadership and Management Skills**	
	A	Innovative Leadership and Design Thinking	
	B	Ethics and Integrity	
	Unit 7	**Universal Human Values**	
	A	Love & Compassion, Non-Violence & Truth	
	B	Righteousness, Peace	
	C	Service, Renunciation (Sacrifice)	
	Unit 8	**Introduction to Quantitative aptitude & Logical Reasoning**	
		Analytical Reasoning & Puzzle Solving	
		Number Systems and its Application in Solving Problems	
	Mode of examination	Class Assignments/Free Speech Exercises / JAM Group Presentations/Problem Solving Scenarios/GD/Simulations	
	Weightage Distribution	Internal (CA +MSE) | External (ESE)	
		25% | 75%	
	Text book/s*	1. Wren, P.C.&Martin H. *High English Grammar and Composition*, S.Chand& Company Ltd, New Delhi.	
	Other References	1. Blum, M. Rosen. *How to Build Better Vocabulary*. London: Bloomsbury Publication	

CO-PO-PSO Mapping

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO1	PSO 2	PSO 3
CO1	1	1	1	1	-	1	-	-	-	-	-	-	-
CO2	1	1	1	1	1	1	1	1	3	3	-	-	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-	-
CO4	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	-	-	-	1	1	-	-	-
CO6	-	-	-	1	2	-	-	-	2	1	-	-	-
Avg	1	1	1	1	1.5	1	1	1	2.4	2	0	0	0

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High

School: SSHSS		Semester – 1	ACADEMIC SESSION:	FOR VAC – 1 Practical
1	Course code	VAC110		
2	Course Title	Yoga for Holistic health		
3	Credits	3		
4	Learning Hours	0-1-4		
5	Course Objective	To make the students familiar with the different practices of yoga, chanting and meditation techniques and learn the correct teaching skills.		
6	Course Outcomes	1. To make the students understand the concept of health and wellness through Yoga 2. To define the concept and principles of Yoga. 3. To interpret and understand the breathing practice. 4. To describe the knowledge about Yoga, its foundations and applications to the aspirants. 5. To make students aware of Yogic impact on the positive health and personality development. 6. The students will learn primary level of Yoga practices, which will groom their personality.		
7.1		**Unit A**	**Importance of Health, Wellness through Yoga**	**CO mapping**
7.11		Unit A Topic 1	Meaning, Definition, Aim of Yoga; Concept of health according to WHO and Ayurveda	CO1, CO2, CO4, CO5, CO6
7.12		Unit A Topic 2	Misconception about Yoga, Difference between asana and physical exercise	CO1, CO2, CO4, CO5, CO6
7.13		Unit A Topic 3	Need, Importance of Yoga in health and wellness	CO1, CO2, CO4, CO5, CO6
7.2		**Unit B**	**Schools of Yoga, Modern and Ancient schools of Yoga existing in India, Yogic diet, Yogic attitudes, Sadhak tatva & Badhak tatva**	
7.21		Unit B Topic 1	Schools/ Streams of Yoga – Ashtanga Yoga, Bhakti Yoga, Karma Yoga, Jnana Yoga	CO3, CO4, CO5, CO6
7.22		Unit B Topic 2	Modern and ancient schools of Yoga existing in India – Natha Sampradaya, Kaivalyadhama, Bihar School of Yoga, Munger, Pragya Yoga (Shantikunj), Iyengar Yoga, Patanjali Yoga Peeth, Ashtanga Vinyasa Yoga	CO3, CO4, CO5, CO6

7.23		Unit B Topic 3	Yoga Ahaara (Yogic diet), Yogic Attitudes – Maitri Karuna, Mudita, Upeksha, Sadhak Tatva Badhak Tatva (facilitating/helping factors and obstacles in Yoga sadhana)	CO3, CO4, CO5, CO6
7.3		**Unit C**	**Beginner level practices – Sukshma Vyayama and Surya Namaskara**	
7.31		Unit C Topic 1	Sukshma Vyayama and their benefits for health Part-1 (Bihar School of Yoga) Part-1	CO4, CO5, CO6
7.32		Unit C Topic 2	Sukshma Vyayama & their benefits for health (Swami Dhirendra Brahmachari) Part-1	CO4, CO5, CO6
7.33		Unit C Topic 3	Surya Namaskara (Sun Salutation) with mantra chanting (12 steps) & their benefits for health	CO4, CO5, CO6
7.4		**Unit D**	**Asana - all categories**	
7.41		Unit D Topic 1	Standing & Sitting - Tadasana, Vrikshasana, Katichakrasana, Padmasana, Vajrasana, Ushtrasana, Paschimottanasana, Vakrasana	CO4, CO5, CO6
7.42		Unit D Topic 2	Supine and Prone: Uttanapadasana, Pawanamuktasana, Shalabhasana, Bhujangasana	CO4, CO5, CO6
7.43		Unit D Topic 3	Balancing and Inverted: Trivikramasana, Sarvangasana, Viparitakarani mudra	CO4, CO5, CO6
7.5		Unit E	**Pre-practices of Pranayama, Pranayama and Dhyana**	
7.51		Unit E Topic 1	Kapalabhati, Mukha dhauti, Vibhagiya pranayama (Sectional breathing)	CO1, CO4, CO5, CO6
7.52		Unit E Topic 2	Anuloma – Viloma, Bhastrika, Shitali	CO1, CO4, CO5, CO6
7.53		Unit E Topic 3	Om Dhyana, Aanapaanasati Dhyana (breath meditation)	CO1, CO4, CO5, CO6
8	**Course Evaluation**			

8.1	Course work:		
8.11	Attendance		
8.12	Homework	Three best out of five assignments: 10 marks	
8.13	Quizzes	Three best out of five tests: 10 marks	
8.14	Projects	None	
8.15	Presentations	One best out of two: 10 marks	
8.2	CA: 60 % Practical		
8.3	End-term examination: 40% Viva		
9	**References**		
9.1	Text book	1. Sri Ananda: The Complete book of Yoga, Orient Course Backs, Delhi, 2003. 2. Basavaraddi, I.V. & other: SHATKARMA: A Comprehensivedescription about Cleansing Process, MDNIY New Delhi, 2009 3. Joshi, K.S.: Yogic Pranayama, Oriental Paperback, New Delhi, 2009 4. Dr. Nagendra H R: Pranayama, The Art & Science, Swami Vivekananda Yoga Prakashan, Bangalore, 2005. 5. Swami Niranjanananda Saraswati: Asana Pranayama Mudra Bandha, Yoga Publication Trust, Munger Bihar. 6. Joshi, K.S.: Yogic Pranayama, Oriental Paperback, New Delhi, 2009 7. Swami Kuvalyananda: Pranayama, Kaivalyadhama, Lonavla, 2010 8. Swami Rama: Science of Breath, A Practical Guide, The Himalayan International Institute, Pennselvenia, 1998. 9. Swami Niranjanananda Saraswati: Prana, Pranayama & Pranavidya, Yoga Publications Trust, Munger, Bihar, 2005	

CO-PO-PSO mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	-	-	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	-	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-	-
Avg	-	-	-	-	-	-	-	-	3	-	-	-	-

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: FBP122 Course Title: Principles of Fruits and Vegetables processing Lab

School: SSBR		**Batch: 2023-2027**
Programme: B.Sc		**Current Academic Year: 2023-2024**
Branch: Food Science and Technology		**Semester: 2nd**
1	Course Code	FBP122
2	Course Title	Principles of Fruits and Vegetables processing Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	• To identify the basic techniques of food preparation for increasing the shelf life of fruits and vegetables. • To analyze the use of chemical preservatives in food. • Identify the impact of certain technological operations and parameters on the success of fruit and vegetable processing and on certain properties of final product. • To develop a knowledge of new product development and waste reduction.
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Demonstrate common post-harvest management and grading techniques. CO2: Explain the importance of various chemicals preservatives in preservation. CO3: Identify the basic techniques used in the estimation of lycopene. CO4: Discuss the importance of microbiological analysis in fruits and vegetables. CO5: Explain the importance of the chemical composition of different varieties of fruits and vegetables intended for processing and processing conditions to the composition and properties of the product. CO6: Compare the nutrient constituents of fruits and vegetables
7	Course Description	The course will introduce students to methods used in preparation, preservation and microbiological examination of fruits and vegetable based processed foods. Students will be exposed to practical training on preparation, and analysis of increased shelf life by using preservatives.

8	**Outline syllabus**	**CO Mapping**
Unit 1	Practical based on post-harvest management and grading of foods.	CO1, CO6
Unit 2	Practical related to preservation of fruits by different methods.	CO2, CO6
Unit 3	Practical related to estimation of lycopene.	CO3, CO6
Unit 4	Practical related to oxidative rancidity.	CO4, CO6
Unit 5	Practical related to development of value-added new product.	CO5, CO6

Mode of examination	Practical/Viva	

Weightage Distribution	CA	CE	ESE	
	25%	25%	50%	
Text book/s*				
Other References	1.Serna-Saldivar, S. O. (2012). *Cereal grains: Laboratory* Laboratory Manual in Food Preservation by Marion L. Fields, Avi Publishing Co Inc.;New edition (December 1983).			

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	1	-	-	2	1	1	1	1	3	2	3
CO2	3	3	-	-	2	2	-	2	2	1	3	1	3
CO3	1	1	-	-	-	3	-	1	2	-	3	-	-
CO4	3	3	-	-	2	2	-	2	2	1	3	1	2
CO5	3	3	-	-	1	2	-	2	2	1	3	3	3
CO6	3	3	-	-	-	2	-	2	2	2	3	2	2
Avg	2.50	2.67	1.00	0	1.67	2.17	1.00	1.67	1.83	1.20	3.00	1.80	2.60

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: FBP123 Course Title: Processing of Cereals and Legumes Lab

School: SSBR		**Batch: 2023-2027**
Programme: B.Sc		**Current Academic Year: 2023-2024**
Branch: Food Science and Technology		**Semester: 2nd**
1	Course Code	FBP123
2	Course Title	Processing of Cereals and Legumes Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	• To develop the knowledge of structure, processing and importance of major cereals, legumes, and oilseed crops.
6	Course Outcomes	After successful completion of this course students will be able to: CO1- Define the importance of testing procedures for cereal and related products. CO2- Explain the adulteration in cereals grains and legumes. CO3- Experiment to determine the acid and saponification value of oilseeds products. CO4- Examine the function of dehulling and milling of cereals and legumes. CO5- Evaluate the nutritional composition of cereal, legumes, and related products CO6- Develop of cereal and legumes-based food products.
7	Course Description	In depth understanding of the methods applied for quality check of processes food.

8	**Outline syllabus**	**CO Mapping**
Unit 1	**Importance of testing procedures for cereal and related products and Identify the adulteration in cereals grains and legumes**	CO1
A	Determination of physicochemical properties of cereals and legumes (Angle of Repose, Bulk density, True Density. colour)	CO1
B	Determination of foreign matter in food grains.	CO2
C	Detection of *kesari* dal powder (*Lathyrus sativus*) in *Besan*	CO2
Unit 2	**Determination of acid and saponification value of oilseeds**	CO3
A	Determination of saponification value in oilseeds Products	CO3
B	Determination of acid value in mustard oil.	
Unit 3	**Dehulling and milling of cereals and legumes**	CO4
A	Principles and methods of dehulling	CO4
B	Dal milling process and visit to dal mill industry.	CO4

Unit 4	**Nutritional analysis of cereal, legumes and related products**	CO5
A	Estimate the crude fiber in cereal grains/legumes and related products	CO5
B	Estimation of fat content in cereal/legumes and related products.	CO5
Unit 5	**Production of cereal and legumes-based food products**	CO6
A	Production of fermented products from cereals/legumes	CO6
B	Production of soymilk	CO6

Mode of examination	Practical/Viva			
Weightage Distribution	CA	CE	ESE	
	25%	25%	50%	
Text book/s*	1.Serna-Saldivar, S. O. (2012). *Cereal grains: Laboratory Reference and Procedures Manual*. CRC Press.			
Other References	2.Nielsen, S. S. (Ed.). (2003). *Food Analysis Laboratory Manual* (p. 557). New York: Kluwer Academic/Plenum Publishers.			

CO-PO-PSO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	-	-	-	1	1	1	1	-	3	3	1
CO2	1	1	-	3	1	1	-	1	2	1	3	1	1
CO3	1	1	-	1	1	1	-	1	2	1	3	1	1
CO4	1	1	-	1	1	1	-	1	2	1	3	2	1
CO5	1	3	-	-	-	2	-	3	3	3	3	2	1
CO6	1	2	-	-	-	2	2	2	2	1	3	3	3
Avg	1.00	1.50	0	1.67	1.00	1.33	1.50	1.50	2.00	1.40	3.00	2.00	1.33

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: VOL102 **Course Title: Essential Techniques in Life Sciences**

School: SSBR		**Batch: 2023-2027**
Programme: B.Sc		**Current Academic Year: 2023-2024**
Branch: Food Science and Technology		**Semester: 2nd**
1	Course Code	VOL 102
2	Course Title	Essential Techniques in Life Sciences
3	Credits	3
4	Contact Hours (L-T-P)	0-0-6
	Course Status	Compulsory
5	Course Objective	• Develop knowledge of a specific area of specialization. • Develop research skills especially in biological experiments, project writing and oral presentation.
6	Course Outcomes	After successful completion of this course students will be able to: CO 1: Define the protein concentration using Lowry method. CO 2: Demonstrate the Electrophoresis technique CO 3: Identify and amplify the DNA using a thermocycler. CO 4: Examine the organic and inorganic solutes in the water CO 5: Assess and able to isolate the bacteria from the milk products CO 6: Estimate the digested DNA using DNA ligase.
7	Course Description	Vocational education is concerned with the training on vocation. It is related to productivity. Vocational education prepares individuals for jobs. It has adequate employment potentialities. It helps in broadening of horizon. It leads to dignity of labour. It is helpful in the maximum utilisation of the material resources of the country

8	**Outline syllabus**	**CO Mapping**
Unit 1	**Biomolecules**	
A	To estimate the protein concentration using Lowry method.	CO1, CO6
B	To estimate the DNA concentration using spectrophotometry method	CO1, CO6
C	To calculate the carbohydrate concentration using Molisch Test	CO1, CO6
Unit 2	**Electrophoresis**	
A	To understand the working principle of gel electrophoresis	CO2, CO6
B	Isolate DNA using kit	CO2, CO6
C	Run on gel electrophoresis	CO2, CO6
Unit 3	**`PCR**	
A	Understand the working of Thermocycler	CO3, CO6
B	To amplify the gene using a thermocycler.	CO3, CO6

C	To purify DNA from an agarose gel	CO3, CO6
Unit 4	**Water Microbiology**	
A	Determination of total dissolved oxygen of water	CO4, CO6
B	Determination of chemical oxygen demand (COD) of water	CO4, CO6
C	Determination of biochemical oxygen demand (BOD) of water	CO4, CO6
Unit 5	**Isolation of Bacteria**	
A	Isolation of Bacteria from milk and gram staining	CO5, CO6
B	Determination of quality of milk sample by methylene blue reduction test	CO5, CO6
C	Detection of Arsenic by microbiological methods	CO5, CO6

Mode of examination	Continuous Assessment (CA): 25 Marks Viva-Voce (on the basis of weekly Viva performance): 25 Marks ETE: 50 marks (Quiz for 15 marks; Lab Work for 15 Marks; Viva for 10 Marks and Lab record for 10 marks)			
Weightage Distribution	CA	CE	ESE	
	25%	25%	50%	
Text book/s*	Experiments in Microbiology, plant pathology and Biotechnology, K R Aneja			
Other References	10 Recent International Journal Articles of repute.			

CO-PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	3	1	-	-	-	1	-	-	1	1	1
CO2	3	3	3	3	1	1	-	1	-	-	3	2	2
CO3	3	3	3	2	-	-	1	1	-	-	3	2	2
CO4	3	3	3	2	-	1	-	-	-	-	3	2	1
CO5	3	3	3	3	2	1	2	1	1	1	3	2	3
CO6	3	3	3	1	1	2	1	1	2	3	3	2	3
Avg	2.67	2.83	3.00	2.00	1.33	1.25	1.33	1.00	1.50	2.00	2.67	1.83	2.00

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: PHR101 Course Title: Introduction to Renewable Energy and Management

School: SSBSR		**Batch: 2023-2027**
Programme: B.Sc		**Current Academic Year: 2023-2024**
Branch: Food Science and Technology		**SEMESTER: 2nd**
1	Course Code	**PHR 101**
2	Course Title	**Introduction to Renewable energy and management**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
5	Course Status	Minor Elective
6	Course Objective	1. To familiarize the concept of energy and its classification. 2. To know the importance of renewable energy. 3. To provide the awareness about climate change. 4. To familiarize with various renewable energy resources and its management.
7	Course Outcomes	After the completion of this course, the student will be able to CO1: comprehend the different types of energy. CO2: examine the importance of fossil fuels and renewable energy resources. CO3: apply the concept of greenhouse effect for climate change. CO4: inculcate the knowledge of renewable energy resources to obtain clean energy and its environmental impact. CO5: familiarize with energy management and sustainable development. CO6: asses the importance of various renewable energy resources and their impacts.
8	Course Description	This course deals with different types of energy and their impact on the climate change. In this course, the students will learn about the energy management and sustainable energy development.

9	**Outline syllabus**		**CO Mapping**
	Unit 1	**Energy and its classification**	CO1, CO2
	A	Introduction to energy: Definition and units of energy and power.	CO1, CO2
	B and C	Forms of energy and conservation of energy. Fossil fuels, renewable and non-renewable energy & their types. Conventional and non-conventional energy.	
	Unit 2	**Fossil fuels and Alternate Sources of Energy**	
	A	Fossil Fuels - Types, Uses, Advantages & Disadvantages, need of renewable energy.	CO1, CO3 CO1, CO3

	B and C	An overview of renewable energy resources: solar energy, wind energy, hydroelectric energy, wave energy, ocean thermal energy, tidal energy, geothermal energy and biomass energy.	CO1, CO3
	Unit 3	**Climate Change**	CO1,CO3 CO1,CO6
	A	Greenhouse gases (GHG) types and sources. The greenhouse effect.	
	B and C	The link between energy and climate change. Climate change – causes and consequences. global warming.	
	Unit 4	**Renewable energy resources**	
	A	Various renewable energy resources- Introduction, availability, classification, relative merits and demerits.	CO4, CO6
	B and C	Social, economic and environmental impacts of renewable energy resources.	CO4, CO6
	Unit 5	**Energy Management**	
	A	Principles of Energy Management, energy needs of growing economy, energy conservation and its importance.	CO5 ,CO6
	B and C	Concept of sustainability; Renewable energy for sustainable development.	CO5 ,CO6

	Mode of examination	20 marks for Test / Quiz / Assignment / Presentation. 05 marks for Class Interaction	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	. Non-conventional energy sources – 1.G.D Rai - Khanna Publishers, New Delhi 2. Solar energy - M P Agarwal - S Chand and Co. Ltd. 3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd. 4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, 5. Oxford University Press, in association with The Open University. 6. Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009 7. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA). 8. http://en.wikipedia.org/wiki/Renewable_energy	

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	1	1	-	1	-	-	-	-
CO2	3	1	-	-	-	-	1	-	1	-	-	-	-
CO3	2	2	1	-	-	-	1	-	1	-	-	-	-
CO4	2	2	2	-	-	3	2	-	1	-	-	-	-
CO5	1	2	2	-	-	-	1	-	2	-	-	-	-
CO6	1	2	2	-	-	1	2	-	2	-	-	-	-
Avg	1.67	1.67	1.75	0	0	1.67	1.33	0	1.33	0	0	0	0

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Semester III

Course code: FST211 Course Title: Chemistry of Food

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2024-25**	
Branch: Food Science and Technology		**SEMESTER: 3rd**	
1	Course Code	**FST211**	
2	Course Title	**Chemistry of Food**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	The objective of the Food Chemistry course is to provide students with a comprehensive understanding of the chemical composition, structure, and properties of food components. Through theoretical knowledge and practical applications, this course aims to equip students with the necessary tools to analyze and evaluate the chemical aspects of food, including its processing, preservation, and nutritional quality. By the end of the course, students should be able to apply their knowledge of food chemistry to critically assess food products, understand their behavior during processing and storage, and make informed decisions regarding food formulation and development.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Define the basic chemistry concept of carbohydrates, proteins and fat. CO2: Illustrate the idea for chemistry of gums, polysaccharides for industrial purpose. CO3: Apply different parameters to evaluate carbohydrates, proteins and fat. CO4: Analyze the concept of carbohydrate, as well as the identification of various anti-nutritional factors found in foods. CO5: Appraise differentiation among enzymes and enzyme activity CO6: Compile the importance of food chemistry in food.	
7.	Course Description	The Food Chemistry course is designed to explore the fundamental principles underlying the chemical aspects of food, from its composition to its transformation and nutritional value. The course will cover a wide range of topics, including the chemistry of carbohydrates, lipids, proteins, and enzymes.	
8.	**Outline syllabus**		**CO Mapping**
	Unit 1	**Carbohydrates**	CO1,CO6
	A	Scope, Introduction, Definition, and Importance of Food Chemistry	
	B	Carbohydrates: Chemistry, classification, function	
	C	Chemical and physical properties of carbohydrates, pentosans, mannans and galactans, pectic substances, gums, types of fibers, celluloses, hemicelluloses, soluble fibers, insoluble fibers and their important functions	
	Unit 2	**Proteins and Amino acids**	CO2, CO6
	A	Types, chemical, physical, and functional properties, gel formation	
	B	Protein denaturation, Milk, Meat and Egg proteins: caseins, whey proteins, Colostrum's, elastin, meat tenderness and muscle proteins	
	C	Egg white proteins and egg yolk, Collagen	

	Unit 3	**Lipids (Fat and Oil)**	CO3, CO6
	A	Classification, Physico-chemical properties, Functions, Oxidation of Oils and Fats	
	B	Chemistry, Functions and Application of Emulsifiers, Antioxidants, Stabilizers and Additives	
	C	Chemistry and functional properties of pigments and flavor compounds (flavonoids)	
	Unit 4	**Antinutritional Factor of Foods**	CO4, CO6
	A	Enzyme inhibitors, trypsin and chymotrypsin inhibitor, amylase inhibitor	
	B	Flatulence causing sugars, Phyto lectins and Allergens, toxic constituents	
	C	Important chemical changes during storage and cooking of foods (plant and animal foods)	
	Unit 5	**Enzymes and Starches**	CO5, CO6
	A	Modified starches, resistant starches.	
	B	Gelatinization of starches, alpha amylase and beta amylase, starch retrogradation	
	C	Enzymatic and non-enzymatic browning, reactions of aldehydes and ketones with amino compounds, caramelization, oxidative changes of polyphenols and their applications	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. Meyer, L.H. (1998) Food Chemistry, Van Nostrand, Reinhold Company Publication, New York, London.	
	Other References	2. Pomeranz, Y and Meloon, R. (1995) Food Analysis: Theory and Practice, Westport, An AVI Publication, New York, Sydney, Toronto. 3. Fennema, R.O (1997) Food Chemistry, Second Edition, Food Science & Technology series, Marcel Dekker, INC., New York	

CO-PO-PSO Mapping

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	-	1	1	3	-	1	2	2	2	2	-
CO2	1	2	-	1	1	1	3	-	1	1	-	3	1
CO3	1	3	-	2	1	1	-	-	1	2	3	1	3
CO4	2	3	1	-	-	1	1	1	1	1	-	3	2
CO5	3	1	-	-	1	2	1	1	2	2	3	2	3
CO6	1	-	-	3	3	2	2	2	1	1	1	-	3
Avg	1.67	2.00	1.00	1.75	1.40	1.67	1.75	1.25	1.33	1.50	2.25	2.20	2.40

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: FST216 Course Title: Food Process and Engineering

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2024-25**	
Branch: Food Science and Technology		**SEMESTER: 3rd**	
1	Course Code	**FST 216**	
2	Course Title	**Food Process and Engineering**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	1. Understand Food Processing Principles: Provide students with a solid understanding of the fundamental principles of food processing, including heat transfer, mass transfer, fluid flow, and thermodynamics as applied to food systems. 2. Apply Engineering Principles to Food Processing: Enable students to apply engineering principles and concepts to the design, optimization, and management of food processing operations. This includes understanding the equipment, unit operations, and processes commonly used in the food industry. 3. Ensure Food Safety and Quality: Familiarize students with the principles and practices necessary to ensure food safety and quality throughout the food processing chain. This includes understanding the role of Good Manufacturing Practices (GMP), Hazard Analysis Critical Control Points (HACCP), and other quality management systems. 4. Optimize Food Processing Operations: Equip students with the knowledge and skills to analyze and optimize food processing operations. This includes techniques such as process modeling, simulation, and analysis to improve efficiency, reduce costs, and enhance product quality	
6	Course Outcomes	After successful completion of this course students will be able to: CO1. Label the plant layout. CO2.Compare the various engineering units and engineering properties of foods. CO3. Solve and understand the liquid transport system according to flow behavior of food. CO4. Categorize and understand the conservation of mass, law of thermodynamics and energy balance of the system. CO5. Explain the steam generation system, fuel utilization system and various laws for electrical energy. CO6.Formulate the engineering approach in food industry.	
7.	Course Description	Food Engineering provides the vast knowledge about engineering calculations related to food industry. For developing any machinery for food industry, one should have knowledge for engineering terms. Workings in food industry also require the knowledge about design of heat exchangers, fluid mechanics and thermodynamics	
8.	**Outline syllabus**		**CO Mapping**
	Unit 1	**Design and Layout of Food Plant**	CO1,CO6
	A	Design and layout of food plants	
	B	Important considerations for designing of food plants;	
	C	Construction and design; Types of layouts	

	Unit 2	**Units and Dimensions**	CO2, CO6
	A	Dimensions – Primary and Secondary; Engineering Units – Base Units,	
	B	Derived Units, and supplementary Units; System – State of a system,	
	C	Extensive and intensive properties; Density – Solid, Particle and Bulk density; Phase diagram of water	
	Unit 3	**Fluid Flow in Food Processing**	CO3, CO6
	A	Liquid Transport Systems– Pipes and Pumps; PUMPS- Definition, classification, positive displacement, and centrifugal pumps; factors affecting choice of a pump	
	B	Properties of liquids - Density, Pressure, Surface tension and Viscosity	
	C	The Continuity equation; Reynold's number	
	Unit 4	**Thermodynamics and Equilibrium**	CO4, CO6
	A	Conservation of mass- conservation of mass for an open system and a closed system	
	B	Thermodynamics – laws of thermodynamics, Equation of state and Perfect Gas Law	
	C	Energy – potential and kinetic energy; Energy balance for a closed system	
	Unit 5	**Energy in Unit Processes**	CO5, CO6
	A	Generation of steam – Steam Generation System, Steam Tables, Steam Utilization;	
	B	Fuel utilization –Systems, Mass and energy balance analysis, Burner efficiency;	
	C	Electric Power Utilization – Electric Terms and Units, Ohm's Law, Electric Circuits, Electric Motors.	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. Heldman, D.R. and Lund, D.B. Handbook of Food Engineering 2nd edition. CRC press, New York, 2007.	
	Other References	1. Dincer, I. Heat Transfer Food Cooling Applications. Taylor and Francis Publishers, USA. 2. Singh, R.P. Introduction to Food Engineering 3rd edition. Academic Press, London. 2004.	

