

CURRICULUM & SYLLABUS



Bachelor of Science Food Technology

or

Bachelor of Science Food Technology (Hons.)/ (Hons. with Research)/

Academic Projects

(A 4 Year Graduate Programme)

Under UGC Framework- 2022 based on NEP- 2020

[w. e. f. Academic Year: 2025-2026]

Department of Food Technology

Faculty of Science & Humanities

**SRM University, Delhi-NCR, Sonapat, Haryana-
131029, India**

SRM UNIVERSITY DELHI-NCR, SONEPAT (HARYANA)

VISION

SRM University Haryana aims to emerge as a leading World Class Institution that creates and disseminates knowledge upholding the highest standards of instruction in Engineering & Technology, Science & Humanities, Commerce, Management, Hotel Management & Medicine & Health Science. Along with academic excellence, our curriculum imparts integrity and social sensitivity so that our graduates may best serve the Nation and the World.

MISSION

- To create a diverse community campus that inspires freedom and innovation.
- Strengthen Excellence in educational & skill development processes
- Continue to build productive international alliances
- Explore optimal development opportunities available to students and faculty
- Cultivate an exciting and rigorous research environment

DEPARTMENT OF FOOD TECHNOLOGY

VISION

The Department of Food Technology offers a modern and comprehensive skill-based curriculum under National Educational Policy (NEP) 2020. Under NEP 2020, Department aim to develop good, thoughtful, well-rounded, and creative individuals. To prepare students for professional as well as private life. To not only train them with the core components but also in areas that are need-based, innovative and relevant keeping in pace with the dynamics of the growing food industry. The department is focused to contribute to scholastic and experimental knowledge through sheer dedication and excellence to prepare future academicians, nutritionists, scientists, and entrepreneurs.

MISSION

- To demonstrate thorough knowledge and understanding of the food technology curriculum.
- To apply the principles of food science to preserve, process and package to assure the quality and safety of food products.
- To understand that the real-world problems in the food industry through the consecutive acquisition of knowledge and its application to improve the safety and quality of a given food or process.
- To bridge the gap between industry and academia by imparting technical/experimental knowledge, along with its application in the practical world.
- To acquaint students with knowledge and skills, including “learning how to learn”, necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, and adapting to changing trades and demands of the workplace through knowledge/skill development/reskilling.
- To provide professional competency and entrepreneurial skills for economic empowerment.
- To encourage innovation through multidisciplinary research and development activities.
- To inculcate human values and ethics into students to serve the society and nation, in all possible ways.

FOOD TECHNOLOGY GRADUATE EMPLOYABILITY ATTRIBUTES

- **Communication Skills:** Enhancing verbal and written communication abilities to effectively convey technical information to diverse stakeholders, including team members, supervisors, and customers.
- **Teamwork and Collaboration:** Fostering teamwork and collaboration through group projects, discussions, and interdisciplinary activities, which are crucial for success in the food industry's dynamic work environment.
- **Critical Thinking and Problem-Solving:** Encouraging students to identify and analyze complex food-related problems, apply scientific methods, and develop innovative solutions.
- **Leadership and Management:** Providing opportunities for students to develop leadership qualities and project management skills to take on leadership roles in the food sector.
- **Practical Skills:** Hands-on training in food processing techniques, equipment operation, and laboratory analysis to develop technical proficiency and practical competence.
- **Technical Knowledge:** A solid foundation in food science, food processing, food safety, quality control, and preservation methods is essential for graduates to excel in the industry.
- **Entrepreneurial Thinking:** Encouraging students to think innovatively, identify entrepreneurial opportunities, and foster a spirit of entrepreneurship to contribute to economic development.
- **Industrial Exposure:** Providing opportunities for internships, industrial visits, and collaborations with food companies to gain real-world experience and exposure to industry practices.
- **Ethical Awareness:** Cultivating an understanding of ethical and societal responsibilities related to food technology, sustainability, and social impact.
- **Food Regulations and Compliance:** Familiarizing students with relevant food safety regulations and quality assurance standards applicable to the food industry.
- **Research and Development:** Introducing students to research methodologies and encouraging participation in food-related research projects to promote innovation in the field.

GRADUATE EMPLOYABILITY ATTRIBUTE

EXIT-1: A student may take exist after completion of one year with 46 credits earned. S/He will get Certificate in the Food Technology.

EA-1: Graduates should possess a clear understanding of their chosen scientific field, including relevant concepts, theories, and methodologies.

EXIT-2: A student may take exist after completion of two years with 95 credits earned. S/He will get Diploma in the Food Technology.

EA-1: Graduates should possess a deep understanding of their chosen scientific field, including relevant concepts, theories, and methodologies.

EA-2: Equipping students with skills like critical thinking, problem-solving, and communication, which are highly valued in today's job market.

EXIT-3: A student may take exist after completion of three years with 145 credits earned. S/He will get Bachelor in the Food Technology.

EA-1: Graduates should possess a deep understanding of their chosen scientific field, including relevant concepts, theories, and methodologies.

EA-2: Equipping students with skills like critical thinking, problem-solving, and communication, which are highly valued in today's job market.

EA-3: Effective learning, including the ability to convey complex scientific information clearly and concisely.

EXIT-4: On completion of Four years with 181 credits earned. S/He will get B.Sc. (Honours/Honours with Research) Food Technology.

EA-1: Graduates should possess a deep understanding of their chosen scientific field, including relevant concepts, theories, and methodologies.

EA-2: Equipping students with skills like critical thinking, problem-solving, and communication, which are highly valued in today's job market.

EA-3: Effective written and verbal communication skills, including the ability to convey complex scientific information clearly and concisely.

EA-4: They should be able to apply their knowledge to solve real-world problems, and analyse data.

EA-5: A strong foundation in research methodologies, including the ability to formulate research questions, design experiments, and interpret results.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

B.Sc. Food Technology is a four-year undergraduate program with specialization in food sciences. The program fosters interdisciplinary approach to not only train them with the core components, but also in areas that are need-based, innovative and relevant keeping in pace with the dynamics of the growing food industry.

The program educational objectives of the course are:

PEO 1: Technical Competence - Demonstrate a strong foundation in food science and technology, including knowledge of food processing, preservation, safety, and quality control, enabling them to contribute effectively to the food industry.

PEO 2: Problem-Solving Skills - Analytical and critical thinking abilities to identify and solve complex problems related to food production, processing, and innovation, fostering innovation and continuous improvement in the food sector.

PEO 3: Professional Development - Develop communication, leadership, and teamwork skills, as well as an understanding of ethical and societal responsibilities, to excel in multidisciplinary teams and take on leadership roles in the food industry.

PEO 4: Adaptability - Adapt to changing technologies, market demands, and global trends in food technology, allowing them to sustainably address challenges in food production, processing, and distribution.

PEO 5: Lifelong Learning - Ability and motivation to engage in lifelong learning, staying abreast of emerging trends and developments in food technology, and pursuing higher studies or professional certifications as necessary.

PEO 6: Entrepreneurship - Knowledge and skills to identify entrepreneurial opportunities in the food sector, enabling them to establish their food-related ventures and contribute to economic development.

PROGRAM LEARNING OUTCOMES (PLOs):

At the end of the program in B.Sc. (Hons./ Hons. with Research) Food Technology, a student is expected to exhibit the under mentioned