CO-PO-PSO Mapping

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	-	1	1	3	-	1	2	2	2	2	-
CO2	1	2	-	1	1	1	3	-	1	1	-	3	1
CO3	1	3	-	2	1	1	-	-	1	2	3	1	3
CO4	2	3	1	-	-	1	1	1	1	1	-	3	2
CO5	3	1	-	-	1	2	1	1	2	2	3	2	3
CO6	1	-	-	3	3	2	2	2	1	1	1	-	3
Avg	1.67	2.00	1.00	1.75	1.40	1.67	1.75	1.25	1.33	1.50	2.25	2.20	2.40

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High

Course code: BBT211 Course Title: Biophysics

School: SSBSR		**Batch: 2023-27**
Programme: B.Sc		**Current Academic Year: 2024-25**
Branch: Food Science and Technology		**SEMESTER: 3rd**
1	Course Code	**BBT211**
2	Course Title	**Biophysics**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Minor
5	Course Objective	The objective of the Biophysics course is to provide students with a comprehensive understanding of the principles and applications of physics in biological systems. Through theoretical knowledge and practical applications, this course aims to equip students with the necessary tools to analyze and investigate the physical phenomena that occur at the molecular, cellular, and organismal levels.
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Choose the basic concepts involved in Biophysics at the molecular and cellular level. CO2**:** Interpret the crucial concepts of optics to understand the techniques used in Biophysics. CO3**:** Organize about Hydrodynamics and its role in biophysics. CO4**:** Simplify the basics of absorbance and spectrometry. CO5: Evaluate the concepts of radiation in association with biophysics. CO6: Design the concepts of biophysics that can be used to study biology associated with research, industry, medicine, and diagnostics.
7.	Course Description	The Biophysics course explores the intersection of physics and biology, focusing on the physical principles that underpin the behavior and function of living organisms. The course will cover a wide range of topics, including the properties of biomolecules, optical techniques, hydrodynamics techniques, Spectroscopy, and radiation biophysics.
8.	**Outline syllabus**	**CO Mapping**
	Unit 1	**Molecular Biophysics** CO1,CO6
	A	Atomic & Molecular structure, Structure of atom-Models & theories, Periodic table, Concept of bonding Secondary bonding: weak interactions, hydrogen bonding; dipole-dipole & dipole induced dipole interactions; London dispersion forces Bonds within molecules-Ionic, covalent, Hydrogen, Electrostatic, Di-sulfide & peptide bonds, Van-der Waals forces Bond lengths & Bond energies , Bond angles, Structural isomerism; optical isomerism & optical activity.
	B	Biophysics of Water and Biological systems: Physicochemical properties of water, Molecular structure, Nature of hydrophobic interactions, Water Structure

	C	First and second laws of thermodynamics, activation energy. Biological systems as open, non-equilibrium systems, Concept of free energy, Enthalpy and entropy	
	Unit 2	**Optical Techniques**	CO2, CO6
	A	Light: Reflection, Refraction, Diffraction, Interference phenomena, Refractometry: Refraction of light and snell's law, refractive index, principle, design, working and application of Abbe's refractometer	
	B	Light microscopy: Simple compound optical microscope, Phase contrast and interference contrast microscope, Fluorescence and polarizing microscope: principle, design, resolution, numerical aperture, care and maintenance of microscopes	
	C	Polarimetry: Polarization of light, stereoisomers, optical activity and its measurement, specific rotation, molar rotation, optical activity of some biomolecules and its significance	
	Unit 3	**Hydrodynamic Techniques**	CO3, CO6
	A	Centrifugation: Concept of sedimentation Basic principles, Forces involved, RCF, Centrifugation techniques-Differential centrifugation, principle, design, types, and applications of different Centrifuges.	
	B	Viscometry: General features of fluid flow. Origin of viscosity of gases and liquids, factors affecting viscosity	
	C	Fick's law, viscometrical measurements, determination of coefficient of viscosity, Stokes law, Oswald's viscometer, relative, specific, and intrinsic viscosity, applications of viscometry in bimolecular structure determination	
	Unit 4	**Absorption & Fluorescence Spectroscopy**	CO4, CO6
	A	Electromagnetic spectrum, properties of electromagnetic radiations, concept and types of spectroscopy, absorption spectrum, energy characteristics of spectrum	
	B	Fundamental laws of photometry: Beer's law and its deviation ,concept of λmax, chromophoric shifts,	
	C	Photometric analysis, Principles of fluorescence, Colorimeter, spectrophotometer.	
	Unit 5	**Radiation Biophysics**	CO5, CO6
	A	Radioactivity, law of Radioactivity, General properties of alpha, beta and gamma radiations, Radiation units: Units of measurement of radioactivity. Curie, Becquerel. Units of exposure	
	B	Radiolysis of water, Production of free radicals & their interactions, Direct and indirect effects of radiation. Target theory, Single hit & Multi hit theory, Effect of radiation on Nucleic acids, Proteins, Enzymes, Action of radiation on living system	
	C	Radiation sources, Tele-gamma Unit (Cobalt unit), Gamma chamber, Particle Accelerators, Nuclear reactors, gamma camera, Principles of radiation detection and measurement, General principles of Dosimeters	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. Ackerman E.A. Ellis, L.E.E. & Williams L.E., Biophysical Science, Prentice-Hall Inc.	
	Other References	1. Molecular Driving Forces: Statistical Thermodynamics in Biology, Chemistry, Physics, and Nanoscience: Ken Dill,	

CO-PO-PSO Mapping

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	-	1	-	1	1	3	-	1	2	2	2	2	-
CO2	1	2	-	1	1	1	-	-	1	1	-	-	1
CO3	1	-	-	2	1	1	-	-	1	2	-	-	-
CO4	2	3	1	-	-	1	1	1	1	1	-	-	-
CO5	2	1	-	-	1	2	1	1	2	2	-	-	-
CO6	1	-	-	1	1	2	2	2	1	1	1	-	2
Avg	1.40	1.75	1.00	1.25	1.00	1.67	1.33	1.25	1.33	1.50	1.50	2.00	1.50

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: ARP207 Course Title: Logical Skills Building and Soft Skills

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2024-25**	
Branch: Food Science and Technology		**SEMESTER: 3rd**	
1	Course Code	**ARP207**	
2	Course Title	Logical Skills Building and Soft Skills	
3	Credits	**2**	
4	Contact Hours (L-T-P)	1-0-2	
	Course Status	Ability Enhancement Course	
5	Course Objective	To enhance holistic development of students and improve their employability skills. To provide a 360-degree exposure to learning elements of Business English readiness programme, behavioral traits, achieve softer communication levels and a positive self-branding along with augmenting numerical and altitudinal abilities. To step up skill and upgrade students across varied industry needs to enhance employability skills. By the end of this semester, a student will have entered the threshold of his/her 1st phase of employability enhancement and skill building activity exercise.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Ascertain a competency level through Building Essential Language and Life Skills CO2: Build positive emotional competence in self and learn GOAL Setting and SMART Goals techniques CO3: Apply positive thinking, goal setting and success-focused attitudes, time Management, which would help them in their academic as well as professional career CO4: Acquire satisfactory competency in use of aptitude, logical and analytical reasoning CO5: Develop strategic thinking and diverse mathematical concepts through building number puzzles CO6: Demonstrate an ability to apply various quantitative aptitude tools for making business decisions	
7.	Course Objective	This Level 1 blended training approach equips the students for Industry employment readiness and combines elements of soft skills and numerical abilities to achieve this purpose.	
8.	**Outline syllabus**		**CO Mapping**
	Unit 1	**BELLS (Building Essential Language and Life Skills)**	
	A	*Know Yourself*: Core Competence. A very unique and interactive approach through an engaging questionnaire to ascertain a student's current skill level to design, architect and expose a student to the right syllabus as also to identify the correct TNI/TNA levels of the student.	CO1
	B	Techniques of Self Awareness | Self Esteem & Effectiveness| Building Positive Attitude | Building Emotional Competence	CO1, CO2
	C	Positive Thinking & Attitude Building | Goal Setting and SMART Goals – Milestone Mapping | Enhancing L S R W G and P (Listening Speaking Reading Writing Grammar and Pronunciation) |	CO1, CO2,CO3

	Unit 2	**Introduction to APTITUDE TRAINING- Reasoning- Logical/ Analytical**	
	A	Syllogism | Letter Series | Coding, Decoding , Ranking & Their Comparison Level-1	CO4
	B	Number Puzzles	CO5
	C	Selection Based On Given Conditions	CO5
	Unit 3	**Quantitative Aptitude**	
	A	Number Systems Level 1 | Vedic Math's Level-1	CO6
	B	Percentage ,Ratio & Proportion | Mensuration - Area & Volume |Algebra	CO6
	Unit 4	**Verbal Abilities – 1**	
	A	Reading Comprehension	CO1
	B	Spotting the Errors	CO2
	Unit 5	**Time & Priority Management**	
	A	Steven Covey Time Management Matrix	CO3
	B	Creating Self Time Management Tracker	CO3
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	**Class Assignment/Free Speech Exercises / JAM – 60% | Group Presentations/Mock Interviews/GD/ Reasoning, Quant & Aptitude – 40%**	
	Text book/s*	Wiley's Quantitative Aptitude-P Anand | **Quantum CAT – Arihant Publications | Quicker Maths- M. Tyra |** Power of Positive Action (English, Paperback, Napoleon Hill) | Streets of Attitude (English, Paperback, Cary Fagan, Elizabeth Wilson) The 6 Pillars of self-esteem and awareness – Nathaniel Brandon | Goal Setting (English, Paperback, Wilson Dobson	

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	1	-	-	-
CO5	-	-	-	-	-	-	-	-	-	1	-	-	-
CO6	-	-	-	-	-	-	-	-	-	1	-	-	-
Avg	-	-	-	-	-	-	-	-	-	1	-	-	-

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: FBP217 Course Title: Food Biochemistry Lab

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2024-25**	
Branch: Food Science and Technology		**SEMESTER: 3rd**	
1	Course Code	**FBP217**	
2	Course Title	**Food Biochemistry Lab**	
3	Credits	**1**	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	The objective of the Food Biochemistry Lab course is to provide students with practical experience and hands-on training in the application of biochemistry principles to the study of food and its components. The course aims to enhance students' understanding of the biochemical reactions and processes that occur in various food systems, and how these reactions influence the quality, safety, and nutritional value of food. Through laboratory exercises and experiments, students will develop skills in the analysis and characterization of food components, such as proteins, carbohydrates, lipids, vitamins, and minerals. The course will also emphasize the application of modern analytical techniques used in food biochemistry research.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Define the significance, purpose, and principle of Food Chemistry CO2: Illustrate total carbohydrates, protein, starch, ash, moisture content from different food samples CO3: Experiment with reducing and non-reducing sugars from different food samples CO4: Analyze the method for determination of pH and acidity from different food samples. CO5: Decide preparation of Primary and Secondary solutions. CO6: Construct method of estimation of ascorbic acid in food samples	
7.	Course Description	The Food Biochemistry Lab course is designed to provide students with a comprehensive understanding of the principles and techniques employed in the analysis of food components and their biochemical properties. The course will cover a range of topics related to the biochemistry of food, including enzyme kinetics, protein structure and function, carbohydrate metabolism, lipid oxidation, vitamins and minerals, and the impact of processing on food composition and quality.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**General Laboratory Principles and Practices** • Practical experience with laboratory equipment related to food processing. • Cleaning of lab glassware and work areas	CO1,CO6
	Unit 2	**Determining the nutritional composition of foods** • Estimation of proximate constituents in a given food sample • Determination of the starch content of food.	CO2, CO6

		• Estimation of reducing and non-reducing sugars using a standard protocol	
	Unit 3	**Estimation of physicochemical properties of foods** • Determination of pH and water activity in various food samples • Determining the acidity of a given food sample	CO3, CO6
	Unit 4	**Preparation of solutions**. • Preparation of Primary and Secondary solutions. • Preparation of Normal, Moral and diluted solution.	CO4, CO6
	Unit 5	**Analysis of ascorbic acid and fat quality** • To comprehend the method of estimating ascorbic acid in food samples • To calculate saponification value and percent free fatty acids.	CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA	CE	ESE
		25%	25%	50%
	Text book/s*	1. Serna-Saldivar, S. O. (2012). Cereal Grains: Laboratory Reference and Procedures Manual. CRC Press.	
	Other References	2. Fennema, R.O (1997) Food Chemistry, Second Edition, Food Science & Technology series, Marcel Dekker, INC., New York	

CO-PO-PSO Mapping

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	1	3	3	2	1	2	2	1	1	3
CO2	2	2	3	1	2	1	3	0	3	1	3	2	3
CO3	2	3	0	2	3	1	0	0	1	2	0	0	1
CO4	1	3	1	0	3	1	0	2	1	1	2	0	1
CO5	1	1	0	2	1	2	3	1	2	3	1	2	2
CO6	1	0	0	3	3	2	2	2	1	1	0	3	2
Avg	1.50	1.67	0.83	1.50	2.50	1.67	1.67	1.00	1.67	1.67	1.17	1.33	2.00

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: FBP216 Course Title: Food Process and Engineering Lab

School: SSBSR		**Batch: 2023-27**
Programme: B.Sc		**Current Academic Year: 2024-25**
Branch: Food Science and Technology		**SEMESTER: 3rd**
1	Course Code	**FBP216**
2	Course Title	**Food Process and Engineering Lab**
3	Credits	**1**
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	The objective of the Food Process and Engineering Lab course is to provide students with practical experience and knowledge in the application of engineering principles to the design, operation, and optimization of food processing systems. Through laboratory exercises and experiments, students will develop skills in the measurement, analysis, and optimization of food processing parameters to ensure the safety, quality, and efficiency of food production.
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Show the fundamentals of food science and food process engineering. CO2: Illustrate the concepts of drying and osmotic dehydration in depth. CO3: Make use of some thermal/non-thermal techniques for different food commodities. CO4: Simplify the physical properties of food materials. CO5: Appraise the engineering properties of food materials. CO6: Design the working principles of Instruments used in Food Processing.
7.	Course Description	The Food Process and Engineering Lab course is designed to provide students with a comprehensive understanding of the principles and techniques used in the engineering and optimization of food processing operations.

7	**Outline syllabus**		**CO Mapping**
	Unit 1	• To get hands on experience on various aspects of food science and food process engineering. • Determination of cooking properties of parboiled and raw rice.	CO1,CO6
	Unit 2	• Determination of rehydration ratio of dehydrated foods. • Experiment on osmotic dehydration of foods	CO2, CO6
	Unit 3	• Blanching and Freezing of Foods. • Microwave heating of foods.	CO3, CO6
	Unit 4	• Determination of color of food material • Determination of Texture properties of food products. • Evaluation of Rheological properties of foods	CO4, CO6
	Unit 5	• Calculation of bulk density • Estimation of True density • To determine the Surface area	CO5, CO6

		• To determine the Porosity		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	CA	CE	ESE
		25%	25%	50%
	Text book/s*	1. Singh, R. Paul and Heldman, R. Dennis.2004. Introduction to Food Engineering. 3rd Edition. Academic Press, London.		
	Other References	1. Kessler, H.G.1981. Food engineering and dairy technology. Verlag A. Kessler, Freising.		

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	1	3	3	2	1	2	2	1	1	3
CO2	2	2	3	1	2	1	3	0	3	1	3	2	3
CO3	2	3	0	2	3	1	0	0	1	2	0	0	1
CO4	1	3	1	0	3	1	0	2	1	1	2	0	1
CO5	1	1	0	2	1	2	3	1	2	3	1	2	2
CO6	1	0	0	3	3	2	2	2	1	1	0	3	2
Avg	1.50	1.67	0.83	1.50	2.50	1.67	1.67	1.00	1.67	1.67	1.17	1.33	2.00

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: VOL201 Course Title: Essential Techniques in Life Sciences

School: SSBSR		**Batch: 2023-27**		
Programme: B.Sc		**Current Academic Year: 2024-25**		
Branch: Food Science and Technology		**SEMESTER: 3rd**		
1	Course Code	**VOL201**		
2	Course Title	Essential Techniques in Life Sciences		
3	Credits	3		
4	Contact Hours (L-T-P)	0-0-6		
	Course Status	Vocational		
5	Course Objective	• Develop knowledge of a specific area of specialization. • Develop research skills especially in biological experiments, project writing and oral presentation		
6	Course Outcomes	After successful completion of this course students will be able to: **CO 1:** Find the basic principles of Blood grouping analysis **CO 2:** Explain the hemagglutination and precipitation **CO 3:** Identify sectioning of plant stem and root. **CO 4:** Categorize analysis using light microscope. **CO 5:** Evaluate a permanent slide of plant tissue **CO 6:** Compile a permanent slide of plant tissue		
7.	Course Description	The Food Process and Engineering Lab course is designed to provide students with a comprehensive understanding of the principles and techniques used in the engineering and optimization of food processing operations.		
7	**Outline syllabus**			**CO Mapping**
	Unit 1	Blood grouping analysis; Rh factor antigen analysis. Studying the hemagglutination and precipitation. Quantitative estimation of antigen by radial immunodiffusion assay. Quantitative estimation of antigen by double immunodiffusion assay.		CO1,CO6
	Unit 2	Vertical sectioning of plant stem and root. Transverse sectioning of plant stem and root.		CO2, CO6
	Unit 3	Studying different plant tissue under compound light microscope.		CO3, CO6
	Unit 4	Hematological analysis using light microscope.		CO4, CO6
	Unit 5	Preparation of a permanent slide of plant tissue		CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	CA	CE	ESE
		25%	25%	50%
	Text book/s*	10 Recent International Journal Articles of repute.		

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	0	1	1	3	0	1	2	2	0	1	3
CO2	1	2	0	3	1	3	3	2	1	1	1	2	3
CO3	3	3	0	2	2	1	0	0	3	2	1	0	1
CO4	3	3	1	3	0	1	2	1	1	2	2	3	1
CO5	1	1	0	3	1	2	1	2	2	2	1	2	3
CO6	2	0	0	3	3	2	2	2	2	1	0	1	2
Avg	1.83	1.67	0.17	2.50	1.33	2.00	1.33	1.33	1.83	1.67	0.83	1.50	2.17

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: RBL 001 **Course Title: Research Based Learning I**

School: SSBSR		**Batch: 2023-27**		
Programme: B.Sc		**Current Academic Year: 2024-25**		
Branch: Food Science and Technology		**SEMESTER: 3rd**		
1	Course Code	**RBL 001**		
2	Course Title	**Research Based learning I**		
3	Credits	**Audit Based**		
4	Contact Hours (L-T-P)	0-0-4		
	Course Status	Compulsory		
5	Course Objective	Develop knowledge of a specific area of specialization. Develop research skills especially in biological experiments, project writing and oral presentation.		
6	Course Outcomes	After successful completion of this course students will be able to: **C**O 1: Articulate research-based investigation done on a topic CO 2: Demonstrate capacity identify theoretical/ experimental method followed in the research articles CO 3: Demonstrate an understanding of the ethical issues associated with practitioner research CO 4: Compare research data and extract the outstanding results CO 5: Report research findings in written and verbal forms CO 6: Use research findings to advance education theory and practice		
7.	Course Description	Research-based learning (RBL) aims to promote and develop student competencies related to research practice and to benefit students through activities linked to research [. This technique implies the application of learning and teaching strategies that link research with teaching		
7	**Outline syllabus**			**CO Mapping**
	Unit 1	**Introduction to various research problems**		CO1,CO6
	Unit 2	**Identify a research question**		CO2, CO6
	Unit 3	**Literature survey**		CO3, CO6
	Unit 4	**Report writing**		CO4, CO6
	Unit 5	**Presentation**		CO5, CO6
	Mode of examination	Continuous Assessment (CA): 25 Marks Viva-Voce (on the basis of weekly Viva performance): 25 Marks ETE: 50 marks (Quiz for 15 marks; Lab Work for 15 Marks; Viva for 10 Marks and Lab record for 10 marks)		
	Weightage Distribution	CA	CE	ESE
		25%	25%	50%
	Text book/s*	10 Recent International Journal Articles of repute.		

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	1	2	1	1	2	2	2	1	2	1	1
CO2	2	2	1	1	1	1	2	1	1	1	2	2	2
CO3	1	2	2	1	2	1	1	1	2	2	1	1	2
CO4	2	3	2	2	1	1	3	3	2	1	3	2	2
CO5	1	1	1	2	1	1	1	2	2	1	3	2	2
CO6	2	3	2	3	1	1	1	2	2	1	3	2	1
Avg	1.50	2.00	1.50	1.83	1.17	1.00	1.67	1.83	1.83	1.17	2.33	1.67	1.67

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: PHR 201 Course Title: Renewable Energy Resources

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2024-25**	
Branch: Food Science and Technology		**SEMESTER: 3rd**	
1	Course Code	**PHR 201**	
2	Course Title	**Renewable Energy Resources**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Minor	
5	Course Objective	This course provides an opportunity to develop knowledge and understanding of the key principles and applications of biomass energy and resources	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Understand and develop knowledge about the different kinds of renewable energy resources. CO2: Analyse the energy consumption (both in rural and urban areas) and energy demand and current Indian energy scene. CO3: Understand the Impact on environmental degradation due to production and utilization of energy. CO4: Understand and Analyse the solar cells CO5: Understand and develop knowledge about the Geothermal, wind, ocean and bioenergy resources. CO6: Students will have deep knowledge about the various renewable resources including solar energy, geothermal energy, wind and ocean energy and adverse effect of energy consumption on environment.	
7.	Course Description	This course provides deep knowledge about the different forms of energy, various renewable resources including solar energy, geothermal energy, wind and ocean energy, solar cells (1st, 2nd, and 3rd generation), and adverse effect of energy consumption on environment.	
8.	**Outline syllabus**		**CO Mapping**
	Unit 1	**Renewable energy and its Resources**	CO1
	A	Definition, units, and power of energy, Forms of energy, Second law of thermodynamics and conversion of energy, Origin and time scale of fossil fuels.	CO1
	B	Conventional and nonconventional energy sources, Renewable-non-renewable energy resources, Green energy, clean energy (definition and example only),	CO1
	C	Energy resources, coal, oil, natural gas, nuclear and hydroelectric power, Concepts of ecological footprint, green footprint, and carbon footprint.	

	Unit 2	**Energy demand, Energy Consumption, and Indian Energy Scene:**	
	A	Role of energy in economic development, Energy consumption in various sectors, Exponential increase in energy consumption and its impact on global economy, Energy demand and Energy trilemma index.	CO2 CO2
	B	Indian Energy Scene: Energy resources available in India, Urban and rural energy consumption, Nuclear energy (scope and future) variation of energy consumption as a function of energy,	CO2
	C	Need of new renewable resources, National Green Tribunal (NGT) act and activities.	
	Unit 3	**Environmental effects on energy consumption**	
	A	Environmental degradation due to production and utilization of energy, Impact of environmental degradation activities on biological damage.	CO3
	B	Environmental effects of thermal power stations and nuclear power generation, Air and water pollution, Effect on Ozone layer, Global warming.	CO3
	C	Hydroelectric power, Geothermal power, Energy harvesting (Ocean, wind, solar and bioenergy).	CO3, CO6
	Unit 4	**Solar Energy and Solar Cells**	
	A	Need of Solar energy, Solar Energy, Solar constant, Solar radiation spectrum	CO4
	B	Classification of solar cells: 1st generation (single vs polycrystalline), 2nd generation, 3rd generation.	CO4, CO6
	C	Key elements of silicon solar cells, PV solar cell, Module, Panel and array, solar thermal system types. Applications of solar thermal systems.	CO4, CO6
	Unit 5	**Geothermal, Wind, Ocean and Bioenergy**	CO5
	A	Geothermal Energy: Introduction, Geothermal power, Geothermal resources, Advantage and disadvantage of geothermal energy over other form of energy.	CO5, CO6
	B	Wind energy: Introduction, Principle of wind energy conversion, Advantage and Disadvantage of wind mills, Application of wind energy.	
	C	Ocean Energy: Introduction, Principle of ocean thermal energy conversion, Tidal power generation, tidal energy technologies, Wave energy conversion, Advantages and Disadvantages. Bio Energy: Introduction, Sources of biomass, Advantage and disadvantage of bio energy over other form of energy.	CO5, CO6
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. Renewable Energy: Power for a Sustainable Future, Godfrey Boyle. 2. Solar Photovoltaics: Fundamentals, Technologies and Applications, Chetan Singh Solanki	
	References Book	1. Physics of Energy Sources, G. C. King 2. Physics and Technology of Sustainable Energy; E L Wolf 3. Advanced renewable Energy Systems, S C Bhatia 3. D.P.Kothari, K.C Singal and Rakesh Ranjan "Renewable Energy Sources And Emerging Technologies", 2011, PHI Learning Private Ltd, New Delhi.	
	Suggestive Digital Platforms / Web Links	1. https://www.edx.org/learn/renewable-energy 2. https://www.coursera.org/courses?query=renewable%20energy 3. National Programme on Technology Enhanced Learning (NPTEL), 4. https://onlinecourses.nptel.ac.in/noc21_ch11/preview	

	Suggested Equivalent Online Courses	1. The Renewable Energy Institute, renewable energy course, 2. National Programme on Technology Enhanced Learning (NPTEL), https://onlinecourses.nptel.ac.in/noc21_ch11/preview 3. https://onlinecourses.nptel.ac.in/noc22_ph44/preview (swayam course)

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	1	-	-	1	2	1	2	1	1	-	1
CO2	-	-	-	-	-	-	-	1	1	1	1	-	1
CO3	2	3	2	-	-	2	2	1	1	1	1	-	1
CO4	2	3	3	-	-	2	2	1	2	1	1	-	1
CO5	2	1	1	-	-	1	1	1	2	1	1	-	1
CO6	2	3	2	-	-	1	1	2	2	1	1	-	1
Avg	1.80	2.20	1.80	0	0	1.40	1.60	1.17	1.67	1.00	1.00	0	1.00

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: BBI203 Course Title: Physical and Chemical aspects of Biological Sciences

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2024-25**	
Branch: Food Science and Technology		**SEMESTER: 3rd**	
1	Course Code	BBI203	
2	Course Title	**Physical and Chemical Aspects of Biological Sciences**	
3	Credits	**4**	
4	Contact Hours (L-T-P)	**4-0-0**	
	Course Status	Minor	
5	Course Objective	Understanding the general properties of vitamins and minerals in the body To understand the physical aspect of biology To understand the chemistry aspect of biology	
6	Course Outcomes	The students at the completion of the course will be able to: CO1: Understand the role of vitamins and minerals in human body CO2: Summarize about the crucial concepts of PCR and Sequencing CO3: Discover the role of thermodynamics in human body CO4: Illustrate the concepts of the redox potential and role of ATP CO5: Appraise the concepts of plasma membrane in a cell CO6: Examine the concepts of physics and chemistry in biology.	
	Course Description	This course comprises of the structure, function, properties and significance of various macromolecules found in biological systems. Several different macromolecules viz. lipids, carbohydrates, amino acids, proteins, and nucleic acids will be studied in details.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Vitamins and micronutrients**	CO1,CO6
	A	Role of micronutrients – vitamins and minerals	
	B	Dietary sources, biochemical functions, requirements	
	C	Deficiency diseases associated with vitamin B complex, C and A, D, E & K vitamins	
	Unit 2	**PCR and sequencing**	CO2, CO6
	A	Tm of DNA, factors of responsible of denaturation and renaturation of DNA.	
	B	Introduction to PCR – Principle and applications	
	C	Introduction to sequencing and utility. Maxman Gilbert Sequencing, and Sangers sequencing	
	Unit 3	**Bioenergetics**	CO3, CO6
	A	Concepts of bioenergetics: Laws of **thermodynamics, Gibbs free energy**	
	B	Enthalpy, Entropy, change in free energy, Standard free energy change pH 7.0 (derivations and numerical)	
	C	Biological systems as open, non-equilibrium systems	
	Unit 4	**Redox potential**	CO4, CO6

	A	Biological oxidation-reduction reactions, redox potential and its significance		
	B	high energy compounds (ATP, GTP)		
	C	Reasons for high group transfer potential of ATP including structural basis, ATP hydrolysis and equilibria of coupled reactions.		
	Unit 5	**Plasma Membrane**		CO5, CO6
	A	Plasma Membrane structure; Membrane lipids; Architecture and composition of bio-membrane, Membrane fluidity – Cholesterol, floppase and flippase		
	B	Transport across membranes: Diffusion, Active and Passive transport, Facilitated transport		
	C	Cell junctions: Tight junctions, Desmosomes, Gap junctions		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	CA+MSE		ESE
		25%		75%
	Text book/s*	Subramanian M A. Biophysics: Principles and Techniques. MJP Publishers Ltd.		
	Other References	R M S. Biophysics: An Introduction. John Wiley& Sons Ltd, England, 2002. Molecular Driving Forces: Statistical Thermodynamics in Biology, Chemistry, Physics, and Nanoscience: Ken Dill, Alka Gupta. Instrumentation & Bioanalytical Techniques. Pragati Edition		

CO-PO-PSO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	1	-	1	-	-	1	-	-
CO5	-	-	-	-	-	-	-	-	-	-	1	-	-
CO6	3	2	-	-	-	-	-	1	2	1	2	-	-
Avg	3.00	2.00	0	0	0	1.00	0	1.00	2.00	1.00	1.60	0	0

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

SEMESTER – IV

Course code: FST 213 Course Title: Fundamentals of Dairy Technology

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2024-25**	
Branch: Food Science and Technology		**SEMESTER: 4th**	
1	Course Code	**FST 213**	
2	Course Title	**Fundamentals of Dairy Technology**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	To make the students aware of the preservation techniques to enhance the quality and shelf life of food products	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Discuss milk and its nutritional value and apply total quality management systems into processes CO2: Analyze the manufacturing aspects of various dairy products. CO3: Explain the importance of utilization and manufacturing of dairy waste products. CO4: Understand the importance of fortification and enrichment in dairy based nutraceuticals. CO5: Explain key functions in production steps, standards, and defects of various dairy products. CO6: Review potential applications and efficiency of various equipment used in dairy products processing.	
7.	Course Description	Dairy Technology is a course which focuses on dairy products and is a part of the food technology and processing industry. Students pursuing dairy technology learn about milk processing as well the manufacturing process for its by-products. The study includes quality control at the time of processing of products. The course helps in gaining technical knowledge about dairy processing equipment.	
8	**Outline syllabus**		**CO Mapping**
	Unit 1	**Technology of milk and dairy products**	CO1,CO6
	A	Introduction, Composition and Processing of milk; Pasteurisation, sterilization, HTST and UHT processes	
	B	TQM in Dairy Industry	
	C	In-plant cleaning system.	
	Unit 2	**Manufacturing of dairy products**	CO2, CO6
	A	Manufacture of condensed milk, milk powder, cheese, ice-cream, butter, ghee, malted products	
	B	Manufacturing of evaporated and dried products, their evaluation and quality parameters,	
	C	Defects encountered during production, packaging, and storage.	
	Unit 3	**Substitutes for milk and milk products**	CO3, CO6
	A	Casein and caseinates, lactose,	

	B	Whey protein concentrates and isolates,		
	C	Milk co precipitates, and other by-products		
	Unit 4	**Fortification and enrichment**		CO4, CO6
	A	Technology of baby foods, weaning foods.		
	B	Therapeutic foods.		
	C	Fortification and enrichment of milk products.		
	Unit 5	**Traditional dairy products processing**		CO5, CO6
	A	Milk confections such as yoghurt, dahi		
	B	Khoa, burfi, kalakand		
	C	Gulab jamun, Rosogolla, Sri Khand, Chhana, Paneer, Ghee.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	Internal (CA+MSE)		ESE
		25%		75%
	Text book/s*	1. Dey, S. 1994. Outlines of Dairy Technology. Oxford Univ. Press, New Delhi.		
	Other References	1. Aneja et al. 2002. Technology of Indian Milk Products. Dairy India Publ. De S.1980. Outlines of Dairy Technology. Oxford Univ. Press. **2.** Walstra et al. 2006. Dairy Science and Technology. 2nd Ed. Taylor & Francis.		

CO-PO-PSO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	2	3	-	1	3	2	3	2	2
CO2	3	3	1	2	2	3	3	-	3	3	3	3	2
CO3	3	3	1	2	2	2	2	-	3	3	3	3	3
CO4	3	3	1	2	2	2	2	-	3	2	3	2	2
CO5	3	3	1	2	2	2	2	-	3	2	3	2	2
CO6	3	3	1	2	2	1	2	3	3	3	2	3	2
Avg	3.00	2.83	1.17	1.83	2.00	2.17	2.20	2.00	3.00	2.50	2.83	2.50	2.17

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: FST 217 Course Title: Basics of Nutrition Sciences

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2024-25**	
Branch: Food Science and Technology		**SEMESTER: 4th**	
1	Course Code	**FST 217**	
2	Course Title	**Basics of Nutrition Sciences**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	To develop basic knowledge of food as nutritional component, its related disorders, food hygiene and regulatory laws.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Define food and its nutritional value. CO2: Provide an overview of the major macro and micronutrients relevant to human health CO3: Comprehend the importance of nutrition in health and disease. CO4: Discuss the scientific rationale for defining nutritional requirements in healthy individuals and populations, with reference to specific conditions such as pregnancy, lactation, and older age. CO5: Describe the role of microbes as food. CO6: Identify and understand the role of personal hygiene and food sanitation in food processing.	
7	Corse discription	This course has been designed to make student understand the value nutritional requirements and the role of food sanitation, safety in food manufacturing.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Components of food**	CO1,CO6
	A	Introduction of Food	
	B	Major nutrition in food: Carbohydrates, Lipids, proteins	
	C	Micro components of Food including minerals and trace elements	
	Unit 2	**Food Disorders**	CO2, CO6
	A	Food proteins disorders;	
	B	Food Carbohydrate and lipids disorders;	
	C	Food trace elements disorders	
	Unit 3	**Growth of Microorganisms in Food**	CO3, CO6
	A	Food as a substrate for microorganisms;	
	B	Factors affecting growth of microbes;	
	C	Use of Microbes in Food industry	
	Unit 4	**Food Safety Aspects at National Level**	CO4, CO6
	A	Personal Hygiene procedures	
	B	Food Safety guidelines	
	C	Food regulatory agencies and laws	
	Unit 5	**Food safety asp[ects**	CO5, CO6

	A	Internals Laws/Regulation for ensuring Food Safety		
	B	Codex Alimentations Commission		
	C	ISO, WTO		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	Internal (CA+MSE)		ESE
		25%		75%
	Text book/s*	1. Food Science - Fifth Edition | Norman N. Potter | Springer		
	Other References	2. Essentials of Food & Nutrition by Swaminathan, Vol. 1 & 2 (2012). 3. Frazier, W. C. and Westhoff, D. C. (2007) Food Microbiology. Tata McGraw Hill Publishing Company Ltd. New Delhi		

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	2	1	2	3	-	2	-	3	3	1	-
CO2	3	2	3	1	2	3	-	2	2	2	2	2	3
CO3	2	2	3	1	2	3	-	2	3	1	3	3	2
CO4	3	2	2	1	2	3	-	1	2	2	2	3	2
CO5	3	-	2	1	2	1	-	1	1	1	3	3	3
CO6	3	-	2	1	2	2	-	2	2	2	3	3	3
Avg	2.50	1.75	2.33	1.00	2.00	2.50	0	1.67	2.00	1.83	2.67	2.50	2.60

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: FST 218 Course Title: Meat, Poultry and Marine food processing

School: SSBSR		**Batch: 2023-27**	
Programme:B.Sc		**Current Academic Year: 2024-25**	
Branch: Food Science and Technology		**SEMESTER: 4th**	
1	Course Code	**FST 218**	
2	Course Title	Meat, Poultry and Marine Food Processing	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Minor	
5	Course Objective	This course shall educate students about the importance of meat and poultry industry in nation's economy. The students shall gain knowledge of the processing and preservation of meat, poultry and seafoods	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Understand the current scenario of meat and poultry industry in India. CO2: Learn the glossary of live market terms for animals and birds. CO3: Understand the processing of meat, poultry, and sea foods. CO4: Grasp knowledge of factors affecting meat quality and different preservation techniques. CO5: Value-addition to poultry and fish by-products. CO6: Better understanding of the meat processing industry to produce highly nutritious and good quality meat and meat products.	
7	Corse description	. This course has been designed to make student understand the processing and preservation technology for meat, poultry, and marine foods.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Introduction**	CO1,CO6
	A	Livestock and poultry population in India,	
	B	Development of meat and poultry industry in India and its need in nation's economy,	
	C	Glossary of live market terms for animals and birds	
	Unit 2	**Meat preservation and quality**	CO2, CO6
	A	Effects of feed, breed and environment on production of meat animals and their quality	
	B	Meat Quality-color, flavor, texture, Water-Holding Capacity (WHC)	
	C	Preservation of meat Refrigeration and freezing, thermal processing-canning of meat, retort pouch, dehydration, and RTE meat products, meat curing	
	Unit 3	**Slaughtering and Carcass Processing**	CO3, CO6
	A	Modern abattoirs, typical layout and features, Ante-mortem handling,	
	B	Stunning methods; Steps in slaughtering and dressing; offal handling and inspection	

	C	Operational factors affecting meat quality; effects of processing on meat tenderization	
	Unit 4	**Processing of Poultry Products**	CO4, CO6
	A	Poultry industry in India; measuring the yields and quality characteristics of poultry products, Microbiology of poultry meat, spoilage factors	
	B	Poultry meat processing operations, equipment used – Defeathering, bleeding, scalding etc.; Packaging of poultry products, refrigerated storage of poultry meat	
	C	By products – eggs, egg products, Whole egg powder, Egg yolk products, their manufacturing, packaging, and storage.	
	Unit 5	**Fish and Marine Products Processing**	CO5, CO6
	A	Commercially important marine products from India; product export and its sustenance	
	B	Preservation of postharvest fish freshness; transportation in refrigerated vehicles; design of refrigerated and insulated trucks, preservation of shell fish.	
	C	Pickling and preparation of fish protein concentrate, fish oil and other by-products.	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	ESE
		25%	75%
	Text book/s*	1. Forrest JC. 1975. Principles of Meat Science. Freeman	
	Other References	2. Govindan TK. 1985. Fish Processing Technology. 3. IBH. Hui YH. 2001. Meat Science and Applications. Marcel Dekker. 4. Kerry J. et al. 2002. Meat Processing. Woodhead Publ. CRC Press. Levie A. 1984.	

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	3	2	3	2	1	3	2	1
CO2	3	1	2	2	2	3	1	-	-	2	3	2	1
CO3	3	3	2	2	3	2	1	2	3	2	3	2	3
CO4	3	3	2	2	3	2	2	2	3	2	3	2	3
CO5	3	3	2	2	3	2	1	2	3	2	3	2	3
CO6	3	3	2	2	3	2	2	2	3	2	3	2	3
Avg	3	2.6	2	1.8	2.6	2.3	1.5	2.2	2.8	1.8	3	2	2.3

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: BBI214 Course Title: Introduction to Human Physiology

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2024-25**	
Branch: Food Science and Technology		**SEMESTER: 4th**	
1	Course Code	**BBI214**	
2	Course Title	**Introduction to Human Physiology**	
3	Credits	**5**	
4	Contact Hours (L-T-P)	**5-0-0**	
	Course Status	Minor	
5	Course Objective	To understand the functioning of major human system including digestive, respiration, kidney, reproductive system etc	
6	Course Outcomes	The student at the completion of the course will be able to: CO1: Understand the digestion and absorption of the body. CO2: Describe the structure and functions of nerve and muscles CO3: Illustrate the concept of physiology of respiration CO4: Compare different ways of the Renal Physiology and Cardiovascular Physiology. CO5: Assess the functioning of Endocrine and Reproductive system CO6: Elaborate the concept of the basic functioning of human physiology.	
	Course Description	This course comprises of the structure, function of major systems to understand the holistic view of human functioning. Several different systems viz. respiratory, digestive, kidney, cardiovascular, reproductive, endocrine system will be studied for basic understanding.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Digestion and Absorption of Food**	CO1,CO6
	A	Structure and function of digestive glands	
	B	Digestion and absorption of carbohydrates, fats and proteins	
	C	Nervous and hormonal control of digestion (in brief)	
	Unit 2	**Functioning of Excitable Tissue (Nerve and Muscle)**	CO2, CO6
	A	Structure of neuron, Propagation of nerve impulse (myelinated and non-myelinated nerve fibre);	
	B	Structure of skeletal muscle	
	C	Mechanism of muscle contraction (Sliding filament theory), Neuromuscular junction	
	Unit 3	**Respiratory Physiology**	CO3, CO6
	A	Ventilation, External and internal Respiration	
	B	Transport of oxygen and carbon dioxide in blood	
	C	Factors affecting transport of gases	
	Unit 4	**Renal Physiology and Cardiovascular Physiology**	CO4, CO6
	A	Functional and anatomy of kidney,	

	B	Mechanism and regulation of urine formation		
	C	Structure of heart, Coordination of heartbeat, Cardiac cycle, ECG		
	Unit 5	**Endocrine and Reproductive Physiology**		CO5, CO6
	A	Structure and function of endocrine glands		
	B	Pituitary, thyroid, parathyroid, pancreas, adrenal, ovaries, and testes,		
	C	Brief account of spermatogenesis and oogenesis, Menstrual cycle		
	Mode of examination	Theory		
	Weightage Distribution	CA+MSE		ESE
		25%		75%
	Text book/s*	Molecular Biotechnology. Principles and Applications. 3rd Edition. Glick BR and Pasternak JJ. ASM Press @2003. ISBN 1-55581-224-4.		
	Other References	Gene cloning and DNA Analysis- An Introduction. 6th Edition. Wiley-Blackwell. Brown TA, 2010		

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO3	-	-	-	-	-	-	-	-	-	-	1	-	-
CO4	-	-	-	-	-	-	-	-	-	-	1	-	-
CO5	-	-	-	-	-	-	-	-	-	-	1	-	-
CO6	-	-	-	-	-	-	-	-	-	-	1	-	-
Avg	-	-	-	-	-	-	-	-	-	-	1	-	-

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: FBP 218 Course Title: Processing of Dairy Products Lab

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2024-25**	
Branch: Food Science and Technology		**SEMESTER: 4th**	
1	Course Code	**FBP 218**	
2	Course Title	**Processing of Dairy Products Lab**	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	The objective of the Processing of Dairy Products Lab is to provide students with hands-on experience and practical knowledge in various aspects of dairy product processing and analysis. The lab aims to enhance their understanding of the principles, techniques, and technologies involved in the production of different dairy products and their quality analysis.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Describe different test to check quality of Raw and processed milk CO2: Evaluate an overview of the major macro and micronutrients relevant to human health available in milk. CO3: Manufacturing and processing of various milk products CO4: Analysis of milk safety and microbial spoilage CO5: Application of Total Quality Management Systems into processes. CO6: Understand processing conditions for different dairy products.	
7	Corse discription	The Processing of Dairy Products Lab is an integral component of the dairy science curriculum, designed to provide students with hands-on experience in the processing and production of various dairy products. This lab complements the theoretical knowledge gained in related courses and offers a practical understanding of the principles, techniques, and technologies involved in the dairy industry.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Platform test to check quality of raw milk**	CO1,CO6
	A	Clot on boiling test (COB), MBR Test	
	B	Alcohol Test, Sediment Test)	
	C	Determination of SNF Content in Milk.	
	Unit 2	**Fat and Protein analysis in Milk**	CO2, CO6
	A	Determination of milk protein content	
	B	Determination of Fat content in Milk sample	
	C	Determination of Fat content in Milk and Milk Products	
	Unit 3	**Development of milk product**	CO3, CO6
	A	Development of Yogurt	
	B	Development of cheese	
	C	Development of Soy Tofu	
	Unit 4	**Other test in milk**	CO4, CO6
	A	Determination of Titratable Acidity in Milk	

	B	Determination of Overrun in Ice cream.		
	C	Determination of Overrun in Ice cream.		
	Unit 5	**Adulteration test in Milk**		CO5, CO6
	A	Adulteration test in Milk		
	B	Determination of Adulteration in Milk products		
	C	Quality Testing of Butter oil / Ghee		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	CA	CE	ESE
		25%	25%	50%
	Text book/s*	1. Ramesh C. Chandan: Dairy-based Ingredients, Eagan Press, 1997		
	Other References	2. Sukumar De: Outlines of Dairy Technology, Oxford University Press, 1980 3. Aneja, Mathur, Chandan & A.K.Bannerji: Technology of Indian Milk Products: Dairy India Publication		

CO-PO-PSO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	2	3	2	1	1	3	3	3	2	2
CO2	3	3	2	2	1	2	1	1	3	3	3	2	2
CO3	3	3	2	2	2	2	2	3	3	3	3	1	2
CO4	3	3	2	2	2	2	2	3	3	3	3	1	2
CO5	3	1	2	2	2	1	2	3	2	2	3	2	2
CO6	3	2	2	2	2	3	1	1	3	2	3	2	2
Avg	3.00	2.50	1.83	2.00	2.00	2.00	1.50	2.00	2.83	2.67	3.00	1.67	2.00

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: FBP 219 Course Title: Basics of Nutrition Sciences Lab

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2024-25**	
Branch: Food Science and Technology		**SEMESTER: 4th**	
1	Course Code	**FBP 219**	
2	Course Title	**Basic of Nutrition Sciences Lab**	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	1. To develop practical knowledge about different food nutrition. 2. To demonstrate the importance of food nutrition in human.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Identify the starchy foods. CO2: Identify the sugary foods. CO3: Identify the presence of fat and protein in food products. CO4: Estimate the moisture and ash content of food products. CO5: Compare the different food products on the basis of nutrients. CO6: Understand the principles of nutrition science.	
7	Corse discription	This course presents the fundamental scientific principles of human nutrition. Students will become familiar with food sources; recommended intake levels, disorder related to food deficiency, microbial spoilage of food and safety aspects of food.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Practical related to starch.**	CO1,CO6
	A	Identify the presence of starch in the given sample.	
	B	Identify the adulteration of food product with starch.	
	C	Isolation of starch from cereals/legumes	
	Unit 2	**Practical related to presence of sugar.**	CO2, CO6
	A	Identify the presence of reducing sugar in given sample.	
	B	Estimation of non-reducing sugar in given sample.	
	C	Estimation of total sugar in given sample.	
	Unit 3	**Practical related to presence of fat and protein.**	CO3, CO6
	A	Estimation of fat in given sample.	
	B	Estimation of protein in given any flour sample.	
	C	Estimation of protein in milk sample.	
	Unit 4	**Practical related to moisture content and ash content.**	CO4, CO6
	A	Determination of moisture content in given sample.	
	B	Determination of ash content in given sample.	
	C	Determination of ash content in given sample.	
	Unit 5	**Practical related to comparison of different food products.**	CO5, CO6
	A	Compare the level of vitamin C in different food products.	

	B	Compare the sweetness of different varieties of apples.		
	C	Compare the level of iron in different breakfast cereals.		
	Mode of examination	Practical and Viva		
	Weightage Distribution	CA	CE	ESE
		25%	25%	50%
	Text book/s*	**1.** Bevier, I. (1914). *Food and Nutrition Laboratory Manual*. Boston: Whitcomb & Barrows.		
	Other References	2. Essentials of Food & Nutrition by Swaminathan, Vol. 1 & 2 (2012).		

CO-PO-PSO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1	1	2	3	-	3	2	2	3	3	2
CO2	2	2	1	1	2	3	-	2	2	2	3	3	2
CO3	2	2	1	1	2	2	-	2	2	2	3	3	2
CO4	3	2	1	1	2	2	-	2	2	2	3	3	2
CO5	3	2	3	1	2	3	-	-	2	2	2	1	1
CO6	3	3	2	2	2	3	1	-	2	2	2	1	1
Avg	2.50	2.17	1.50	1.17	2.00	2.67	1.00	2.25	2.00	2.00	2.67	2.33	1.67

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: FBP 214 **Course Title: Animal Food Lab**

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2024-25**	
Branch: Food Science and Technology		**SEMESTER: 4th**	
1	Course Code	**FBP214**	
2	Course Title	**Animal Food Lab**	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status	Minor	
5	Course Objective	1. To develop practical knowledge about different Animal foods 2. To demonstrate the importance of food nutrition in human. 3. To determine the amount of different nutrient content in animal food. 4. To check the shelf life of meat, poultry and egg products and microbial spoilage in meat products.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Identify the quality parameters of egg. CO2: Understand basic techniques to preserve meat and meat products. CO3: Explain the importance of Crude fiber in daily life and how to analyses it from animal feed. CO4: Understand how to prepare standard solution and able to explain normality and Molarity. CO5: Analyze the microbial quality of meat and poultry. CO6: Estimation of physical properties of the animal products and industrial visit.	
7	Corse discription	This course presents the fundamental scientific principles of human nutrition. Students will become familiar with food sources; recommended intake levels, disorder related to food deficiency, microbial spoilage of food and safety aspects of food.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Practical related to starch.**	CO1,CO6
	A	Identify the presence of starch in the given sample.	
	B	Identify the adulteration of food product with starch.	
	C	Isolation of starch from cereals/legumes	
	Unit 2	**Practical related to presence of sugar.**	CO2, CO6
	A	Identify the presence of reducing sugar in given sample.	
	B	Estimation of non-reducing sugar in given sample.	
	C	Estimation of total sugar in given sample.	
	Unit 3	**Practical related to presence of fat and protein.**	CO3, CO6
	A	Estimation of fat in given sample.	
	B	Estimation of protein in given any flour sample.	
	C	Estimation of protein in milk sample.	
	Unit 4	**Practical related to moisture content and ash content.**	CO4, CO6

	A	Determination of moisture content in given sample.	
	B	Determination of ash content in given sample.	
	C	Determination of ash content in given sample.	
	Unit 5	**Practical related to comparison of different food products.**	CO5, CO6
	A	Compare the level of vitamin C in different food products.	
	B	Compare the sweetness of different varieties of apples.	
	C	Compare the level of iron in different breakfast cereals.	
	Mode of examination	Practical and Viva	
	Weightage Distribution	Internal (CA+MSE)	ESE
		25%	75%
	Text book/s*	**1.** Bevier, I. (1914). *Food and Nutrition Laboratory Manual*. Boston: Whitcomb & Barrows.	
	Other References	2. Essentials of Food & Nutrition by Swaminathan, Vol. 1 & 2 (2012).	

CO-PO-PSO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	1	2	3	-	3	2	2	3	3	2
CO2	3	2	1	1	2	3	-	2	2	2	3	3	2
CO3	3	2	1	1	2	2	-	2	2	2	3	3	2
CO4	3	2	1	1	2	2	-	2	2	2	3	3	2
CO5	3	2	3	1	2	3	-	-	2	2	2	1	1
CO6	3	3	2	2	2	3	-	-	2	2	2	1	1
Avg	3.00	2.17	1.50	1.17	2.00	2.67	0	2.25	2.00	2.00	2.67	2.33	1.67

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: RBL 002 **Course Title: Research Based Learning II**

School: SSBSR		**Batch: 2023-27**		
Programme: B.Sc		**Current Academic Year: 2024-25**		
Branch: Food Science and Technology		**SEMESTER: 4th**		
1	Course Code	**RBL 002**		
2	Course Title	**Research Based Learning II**		
3	Credits	**Audit Based**		
4	Contact Hours (L-T-P)	**0-0-4**		
	Course Status	Compulsory		
5	Course Objective	Develop knowledge of a specific area of specialization. Develop research skills especially in biological experiments, project writing and oral presentation		
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Articulate research-based investigation done on a topic CO2: Demonstrate capacity to identify theoretical/experimental method followed in the research articles CO 3: Demonstrate an understanding of the ethical issues associated with practitioner research CO4: Compare research data and extract the outstanding results CO5: Report research findings in written and verbal forms CO6: Use research findings to advance education theory and practice		
7	Corse discription	Research-based learning (RBL) aims to promote and develop student competencies related to research practice and to benefit students through activities linked to research [This technique implies the application of learning and teaching strategies that link research with teaching		
7	**Outline syllabus**			**CO Mapping**
	Unit 1	Introduction to various research problems		CO1,CO6
	Unit 2	Design experiments to find a solution to the problem		CO2,CO6
	Unit 3	Perform experiments		CO3,CO6
	Unit 4	Compile and analyse results		CO4,CO6
	Unit 5	Presentation and Report writing		CO5 ,CO6
	Mode of examination	Continuous Assessment (CA): 25 Marks Viva-Voce (on the basis of weekly Viva performance): 25 Marks ETE: 50 marks (Quiz for 15 marks; Lab Work for 15 Marks; Viva for 10 Marks and Lab record for 10 marks)		
	Weightage Distribution	CA	CE	ESE
		25%	25%	75%
	Text book/s*	Any lab manual related subject and peer reviewed Research Articles		

CO-PO-PSO Mapping

COs /POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	1	2	1	1	2	2	2	1	2	1	1
CO2	2	2	1	1	1	1	2	1	1	1	2	2	2
CO3	1	2	2	1	2	1	1	1	2	2	1	1	2
CO4	2	3	2	2	1	1	3	3	2	1	3	2	2
CO5	1	1	1	2	1	1	1	2	2	1	3	2	2
CO6	2	3	2	3	1	1	1	2	2	1	3	2	1
Avg	1.50	2.00	1.50	1.83	1.17	1.00	1.67	1.83	1.83	1.17	2.33	1.67	1.67

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: CHE 113 **Course Title: Chemistry IV**

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2024-25**	
Branch: Food Science Technology		**SEMESTER: 4th**	
1	Course Code	**CHE 113**	
2	Course Title	**Chemistry IV**	
3	Credits	**3**	
4	Contact Hours (L-T-P)	**3-0-0**	
	Course Status	Minor	
5	Course Objective	1.To provide the basics of Chemical equilibrium, ionic equilibrium, thermochemistry and chemical kinetics so as to apply on various biological systems. 2.To make students confident in making solutions of concentrations and standardize them.	
6	Course Outcomes	After successful completion of this course students will be able to: 1. Understand basics of Chemical equilibrium. 2. Identify the components of a buffer and their function and realize the different types of salts solution and their pH 3. explain the concept of enthalpy change in different reactions and Heat capacities. 4. recognize the order of reactions and role and working of catalyst 5. prepare solutions with desired molar or percent concentrations and carry out dilutions of these solutions and different types of titrations and understand the choice of indicators apply the basic knowledge to solve various analytical problems.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Chemical Equilibrium**	
	A	Law of mass action; Thermodynamic treatment of Law of mass action, Relation between Kp, Kc and Kx	CO1
	B	Variation of equilibrium constant with temperature - The Van't Hoff Equation;	CO1
	C	Le-chatelier's principle and its application.	CO1,CO6
	Unit 2	**Ionic Equilibrium**	
	A	Strong and Weak acids and bases, ionization constants of weak acids and bases, pH and pOH, Ionic product of water	CO2,
	B	Common Ion Effect, Buffers and their types, pH of buffers- Henderson equation for acidic and basic buffers.	CO2, CO6
	C	Solubility products, Salt Hydrolysis and pH of salt solutions	CO2
	Unit 3	**Thermochemistry**	
	A	Principles of heat flow, enthalpy, calorimetry, Heat capacity (C_v and C_p) and specific heats	CO3, CO6
	B	Hess's Law, heats of formation, Different types of Heat of a reaction	CO3, CO6
	C	Effect of temperature on heat of reaction, at constant pressure	

		(Kirchoff's Equation).	CO3, CO6
	Unit 4	**Chemical Kinetics**	
	A	Rates of reactions and its expressions, Reactions of Zero, First and second order, half lives	CO4, CO6
	B	Determination of order of reactions by half life method, Activation energy, Effect of temperature on rate of reaction	CO4, CO6
	C	Types and characteristics of catalysis, Elementary enzyme catalyzed reactions	CO4, CO6
	Unit 5	**Titrations**	
	A	General principle. Requirements for titrimetric analysis and Concentration systems	CO5, CO6
	B	Primary and secondary standards, criteria for primary standards, Types of titrations, Limitation of volumetric analysis	CO5, CO6
	C	endpoint and equivalence point, Theoretical aspects of acid-base titration curves and end point evaluation, Choice of indicators	CO5, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA+MSE	ESE
		25%	75%
	Text book/s*	1. Essentials of Physical Chemistry by B.S. Bahl and G.D. Tuli. 2. Concise Inorganic Chemistry by J. D. Lee 5th Edition. 3. Stereochemistry Conformation and Mechanism By P S Kalsi 4. College Chemistry by Linus Pauling	
	Other References	1. Text Book of Physical Chemistry by Samuel Glasstone 2. Physical Chemistry by Walter J Moore 3. Physical Chemistry by Atkin Arthur I. Vogel's Quantitative Inorganic Analysis including Elementary Instrumental Analysis, ELBS, Longmann Group, 5th Edition, 1989.	

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	2	-	-	2	-	-
CO2	2	2	1	-	-	-	2	1	1	1	3	-	-
CO3	2	1	1	-	-	-	1	1	1	1	2	-	-
CO4	2	2	1	-	-	-	2	1	1	1	2	-	-
CO5	2	2	2	-	-	-	2	1	1	1	2	-	-
CO6	2	3	2	-	-	-	2	2	1	1	2	-	-
Avg	2.00	2.00	1.40	0	0	0	1.80	1.33	1.00	1.00	2.17	0	0

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

SEMESTER – V

Course code: FST312 Course Title: Principles and Process of Food Preservation

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2023-2024**	
Branch: Food Science and Technology		**SEMESTER: 5th**	
1	Course Code	FST312	
2	Course Title	Principles and Process of Food Preservation	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	• The course is designed for understanding of student about the various principles involve in food preservation. • 2. This course demonstrates technology and various industrial processes which involved in food preservation	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Define the principles and methods of food preservation, thermal processing equipment and calculate adequacy of heat treatment. CO2: Demonstrate the principles, technology, industrial methods and application of preservation by low temperature CO3: Apply the principles, technology, industrial methods and application of preservation by moisture removal CO4: Compare the principles, technology, industrial methods and application of preservation by irradiation and membrane technology CO5: Define the uses and effects of chemical preservatives in food Industry with principle, mechanism, and application of various novel techniques in food preservation CO6: Adopt the various conventional and novel food preservation techniques	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Principles of preservation**	CO1, CO6
	A	Scope and importance of food processing, Historical developments in food processing.	
	B	Types of foods and causes of food spoilage.	
	C	Principles and methods of preservation. Heat preservation and processing, heat resistance of microorganisms, thermal death curve, D, F and Z value, types of heat treatments and effects on foods, Canning of foods, cans and container types, spoilage of canned foods, heat penetration.	
	Unit 2	**Cold preservation**	CO2, CO6
	A	Cold preservation and processing	
	B	Requirement of refrigeration and freezing, vapour compression cycle, Difference between refrigeration and freezing, effect of low temperature on fresh food, storage changes in food during refrigerated storage.	

	C	Freezing and frozen storage, Slow and quick freezing, freezing curves, Freezing methods, factors determining freezing rate, changes in food during freezing, Frozen food storage.	
	Unit 3	**Moisture reduction in Preservation**	CO3, CO6
	A	Drying, Dehydration and concentration, Sun drying and solar dehydration, Drying methods Drying curves, and type of dryers	
	B	Food concentration, Methods of concentration of fruit juices, Liquid food concentrates, Changes in food during dehydration and concentration.	
	C	Water activity; Role of water activity in food preservation, Intermediate moisture foods (IMF), Principles, characteristics, advantages and problems of IM foods	
	Unit 4	**Irradiation**	CO4, CO6
	A	Food Irradiation, Use of ionization radiations in food preservation, Sources, Units, effects, limitations, dose determination, safety and wholesomeness of irradiated foods,	
	B	Food irradiation techniques and recent applications of irradiation in food preservation.	
	C	Chemical Preservation, Uses and effects of class I and class II preservatives in foods, membrane technology	
	Unit 5	**Novel Techniques in Food Preservation**	CO5, CO6
	A	Hydrostatic pressure, dielectric heating, microwave processing.	
	B	Hurdle technology- Properties, mechanism of heating.	
	C	Application in food processing and its effects on nutrients.	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. Norman, N.P and Joseph, H.H. (1997). Food Science, Fifth edition, CBS Publication, New Delhi.	
	Other References	1.Kalia M. and Sangita, S. (1996): Food Preservation and Processing, First edition, Kalyani Publishers, New Delhi. 2.Sivasankar, B. (2002): Food Processing and Preservation, Prentice Hall of India Pvt. Ltd., New Delhi.	

CO-PO PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	1	0	1	1	1	2	2	2	3	1	2
CO2	3	2	0	2	1	1	3	3	3	2	3	1	3
CO3	3	3	0	2	1	2	1	3	3	1	3	1	3
CO4	3	3	0	2	1	2	1	3	3	1	3	1	3
CO5	3	3	0	2	1	2	1	3	3	1	3	1	3
CO6	3	3	0	2	1	2	1	3	3	1	3	1	3
Avg	3.00	2.83	0.17	1.67	1.00	1.67	1.33	2.83	2.83	1.33	3.00	1.00	2.83

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: FST311 **Course Title: Principles of Food Microbiology**

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2023-2024**	
Branch: Food Science and Technology		**SEMESTER: 5th**	
1	Course Code	FST311	
2	Course Title	Principles of Food Microbiology	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	To develop knowledge of different groups of microbes and getting an overall idea of food-borne microbes involved in beneficial and harmful activities	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Select the microbes associated with food, their classification and factors affecting their growth CO2: Explain fermented foods and their microflora CO3: Identify the food spoilage in different classes of food CO4: Examine and detect food-borne pathogens CO5: Compare the microbial destruction methods CO6: Develop an overall idea of food-borne microbes involved in beneficial and harmful activities and methods of influencing their growth and survival	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Microorganisms of Food**	CO1, CO6
	A	History of Food Microbiology	
	B	Microorganisms associated with foods. Bacteria, fungi, viruses, protozoa, toxic algae.	
	C	Extrinsic and Intrinsic Factors affecting Microbial Growth.	
	Unit 2	**Fermented and microbial foods**	CO2, CO6
	A	Fermented and microbial foods: Fermented Milk and milk products, Single cell protein, Fermented fruits and vegetables, Fermented fish, Fermented meats	
	B	Fermented beverages- Beer, Vinegar and Wine	
	C	Concept of Probiotics and health benefits	
	Unit 3	**Food Spoilage**	CO3, CO6
	A	Detection of food-borne organisms and diseases,	
	B	Concept of Metabolically injured organisms their examination,	
	C	Bioassays for detecting microbes	
	Unit 4	**Diagnosis**	CO4, CO6
	A	Detection of food-borne organisms and diseases,	
	B	Concept of Metabolically injured organisms their examination,	
	C	Bioassays for detecting microbes	
	Unit 5	**Destruction of microorganisms**	CO5, CO6

	A	Principles underlying the destruction of microorganisms,		
	B	Destruction of microorganisms by physical and chemical methods.		
	C	Heating process, Irradiation, Low temperature storage, Chemical preservatives, High-pressure processing, Control of water activity.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	Internal (CA+MSE)		ESE
		25%		75%
	Text book/s*	1. Frazier, W. C. and Westhoff, D. C. (2007) Food Microbiology. Tata McGraw Hill Publishing Company Ltd. New Delhi. 2. Adams, M. R. and Moss, M. O. (2005) Food Microbiology (Second edition).Royal Society of Chemistry Publication, Cambridge.		
	Other References	1. Jay, J.M. (2008) Modern Food Microbiology (Sixth Edition).Aspen Publishers, Inc. Gaithersburg, Maryland.		

CO-PO PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	0	1	1	1	0	1	1	1	3	1	2
CO2	3	2	0	2	1	1	0	1	1	2	2	3	3
CO3	3	1	1	2	1	1	1	2	1	2	3	2	3
CO4	3	1	1	2	1	1	1	2	1	2	3	2	3
CO5	3	2	1	2	1	1	2	1	3	2	3	1	3
CO6	3	2	1	2	1	2	1	3	2	3	3	1	2
Avg	2.67	1.50	0.67	1.83	1.00	1.17	0.83	1.67	1.50	2.00	2.83	1.67	2.67

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: FST313 Course Title: Sensory Evaluation of Food

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2023-2024**	
Branch: Food Science and Technology		**SEMESTER: 5th**	
1	Course Code	FST313	
2	Course Title	Sensory Evaluation of Food	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	This course aims to provide deeper and broader knowledge and practical tools in experimental design and sensory analysis**.** Students can apply the sensory evaluation skills to evaluate the acceptability of new food products after the R&D development.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Define the basics of sensory evaluation, various factors and types of flavours in foods CO2: Explain the perception of flavours in the form of taste and odours CO3: Identify the perception of flavours in the form of colour and texture CO4: Analyse and apply sensory evaluation methodology CO5: Explain and apply various instrumentation methodologies for sensory evaluation CO6: Discuss the application of sensory evaluation in Food Industry.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Introduction**	CO1, CO6
	A	Importance of sensory evaluation of food products in relation to consumer acceptability and economic aspects;	
	B	Factors affecting food acceptance; Terminology related to sensory evaluation-Flavour and odour, sensory testing environment and protocols	
	C	Factors influencing sensory measurements, Flavouring materials and flavouring materials made by processing, Artificial flavour	
	Unit 2	**Basic Principles of sensory perception – I**	CO2, CO6
	A	Taste: Introduction and importance of taste, Structure and physiology of taste organs- tongue, papillae, taste buds, salivary glands,	
	B	Mechanism of taste perception, Chemical dimensions of basic tastes- sweet, salt, sour, bitter and umami, Factors affecting taste quality, reaction time, taste modification, absolute and recognition threshold, Taste abnormalities, Taste measurement	
	C	Odour: Introduction, definition and importance of odour and flavour, Anatomy of the nose, physiology of odour perception, Mechanism of odour perception, Odour classification, chemical specificity of odour, Odour measurement using different techniques –historical perspective and emphasis on recent techniques like e-nose, Merits and demerits of each method. Olfactory abnormalities	

	Unit 3	**Basic Principles of sensory perception – II**	CO3, CO6
	A	Colour: Introduction and importance of colour, Dimensions and attributes of colour, appearance factors, gloss etc., Perception of colour, Colour abnormalities.	
	B	Measurement of colour; Munsell colour system, CIE colour system, Hunter colour system, spectrophotometry, colourimetry, advances in colour measurement.	
	C	Texture: Introduction, definition and importance of texture, Phases of oral processing, Texture perception, receptors involved in texture perception, Texture classification, Texture measurement – basic rheological models, forces involved in texture measurement, Some objective methods of texture evaluation of foods- mixograph, amylograph, spreadimeter, compressimeter etc.	
	Unit 4	**Sensory Evaluation Methodology**	CO4, CO6
	A	Sampling procedures, Laboratory quality measurement: Types of tests, panel selection and testing environment, serving procedures, instruction to judges	
	B	Difference tests, directional difference tests, classification of difference tests, two-sample tests, three-sample tests, multisampling tests, comparison of procedures, ranking, scoring, hedonic scaling, dilution procedures, descriptive sensory analysis, contour method, other procedures.	
	C	Application of sensory testing: sensory evaluation in food product development, sensory evaluation in quality control and assessment.	
	Unit 5	**Instrumentation in sensory evaluation**	CO5, CO6
	A	Inter-relationship between sensory properties of food products and various instrumental and physicochemical tests.	
	B	Generally used analytical testing methods: Density/Specific Gravity, Refractive Index, Optical Rotation, Alcohol Content, Residual Solvent, Particle Size of Emulsions, Volatile Oil, Surface Oil, Moisture Content, Gas Chromatography, Spectroscopic Analysis, Microbial analysis, Aroma isolation methods, analysis of volatiles by gas chromatography, HPLC, Infrared spectrometry, Mass spectrometry.	
	C	Inter-relationship between sensory properties of food products and various instrumental and physicochemical tests.	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. Rao, E. S. (2013). *Food Quality Evaluation* (I ed.). New Delhi: Variety Book Publishers. 2. Reineccius, G. (2005). Flavor chemistry and technology. CRC press. 3. Taylor, A. J., & Linforth, R. S. (Eds.). (2002). Food flavour technology (p. 302). Sheffield: Sheffield Academic Press.	
	Other References	1. Lawless, H. T., & Heymann, H. (2010). Sensory evaluation of food: principles and practices (Vol. 2). New York: Springer. 2. Amerine, M. A., Pangborn, R. M., & Roessler, E. B. (2013). Principles of sensory evaluation of food. Elsevier.	

CO-PO PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	0	1	1	2	1	2	1	1	2	2	2
CO2	2	3	0	1	1	2	1	2	3	1	2	2	2
CO3	2	3	0	1	1	2	1	2	3	1	2	2	2
CO4	2	2	1	1	2	2	2	3	3	1	3	2	3
CO5	2	3	1	0	1	3	1	3	1	1	1	1	2
CO6	2	2	1	2	2	2	1	2	1	1	1	2	3
Avg	2.00	2.33	0.50	1.00	1.33	2.17	1.17	2.33	2.00	1.00	1.83	1.83	2.33

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: FST314 Course Title: Food Waste Management

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2023-2024**	
Branch: Food Science and Technology		**SEMESTER: 5th**	
1	Course Code	FST314	
2	Course Title	Food Waste Management	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Multidisplinary	
5	Course Objective	• Understanding the food industry waste. • Importance and need of management the industrial waste. • Various treatment methods available for food waste. • Types, availability and utilization of by-products from waste. • Bio methanation and bio composting technology for organic waste utilization • Industrial waste treatments and ways for waste disposal method. • 7.Food Additives; Food Adulteration	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Define the basic concept of waste and types. CO2: Illustrate the waste disposal method. Recognize the importance and utility of waste from food Industry CO3: Develop the treatment of plant waste by physical, chemical, and biological methods, Effluent treatment plants, Use of waste and waste water. Various hazards and their control measures. CO4: Compare the types, availability, and utilization of by-products of cereals, legumes & oilseeds, Utilization of by-products from food processing Industries. CO5: Explain status and utilization of dairy by-products. Industrial waste management CO6: Case study.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Introduction**	CO1, CO6
	A	Classification and characterization of food industrial wastes from fruit and vegetable processing industry, beverage industry, fish, meat and poultry industry, sugar industry and dairy industry;	
	B	Waste disposal methods – physical, chemical and biological; Economical aspects of waste treatment and disposal.	
	C	Identification of waste	
	Unit 2	**Treatment methods for liquid wastes**	CO2, CO6
	A	Treatment methods for liquid wastes, Treatment methods from food process industries;	
	B	Design of activated sludge process,	
	C	Rotating biological contactors, Trickling filters, UASB, Biogas plant.	
	Unit 3	**Treatment methods of solid wastes**	CO3, CO6
	A	Treatment methods of solid wastes,	

		Biological composting, drying and incineration; Design of solid waste, management system: Landfill digester, Vermicomposting pit.	
	B	Treatment methods of solid wastes, Biological composting, drying and incineration; Design of solid waste, management system: Landfill digester, Vermicomposting pit.	
	C	Treatment methods of solid wastes, Biological composting, drying and incineration; Design of solid waste, management system: Landfill digester, Vermicomposting pit.	
	Unit 4	**Bio filters and bio clarifiers**	CO4, CO6
	A	Bio filters and bio clarifiers,	
	B	Ion exchange treatment of waste water,	
	C	Drinking-water treatment, Recovery of useful materials from effluents by different methods	
	Unit 5	**Case Studies**	CO5, CO6
	A	Cane Sugar waste, molasses for alcohol,	
	B	Baggasse for paper pulp, chemicals, bioethanol, cogeneration	
	C	Milk Industry Case studies	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	ESE
		25%	75%
	Text book/s*	1.Handbook of Waste management and co-product recovery in Food Processing – Vol.1-Keith Waldron	
	Other References	1. Food Industry Wastes: Disposal and Recovery; Herzka A & Booth RG; 1981, Applied Science Pub Ltd.	

CO-PO PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	1	3	2	1	0	1	1	3	2	1	1
CO2	1	1	1	3	2	0	0	1	2	2	1	1	1
CO3	1	1	0	2	1	1	0	2	1	2	1	0	0
CO4	2	2	0	1	1	1	1	2	2	1	1	2	1
CO5	1	3	0	2	1	2	1	2	2	1	1	3	2
CO6	1	1	2	1	2	3	2	3	3	3	0	1	1
Avg	1.17	1.50	0.67	2.00	1.50	1.33	0.67	1.83	1.83	2.00	1.00	1.33	1.00

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

School: SBSR		**Batch: 2023-2027**	
Programme: B.Sc.		**Current Academic Year:**	
Branch: Food Science and Technology		**Semester: 5th**	
1	Course Code	**BMB 303**	
2	Course Title	Modern Industrial Microbiology	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Multidisplinary	
5	Course Objective	To acquaint students with basic concepts of industrial microbiology.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Understand the Bioreactor / Fermenter CO2: Describe about the Technology of Microbial cell maintenance. CO3: Explain about Downstream processing. CO4: Illustrate the Enzyme technology. CO5: Analyze about the Biological fuel generation CO6: Design the biotechnological methods in specific medical and industrial application.	
7	Outline syllabus		CO Mapping
	Unit 1	**Bioreactor / Fermenter**	
	A	Types & operation of Bioreactors, physicochemical standards used in bioreactors, limitations of bioreactors, stages of fermentation processes, Media design for fermentation processes, Solid substrate	CO1, CO6
	B	Fermentation, Fermenters (Stirred tank, bubble columns, airlift. Bioreactors, Static,	
	C	Submerged and agitated fermentation), advantages & disadvantages of solid substrate & liquid fermentations.	
	Unit 2	**Technology of Microbial cell maintenance**	
	A	Steps to maintain microbial culture in an aseptic & sterile environment (how to inoculate, preserve & maintain).	CO2, CO6
	B	Strain Preservation, maintenance and	
	C	Strain improvement by mutation of gene transfer.	
	Unit 3	**Downstream processing**	
	A	Extraction, separation, concentration, recovery & purification, operations (Insulin, Vitamins, Metabolites),	CO3, CO6

	B	Industrial production of Ethyl alcohol, Acetic Acid (Vinegar), Citric acid, lactic acid, α-amylase, protease penicillin, tetracycline and vitamin B12, with reference to easily available raw materials.			
	C	Production of herbal drugs.			
	Unit 4	**Enzyme technology**			
	A	Nature of enzymes, application of enzymes, limitations of microbial cells used as catalysts in fermentation,			CO4, CO6
	B	Multi-enzyme reactors, genetic engineering & protein engineering of enzymes, cloning strategy for enzymes, technology of enzyme production,			
	C	Use of immobilized cells and enzymes (Ca-alginate beads, polyacrylamide), industrial applications of immobilized enzymes.			
	Unit 5	**Biological fuel generation**			
	A	Photosynthesis, sources of biomass, ethanol from biomass, methane from biomass, hydrogen, microbial recovery of petroleum.			CO5, CO6
	B	Biotechnology in specific medical & industrial applications- Retting of jute, microbial process for immunization (Production of monoclonal antibodies), Deterioration of paper, textiles, painted surfaces and their prevention, Biofilms, microbial biopolymers, biosurfactants,			
	C	Microbial culture selection with high yield potential.			
	Mode of examination	**Theory/Practical/Viva**			
	Weightage Distribution	Internal (CA+MSE)		External (ESE)	
		25%		75%	
	Text book/s*	Patel A.H. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.			

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	-	-	1	-	-	2	-	1	2	-	1	-	-
CO2	-	-	1	-	-	2	-	1	1	-	1	-	-
CO3	-	-	1	1	-	2	-	1	3	-	1	-	-
CO4	-	-	1	1	-	2	-	1	3	-	1	-	-
CO5	-	-	1	1	-	2	-	1	3	-	1	-	-
CO6	-	-	1	1	-	2	-	1	3	-	1	-	-
Avg	0	0	1.00	1.00	0	2.00	0	1.00	2.50	0	1.00	0	0

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course code: FBP312 Course Title: Principles and Process of Food Preservation Lab

School: SSBR		**Batch: 2023-2027**
Programme: B.Sc		**Current Academic Year: 2023-2024**
Branch: Food Science and Technology		**Semester: 5th**
1	Course Code	FBP312
2	Course Title	Principles and Process of Food Preservation Lab
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Status	Compulsory
5	Course Objective	1. The course is designed for understanding of student about the various principles involve in food preservation. 2. This course demonstrates technology and various industrial processes which involved in food preservation
6	Course Outcomes	After successful completion of this course students will be able to: CO1.List the principles and methods of food preservation, Thermal processing equipment and calculate adequacy of heat treatment. CO2. Demonstrate the principles, technology, industrial methods and application of preservation by low temperature. CO3.Apply the principles, technology, industrial methods and application of preservation by moisture removal. CO4.Compare the principles, technology, industrial methods and application of preservation by irradiation and membrane technology. CO5. Determine the uses and effects of chemical preservatives in food Industry with principle, mechanism and application of various Novel techniques in food preservation. CO6 Design the various conventional and novel food preservation techniques.
7	Course Description	Food preservation is an important part of food industry. Principles of food preservation describe various principles to be followed for food preservation. This course covers various methods like high temperature treatment, low temperature treatment, drying/dehydration, chemical preservation and novel techniques.

8	**Outline syllabus**	**CO Mapping**
Unit 1	**Principles of Preservation**	CO1, CO6
A	Scope and importance of food processing, Types of foods and causes of food spoilage	
B	Heat preservation and processing	
C	Canning of foods	
Unit 2	**Cold preservation**	CO2, CO6
A	Cold preservation and processing	
B	Effect of low temperature on fresh food	
C	Freezing curves, Freezing methods	
Unit 3	**Moisture reduction in Preservation**	CO3, CO6
A	Drying methods and type of dryers	

B	Food concentration, Methods of concentration of fruit juices, Liquid food concentrates	
C	Water activity; Role of water activity in food preservation, Intermediate moisture foods (IMF)	
Unit 4	**Irradiation**	CO4, CO6
A	Food Irradiation, Use of ionization radiations in food preservation	
B	Food irradiation techniques and recent applications of irradiation in food preservation	
C	Chemical Preservation, Uses and effects of class I and class II preservatives in foods	
Unit 5	**Novel Techniques in Food Preservation**	CO5, CO6
A	Hydrostatic pressure	
B	Dielectric heating, microwave processing.	
C	Hurdle technology- Properties, mechanism of heating, Application in food processing and effects on nutrients.	

Mode of examination	Practical/Viva			
Weightage Distribution	CA	CE	ESE	
	25%	25%	50%	
Text book/s*	1. Norman, N.P and Joseph, H.H. (1997). Food Science, Fifth edition, CBS Publication, New Delhi			
Other References	1. Frazier, W. and Westhoff, D. (2014). Food Microbiology. 5th ed. New Delhi: McGraw Hill Education (India) Private Limited			

CO-PO PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	0	1	2	2	0	2	2	1	2	1	1
CO2	3	2	1	1	3	2	2	2	3	1	2	2	1
CO3	3	2	1	1	3	2	2	2	3	1	2	2	1
CO4	3	2	1	1	3	2	2	2	3	1	2	2	1
CO5	3	2	1	1	3	2	2	2	3	1	2	2	1
CO6	3	2	1	1	3	2	2	2	3	1	2	2	1
Avg	3.00	2.00	0.83	1.00	2.83	2.00	1.67	2.00	2.83	1.00	2.00	1.83	1.00

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: FBP311 Course Title: Basics of Food Microbiology Lab

School: SSBR		**Batch: 2023-2027**
Programme: B.Sc		**Current Academic Year: 2023-2024**
Branch: Food Science and Technology		**Semester: 5th**
1	Course Code	FBP311
2	Course Title	Basics of Food Microbiology Lab
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Status	Compulsory
5	Course Objective	1. To train the students about the basic principles, application of food microbiology. 2. To acquaint students with microbiology and industrial production of different food product
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Select common aseptic techniques used in microbiology laboratory CO2: Illustrate the ubiquitous nature of microorganisms and how they can be isolated for study CO3:To build basic principles of food microbiology and media preparation CO4: Classify basic techniques used in the observation and identification of microorganisms CO5: Evaluate various bio-techniques in the enumeration of different compounds CO6: Develop various food products via microbial fermentation
7	Course Description	The course will introduce students to methods used in preparation, preservation and microbiological examination of fruits and vegetable based processed foods. Students will be exposed to practical training on preparation, and analysis of increased shelf life by using preservatives.

8	**Outline syllabus**	**CO Mapping**
Unit 1		
A	Introduction to basic microbiology	CO1
B	Laboratory Practices and Cleaning and Sterilization of glassware's	CO1
C	Laboratory Equipment.	CO1
Unit 2		
A	Study of Compound Microscope	CO2
B	Cultivation and sub-culturing of microbes	CO2
Unit 3		
A	Staining Techniques	CO3
B	Preparation of nutrient media	CO3
Unit 4		
A	Standard Plate Count Method	CO4
B	Estimation of Coliforms Count	CO4
C	Yeast and Mould Count Method	CO4
Unit 5		CO5

A	Microscopic examination of microorganisms in food products			CO5
B	Biotechnology and Industrial production of food products			CO6
Mode of examination	Practical/Viva			
Weightage Distribution	CA	CE	ESE	
	25%	25%	50%	
Text book/s*				
Other References	1. Dubey, R. C., & Maheshwari, D. K. (2012). *Practical Microbiology*. S. Chand Pvt. Limited. 2. Pelczar, M. J., Chan, E. C. S., & Krieg, N. R. Microbiology. (1993). Tata McGrow Hill publication, New Delhi, India.			

CO-PO PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	1	0	2	2	0	2	3	1	3	0	1
CO2	2	2	1	1	1	3	0	1	1	1	3	1	0
CO3	2	1	0	0	1	3	1	1	2	1	3	0	0
CO4	3	1	1	1	1	3	1	2	2	1	3	1	0
CO5	3	2	0	0	1	3	1	2	2	2	3	1	1
CO6	3	3	1	0	1	3	1	2	2	1	3	3	3
Avg	2.50	2.00	0.67	0.33	1.17	2.83	0.67	1.67	2.00	1.17	3.00	1.00	0.83

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: RBL 003 Course Title: Research Based Learning -3

School: SSBR		**Batch: 2023-2027**	
Programme: B.Sc		**Current Academic Year: 2023-2024**	
Branch: Food Science and Technology		**Semester: 5th**	
1	Course Code	RBL 003	
2	Course Title	Research Based Learning (RBL)-3	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	Develop knowledge of a specific area of specialization. Develop research skills especially in project writingand oral presentation.	
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Define the various research articles to identify research gap on a given topic CO2: Explain the outline of approach to overcome the research gap CO3: Choose appropriate method/s suitable for a givenproblem CO 4: Categorize techniques/theoreticalanalysis for obtaining result CO 5: Explain graphs, diagrams, flow chart etc. CO 6: Originate report research findings in written and verbal forms	
7	Course Description	Reading in a field of special interest under the supervision of a faculty member. Intended for students interested in studying topics not offered in regularly available courses. Format and grading are determined by the supervising faculty member and the audit members then approved by the Head of Department.	
8	Outline		**CO Mapping**
	Unit 1	Introduction to various research problems	CO1
	Unit 2	Identify a research question	CO2, CO3
	Unit 3	Literature survey	CO4
	Unit 4	Report writing	CO5
	Unit 5	Presentation	CO6

Mode of examination	1. Rubric assessment 2. Monthly Presentation to be audited by supervisor 3. Mid Term Presentation and End Term Presentation			
Weightage Distribution	CA	CE	ESE	
	25%	25%	50%	
Text book/s*				
Other References	10 Recent International Journal Articles of repute.			

CO-PO PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	3	0	1	0	0	0	0	1	1	1	1
CO2	2	1	3	0	1	1	0	0	1	1	1	1	1
CO3	2	1	3	0	1	1	0	0	1	1	1	1	1
CO4	2	1	3	0	1	1	0	0	1	1	1	1	1
CO5	2	1	3	0	1	1	0	0	1	1	1	1	1
CO6	2	1	3	0	1	1	0	0	1	1	1	1	1
Avg	1.83	1.00	3.00	0.00	1.00	0.83	0.00	0.00	0.83	1.00	1.00	1.00	1.00

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: INC001 Course Title: Industry Connect

<table>
<tr><td colspan="2">Programme: BSc</td><td colspan="3">Year: Third</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td colspan="2">Subject: Food Science and Technology (Degree)</td><td colspan="3">Semester: 5th</td></tr>
<tr><td>1</td><td>Course Number</td><td colspan="3">Course Code: INC001</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="3">Industry Connect</td></tr>
<tr><td>3</td><td>Credits</td><td colspan="3">2 Course Status: Training/Survey/Project</td></tr>
<tr><td>4</td><td>(L-T-P)</td><td colspan="3">(0-0-4)</td></tr>
<tr><td>5</td><td>Learning Hours</td><td></td><td>Contact Hours</td><td>30</td></tr>
<tr><td></td><td></td><td></td><td>Project/Field Work</td><td>20</td></tr>
<tr><td></td><td></td><td></td><td>Assessment</td><td>00</td></tr>
<tr><td></td><td></td><td></td><td>Guided Study</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>Total hours</td><td>60</td></tr>
<tr><td>6</td><td>Course Objectives</td><td colspan="3">1. Contribute to the holistic development of students by making them more aware of socially and economically disadvantaged communities and their specific issues
2. Provide more richer context to classrooms, so as to make them more effectivelaboratories of learning by aligning them to social realities beyond textbooks
3. Provide scope to faculty members to align their teaching and research goals by giving them ample opportunity to carry out community -oriented projects
4. Ensure that the community connect programmes provides benefits to communities in tangible ways so that they may feel perceptibly better off post the interaction and involvement of the Sharda academic community
5. Provide ample opportunity for Sharda University academic community to contribute effectively to society and nation building</td></tr>
<tr><td>7</td><td>Course Outcomes</td><td colspan="3">After completion of this course students will be able to:
CO1: Students learn to be sensitive to the living challenges of disadvantaged communities.
CO2: Students learn to appreciate societal realities beyond textbooks and classrooms
CO3: Students learn to apply their knowledge via research, and training for community benefit</td></tr>
</table>

		CO4: Students learn to work on socio-economic projects with teamwork and timely delivery **CO5:** Students learn to engage with communities for meaningful contribution to society
8	**Theme**	**Major themes for research:** 1. ***Survey and self-learning***: In this mode, students will make survey, analyze data and will extract results out of it to correlate with their theoretical knowledge. E.g. Crops and animals, land holding, labour problems, medical problems of animals and humans, savage and sanitation situation, waste management etc. 2. ***Survey and solution providing***: In this mode, students will identify the common problems and will provide solution/ educate rural population. E.g. air and water pollution, need of after treatment, use of renewable (mainly solar) energy, electricity saving devices, inefficiencies in cropping system, animal husbandry, poultry, pest control, irrigation, machining in agriculture etc. 3. ***Survey and reporting***: In this mode students will educate villagers and survey the ground level status of various government schemes meant for rural development. The analyzed results will be reported to concerned agencies which will help them for taking necessary/corrective measures. E.g. Pradhan Mantri Jan Dhan Yojana, Pradhan Mantri MUDRA Yojana, Pradhan Mantri Jeevan Jyoti Bima Yojana, Atal pension Yojana, Pradhan Mantri Awas Yojana, Pradhan Mantri FasalBima Yojana, Swachh Bharat Abhiyan, Soil Health Card Scheme, Digital India, Skill India Programme,BetiBachao, BetiPadhao Yojana, DeenDayal Upadhyaya Gram Jyoti Yojana, Shyama Prasad Mukherjee Rurban Mission, UJWAL Discom Assurance Yojana, PAHAL,Pradhan Mantri Awas Yojana-Gramin, Pradhan Mantri Yuva Yojana, Pradhan Mantri Jan Aushadhi Yojana, Pradhan Mantri KhanijKshetra Kalyan Yojana, Pradhan Mantri Suraksha Bima Yojana, UDAN scheme, DeenDayal Upadhyaya Grameen Kaushalya Yojana, Pradhan Mantri Sukanya Samriddhi Yojana, Sansad Adarsh Gram Yojana, Pradhan Mantri SurakshitMatritva Abhiyan, Pradhan Mantri RojgarProtsahan Yojana, Midday Meal Scheme, Pradhan Mantri Vaya Vandana Yojana, Pradhan Mantri Matritva Vandana Yojana, and Ayushman Bharat Yojana.
9.1	**<u>Guidelines for Faculty Members</u>**	It will be a group assignment. There should be not more than 10 students in each group. The faculty guide will guide the students and approve the project title and help the studentin preparing the questionnaire and final report. The questionnaire should be well design and it should carry at least 20 questions (Including demographic questions). The faculty will guide the student to prepare the PPT. The topic of the research should be related to social, economical or environmental issues concerning the common man. The report should contain 2,500 to 3,000 words and relevant charts, tables and photographs.

		Plagiarism check of the report must. ETE will conduct out of 100, divided in three parts (i) 30 Marks for report (ii) 30 Marksfor presentation (iii) 40 Marks for knowledge. The student should **submit the report** to CCC-Coordinator signed by the faculty guide by …… The students have to send the hard copy of the **report and PPT**, and then only they willbe allowed for ETE.
9.2	**Role of CCC-Coordinator**	The CCC Coordinator will supervise the whole process and assign students to facultymembers. 1. PG- M.Sc.-Semester II - the students will be allocated to faculty member (mentors/faculty member) in odd term.
9.3	**Layout of the Report**	Abstract (250 words) a. Introduction b. Literature review(optional) c. Objective of the research d. Research Methodology e. Finding and discussion f. Conclusion and recommendation g. References Note: Research report should base on primary data.
9.4	**Guideline for Report Writing**	**Title Page: The following elements must be included:** • Title of the article; • Name(s) and initial(s) of author(s), preferably with first names spelled out; • Affiliation(s) of author(s); • Name of the faculty guide and Co-guide **Abstract:** Each article is to be preceded by a succinct abstract, of up to 250 words, thathighlights the objectives, methods, results, and conclusions of the paper. **Text: Manuscripts should be submitted in Word.** • Use a normal, plain font (e.g., 12-point Times Roman) for text. • Use italics for emphasis. • *Use the automatic page numbering function to number the pages.* • *Save your file in docx format* (Word 2007 or higher) or doc format (older Wordversions) **Reference list:** The list of references should only include works that are cited in the text and that have been published or accepted for publication. The entries in the list should be in alphabetical order.Journal article

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	1	0	0	0	1	0	0	1	0	0	0
CO2	1	1	1	0	1	0	2	0	1	1	0	0	0
CO3	1	1	1	0	2	0	1	0	1	1	0	0	0
CO4	1	1	1	0	3	0	1	0	0	1	0	0	0
CO5	1	1	1	0	2	0	1	0	0	3	0	0	0
CO6	1	1	1	0	0	0	0	0	0	0	0	0	0
Avg	1.00	1.00	1.00	0.00	1.33	0.00	1.00	0.00	0.33	1.17	0.00	0.00	0.00

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

SEMESTER – VI

Course code: FST315 Course Title: Food Biotechnology

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2023-2024**	
Branch: Food Science and Technology		**SEMESTER: 6th**	
1	Course Code	FST315	
2	Course Title	Food Biotechnology	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	1. To train the students about the basic principles, application of food biotechnology. 2. To develop knowledge of downstream processing in food industry. 3. To acquaint students with biotechnology and industrial production of different food product	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Describe the basic principles, application, safety, regulations and food authentication methods of food biotechnology. CO2: Explain fundamentals of downstream processing and biosensors in food industry CO3: Various application of food biotechnology in Industry CO4: Explain natural control of micro-organism and production with control of Aflatoxin, industrial production of different food product and fermented food products manufacturing is based on biotechnology. CO5: Explain all about GMOs and Protein Engineering applications in food industry CO6: Biotechnology is tool for various quality measurements in food products like PCR, Immunological methods and DNA based methods. Biotechnology produces various purification operations for food products.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Introduction**	CO1, CO6
	A	Introduction to Food Biotechnology, basic principles of Gene technology and its application in food industry.	
	B	Food safety and biotechnology- Impact of Biotechnology on food	
	C	Impact of Biotechnology on foods. Real time PCR based methods	
	Unit 2	**Downstream processing**	CO2, CO6
	A	Principle and types of downstream processing of food products, General types and stages in downstream processing	
	B	Bacterial starter culture, Methods of inoculation, media preparation, Slurry processing and product isolation.	
	C	Biosensors types and applications in food processing.	
	Unit 3	**Industrial Application**	CO3, CO6
	A	Biotechnology and industrial production of enzymes	
	B	Industrial production of beer, wine, amino acids, organic acids, vitamins	
	C	Industrial production of baker's yeast, brewer's yeast and single cell protein	

	Unit 4	**Other Applications of Bio-Technology**	CO4, CO6
	A	Applications of bacteriocins in food systems.	
	B	Various Fermentative Products	
	C	Other applications	
	Unit 5	**GMO**	CO5, CO6
	A	Transgenic plants and animals: Current status of transgenic Plants and animals, methods, concept, risks regulation and application	
	B	Ethical issues	
	C	Protein engineering in Food technology –objectives, methods, limitations, and applications (e.g., Lactobacillus, β-galactosidase, nisin and Glucose isomerase)	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	VK Joshi and Ashok Pandey (1999). Biotechnology- Food fermentation, Volume 1&2 Educational publishers and Distributors.	
	Other References	Tombs, M.P. (1991). Biotechnology in Food Industry, Open University Press, Milton Keynes	

CO-PO PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	1	1	1	0	2	0	2	2	1	3	1	1
CO2	2	2	0	0	0	3	0	3	3	1	2	0	0
CO3	2	2	1	0	1	3	2	2	3	2	3	3	3
CO4	2	2	1	0	1	3	2	2	3	2	3	3	3
CO5	2	2	1	3	2	3	1	3	2	2	3	2	3
CO6	3	2	1	1	1	3	1	3	3	1	3	3	3
Avg	2.33	1.83	0.83	0.83	0.83	2.83	1.00	2.50	2.67	1.50	2.83	2.00	2.17

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: FST316 **Course Title: Enzyme Technology**

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2023-2024**	
Branch: Food Science and Technology		**SEMESTER: 6th**	
1	Course Code	FST316	
2	Course Title	Principles of Enzyme Technology	
3	Credits	5	
4	Contact Hours (L-T-P)	5-0-0	
	Course Status	Compulsory	
5	Course Objective	• To introduce the Food Enzymology and its industrial application. • To develop the knowledge of Food Enzymes. • To set up appropriate examples for enzymes used as chemistry in terms of food product development. • 4.To develop the knowledge of chemistry behind enzymes	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Define the basic chemistry concept of enzymes and their role. CO2: Explain idea for chemistry of enzymes action on food. CO3: Choose different parameters use to evaluate enzyme activity in carbohydrates, proteins, and fat. CO4: Analyse enzymes and their role in food. Enzymes as Additives. Differentiation among enzymes and enzyme activity. CO5: Recognize the importance and utility of food enzyme chemistry in food. Basic understanding chemistry with food. CO6: Discuss food enzymes used in food preservation and chemicals	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Enzymes**	CO1, CO6
	A	Introduction, Definition and functions	
	B	Characterization, kinetics and immobilization; fermentative production of enzymes (amylases, proteases, cellulases, pectinases, xylanases, lipases)	
	C	Enzymes used in food industry and their downstream processing.	
	Unit 2	**Enzymes in processing of food**	CO2, CO6
	A	Role of enzymes in baking (fungal α-amylase for bread making; maltogenic α-amylases for anti-staling; xylanases and pentosanases as dough conditioners	
	B	Lipases or dough conditioning; oxidases as replacers of chemical oxidants; synergistic effect of enzymes);	
	C	Enzymes in meat processing (meat tenderization) and egg processing.	
	Unit 3	**Role of enzymes in fruit juices**	CO3, CO6
	A	Liquefaction, clarification, peeling, de bittering, decolourization	

	B	Enzymes in brewing: Enzymes in malting and mashing, Enzymes for process improvement, starch- haze removal	
	C	Applications of enzymes: protein cross-linking and oil degumming enzymatic approach to tailor- made fats.	
	Unit 4	**Enzyme processing for flavours**	CO4, CO6
	A	Enzyme-aided extraction of plant materials for production of flavours.	
	B	Production of flavour enhancers such as nucleotides; flavours from hydrolyzed animal/vegetable protein	
	C	Role of enzymes in cheese making, whey processing.	
	Unit 5	**Other applications**	CO5, CO6
	A	Enzymes for production of protein hydrolysates and bioactive peptides	
	B	Enzyme safety and regulations	
	C	Regulations of enzyme products	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. A Wiley- Inter Science Publ. Kruger JE. et al. 1987. Enzymes and their Role in Cereal Technology. American Association of Cereal Chemists Inc.	
	Other References	2. Nagodawithana T & Reed G. 1993. Enzymes in Food Processing. Academic Press.	

CO-PO PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	1	0	0	1	1	0	1	1	1	3	1	0
CO2	3	1	0	0	1	2	0	1	1	1	3	1	0
CO3	3	1	0	0	1	2	0	2	2	1	3	1	0
CO4	3	1	0	0	1	2	0	2	2	1	3	2	1
CO5	3	1	0	0	1	2	0	2	2	1	3	2	2
CO6	3	3	0	0	2	2	1	2	1	1	3	2	2
Avg	3.00	1.33	0.00	0.00	1.17	1.83	0.17	1.67	1.50	1.00	3.00	1.50	0.83

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: FST 317 Course Title: Food Safety and Regulatory Aspect

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2023-2024**	
Branch: Food Science and Technology		**SEMESTER: 6th**	
1	Course Code	FST 317	
2	Course Title	Food Safety and Regulatory Aspect	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	• To develop knowledge for food safety and quality assurance. • To acquaint students with various national and international laws associated with safety. • To train students for food industry	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Define general principles of food safety and hygiene. CO2: Classify the food safety regulations CO3: Demonstrate national food laws. CO4: Analyse the role of international bodies dealing in standardization CO5: Evaluate current concerns for food safety CO6: Discuss for working in food industry and other food laws governing bodies.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**General Principles for Food Safety and Hygiene s**	CO1, CO6
	A	Principles of food safety and quality –Food Safety System - Quality attributes- Total Quality Management.	
	B	Introduction to Risk Analysis, Risk Management, Risk Assessment, Risk Communication, CCP, Principles and Implementation of HACCP.	
	C	Traceability and authentication, Certification, and quality assurance**.**	
	Unit 2	**General Principles for Food Safety Regulation**	CO2, CO6
	A	The Structure of Food Law, Food Regulation, Laws and Regulations to Prevent Adulteration and Cross Contamination, Microbial Contamination	
	B	Hygienic Practice, Chemical and Environmental Contamination	
	C	Food Additives, Labelling.	
	Unit 3	**National Standards**	CO3, CO6
	A	PFA, FPO, MMPO, MPO, AGMARK, BIS, Environment and Pollution Control Board, Trends in Food Standardization.	
	B	An Overview and structure of 9001:2000/2008, Clause wise Interpretation of ISO 9001:2000,	
	C	An overview and Structure of 22000:2005.	
	Unit 4	**International Bodies Dealing in Standardization**	CO4, CO6
	A	International Standardization Organization (ISO), Joint FAO/WHO Food Standards Programme.	

	B	Codex Alimentarius Commission (CAC), Other International Organizations Active in Food Standard Harmonization.	
	C	Advantages of Utilizing International Standards**.**	
	Unit 5	**Recent Concerns**	CO5, CO6
	A	Packaging, Product labelling and Nutritional labelling,	
	B	Organic foods	
	C	Newer approaches to food safety	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. De Vries. Food Safety and Toxicity, CRC, New York, 1997	
	Other References	1.Manay, S. & Shadaksharaswami, M., Foods: Facts and Principles, New Age Publishers, 2004	

CO-PO PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	0	1	1	2	1	1	1	1	3	1	3
CO2	3	2	0	1	1	1	2	0	1	2	3	2	2
CO3	3	2	0	1	1	1	2	0	1	2	3	2	2
CO4	2	2	0	2	1	1	2	0	0	2	3	2	2
CO5	3	3	1	2	2	1	1	1	1	2	3	3	3
CO6	3	3	1	2	2	1	2	1	1	2	3	2	2
Avg	2.83	2.33	0.33	1.50	1.33	1.17	1.67	0.50	0.83	1.83	3.00	2.00	2.33

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: FBP315 Course Title: Biotechnology in Food Industry Lab

School: SSBR		**Batch: 2023-2027**
Programme: B.Sc		**Current Academic Year: 2023-2024**
Branch: Food Science and Technology		**Semester: 6th**
1	Course Code	FBP 315
2	Course Title	Biotechnology in Food Industry Lab
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Status	Compulsory
5	Course Objective	• To train the students about the basic principles, application of food biotechnology and microbiology • To acquaint students with biotechnology and industrial production of different food product
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Describe the basic **biotechnology tool and techniques** CO2: Demonstrate the method used for isolation and purification of nucleic acid CO3: Experiment of **gel electrophoresis and molecular size determination** CO4: Analyse the importance of quantification of protein CO5: Evaluate the detailed study of **assay (ELISA)** CO6: Elaborate the **biotechnology techniques in details**
7	Course Description	Biotechnology is tool for various quality measurements in food products. Microbiology course outlines the general characteristics of different microorganisms and also provides the basic knowledge of significance of different microbes affecting the human beings.

8	**Outline**	**CO Mapping**
Unit 1		CO1, CO6
A	Food biotechnology techniques (Basic lab procedures, equipment's, safety and food sampling and storage)	CO1, CO6
B	Bioinformatics (Food pathogens related -genes, marker and single nucleotide polymorphism (SNP) analysis using online tools	CO1, CO6
Unit 2		CO2, CO6
A	Genomic DNA isolation and purification from food samples	CO2, CO6
B	Spectrophotometric determination (DNA quantification and purity)	CO2, CO6
Unit 3		CO3, CO6
A	Agarose gel electrophoresis of DNA RFLP & DNA Molecular Size Determination	CO3, CO6
Unit 4		CO4, CO6
A	Quantitative determination of Total proteins by Bradford method	CO4, CO6
B	Protein Molecular weight Determination	CO4, CO6
Unit 5		CO5, CO6
A	SDS- Polyacrylamide slab gel electrophoresis	CO5, CO6
B	Enzyme linked immunosorbent assay (ELISA)	CO5, CO6

Mode of examination	Practical/Viva			
Weightage Distribution	CA	CE	ESE	
	25%	25%	50%	
Text book/s*				
Other References	1.Smith, S. (2010). *Food Biotechnology: Practical Manual*. Deakin University. 2. Gutiérrez-López, G. F. (2003). *Food science and food biotechnology*. CRC press.			

CO-PO PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	3	1	3	0	2	2	1	2	3	3
CO2	3	2	3	3	2	3	0	2	2	1	2	2	3
CO3	3	2	3	3	2	3	0	2	2	1	3	3	3
CO4	3	2	2	2	2	3	0	2	2	1	2	3	2
CO5	3	2	2	2	2	3	0	2	2	1	3	3	3
CO6	3	2	2	2	2	3	0	2	2	1	3	3	3
Avg	3.00	2.00	2.50	2.50	1.83	3.00	0.00	2.00	2.00	1.00	2.50	2.83	2.83

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: RBL 004 Course Title: Research Based Learning (RBL) -4

School: SSBR		**Batch: 2023-2027**
Programme: B.Sc		**Current Academic Year: 2023-2024**
Branch: Food Science and Technology		**Semester: 6th**
1	Course Code	RBL 004
2	Course Title	Research Based Learning (RBL)-4
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	• Develop knowledge of a specific area of specialization. • Develop research skills especially in project writingand oral presentation.
6	Course Outcomes	After successfully completion of this course students will be able to: CO 1: List a research topic under study CO 2: Explain the research gap CO 3: Develop the best method to solve the problem CO 4: Categorize and correlate the observations CO 5: Determine the observations and tabulate major researchfindings CO 6: Design report research findings in written and verbal forms
7	Course Description	Reading in a field of special interest under the supervision of a faculty member. Intended for students interested in studying topics not offered in regularly available courses. Format and grading are determined by the supervising faculty member and the audit members then approved by the Head of Department.

8.		Outline			**CO Mapping**
	Unit 1	Introduction to various research problems			CO1
	Unit 2	Identify a research question			CO2, CO3
	Unit 3	Literature survey			CO4
	Unit 4	Report writing			CO5
	Unit 5	Presentation			CO6
Mode of examination		Practical/Viva			
Weightage Distribution		CA	CE	ESE	
		25%	25%	50%	
Text book/s*					
Other References		1.Smith, S. (2010). *Food Biotechnology: Practical Manual*. Deakin University. 2. Gutiérrez-López, G. F. (2003). *Food science and food biotechnology*. CRC press.			

CO-PO -PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	3	0	1	0	0	0	0	1	1	1	1
CO2	2	1	3	0	1	1	0	0	1	1	1	1	1
CO3	2	1	3	0	1	1	0	0	1	1	1	1	1
CO4	2	1	3	0	1	1	0	0	1	1	1	1	1
CO5	2	1	3	0	1	1	0	0	1	1	1	1	1
CO6	2	1	3	0	1	1	0	0	1	1	1	1	1
Avg	1.83	1.00	3.00	0.00	1.00	0.83	0.00	0.00	0.83	1.00	1.00	1.00	1.00

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: CCU108 **Course Title: Community Connect**

<table>
<tr><td colspan="2">Programme: B.Sc</td><td colspan="3">Semester: 6th</td></tr>
<tr><td colspan="5">Subject: Food Science and Technology</td></tr>
<tr><td>1</td><td>Course Number</td><td colspan="3">Course Code: CCU108</td></tr>
<tr><td>2</td><td>Course Title:</td><td colspan="3">Community Connect</td></tr>
<tr><td>3</td><td>Credits</td><td colspan="3">2</td></tr>
<tr><td>4.</td><td>Course Status</td><td colspan="3">Training/Survey/Project/Multidisciplinary</td></tr>
<tr><td>4</td><td>(L-T-P)</td><td colspan="3">(0-0-4)</td></tr>
<tr><td>5</td><td>Learning Hours</td><td></td><td>Contact Hours
Project/Field Work
Assessment
Guided Study
Total hours</td><td>30
20
00
10
60</td></tr>
<tr><td>6</td><td>Course Objectives</td><td colspan="3">• Contribute to the holistic development of students by making them more aware of socially and economically disadvantaged communities and their specific issues
• Provide more richer context to classrooms, so as to make them more effective laboratories of learning by aligning them to social realities beyond textbooks
• Provide scope to faculty members to align their teaching and research goals by giving them ample opportunity to carry out community -oriented projects
• Ensure that the community connect programmes provides benefits to communities in tangible ways so that they may feel perceptibly better off post the interaction and involvement of the Sharda academic community
• Provide ample opportunity for Sharda University academic community to contribute effectively to society and nation building</td></tr>
<tr><td>7</td><td>Course Outcomes</td><td colspan="3">After completion of this course students will be able to:

CO1: Students learn to be sensitive to the living challenges of disadvantagedcommunities.

CO2: Students learn to appreciate societal realities beyond textbooks and classrooms

CO3: Students learn to apply their knowledge via research, and training forcommunity benefit

CO4: Students learn to work on socio-economic projects with teamwork and timelydelivery

CO5: Students learn to engage with communities for meaningful contribution to society.</td></tr>
</table>

8	**Theme**	**Major themes for research:** 1. ***Survey and self-learning***: In this mode, students will make survey, analyze dataand will extract results out of it to correlate with their theoretical knowledge. E.g.Crops and animals, land holding, labour problems, medical problems of animals and humans, savage and sanitation situation, waste management etc. 2. ***Survey and solution providing***: In this mode, students will identify the common problems and will provide solution/ educate rural population. E.g. air and water pollution, need of after treatment, use of renewable (mainly solar) energy,electricity saving devices, inefficiencies in cropping system, animal husbandry, poultry, pest control, irrigation, machining in agriculture etc. 3. ***Survey and reporting***: In this mode students will educate villagers and survey the ground level status of various government schemes meant for rural development.The analyzed results will be reported to concerned agencies which will help themfor taking necessary/corrective measures. E.g. Pradhan Mantri Jan Dhan Yojana, Pradhan Mantri MUDRA Yojana, Pradhan Mantri Jeevan Jyoti Bima Yojana, Atal pension Yojana, Pradhan Mantri Awas Yojana, Pradhan Mantri FasalBima Yojana, Swachh Bharat Abhiyan, Soil Health Card Scheme, Digital India, Skill India Programme,BetiBachao, BetiPadhao Yojana, DeenDayal Upadhyaya Gram Jyoti Yojana, Shyama Prasad Mukherjee Rurban Mission, UJWAL Discom Assurance Yojana, PAHAL,Pradhan Mantri Awas Yojana-Gramin, Pradhan Mantri Yuva Yojana, Pradhan Mantri Jan Aushadhi Yojana, Pradhan Mantri KhanijKshetra Kalyan Yojana, Pradhan Mantri Suraksha Bima Yojana, UDAN scheme, DeenDayal Upadhyaya Grameen Kaushalya Yojana, Pradhan Mantri Sukanya Samriddhi Yojana, Sansad Adarsh Gram Yojana, Pradhan Mantri SurakshitMatritva Abhiyan, Pradhan Mantri RojgarProtsahan Yojana, Midday Meal Scheme, Pradhan Mantri Vaya Vandana Yojana, Pradhan Mantri MatritvaVandana Yojana, and Ayushman Bharat Yojana.
9.1	**Guidelines for Faculty Members**	It will be a group assignment. There should be not more than 10 students in each group. The faculty guide will guide the students and approve the project title and help the studentin preparing the questionnaire and final report. The questionnaire should be well design and it should carry at least 20 questions (Including demographic questions). The faculty will guide the student to prepare the PPT. The topic of the research should be related to social, economical or environmental issues concerning the common man. The report should contain 2,500 to 3,000 words and relevant charts, tables and photographs.

		Plagiarism check of the report must. ETE will conduct out of 100, divided in three parts (i) 30 Marks for report (ii) 30 Marksfor presentation (iii) 40 Marks for knowledge. The student should **submit the report** to CCC-Coordinator signed by the faculty guide by …… The students have to send the hard copy of the **report and PPT**, and then only they willbe allowed for ETE.
9.2	**Role of CCC-Coordinator**	The CCC Coordinator will supervise the whole process and assign students to facultymembers. 1. PG- M.Sc.-Semester II - the students will be allocated to faculty member (mentors/faculty member) in odd term.
9.3	**Layout of the Report**	Abstract (250 words) h. Introduction i. Literature review(optional) j. Objective of the research k. Research Methodology l. Finding and discussion m. Conclusion and recommendation n. References Note: Research report should base on primary data.
9.4	**Guideline for Report Writing**	**Title Page: The following elements must be included:** • Title of the article; • Name(s) and initial(s) of author(s), preferably with first names spelled out; • Affiliation(s) of author(s); • Name of the faculty guide and Co-guide **Abstract:** Each article is to be preceded by a succinct abstract, of up to 250 words, thathighlights the objectives, methods, results, and conclusions of the paper. **Text: Manuscripts should be submitted in Word.** • Use a normal, plain font (e.g., 12-point Times Roman) for text. • Use italics for emphasis. • *Use the automatic page numbering function to number the pages.* • *Save your file in docx format* (Word 2007 or higher) or doc format (older Wordversions) **Reference list:** The list of references should only include works that are cited in the text and that have been published or accepted for publication. The entries in the list should be in alphabetical order.Journal article

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	2	3	3	1	-	-	1	1	-	-	-
CO2	1	1	2	3	3	1	-	-	1	1	-	-	-
CO3	1	1	2	2	2	1	-	-	1	1	-	-	-
CO4	1	1	2	1	3	1	-	-	1	1	-	-	-
CO5	1	1	2	1	3	1	-	-	1	3	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg	1.00	1.00	2.00	2.00	2.80	1.00	0	0	1.00	1.40	0	0	0

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: CHE 111 Course Title: Chemistry II

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2023-2024**	
Branch: Food Science and Technology		**SEMESTER: 6th**	
1	Course Code	**CHE 111**	
2	Course Title	**Chemistry II**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Minor	
5	Course Objective	The objectives of the course are to 1.To provide basic knowledge of quantum mechanics. 2. To learn MO theory in the perspective of quantum chemistry. 3. To understand Hartree-Fock theory of quantum chemical calculations. 4. To teach the concept of ab initio theory in quantum chemistry calculations. 5. To introduce the implementation of DFT to solve quantum mechanical problems. 6.To provide knowledge of various electronic structure theory to solve problems theoretically	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Develop the knowledge of quantum mechanics in the context of chemical systems. CO2: Master fundamental concept of MO theory of quantum chemistry. CO3: Understand the essential features of Hartree Fock theory. CO4: Apply the concepts of ab initio theory in computational chemistry. CO5: Able to understand the role of DFT to solve quantum mechanical problems. CO6: Develop deep knowledge and application of electronic structure theory to solve quantum mechanical problems.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Quantum Mechanics**	CO1, CO6
		Introduction of Quantum mechanics, Schrodinger equation, Position and momentum, MO formation, Operators, Hamiltonian operator, Quantum oscillator, Oscillator Eigen value problems, Quantum numbers, Labelling of atomic electrons.	
	Unit 2	**Huckels MO theory**	CO2, CO6
		Huckel's MO theory, approximate and exact solution of Schrodinger equation, exception values of energy. Computational techniques: Introduction to molecular descriptors, Curve fitting	
	Unit 3	**SCF theory and Hartree-Fock equation** Self consistent field theory, Elements of secular matrix, Vibrational calculations, Semi empirical methods, Slater determinants, Hartree equation, Fock equation.	CO3, CO6

	Unit 4	**Ab initio theory**	CO4, CO6
		Ab-initio calculations, Gaussian implementations, Koopman's theorem.	
	Unit 5	**Density Functional Theory**	CO5, CO6
		Concept of Density Functional Theory and its applications, DFT for larger molecules. Computer aided assignments/mini projects with softwares.	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. Quantum Chemistry, I.N. Levine, Tata McGraw Hill Pub. Co. Ltd., New Delhi. 2. Alberty,R A, Physical Chemistry,4 th edition, Wiley Eastern Ltd ,2001. 3. Atkins,P W,the elements of physical chemistry,Oxford ,1991 4. Barrow,G .M,International student Edition .McGraw Hill, McGraw-Hill,1973.	

CO-PO PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	2	-	-	2	-	-
CO2	2	2	1	-	-	-	2	1	1	1	3	-	-
CO3	2	1	1	-	-	-	1	1	1	1	2	-	-
CO4	2	2	1	-	-	-	2	1	1	1	2	-	-
CO5	2	2	2	-	-	-	2	1	1	1	2	-	-
CO6	2	3	2	-	-	-	2	2	1	1	2	-	-
Avg	2.00	2.00	1.40	0	0	0	1.80	1.33	1.00	1.00	2.17	0	0

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

SEMESTER – VII

Bachelors (Honors)
in Food Science and Technology

Course code: 411 Course Title: Bakery and Confectionary Technology

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc.		**Current Academic Year:**	
Branch: Food Science and Technology		**SEMESTER: 7th**	
1	Course Code	**FST411**	
2	Course Title	**Bakery and Confectionary Technology**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	1. To develop industrial approach in students for bakery, chocolate, and confectionary industry. 2. To develop the expertise for new techniques for snack food.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Identify the key ingredients, tools, and equipment used in bakery and confectionary production CO2: Explain the scientific principles underlying the baking and confectionary processes and explain manufacturing process for bakery products. CO3: Perform the analysis of bakery ingredients and manufacture various bakery products and chocolate with maintaining safety and hygiene of bakery plants. CO4: Evaluate the quality of baked goods and confectionaries based on visual appearance, taste, texture, and aroma and also understand the importance of quality control and food safety in bakery and confectionary operations. CO5:Understand about extrusion cooking, machineries and products and Develop strategies for product diversification and expansion of extruded products. CO6**:** Describe the processing technology of bakery, confectionery and extruded products and evaluate the effectiveness of quality control measures and implement necessary improvements.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Introduction**	CO1,CO6
	A	Introduction to baking; Bakery ingredients and their functions; Machines and equipment for batch and continuous processing of bakery products.	
	B	Dough development; methods of dough mixing; dough chemistry.	
	C	Rheological testing of dough-Farinograph, Mixograph, Extensograph, Amylograph / Rapid Visco Analyzer, Falling number, Hosney's dough stickiness tester	
	Unit 2	**Manufacturing of bakery products**	CO2, CO6
	A	Technology for the manufacture of bakery products-bread, biscuits, cakes.	
	B	Effect of variations in formulation and process parameters on the quality of the finished product.	
	C	Quality consideration and parameters; Staling and losses in baking.	

	Unit 3	**Analysis of bakery products**	CO3, CO6
	A	Testing of flour; Cake icing techniques, wafer manufacture, cookies, crackers, dusting, or breading	
	B	Manufacture of bread rolls, sweet yeast dough products, cake specialties, pies and pastries, doughnuts, chocolates, and candies	
	C	Coating or enrobing of chocolate (including pan-coating); Maintenance, safety, and hygiene of bakery plants.	
	Unit 4	**Quality characteristics of confectionery ingredients**	CO4, CO6
	A	Quality characteristics of confectionery ingredients; technology for manufacture of flour, fruit, milk, sugar, chocolate, and special confectionery products	
	B	Colour, flavour, and texture of confectionery; standards and regulations.	
	C	Machineries used in confectionery industry	
	Unit 5	**Extrusion**	CO5, CO6
	A	Importance and applications of extrusion in food processing; Pre and post extrusion treatments.	
	B	Manufacturing process of extruded products	
	C	Change of functional properties of food components during extrusion	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. Bakery Technology & Engineering; Matz SA; 1960; AVI Pub.	
	Other References	1. Extrusion of Food, Vol 2; Harper JM; 1981, CRC Press. 2. Up to-date Bread Making; Fance WJ &Wrogg BH; 1968, Maclasen & Sons Ltd.	

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	1	1	1	2	1	1	-	1	1	1
CO2	3	2	3	1	1	2	1	2	3	-	2	1	1
CO3	3	2	3	1	1	2	2	2	3	-	2	1	1
CO4	3	2	3	1	1	-	3	2	2	-	1	3	2
CO5	3	2	3	1	1	2	2	2	2	-	3	2	2
CO6	3	2	3	1	1	1	2	2	2	-	2	2	2
Avg	3.00	2.00	3.00	1.00	1.00	1.60	2.00	1.83	2.17	0	1.83	1.67	1.50

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: FST412 Course Title: Fundamentals of Biostatistics, Bioethics and IPR

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2026-27**	
Branch: Food Science and Technology		**SEMESTER: 7th**	
1	Course Code	**FST412**	
2	Course Title	**Fundamentals of Biostatistics, Bioethics and IPR**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	To understand the concepts of statistics and able to utilize it on the experimental biological data.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Understand the basic concepts of Statistics CO2: Apply the concept of probability and its application CO3: Analyse the correlation and regression using appropriate data CO4: Evaluate and apply the concepts of IPR CO5: To understand the bioethics in biology CO6: Create and evaluate the biostatistics data for biological application	
7	Course Description	In-depth understanding of statistics as well as to know the basics of bioethics and IPR.	
8	**Outline syllabus**		**CO Mapping**
	Unit 1	Introduction	CO1,CO6
	A	Introduction to Biostatistics	
	B	Frequency distribution: Measures of central tendency: Mean, Median, Mode, standard deviation.	
	C	Measures of dispersion: Skewness & Kurtosis	
	Unit 2	**Probability and Correlation**	CO2, CO6
	A	Probability: definition of probability and binomial distribution (numerical)	
	B	Sample, Population, large sample, small sample. Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, difference	
	C	Correlation: Definition, Karl Pearson's coefficient of correlation, Simple Regression,	
	Unit 3	**Hypothesis and Error**	CO3, CO6
	A	Concept of Test of Hypothesis. Applications of t-test statistics to biological problems/data	
	B	Chi square, statistic applications in Biology	
	C	Error-I type, Error-II type, Standard error of mean	

	Unit 4		CO4, CO6
	A	The concept of intellectual property, Importance of IPR in biotechnology, Indian laws and treaties for IPR	
	B	Patents-basic concepts, Infringement, compulsory licenses, Exploitation of the Patented Invention, Compulsory Licenses	
	C	Copyright and related rights; piracy and infringement and their remedies Definitions, Signs which serve as trademarks	
	Unit 5	**Bioethics**	CO5, CO6
	A	Introduction to Biosafety, Need for Biosafety in present scenario	
	B	Classification and Description of Biosafety Levels, Design of Clean rooms, Design of Biosafety Labs, Biosafety Regulations,	
	C	Laws and Policies, Biosafety and Agriculture**, Genetic Engineering and Health; Genetic Engineering and Food Safety**	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. Fundamental of Statistics by S.C. Gupta, Himalaya Publishing House.	
	Other References	1. Pharmaceutical Statistics- Practical and Clinical Applications by Sanford Bolton, Marcel Dekker Inc. New York. 2. •Design and Analysis of Experiments by R. Pannerselvam, PHI Learning Private Limited. 3. •Design and Analysis of Experiments by Douglas and C. Montgomery, Wiley Students Edition.	

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	1	1	1	1	2
CO2	1	2	2	2	1	1	2	1	1	1	1	1	1
CO3	1	1	1	1	1	1	2	2	1	1	1	1	1
CO4	2	1	2	1	2	1	1	1	1	2	2	1	2
CO5	2	1	1	2	2	1	2	1	1	2	2	1	1
CO6	1	1	1	1	1	1	2	2	1	1	1	1	2
Avg	1.33	1.17	1.33	1.33	1.33	1.00	1.83	1.50	1.00	1.33	1.33	1.00	1.50

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: FST413 Course Title: Functional Food and Nutraceuticals

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2026-27**	
Branch: Food Science and Technology		**SEMESTER: 7th**	
1	Course Code	**FST413**	
2	Course Title	**Functional Food and Nutraceuticals**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	DSE	
5	Course Objective	• To understand the interrelationship between nutraceuticals and health maintenance. • Understanding the traditional system of medicine as well as the need for changing trends in the nutraceutical Functional Food Industry. • To learn the efficacy and safety of nutraceutical and functional food products. • 4. To learn the packaging and labelling strategies of remedial food.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Recall the basic principles and concepts of functional food and nutraceuticals. CO2: Describe and understand the properties, structure, and functions of nutraceuticals. CO3: Apply the principles of formulation and development of functional food and nutraceutical products for specific health conditions or populations CO4**:** Analyze about the different sources of functional food and nutraceuticals, there application and packaging and labelling requirements. CO5: Assess the potential risks and benefits associated with the consumption of specific functional food and nutraceutical products and Safety regulations in USA, EU and India. CO6: Understand the basic concepts of nutraceuticals and functional food and use those concepts to development of food products and Evaluate the impact of functional food and nutraceutical interventions on the overall health and well-being of individuals	
7	Course Description	This course comprises of the structure, function, properties and significance of functional and nutraceutical food. Sources and health benefits will be studied in details.	
8	**Outline syllabus**		**CO Mapping**
	Unit 1	**Introduction to Nutraceuticals and Functional Food**	CO1,CO6
	A	Definition, national and international status, scope & prospects of nutraceuticals and functional food.	
	B	Applied aspects of the Nutraceutical and Functional Food Science. Sources of Nutraceuticals. Relation of functional foods & Nutraceutical to foods.	
	C	Formulation considerations and challenges, new product development	
	Unit 2	**Properties and Functions of Nutraceuticals and Functional Foods**	CO2, CO6
	A	Nutraceuticals: Glucosamine, Octacosanol, Lycopene, Carnitine, Melatonin and Ornithine alpha-ketoglutarate, pro-anthocyanidins, grape products, flaxseed oil and others	

	B	Functional Foods: Sources and role of Isoprenoids, Isoflavones, Flavonoids, carotenoids, Tocotrienols, Polyunsaturated fatty acids, sphingolipids, lecithin, choline, Terpenoids	
	C	Vegetables, Cereals, milk and dairy products as Functional foods and others.	
	Unit 3	**Role of Functional Foods as Remedial Foods and Disease Prevention**	CO3, CO6
	A	Nutraceuticals bridge the gap between food and drug.	
	B	Nutraceuticals – garlic, grape, wine, tea, soy proteins and soy isoflavones, dietary fibre, omega-3 fatty acids, antioxidants and phytochemicals, single-cell proteins, and marine-derived nutraceuticals.	
	C	Nutraceutical remedies for common disorders like circulatory problems, hypo-glycemia, nephrological disorders, liver disorders, osteoporosis, gastrointestinal disorders, and cardiovascular diseases.	
	Unit 4	**Nutraceutical Sources and Packaging & Labelling Requirements for Functional Food Products**	CO4, CO6
	A	Plant secondary metabolites: Role of Plant Sterols and Phytoestrogens in Functional Foods, Phenolics in Herbal and Nutraceutical Products.	
	B	Animal metabolites: Fat-rich functional food and their applications - Functional Fats and Spreads, modified fats and oils. Functional Meat as Functional Foods, Functional Confectionery and other functional Products	
	C	Packaging and labelling requirements: Packaging and packaging materials, an overview of dietary supplements labelling, nutrition labelling requirements.	
	Unit 5	**Claims, Marketing and Regulations for Functional Food Products**	CO5, CO6
	A	Nutritional content claims, health claims and exemption from FDA requirements, Dietary supplements labelling issues, regulatory agencies views on label claims.	
	B	The market for Functional Food Products: Market scenario, Functional foods and consumers.	
	C	The role of health in food choice; Functional foods market; Regulations and laws for functional food. Regulations in USA, EU and India	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. A. E. Bender, “Nutrition and Dietetic Foods”, Chem. Pub. Co. New York, 2ndEdition, 2004. 2. P. S. Howe, “Basic Nutrition in Health and Disease”,2ndEdition,W. B. Saunders Company, London, 2003. 3. Kramer, “Nutraceuticals in Health and Disease Prevention”, Hoppe and Packer, Marcel Dekker, Inc., NY 2001.	
	Other References	1. Bao and Fenwick, “Phytochemicals in Health and Disease”, Marcel Decker, Inc. NY 2004. 2. Rotimi E.Aluko. Functional Foods and Nutraceuticals. Springer.	

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	1	1	-	2	-	-	-	1	1	1
CO2	3	2	3	1	1	2	3	1	-	-	2	1	1
CO3	1	2	3	1	1	-	3	2	2	2	2	1	1
CO4	2	2	3	1	1	1	3	2	1	2	1	3	2
CO5	1	2	3	1	1	2	3	2	1	2	3	2	2
CO6	3	2	3	1	1	2	3	2	1	2	2	2	2
Avg	2.17	2.00	3.00	1.00	1.00	1.75	2.83	1.80	1.25	2.00	1.83	1.67	1.50

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: FST414 Course Title: Food Quality Analysis

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2026-27**	
Branch: Food Science and Technology		**SEMESTER: 7th**	
1	Course Code	**FST414**	
2	Course Title	**Food Quality and Analysis**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	DSE	
5	Course Objective	• Understanding about food laws and Acts. • Importance and need of food regulations. • Various hazards in food. • Food Quality and Quality Assurance. • Food Toxicology and its related studies. • Codex; Food Packaging and labeling. • Food Additives; Food Adulteration • FSSAI, PFA, HACCP AND CCP	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Recall the basic concept of Food Laws and Regulations in India. CO2: Interpret and explain the concepts and techniques used in food quality assessment and Role of HACCP in that. CO3: Implement of national standards such as FSSAI to monitor and ensure the quality and safety of food products. CO4: Application of International standards to monitor the presence of contaminants in food and toxicity due to various pathogens. CO5: Critically evaluate the compliance of food products with regulatory standards and industry guidelines. CO6: Recognize the importance and utility of Food safety norms in food Industry. Basic understanding with Codex.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**General principles for food safety and hygiene**	CO1,CO6
	A	Introduction, Definition, functions, and General aspects of Food Safety	
	B	Various aspect of Food Quality and Quality Assurance; ISO's	
	C	Mandatory laws for food processing.	
	Unit 2	**Implementation, documentation, and record keeping**	CO2, CO6
	A	Types of food hazards: biological, chemical and physical, Risk assessment.	
	B	Existing and emerging pathogens due to globalisation of food trade.	
	C	Newer systems of safety evaluation such as HACCP and CCP	
	Unit 3	**National standards**	CO3, CO6
	A	Salient features of Food Safety & Standards Act, 2006, Structure of FSSAI.	

	B	Prevention of Food Adulteration	
	C	ISO 22000 (Food Safety Management System)	
	Unit 4	**International bodies dealing in standardization**	CO4, CO6
	A	Intentional and unintentional contaminants in food industry, Common screening methods.	
	B	Toxicity due to microbial toxins including botulinum and staphylococcal toxins, mycotoxin and due to other food pathogens.	
	C	Food allergy and intolerance; Causes, symptoms and novel methods/products to reduce the effect.	
	Unit 5	**Recent concerns**	CO5, CO6
	A	Food Adulteration (Common adulterants), Food Additives (functional role, safety issues).	
	B	Food Packaging & labelling (Packaging types, understanding labelling rules & Regulation).	
	C	Labelling requirements for pre-packaged food as per CODEX.	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. FSSAI ACTS AND LAWS	
	Other References	1. EMERGING TECHNOLOGIES; FOOD PROCESS BY DA-WEN, 2005 2. FOOD SAFETY by Laura K Egendorf, 2000 3. International standards of food safety by Naomi Rees, David Watson, 2000 4. Codex alimentarius by FAO & WHO, 2007	

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	1	2	1	1	-	1	-	3	2	1
CO2	3	3	2	1	2	1	2	-	2	1	3	2	3
CO3	3	3	2	1	2	1	2	-	2	1	3	2	1
CO4	3	3	2	1	2	1	2	-	2	1	3	2	1
CO5	3	3	2	1	2	1	2	-	2	1	3	3	1
CO6	3	3	2	2	1	1	2	-	2	2	3	2	2
Avg	2.83	2.67	1.83	1.17	1.83	1.00	1.83	#DIV/0!	1.83	1.20	3.00	2.17	1.50

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: FBP 414 **Course Title: Food Quality Analysis Lab**

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2026-27**	
Branch: Food Science and Technology		**SEMESTER: 7th**	
1	Course Code	**FBP 414**	
2	Course Title	**Food Quality and Analysis Lab**	
3	Credits	**1**	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	DSE	
5	Course Objective	• To develop a sense of food quality assessment of food products • To use traditional methods to know about type biological hazards in products • To have an overview of the various microbiological methods involved in the determination of contaminants in food. • To develop a working knowledge of the use of food quality in nutritional segment.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Comprehend the basic concept of Food adulteration. CO2: Develop idea for purpose of this in food safety. CO3: Different methodology used to identify various biological hazards and their control measures in food processing CO4: Various internal and external factors involved in of Food Quality and self-life of products. CO5: Recognize the importance and utility of microbial test in Food quality and in food Industry CO6: To plan and compile different Quality assessment methods to maintain the quality of food products.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	Practical based on FSMS:22000 Quality Assessment	CO1,CO6
	Unit 2	Practical related to –HACCP Hazards Evaluation	CO2, CO6
	Unit 3	Practical related to---Physical, Chemical Hazards Evaluation	CO3, CO6
	Unit 4	Practical related to---Evaluation to Biological Hazard	CO4, CO6
	Unit 5	Practical related to---Implementation of Quality assessment Methods on Food Industries	CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MTE)	External (ETE)
		25%	**75%**

	Text book/s*	1. FSSAI ACTS AND LAWS
	Other References	1. Emerging Technologies: Food process by DA-WEN, 2005 2. Food safety by Laura K Egendorf, 2000 3. International standards of food safety by Naomi Rees, David Watson, 2000 4. Codex Alimentarius by FAO & WHO, 2007

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	1	-	3	2	1	-	1	-	2	1	1
CO2	2	3	2	1	2	2	1	-	1	1	2	1	2
CO3	3	3	2	1	2	1	2	-	2	1	3	1	2
CO4	3	3	2	1	2	1	2	-	2	1	3	1	1
CO5	3	3	2	2	2	1	3	-	2	1	2	-	1
CO6	3	3	2	2	1	1	3	-	2	2	2	2	1
Avg	2.50	2.83	1.83	1.40	2.00	1.33	2.00	0	1.67	1.20	2.33	1.20	1.33

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: BBI402 **Course Title: Introduction to Nanotoxicology**

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2026-27**	
Branch: Food Science and Technology		**SEMESTER: 7th**	
1	Course Code	**BBI402**	
2	Course Title	**Introduction to Nanotoxicology**	
3	Credits	**3**	
4	Contact Hours (L-T-P)	**3-0-0**	
	Course Status	DSE	
5	Course Objective	The objective of Nano-toxicology is to understand the inorganic-based nanomaterials, carbon-based nanomaterials, organic-based nanomaterials; and composite-based nanomaterials. Students will be able to understand the effects of nano particulates on human system.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Understand the concepts of nanomaterials and toxicity. CO2: To apply the knowledge of nanomaterials on human health CO3: To analyze the toxicity of nanomaterials. CO4: Evaluate the role of various factors and their effects on the level of nanotoxicity CO5: Apply the knowledge of risk and reach analysis emphasizing the role of regulatory guidelines CO6: Create the knowledge of toxicity with reference to nanomaterials prior to clinical use	
7	Course Description	Nanotoxicology is a new area of study that deals with the toxicological profiles of nanomaterials (NMs). Compared with the larger counterparts, the quantum size effects and large surface area to volume ratio brings NMs their unique properties that may or may not be toxic to living things	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Introduction to Nanomaterials and Nanotoxicology**	CO1,CO6
	A	Natural and synthetic nanomaterials,	
	B	Biological and Environmental applications of nanomaterials,	
	C	Study of nano-bio interface	
	Unit 2	**Nanotoxicity and human health**	CO2, CO6
	A	Fate of nanomaterials in human body: short term and long-term effects	
	B	Acute and chronic toxicity,	
	C	Study of different levels toxicity based on organs	
	Unit 3	**Determination of nanotoxicity**	CO3, CO6
	A	In vitro, in vivo, and ex vivo models to study the effects of nanomaterials on mammalian cells and tissues	
	B	Histological Analysis	
	C	hematological analysis, serum biochemical analysis	
	Unit 4	**Factors for determining nanotoxicity**	CO4, CO6
	A	Size, shape, charge, aggregation, and interaction behavior of	

		nanomaterials for determining the toxicity level,		
	B	Nanomaterials interactions with serum proteins,		
	C	protein-corona formation		
	Unit 5	**Regulatory guidelines for nanomaterials**		CO5, CO6
	A	Risk assessment analysis,		
	B	Regulatory guidelines like ISO guidelines,		
	C	ASTM guidelines, CDSO and reach analysis		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	Internal (CA+MSE)		External (ESE)
		25%		75%
	Text book/s*	Fundamentals of Nanotoxicology, Editor P.K. Gupta, Academic Press, 2022, ISBN 9780323903998		
	Other References	Nanotoxicity: From In Vivo and In Vitro Models to Health Risks, Editor(s): Saura C. Sahu Daniel A. Casciano 2- Nanotoxicity Methods and Protocols, Editors Joshua Reineke 3- Recent research articles		

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	-	1	1	1	-	2	1	2	1	1	1
CO2	2	1	1	1	1	1	2	1	1	2	1	1	2
CO3	2	1	2	1	1	1	1	1	1	2	1	1	2
CO4	2	2	1	1	1	1	1	2	1	1	1	1	2
CO5	2	1	1	1	1	1	2	1	1	2	1	1	2
CO6	2	2	2	1	1	1	2	2	1	2	1	1	2
Avg	1.83	1.33	1.40	1.00	1.00	1.00	1.60	1.50	1.00	1.83	1.00	1.00	1.83

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: BBI404 Course Title: Introduction to Nanotoxicology Lab

School: SSBSR		**Batch: 2023-27**
Programme: B.Sc		**Current Academic Year: 2026-2027**
Branch: Food Science and Technology		**SEMESTER: 7th**
1	Course Code	**BBI404**
2	Course Title	**Introduction to Nanotoxicology Lab**
3	Credits	**1**
4	Contact Hours (L-T-P)	**0-0-2**
	Course Status	DSE
5	Course Objective	The objective of Nano-toxicology is to understand the inorganic-based nanomaterials, carbon-based nanomaterials, organic-based nanomaterials; and composite-based nanomaterials. Students will be able to understand the effects of nano particulates on human system.
6	Course Outcomes	After successful completion of this course students will be able to: CO1: To studying the development of various nanomaterials CO2: To examine the physicochemical properties of nanomaterials CO3: To determine the nanotoxicity on in vitro models CO4: Determining the nano-bio interface at protein levels CO5: To analyze the nanomaterial toxicity using bioinformatics approaches CO6**:** Overall studying the physicochemical parameters of nanomaterials and emphasizing their role on nanotoxicity
7	Course Description	Nanotoxicology is a new area of study that deals with the toxicological profiles of nanomaterials (NMs). Compared with the larger counterparts, the quantum size effects and large surface area to volume ratio brings NMs their unique properties that may or may not be toxic to living things

8.	Outline syllabus		CO Mapping
	Unit 1	**Development of nanomaterials**	
	A	Introduction to Nanotoxicology Lab; GLP	CO1, CO6
	B	Fabrication of organic (polymer) nanomaterials via different methodological approaches	CO1,CO6
	C	Fabrication of inorganic (metal/metal oxide) nanomaterials via different methodological approaches	CO1,CO6
	Unit 2	**Physicochemical characterization analysis**	
	A	Determining the surface plasmon resonance property	CO2, CO6

	B	Determining the magnetization, size, shape, crystanillity.			CO2, CO6
	C	Determining the particle composition and thermal analysis			CO2, CO6
	Unit 3	**Determination of nanotoxicity on in vitro models**			
	A	Introduction to nanomaterial Toxicity			CO3, CO6
	B	Studying the nanomaterial toxicity on mouse fibroblast cells (MTT test)			CO3, CO6
	C	Studying the hemocompatibility of nanomaterial			
	Unit 4	**Toxic effects of nanomaterials on serum proteins**			
	A	Nanoparticle-protein interaction study			CO4, CO6
	B	Nanoparticle-protein degradation and conformational change analysis			CO4, CO6
	C	Nanoparticle-protein protein-corona analysis			CO4, CO6
	Unit 5	**Bioinformatic analysis of nanomaterial toxicity**			
	A	Determining the effects of nanomaterials on various structural and functional proteins.			CO5, CO6
	B	Effects of nanomaterials on DNA damage			CO5, CO6
	C	Oxidative stress analysis			CO5, CO6
	Mode of examination	Continuous Assessment (CA): 25 Marks Viva-Voce (on the basis of weekly Viva performance): 25 Marks ESE: 50 marks (Quiz for 15 marks; Lab Work for 15 Marks; Viva for 10 Marks and Lab record for 10 marks)			
	Weightage Distribution	CA	CE	ESE	
		25%	25%	50%	
	Text books	Nanotoxicity: From In Vivo and In Vitro Models to Health Risks, Editor(s): Saura C. Sahu Daniel A. Casciano			
	Reference books	2- Nanotoxicity Methods and Protocols, Editors Joshua Reineke 3- Recent research articles			

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	-	1	1	1	-	2	1	2	1	-	-
CO2	1	1	-	1	1	1	-	2	1	2	1	-	-
CO3	1	1	-	1	1	1	-	1	1	2	1	-	-
CO4	1	1	-	1	1	1	-	2	1	1	1	-	-
CO5	1	1	-	1	1	1	-	1	1	2	1	-	-
CO6	1	1	-	1	1	1	-	2	1	2	1	-	-
Avg	1.00	1.00	0	1.00	1.00	1.00	0	1.67	1.00	1.83	1.00	0	0

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: CHE 101 **Course Title: Fundamentals of Chemistry**

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2026-27**	
Branch: Food Science and Technology		**SEMESTER: 7th**	
1	Course Code	**CHE101**	
2	Course Title	**Fundamentals of Chemistry**	
3	Credits	**3**	
4	Contact Hours (L-T-P)	**3-0-0**	
	Course Status	Minor	
5	Course Objective	1. Molecular polarity and weak chemical forces. 2. Current bonding models for simple inorganic and organic molecules in order to predict structures and important bonding parameters. 3. Periodic properties of elements. 4. The basics of organic chemistry give the most primary and utmost important knowledge and concepts of organic Chemistry, theoretical picture in multiple stages in an overall chemical reaction. 5. Reactive intermediates, transition states and states of all the bonds broken and formed, reaction mechanism. 6. Stereochemistry of simple organic molecules.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Explain molecular polarity and weak chemical forces CO2: Describe simple bonding theories of molecules. CO3: Discuss periodic properties of elements and recapitulate basics of Organic Chemistry CO4: Explain mechanism of organic reactions. CO5: Illustrate stereochemistry of simple organic molecules. CO6: Apply the knowledge to solve simple scientific problems.	
7	Course Description	This course includes introduction to Indian ancient Chemistry and the contribution of Indian Chemists, describes molecular polarity, weak chemical forces, chemical bonding, periodic properties of elements, organic reaction intermediate, reaction mechanism, stereochemistry.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Molecular Polarity and Weak Chemical Forces**	CO1
	A	Introduction to Indian Ancient Chemistry and contribution of Indian Chemists. Formal charge, Van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interaction, dipole moment and molecular Structure (Diatomic and polyatomic molecules), Percentage ionic character from dipole moment.	
	B	Polarizing power and polarizability. Fajan's rules and consequences of polarization. Hydrogen bonding.	CO1, CO6 CO1, CO6

	C	Effects of weak chemical forces, melting and boiling points, solubility, energetics of dissolution process. Lattice energy and Born-Haber cycle, solvation energy, and solubility of ionic solids.	
	Unit 2	**Simple Bonding theories of Molecules**	CO2, CO6
	A	Atomic orbitals, Aufbau principle, multiple bonding (σ and π bond approach), valence bond theory (VBT), Concept of hybridization, hybrid orbitals and molecular geometry.	
	B	Bent's rule, Valence shell electron pair repulsion theory (VSEPR), shapes of the following simple molecules and ions containing lone pairs and bond pairs of electrons: H_2O, NH_3, PCl_5, SF_6, SF_4, ClF_3, I_3^-, ClF_2^{--}.	
	C	Molecular orbital theory (MOT). Molecular orbital diagrams, bond orders of homonuclear and heteronuclear diatomic molecules and ions (N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions).	
	Unit 3		CO3, CO6
	A	**Periodic Properties of Elements** Brief discussion, factors affecting and variation trends of following properties in groups and periods. Effective nuclear charge, shielding or screening effect, Slater rules, Atomic and ionic radii, Electronegativity, Pauling's/ Allred Rochow's scales, Ionization enthalpy, Electron gain enthalpy.	
	B	**Recapitulation of Basics of Organic Chemistry** Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bonding, Van der Waals interactions, inclusion compounds, Clathrates, Charge transfer complexes, hyperconjugation, Dipole moment	
	C	Electronic Displacements: Inductive, electromeric, resonance, mesomeric effects and their applications	
	Unit 4	**Mechanism of Organic Reactions**	CO4, CO6
	A	**Mechanism of Organic Reactions** Curved arrow notation, drawing electron movements with allows, half-headed and double-headed arrows, homolytic and heterolytic bond fission, Types of reagents – electrophiles and nucleophiles.	
	B	Reactive intermediates – Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples).	
	C	Types of organic reactions, Energy considerations.	
	Unit 5		CO5, CO6
	A	Concept of isomerism, Types of isomerism; Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, Newman projection and Sawhorse formulae, Fischer and flying wedge formulae, Difference between configuration and conformation.	
	B	Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature. Geometric isomerism – determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.	
	C	Conformational isomerism – conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds	

	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	Internal (CA+MSE)		External (ESE)
		25%		75%
	Text book/s*	1. Lee, J.D. Concise Inorganic Chemistry, Pearson Education 2010. 2. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 3. Graham Solomons, T.W., Fryhle, C. B. Organic Chemistry, John Wiley & Sons, Inc.		
	Other References	1. Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry, Oxford, 1970. 2. Carey, F. A., Guiliano, R. M.Organic Chemistry, Eighth edition, McGraw Hill Education, 2012. 3. Clayden, J., Greeves, N. &Warren, S. Organic Chemistry, 2nd edition, Oxford University Press, 2012. 4. Shriver, D.D. & P. Atkins, Inorganic Chemistry 2nd Ed., Oxford University Press, 1994.		

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	-	1	1	1	-	1	1	-	2	1	1
CO2	1	1	1	1	1	1	1	1	1	-	2	1	1
CO3	1	1	1	1	1	1	1	1	1	-	2	1	1
CO4	1	1	1	1	1	1	1	1	1	-	2	1	1
CO5	1	1	1	1	1	1	1	1	1	-	2	1	1
CO6	1	1	1	1	1	1	1	1	1	1	2	1	1
Avg	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00	1.00

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

SEMESTER – VIII

Bachelors (Honors)
in Food Science and Technology

Course code: FST417 **Course Title: Food Packaging Technology**

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2026-27**	
Branch: Food Science and Technology		**SEMESTER: 8th**	
1	Course Code	**FST417**	
2	Course Title	**Food Packaging Technology**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	**1.** Understanding about food packaging. 2. Importance and need of packaging in the industrial use. 3. Various packaging materials, available for food Products. 4. Types of plastics, methodology and technologies involved in packaging. 5. Industrial use and ways for packaging material. Food labelling and packaging. Codex Guidelines	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Recall the basic principles and concepts of food packaging technology. CO2: Interpret the functions and characteristics of different packaging components, such as films, containers, labels, and closures. CO3: Understand and apply new concepts of food packaging. CO4: Analyze the quality of different packaging material by various test and impact of packaging material on food quality, safety, and shelf-life CO5: Evaluate the packaging material for final products and nutritional labelling standards CO6: Types, availability, and utilization of packaging material for food processing Industries.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Introduction**	CO1,CO6
	A	Introduction to food packaging	
	B	Types of food processing industries & their present methods of shelf-life enhancement in packaging.	
	C	Identification of different packaging materials.	
	Unit 2	**Materials for food packaging, types, uses, merits and drawbacks**	CO2, CO6
	A	Properties for packing materials	
	B	Food packages -Paper, bags ,pouches ,wrappers, Tin, Aluminium, Plastic, Boxes, Jars; Food packages -Paper, bags ,pouches ,wrappers, Tin, Aluminium, Plastic, Boxes, Jars;	
	C	Tetra packs, aerosol containers	
	Unit 3	**Modern concepts of packaging technology**	CO3, CO6
	A	Aseptic process and Packaging	
	B	Modified atmospheric packaging and controlled atmospheric packaging	
	C	Active, smart and edible packaging	

	Unit 4	**Quality Testing Of Packaging Materials**	CO4, CO6
	A	Weighing, filling, scaling, wrapping, cartooning, labeling, marking and trapping	
	B	Physical and chemical test for plastics	
	C	Shelf-life testing of different types of packaging materials	
	Unit 5	**Packaging of finished goods**	CO5, CO6
	A	Weighing, filling, scaling, wrapping, cartooning	
	B	labeling, marking, and trapping; Labeling: Standards, purpose,	
	C	labeling regulation barcode; Nutrition labeling, health claims, and mandatory labeling provision	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	Food Packaging Technology by Richard Coles ; © 2003 by Blackwell Publishing Ltd	
	Other References	Crosby NT.1981. Food Packaging: Aspects of Analysis and Migration Contaminants. App. Sci. Publ.	

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	1	-	1	3	1	3	3	1	1	3	1
CO2	3	2	1	1	1	2	-	2	2	-	2	2	2
CO3	3	2	1	2	1	-	-	3	3	2	2	2	1
CO4	3	3	1	2	1	-	1	2	2	2	2	2	1
CO5	3	3	1	-	1	1	3	2	2	2	2	1	1
CO6	3	3	1	2	1	2	2	2	3	3	3	1	1
Avg	3.00	2.67	1.00	1.75	1.00	2.00	1.75	2.33	2.50	2.00	2.00	1.83	1.17

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: FST 416 Course Title: Food Additives

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc		**Current Academic Year: 2026-27**	
Branch: Food Science and Technology		**SEMESTER: 8th**	
1	Course Code	**FST 416**	
2	Course Title	**Food Additives**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	The objective of the Food Additive Course is to provide students with a comprehensive understanding of food additives, their functions, regulatory frameworks, and their impact on food quality, safety, and consumer health.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Define food additives and explain their purpose in the food industry. CO2: Understand the principles behind the selection and application of food additives in various food products. CO3: Discover the role of nutrient supplements and thickeners as a food additive CO4: Discuss the role of sweeteners and emulsifiers as a food additive in food preservation, shelf-life extension, and food safety. CO5: Explain the regulatory frameworks and guidelines governing the use of food additives at national and international levels. CO6: Evaluate the potential benefits and risks associated with the use of food additives.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Introduction**	CO1,CO6
	A	Definitions, classification and applications, food preservatives-classifications, antimicrobial agents, types and their action, safety concerns, regulatory issues in India, international legal issues	
	B	Antioxidants (synthetic and natural, inhibition mechanism of oxidation); Chelating agents: types, uses and mode of action; Coloring agents: color retention agents, applications and natural colorants, sources of natural color, misbranded colors, color extraction techniques, color stabilization.	
	C	Market scenario, formulation considerations and challenges	
	Unit 2	**Flavouring agent**	CO2, CO6
	A	Flavours (natural and synthetic flavours), flavour enhancers, flavour stabilization. agents	
	B	Flavour encapsulation techniques	
	C	Flour improvers: leavening agents, humectants and sequestrant, hydrocolloids, acidulants, pH control agents buffering salts, anticaking	
	Unit 3	**Nutrient supplements and Thickeners**	CO3, CO6
	A	Polysaccharides, bulking agents, antifoaming agents, synergists, antagonists.	

	B	Additives food uses and functions in formulations, permitted dosages, indirect food additives.	
	C	Harmful effects/side effects associated with various additives (various diseases)	
	Unit 4	**Sweeteners as food additives**	CO4, CO6
	A	Natural and artificial sweeteners, nutritive and non-nutritive sweeteners	
	B	Properties and uses of saccharin, acesulfame-K, aspartame, corn sweeteners, invert sugar sucrose and sugar alcohols (polyols)	
	C	Emulsifiers: types, selection of emulsifiers, emulsion stability, functions and mechanism of action.	
	Unit 5	**FSSAI Guidelines**	CO5, CO6
	A	Guidelines for Food additives	
	B	Types of additives in food, their permissible amount in any food product	
	C	Information on spices and herbs Source, Description, identification, therapeutic and food value of Basil, Clove, Mint, Cinnamon, Turmeric, Garlic, Capsicum, Ginger and Black pepper	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. Branen A. L., Davidson P. M., and Salminen S. (2001) Food Additives. 2nd Ed. Marcel Dekker.	
	Other References	1. Gerorge A. B., (1996) Encyclopedia of Food and Color Additives. Vol. III. CRC Press. 2. Gerorge A. B., (2004) Fenaroli's Handbook of Flavor Ingredients 5th Ed. CRC Press. 3. Morton I. D., and Macleod A. J., (1990) Food Flavours. Part A, B & C. Elsevier. 4. Stephen A. M., (2006) Food Polysaccharides and Their Applications. Marcel Dekker.	

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	1	-	1	1	3	-	1	2	2	2	2	-
CO2	1	2	-	1	1	1	3	-	1	1	-	3	1
CO3	1	3	-	2	1	1	-		1	2	3	1	3
CO4	2	3	1	-	-	1	1	1	1	1	-	3	2
CO5	3	1	-	-	1	2	1	1	2	2	3	2	3
CO6	1	-	-	3	3	2	2	2	1	1	1	-	3
Avg	1.83	2.00	1.00	1.75	1.40	1.67	1.75	1.25	1.33	1.50	2.25	2.20	2.40

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High

Course code: FST 415 Course Title: Processing of Edible Oil and Fats

School: SSBSR		**Batch: 2023-27**
Programme: B.Sc		**Current Academic Year: 2026-27**
Branch: Food Science and Technology		**SEMESTER: 8th**
1	Course Code	**FST 415**
2	Course Title	**Processing of Edible Oil and Fats**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Compulsory
5	Course Objective	• To understand the chemistry of fats and oils • To understand and identify various edible sources of fats and oils • To understand the extraction of fats and oils • To understand various processing methods for fats and oils • To understand packaging and quality assessment for fats and oil products
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Define the physical and chemical property of oils and fats CO2: Compare different methods of oil extraction for edible purpose CO3: Develop the process flow line for oil extraction CO4: Analyze different types of fat and oil products CO5: Explain about the various storage and packaging materials use CO6: Examine the regulatory standards and guidelines governing the production and labeling of edible oils and fats.
7	Course description	The course will provide theoretical knowledge about oils and fats, their supply chain, and extraction process of oil. Furthermore, students will learn the difference between oils and fats and their functionality. They will gain a deeper understanding of the chemistry involved in fats and oils, storage, refining, modification, and nutrition.

7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Introduction-Chemistry of Fats & Oils**	CO1,CO6
	A	Types, composition & function of lipids; Fatty acids - saturated, unsaturated, and branched.	
	B	Biological significance of lipids, classification occurrence, chemical and physical characteristics of lipids: Triglycerides, Cis & trans, essential fatty acids, -fatty acids; Acylglycerol, phospholipids, sterols, terpenes.	
	C	Chemical reactions & processes.	
	Unit 2	**Sources of Fats and Oils**	CO2, CO6
	A	*Plant sources*: palm oil, canola oil, sunflower oil, soybean oil, mustard oil, almond oil, algal oils, cocoa butter, and shea butter.	
	B	*Animal fat*: Lard - pre-treatment / trimming of fatty tissues from slaughtered carcasses, Rendering, Prime steam lard, *Fish oils.*	
	C	*Dairy fat*: Centrifugal separation, Cream, Butter, Ghee.	
	Unit 3	**Extractions of Fats and Oil**	CO3, CO6

	A	Pre-treatments of oilseeds - cleaning, dehulling, heat treatment, flaking, milling, etc.; enzymatic pre-treatments.	
	B	Mechanical expression - Hot & cold; Ghani, pressing, screw expelling; Expellers - batch & continuous; Hydraulic & screw presses.	
	C	*Solvent Extraction*: Principles and mechanism, solvent types & properties, factors affecting solvent extraction process; Pre-press solvent extraction, Extractors - batch & continuous; Miscella distillation; Meal desolventization	
	Unit 4	**Processing of Fats & Oils and Products**	CO4, CO6
	A	*Refining*: filtration, degumming, neutralization, bleaching, deodorization and physical refining	
	B	*Other methods*: Membrane technology. Equipment & machinery, Hydrogenation, interesterification, fractionation, winterization, plasticization - conventional processes and recent development; Trans-free modification techniques.	
	C	*Products*: Industrial fats and oils, margarine, shortenings & bakery fats, salad oils, margarine, non-caloric fats; standard and quality control, packaging and storage of fats and fatty foods. Changes during processing and storage of oils and fats, polymorphism, rancidity and reversion.	
	Unit 5	**Packaging and Quality Assessment**	CO5, CO6
	A	Packaging - material characteristics and technology; Handling & storage requirements.	
	B	Quality and safety attributes & measurement techniques.	
	C	FSSAI regulations, Oil blending and fortification, Toxicity and safety aspect of fats and oils.	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1 Damodaran, S., Parkin, K. L., & Fennema, O. R. (Eds.). (2007). Fennema's food chemistry. CRC press.	
	Other References	1.Gunstone, F. (Ed.). (2011). Vegetable oils in food technology: composition, properties and uses. John Wiley & Sons. 2. Lawson, H. W. (1995).Food oils and fats: technology, utilization, and nutrition. Springer Science & Business Media. 3. O'Brien, R. D. (2008). Fats and oils: formulating and processing for applications. CRC press. 4. Talbot, G. (Ed.). (2015). Specialty oils and fats in food and nutrition: properties, processing, and applications. Woodhead publishing.	

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	0	1	1	3	0	1	2	2	2	2	0
CO2	3	2	0	1	3	1	3	3	2	1	0	3	1
CO3	2	2	3	2	1	1	2	0	1	2	3	1	3
CO4	2	3	1	0	0	1	1	1	1	1	0	3	2
CO5	3	1	0	0	1	2	1	1	2	2	3	2	3
CO6	1	3	1	3	3	2	2	2	1	1	1	0	3
Avg	2.17	2.00	0.83	1.17	1.50	1.67	1.50	1.33	1.50	1.50	1.50	1.83	2.00

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High

Course code: FST 418 Course Title: Food Toxicity and Safety Regulations

School: SSBSR		**Batch: 2023-27**
Programme: B.Sc		**Current Academic Year: 2026-27**
Branch: Food Science and Technology		**SEMESTER: 8th**
1	Course Code	**FST 418**
2	Course Title	Food Toxicity and Safety Regulations
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	DSE
5	Course Objective	The objective of the course "Food Safety Management and Quality System" is to provide students with a comprehensive understanding of the principles, practices, and processes involved in ensuring food safety and maintaining quality in the food industry.
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Define the basic concept of Food Laws and Regulations in India. CO2: Explain the idea for purpose and action on food safety. CO3: Identify laws and Acts. Food Hazards and Toxicology. Various hazards and their control measures CO4: Simplify the terms of Food Quality and Quality assurance and its role in food. Food Adulteration and Food Additives CO5: Justify the importance and utility of Food safety norms in food Industry. CO6: Develop the basic understanding with Codex
7	Course description	Food safety is an application of various laws and regulations employs on food manufacture Industries. Food safety application in new product development. The types of hazards during processing identification are beneficial in food preservation. In the future Food Toxicology could offer more depth knowledge with toxicological studies of food. In this course, students will learn about the different regulatory bodies national and international dealing in manufacturing of food products.

7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Introduction**	CO1,CO6
	A	Introduction, Definition , functions, and General aspects of Food Safety	
	B	Various aspect of Food Quality and Quality Assurance ;ISO	
	C	Mandatory laws for food processing	
	Unit 2	**Food Hazards and Their Evaluation**	CO2, CO6
	A	Types of food hazards: biological, chemical, and physical, Risk assessment	
	B	Existing and emerging pathogens due to globalization of food trade	
	C	Newer systems of safety evaluation such as HACCP and CCP.	
	Unit 3	**Regulatory Bodies and Acts**	CO3, CO6
	A	Salient features of Food Safety & Standards Act, 2006, Structure of FSSAI	

	B	PFA and ISO 22000 (Food Safety Management System)	
	C	Managing risks through the food chain via Traceability and Food Recall.	
	Unit 4	**Toxicity**	CO4, CO6
	A	Intentional and unintentional contaminants in food industry; Common screening methods.	
	B	Toxicity due to microbial toxins including botulinum and staphylococcal toxins, mycotoxin and due to other food pathogens.	
	C	Food allergy and intolerance; Causes, symptoms and novel methods/products to reduce the effect.	
	Unit 5	**Packaging and Labelling**	CO5, CO6
	A	Food Adulteration (Common adulterants), Food Additives (functional role, safety issues)	
	B	Food Packaging & labeling (Packaging types, understanding labelling rules & Regulation).	
	C	Labelling requirements for pre-packaged food as per CODEX	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	ESE
		25%	75%
	Text book/s*	1. FSSAI ACTS AND LAWS	
	Other References	1. EMERGING TECHNOLOGIES; FOOD PROCESS BY DA-WEN, 2005 4. FOOD SAFETY by Laura K Egendorf, 2000 5. International standards of food safety by Naomi Rees, David Watson, 2000 6. Codex alimentarius by FAO & WHO, 2007	

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	1	1	3	0	2	2	2	1	2	0
CO2	2	2	3	1	1	1	2	0	1	1	0	3	1
CO3	2	3	2	2	1	1	1	0	1	2	3	1	3
CO4	2	3	1	1	0	1	1	1	1	1	0	3	2
CO5	3	1	1	1	1	1	1	1	2	2	3	2	3
CO6	2	0	0	2	2	1	1	2	1	1	1	0	3
Avg	2.33	1.83	1.67	1.33	1.00	1.33	1.00	1.00	1.33	1.50	1.33	1.83	2.00

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: FBP 418 Course Title: Food Toxicity and Safety Regulations Lab

School: SSBSR		**Batch: 2023-27**			
Programme: B.Sc		**Current Academic Year: 2026-27**			
Branch: Food Science and Technology		**SEMESTER: 8th**			
1	Course Code	**FBP 418**			
2	Course Title	Food Toxicity and Safety Regulations Lab			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	DSE			
5	Course Objective	The objective of the Food Safety Management and Quality System Lab Class is to provide students with practical, hands-on experience in applying the principles and techniques of food safety management and quality control			
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Comprehend the basic concept of Food Laws and Regulations in India. CO2: Develop idea for purpose and action on food safety. CO3: Different laws and Acts. Food Hazards and Toxicology. Various hazards and their control measures CO4: Various terms of Food Quality and Quality assurance and its role in food. Food Adulteration and Food Additives CO5: Recognize the importance and utility of Food safety norms in food Industry. CO6: Built the knowledge of HACCP.			
7	**Outline syllabus**				**CO Mapping**
	Unit 1	Practical based on Quality Assessment			CO1,CO6
	Unit 2	Practical related to Physical Hazards Evaluation			CO2, CO6
	Unit 3	Practical related to Chemical Hazards Evaluation			CO3, CO6
	Unit 4	Practical related to Evaluation to Biological Hazard			CO4, CO6
	Unit 5	Practical related to Implementation of HACCP			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	CE	ESE	
		25%	25%	50%	
	Text book/s*	1. FSSAI ACTS AND LAWS			
	Other References	1. Emerging Technologies: Food process by DA-WEN, 2005 2. Food safety by Laura K Egendorf, 2000 3. International standards of food safety by Naomi Rees, David Watson, 2000			

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	1	-	3	2	1	-	1	-	2	1	1
CO2	2	2	2	1	2	2	1	-	1	1	2	1	2
CO3	3	1	2	1	2	1	2	-	2	1	3	1	2
CO4	3	1	2	1	2	1	2	-	2	1	3	1	1
CO5	3	2	2	2	2	1	3	-	2	1	2	-	1
CO6	3	2	2	2	1	1	3	-	2	2	2	2	1
Avg	2.50	1.67	1.83	1.40	2.00	1.33	2.00	0	1.67	1.20	2.33	1.20	1.33

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: BMB 413 **Course Title: Bioreactors and Down-stream Processing**

School: SBSR		**Batch: 2023-27**	
Programme: B.Sc.		**Current Academic Year: 2026-27**	
Branch: Food Science and Technology		**Semester: 8th**	
1	Course Code	**BMB 413**	
2	Course Title	**Bioreactors and Downstream Processing**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	DSE	
5	Course Objective	1. To enable students bridge the gap between theoretical concepts and practical aspects in industrial settings. 2. To have In-depth knowledge and hands-on laboratory/industrial skills required for employment or for creation of employment in desired product processing.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Improve the yield of products by improving fermentation efficiency by choosing correct mode of operation and nutritional requirement of microbes involved. CO2: Design bioreactors to achieve desired results (i.e. specified cell concentration, production rates, etc.). CO3: To separate different bio-products from any mixture keeping in mind the cost involved for the production. CO4: To extract product from extracellular/intracellular compartment of cells and carry out different membrane-based strategies for differentiating between the products of varying sizes. CO5: Choose various chromatographic techniques for separating pigments, drugs, amino acids and hormones etc. and carry out finishing of product for marketability. CO6:Create experiments for integrating separation, extraction and bioanalytical techniques for problem solving.	
8	Outline syllabus		CO Mapping
	Unit 1	**Fermentation process**	
	A	Introduction to fermentation process, Microbial growth kinetics, Industrial media/nutrients	CO1, CO6
	B	Modes of operation of fermenters- batch, continuous and fed batch mode	
	C	Inoculum development and transfer into fermenter	
	Unit 2	**Bioreactor design and operations**	
	A	Definition of bioreactor, Types of bioreactor- Continuous stirred tank bioreactor (CSTR)	CO2, CO6
	B	Tower reactor, Loop reactor, Anaerobic digester	
	C	Activated sludge bioreactor, Uses of bioreactor for biotechnological applications	
	Unit 3	**Bio-separation process in Biotechnology**	

	A	Range and characteristics of Bioproducts, Need for downstream processing			CO3, CO6
	B	Nature of bio-separation, Differences between chemical separation and bio-separation			
	C	Economic importance of bio-separation, RIPP scheme, cost cutting strategies in downstream processing			
	Unit 4	**Membrane based separations and cell disruption**			
	A	Membrane based purification, Microfiltration, Dialysis			CO4, CO6
	B	Ultrafiltration, Filtration processes, Types of filtration equipments, Floatation			
	C	Mechanical and enzymatic based methods for cell disruption			
	Unit 5	**Resolution of products and case studies**			
	A	Centrifugation- Differential and Density gradient, Molecular sieve chromatography			CO5, CO6
	B	Affinity Chromatography, Ion-exchange chromatography, High performance liquid chromatography			
	C	Production and polishing of Glutamic acid, Citric acid, Penicillin			
	Mode of examination	Theory			
	Weightage Distribution	Internal (CA+MSE)		External (ESE)	
		25%		75%	
	Textbook/s*	Bioseperations: Principles and Techniques- B. Sivasankar, Published by PHI Learning Pvt. Ltd., 2006.			
	Other References	1. Principles and Techniques of Practical Biochemistry- Keith Wilson And John Walker, Cambridge Press. 2. Bioseparation Technology- Mishra Neeraj, Publisher: CRC Press, 2008.			

CO/PO/PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	-	1	1	1	1	-	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-	-
CO3	-	-	-	-	-	1	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	1	-	1	1	-	-	-	1
CO6	-	-	-	-	-	2	-	2	-	-	-	-	-
Avg	0	0	0	0	0	1.40	0	1.33	1.00	1.00	1.00	0	1.00

SEMESTER - VII

Bachelor (Honors with Research)
in
Food Science and Technology

Course code: 411 Course Title: Bakery and Confectionary Technology

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc/Hons with research		**Current Academic Year:**	
Branch: Food Science and Technology		**SEMESTER: 7th**	
1	Course Code	**FST411**	
2	Course Title	**Bakery and Confectionary Technology**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	1. To develop industrial approach in students for bakery, chocolate, and confectionary industry. 2. To develop the expertise for new techniques for snack food.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Identify the key ingredients, tools, and equipment used in bakery and confectionary production CO2: Explain the scientific principles underlying the baking and confectionary processes and explain manufacturing process for bakery products. CO3: Perform the analysis of bakery ingredients and manufacture various bakery products and chocolate with maintaining safety and hygiene of bakery plants. CO4: Evaluate the quality of baked goods and confectionaries based on visual appearance, taste, texture, and aroma and also understand the importance of quality control and food safety in bakery and confectionary operations. CO5:Understand about extrusion cooking, machineries and products and Develop strategies for product diversification and expansion of extruded products. CO6: Describe the processing technology of bakery, confectionery and extruded products and evaluate the effectiveness of quality control measures and implement necessary improvements.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Introduction**	CO1,CO6
	A	Introduction to baking; Bakery ingredients and their functions; Machines and equipment for batch and continuous processing of bakery products.	
	B	Dough development; methods of dough mixing; dough chemistry.	
	C	Rheological testing of dough-Farinograph, Mixograph, Extensograph, Amylograph / Rapid Visco Analyzer, Falling number, Hosney's dough stickiness tester	
	Unit 2	**Manufacturing of bakery products**	CO2, CO6
	A	Technology for the manufacture of bakery products-bread, biscuits, cakes.	
	B	Effect of variations in formulation and process parameters on the quality of the finished product.	

	C	Quality consideration and parameters; Staling and losses in baking.	
	Unit 3	**Analysis of bakery products**	CO3, CO6
	A	Testing of flour; Cake icing techniques, wafer manufacture, cookies, crackers, dusting, or breading	
	B	Manufacture of bread rolls, sweet yeast dough products, cake specialties, pies and pastries, doughnuts, chocolates, and candies	
	C	Coating or enrobing of chocolate (including pan-coating); Maintenance, safety, and hygiene of bakery plants.	
	Unit 4	**Quality characteristics of confectionery ingredients**	CO4, CO6
	A	Quality characteristics of confectionery ingredients; technology for manufacture of flour, fruit, milk, sugar, chocolate, and special confectionery products	
	B	Colour, flavour, and texture of confectionery; standards and regulations.	
	C	Machineries used in confectionery industry	
	Unit 5	**Extrusion**	CO5, CO6
	A	Importance and applications of extrusion in food processing; Pre and post extrusion treatments.	
	B	Manufacturing process of extruded products	
	C	Change of functional properties of food components during extrusion	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. Bakery Technology & Engineering; Matz SA; 1960; AVI Pub.	
	Other References	1. Extrusion of Food, Vol 2; Harper JM; 1981, CRC Press. 2. Up to-date Bread Making; Fance WJ &Wrogg BH; 1968, Maclasen & Sons Ltd.	

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	1	1	1	2	1	1	-	1	1	1
CO2	3	2	3	1	1	2	1	2	3	-	2	1	1
CO3	3	2	3	1	1	2	2	2	3	-	2	1	1
CO4	3	2	3	1	1	-	3	2	2	-	1	3	2
CO5	3	2	3	1	1	2	2	2	2	-	3	2	2
CO6	3	2	3	1	1	1	2	2	2	-	2	2	2
Avg	3.00	2.00	3.00	1.00	1.00	1.60	2.00	1.83	2.17	0	1.83	1.67	1.50

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: FST412 Course Title: Fundamentals of Biostatistics, Bioethics and IPR

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc/Hons with research		**Current Academic Year: 2026-27**	
Branch: Food Science and Technology		**SEMESTER: 7th**	
1	Course Code	**FST412**	
2	Course Title	**Fundamentals of Biostatistics, Bioethics and IPR**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	To understand the concepts of statistics and able to utilize it on the experimental biological data.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Understand the basic concepts of Statistics CO2: Apply the concept of probability and its application CO3: Analyze the correlation and regression using appropriate data CO4: Evaluate and apply the concepts of IPR CO5: To understand the bioethics in biology CO6: Create and evaluate the biostatistics data for biological application	
7	Course Description	In-depth understanding of statistics as well as to know the basics of bioethics and IPR.	
8	**Outline syllabus**		**CO Mapping**
	Unit 1	Introduction	CO1,CO6
	A	Introduction to Biostatistics	
	B	Frequency distribution: Measures of central tendency: Mean, Median, Mode, standard deviation.	
	C	Measures of dispersion: Skewness & Kurtosis	
	Unit 2	**Probability and Correlation**	CO2, CO6
	A	Probability: definition of probability and binomial distribution (numerical)	
	B	Sample, Population, large sample, small sample. Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, difference	
	C	Correlation: Definition, Karl Pearson's coefficient of correlation, Simple Regression,	
	Unit 3	**Hypothesis and Error**	CO3, CO6
	A	Concept of Test of Hypothesis. Applications of t-test statistics to biological problems/data	
	B	Chi square, statistic applications in Biology	
	C	Error-I type, Error-II type, Standard error of mean	

	Unit 4		CO4, CO6
	A	The concept of intellectual property, Importance of IPR in biotechnology, Indian laws and treaties for IPR	
	B	Patents-basic concepts, Infringement, compulsory licenses, Exploitation of the Patented Invention, Compulsory Licenses	
	C	Copyright and related rights; piracy and infringement and their remedies Definitions, Signs which serve as trademarks	
	Unit 5	**Bioethics**	CO5, CO6
	A	Introduction to Biosafety, Need for Biosafety in present scenario	
	B	Classification and Description of Biosafety Levels, Design of Clean rooms, Design of Biosafety Labs, Biosafety Regulations,	
	C	Laws and Policies, Biosafety and Agriculture**, Genetic Engineering and Health; Genetic Engineering and Food Safety,** International Centre for Genetic Engineering and Biotechnology (ICGEB)	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. Fundamental of Statistics by S.C. Gupta, Himalaya Publishing House.	
	Other References	4. Pharmaceutical Statistics- Practical and Clinical Applications by Sanford Bolton, Marcel Dekker Inc. New York. 5. •Design and Analysis of Experiments by R. Pannerselvam, PHI Learning Private Limited. 6. •Design and Analysis of Experiments by Douglas and C. Montgomery, Wiley Students Edition.	

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	1	1	1	1	2
CO2	1	2	2	2	1	1	2	1	1	1	1	1	1
CO3	1	1	1	1	1	1	2	2	1	1	1	1	1
CO4	2	1	2	1	2	1	1	1	1	2	2	1	2
CO5	2	1	1	2	2	1	2	1	1	2	2	1	1
CO6	1	1	1	1	1	1	2	2	1	1	1	1	2
Avg	1.33	1.17	1.33	1.33	1.33	1.00	1.83	1.50	1.00	1.33	1.33	1.00	1.50

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: FST413 Course Title: Functional Food and Nutraceuticals

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc/Hons with research		**Current Academic Year: 2026-27**	
Branch: Food Science and Technology		**SEMESTER: 7th**	
1	Course Code	**FST413**	
2	Course Title	**Functional Food and Nutraceuticals**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	• To understand the interrelationship between nutraceuticals and health maintenance. • Understanding the traditional system of medicine as well as the need for changing trends in the nutraceutical Functional Food Industry. • To learn the efficacy and safety of nutraceutical and functional food products. • 4. To learn the packaging and labelling strategies of remedial food.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Recall the basic principles and concepts of functional food and nutraceuticals. CO2: Describe and understand the properties, structure, and functions of nutraceuticals. CO3: Apply the principles of formulation and development of functional food and nutraceutical products for specific health conditions or populations CO4**:** Analyze about the different sources of functional food and nutraceuticals, there application and packaging and labelling requirements. CO5: Assess the potential risks and benefits associated with the consumption of specific functional food and nutraceutical products and Safety regulations in USA, EU and India. CO6: Understand the basic concepts of nutraceuticals and functional food and use those concepts to development of food products and Evaluate the impact of functional food and nutraceutical interventions on the overall health and well-being of individuals	
7	Course Description	This course comprises of the structure, function, properties and significance of functional and nutraceutical food. Sources and health benefits will be studied in details.	
8	**Outline syllabus**		**CO Mapping**
	Unit 1	**Introduction to Nutraceuticals and Functional Food**	CO1,CO6
	A	Definition, national and international status, scope & prospects of nutraceuticals and functional food.	
	B	Applied aspects of the Nutraceutical and Functional Food Science. Sources of Nutraceuticals. Relation of functional foods & Nutraceutical to foods.	
	C	Formulation considerations and challenges, new product development	
	Unit 2	**Properties and Functions of Nutraceuticals and Functional Foods**	CO2, CO6

	A	Nutraceuticals: Glucosamine, Octacosanol, Lycopene, Carnitine, Melatonin and Ornithine alpha-ketoglutarate, pro-anthocyanidins, grape products, flaxseed oil and others	
	B	Functional Foods: Sources and role of Isoprenoids, Isoflavones, Flavonoids, carotenoids, Tocotrienols, Polyunsaturated fatty acids, sphingolipids, lecithin, choline, Terpenoids	
	C	Vegetables, Cereals, milk and dairy products as Functional foods and others.	
	Unit 3	**Role of Functional Foods as Remedial Foods and Disease Prevention**	CO3, CO6
	A	Nutraceuticals bridge the gap between food and drug.	
	B	Nutraceuticals – garlic, grape, wine, tea, soy proteins and soy isoflavones, dietary fibre, omega-3 fatty acids, antioxidants and phytochemicals, single-cell proteins, and marine-derived nutraceuticals.	
	C	Nutraceutical remedies for common disorders like circulatory problems, hypo-glycemia, nephrological disorders, liver disorders, osteoporosis, gastrointestinal disorders, and cardiovascular diseases.	
	Unit 4	**Nutraceutical Sources and Packaging & Labelling Requirements for Functional Food Products**	CO4, CO6
	A	Plant secondary metabolites: Role of Plant Sterols and Phytoestrogens in Functional Foods, Phenolics in Herbal and Nutraceutical Products.	
	B	Animal metabolites: Fat-rich functional food and their applications - Functional Fats and Spreads, modified fats and oils. Functional Meat as Functional Foods, Functional Confectionery and other functional Products	
	C	Packaging and labelling requirements: Packaging and packaging materials, an overview of dietary supplements labelling, nutrition labelling requirements.	
	Unit 5	**Claims, Marketing and Regulations for Functional Food Products**	CO5, CO6
	A	Nutritional content claims, health claims and exemption from FDA requirements, Dietary supplements labelling issues, regulatory agencies views on label claims.	
	B	The market for Functional Food Products: Market scenario, Functional foods and consumers.	
	C	The role of health in food choice; Functional foods market; Regulations and laws for functional food. Regulations in USA, EU and India	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	4. A. E. Bender, “Nutrition and Dietetic Foods”, Chem. Pub. Co. New York, 2ndEdition, 2004. 5. P. S. Howe, “Basic Nutrition in Health and Disease”,2ndEdition,W. B. Saunders Company, London, 2003. 6. Kramer, “Nutraceuticals in Health and Disease Prevention”, Hoppe and Packer, Marcel Dekker, Inc., NY 2001.	
	Other References	3. Bao and Fenwick, “Phytochemicals in Health and Disease”, Marcel Decker, Inc. NY 2004. 4. Rotimi E.Aluko. Functional Foods and Nutraceuticals. Springer.	

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	1	1	-	2	-	-	-	1	1	1
CO2	3	2	3	1	1	2	3	1	-	-	2	1	1
CO3	1	2	3	1	1	-	3	2	-	-	2	1	1
CO4	2	2	3	1	1	1	3	2	1	-	1	3	2
CO5	1	2	3	1	1	2	3	2	1	-	3	2	2
CO6	3	2	3	1	1	2	3	2	1	-	2	2	2
Avg	2.17	2.00	3.00	1.00	1.00	1.75	2.83	1.80	1.00	0	1.83	1.67	1.50

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: FST414 Course Title: Food Quality Analysis

School: SSBSR		**Batch: 2023-27**
Programme: B.Sc/Hons with research		**Current Academic Year: 2026-27**
Branch: Food Science and Technology		**SEMESTER: 7th**
1	Course Code	**FST414**
2	Course Title	**Food Quality and Analysis**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	• Understanding about food laws and Acts. • Importance and need of food regulations. • Various hazards in food. • Food Quality and Quality Assurance. • Food Toxicology and its related studies. • Codex; Food Packaging and labeling. • Food Additives; Food Adulteration • FSSAI, PFA, HACCP AND CCP
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Recall the basic concept of Food Laws and Regulations in India. CO2: Interpret and explain the concepts and techniques used in food quality assessment and Role of HACCP in that. CO3: Implement of national standards such as FSSAI to monitor and ensure the quality and safety of food products. CO4: Application of International standards to monitor the presence of contaminants in food and toxicity due to various pathogens. CO5: Critically evaluate the compliance of food products with regulatory standards and industry guidelines. CO6: Recognize the importance and utility of Food safety norms in food Industry. Basic understanding with Codex.
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**General principles for food safety and hygiene**	CO1,CO6
	A	Introduction, Definition, functions, and General aspects of Food Safety	
	B	Various aspect of Food Quality and Quality Assurance; ISO's	
	C	Mandatory laws for food processing.	
	Unit 2	**Implementation, documentation, and record keeping**	CO2, CO6
	A	Types of food hazards: biological, chemical and physical, Risk assessment.	

	B	Existing and emerging pathogens due to globalisation of food trade.	
	C	Newer systems of safety evaluation such as HACCP and CCP	
	Unit 3	**National standards**	CO3, CO6
	A	Salient features of Food Safety & Standards Act, 2006, Structure of FSSAI.	
	B	Prevention of Food Adulteration	
	C	ISO 22000 (Food Safety Management System)	
	Unit 4	**International bodies dealing in standardization**	CO4, CO6
	A	Intentional and unintentional contaminants in food industry, Common screening methods.	
	B	Toxicity due to microbial toxins including botulinum and staphylococcal toxins, mycotoxin and due to other food pathogens.	
	C	Food allergy and intolerance; Causes, symptoms and novel methods/products to reduce the effect.	
	Unit 5	**Recent concerns**	CO5, CO6
	A	Food Adulteration (Common adulterants), Food Additives (functional role, safety issues).	
	B	Food Packaging & labelling (Packaging types, understanding labelling rules & Regulation).	
	C	Labelling requirements for pre-packaged food as per CODEX.	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. FSSAI ACTS AND LAWS	
	Other References	1. EMERGING TECHNOLOGIES; FOOD PROCESS BY DA-WEN, 2005 2. FOOD SAFETY by Laura K Egendorf, 2000 3. International standards of food safety by Naomi Rees, David Watson, 2000 4. Codex alimentarius by FAO & WHO, 2007	

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	1	2	1	1	-	1	-	3	2	1
CO2	3	3	2	1	2	1	2	-	2	1	3	2	3
CO3	3	3	2	1	2	1	2	-	2	1	3	2	1
CO4	3	3	2	1	2	1	2	-	2	1	3	2	1
CO5	3	3	2	1	2	1	2	-	2	1	3	3	1
CO6	3	3	2	2	1	1	2	-	2	2	3	2	2
Avg	2.83	2.67	1.83	1.17	1.83	1.00	1.83	0	1.83	1.20	3.00	2.17	1.50

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High

Course code: FBP 414 **Course Title: Food Quality Analysis Lab**

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc/Hons with research		**Current Academic Year: 2026-27**	
Branch: Food Science and Technology		**SEMESTER: 7th**	
1	Course Code	**FBP 414**	
2	Course Title	**Food Quality and Analysis Lab**	
3	Credits	**1**	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	• To develop a sense of food quality assessment of food products • To use traditional methods to know about type biological hazards in products • To have an overview of the various microbiological methods involved in the determination of contaminants in food. • To develop a working knowledge of the use of food quality in nutritional segment.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Comprehend the basic concept of Food adulteration. CO2: Develop idea for purpose of this in food safety. CO3: Different methodology used to identify various biological hazards and their control measures in food processing CO4: Various internal and external factors involved in of Food Quality and self-life of products. CO5: Recognize the importance and utility of microbial test in Food quality and in food Industry CO6: To plan and compile different Quality assessment methods to maintain the quality of food products.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	Practical based on FSMS:22000 Quality Assessment	CO1,CO6
	Unit 2	Practical related to –HACCP Hazards Evaluation	CO2, CO6
	Unit 3	Practical related to---Physical, Chemical Hazards Evaluation	CO3, CO6
	Unit 4	Practical related to---Evaluation to Biological Hazard	CO4, CO6
	Unit 5	Practical related to---Implementation of Quality assessment Methods on Food Industries	CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva	

	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. FSSAI ACTS AND LAWS	
	Other References	1. Emerging Technologies: Food process by DA-WEN, 2005 2. Food safety by Laura K Egendorf, 2000 3. International standards of food safety by Naomi Rees, David Watson, 2000 4. Codex Alimentarius by FAO & WHO, 2007	

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	1	-	3	2	1	-	1	-	2	1	1
CO2	2	3	2	1	2	2	1	-	1	1	2	1	2
CO3	3	3	2	1	2	1	2	-	2	1	3	1	2
CO4	3	3	2	1	2	1	2	-	2	1	3	1	1
CO5	3	3	2	2	2	1	3	-	2	1	2	-	1
CO6	3	3	2	2	1	1	3	-	2	2	2	2	1
Avg	2.50	2.83	1.83	1.40	2.00	1.33	2.00	0	1.67	1.20	2.33	1.20	1.33

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course code: CHE 101 **Course Title: Fundamentals of Chemistry**

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc/Hons with research		**Current Academic Year: 2026-27**	
Branch: Food Science and Technology		**SEMESTER: 7th**	
1	Course Code	**CHE101**	
2	Course Title	**Fundamentals of Chemistry**	
3	Credits	**3**	
4	Contact Hours (L-T-P)	**3-0-0**	
	Course Status	Minor	
5	Course Objective	1. Molecular polarity and weak chemical forces. 2. Current bonding models for simple inorganic and organic molecules in order to predict structures and important bonding parameters. 3. Periodic properties of elements. 4. The basics of organic chemistry give the most primary and utmost important knowledge and concepts of organic Chemistry, theoretical picture in multiple stages in an overall chemical reaction. 5. Reactive intermediates, transition states and states of all the bonds broken and formed, reaction mechanism. 6. Stereochemistry of simple organic molecules.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Explain molecular polarity and weak chemical forces CO2: Describe simple bonding theories of molecules. CO3: Discuss periodic properties of elements and recapitulate basics of Organic Chemistry CO4: Explain mechanism of organic reactions. CO5: Illustrate stereochemistry of simple organic molecules. CO6: Apply the knowledge to solve simple scientific problems.	
7	Course Description	This course includes introduction to Indian ancient Chemistry and the contribution of Indian Chemists, describes molecular polarity, weak chemical forces, chemical bonding, periodic properties of elements, organic reaction intermediate, reaction mechanism, stereochemistry.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Molecular Polarity and Weak Chemical Forces**	CO1
	A	Introduction to Indian Ancient Chemistry and contribution of Indian Chemists. Formal charge, Van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interaction, dipole moment	

		and molecular Structure (Diatomic and polyatomic molecules), Percentage ionic character from dipole moment.	
	B	Polarizing power and polarizability. Fajan's rules and consequences of polarization. Hydrogen bonding.	CO1, CO6
	C	Effects of weak chemical forces, melting and boiling points, solubility, energetics of dissolution process. Lattice energy and Born-Haber cycle, solvation energy, and solubility of ionic solids.	CO1, CO6
	Unit 2	**Simple Bonding theories of Molecules**	CO2, CO6
	A	Atomic orbitals, Aufbau principle, multiple bonding (σ and π bond approach), valence bond theory (VBT), Concept of hybridization, hybrid orbitals and molecular geometry.	
	B	Bent's rule, Valence shell electron pair repulsion theory (VSEPR), shapes of the following simple molecules and ions containing lone pairs and bond pairs of electrons: H_2O, NH_3, PCl_5, SF_6, SF_4, ClF_3, I_3^-, ClF_2^{--}.	
	C	Molecular orbital theory (MOT). Molecular orbital diagrams, bond orders of homonuclear and heteronuclear diatomic molecules and ions (N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions).	
	Unit 3		CO3, CO6
	A	**Periodic Properties of Elements** Brief discussion, factors affecting and variation trends of following properties in groups and periods. Effective nuclear charge, shielding or screening effect, Slater rules, Atomic and ionic radii, Electronegativity, Pauling's/ Allred Rochow's scales, Ionization enthalpy, Electron gain enthalpy.	
	B	**Recapitulation of Basics of Organic Chemistry** Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bonding, Van der Waals interactions, inclusion compounds, Clathrates, Charge transfer complexes, hyperconjugation, Dipole moment	
	C	Electronic Displacements: Inductive, electromeric, resonance, mesomeric effects and their applications	
	Unit 4	**Mechanism of Organic Reactions**	CO4, CO6
	A	**Mechanism of Organic Reactions** Curved arrow notation, drawing electron movements with allows, half-headed and double-headed arrows, homolytic and heterolytic bond fission, Types of reagents – electrophiles and nucleophiles.	
	B	Reactive intermediates – Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples).	
	C	Types of organic reactions, Energy considerations.	
	Unit 5		CO5, CO6
	A	Concept of isomerism, Types of isomerism; Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, Newman projection and Sawhorse formulae, Fischer and flying wedge formulae, Difference between configuration and conformation.	
	B	Relative and absolute configuration, sequence rules, D & L and R & S	

		systems of nomenclature. Geometric isomerism – determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.		
	C	Conformational isomerism – conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	Internal (CA+MSE)		External (ESE)
		25%		75%
	Text book/s*	1. Lee, J.D. Concise Inorganic Chemistry, Pearson Education 2010. 2. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 3. Graham Solomons, T.W., Fryhle, C. B. Organic Chemistry, John Wiley & Sons, Inc.		
	Other References	1. Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry, Oxford, 1970. 2. Carey, F. A., Guiliano, R. M.Organic Chemistry, Eighth edition, McGraw Hill Education, 2012. 3. Clayden, J., Greeves, N. &Warren, S. Organic Chemistry, 2nd edition, Oxford University Press, 2012. 4. Shriver, D.D. & P. Atkins, Inorganic Chemistry 2nd Ed., Oxford University Press, 1994.		

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	-	1	1	1	-	1	1	-	2	1	1
CO2	1	1	1	1	1	1	1	1	1	-	2	1	1
CO3	1	1	1	1	1	1	1	1	1	-	2	1	1
CO4	1	1	1	1	1	1	1	1	1	-	2	1	1
CO5	1	1	1	1	1	1	1	1	1	-	2	1	1
CO6	1	1	1	1	1	1	1	1	1	1	2	1	1
Avg	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00	1.00

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

SEMESTER – VIII

Bachelor (Honors with Research)
in
Food Science and Technology

Course code: FST419 Course Title: Basic Concepts of Research Design and Methodology

School: SSBSR		**Batch: 2023-27**	
Programme: B.Sc. Hons with Research		**Current Academic Year: 2026-27**	
Branch: Food Science and Technology		**SEMESTER: 8th**	
1	Course Code	**FST 419**	
2	Course Title	Basic Concepts of Research Design and Methodology	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	1. To understand the various research concepts. 2. To understand the research design, hypothesis and selecting the research problem. 3. To learn the sampling procedure and data collection. 4. To learn the data interpretation, data analysis, writing research project.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Define various research concepts. CO2: Explain research design, hypothesis and selecting the research problem CO3: Identify and discuss the concepts and procedure of sampling, data collection. CO4: Identify, explain compare and prepare the key element of a research proposal and report CO5: Evaluate the data interpretation and data analysis. CO6: Demonstrate the knowledge of research process, research design and complete research hypothesis in research methodology.	
7	**Outline syllabus**		**CO Mapping**
	Unit 1	**Basics of Research in Food Science**	CO1,CO6
	A	Exploration, Description, Explanation, Scientific method and research.	
	B	Research Designs –Experimental and Observational, Quantitative and Qualitative approaches	
	C	Conceptualization and Measurement, Variables, concepts and measurement.	
	Unit 2	**Sampling & Tools**	CO2, CO6
	A	Role of sampling in research, Types of sampling	
	B	Research Tools and Techniques, Validity and reliability	
	C	Interviewing and observational methods	
	Unit 3	**Research Process**	CO3, CO6
	A	Defining the problem, research questions, objectives, hypotheses, Review of related literature and originality in writing	
	B	Planning the research, Subjects context and ethics, Methodology, and tools	

	C	Citation formats: in biological sciences.	
	Unit 4	**Sampling Process**	CO4, CO6
	A	Exercise in sampling, Random Number Table, Exercise in designing tools and their analysis	
	B	Interview and Questionnaire method	
	C	Data collection Process: Conducting interviews, FGDs (focus on group discussion)	
	Unit 5	**Data Collection**	CO5, CO6
	A	Levels of measurement	
	B	Units of analysis, Case studies	
	C	Result Interpretation	
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	Internal (CA+MSE)	External (ESE)
		25%	**75%**
	Text book/s*	1. Kumar, R. (2005) Research Methodology: A Step-by-Step Guide for Beginners. Sage 2. Kothari C.R. (2008) Research Methodology: Methods and Techniques 2nd Ed New Age-International Pvt Tld, New Delhi.	
	Other References	1.Kerlinger F.N. and Lee, H.B. (2000) Foundations of Behavioural Research 4th Ed. Harcour College Publishers 2. Black J.A. & Champion, D.J. (1976) Methods and Issue in Social Research. New York Wiley and Sons.	

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	2	-	1	3	1	2	3	2	1	1	1
CO2	2	2	3	-	3	3	1	2	1	2	1	2	1
CO3	2	2	3	-	2	3	-	1	1	3	1	2	1
CO4	1	1	2	-	2	3	-	2	1	2	1	1	1
CO5	1	1	2	-	2	3	-	2	1	2	1	1	1
CO6	1	1	2	-	2	3	-	3	1	3	1	1	1
Avg	1.67	1.50	2.33	0	2.00	3.00	1.00	2.00	1.33	2.33	1.00	1.33	1.00

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)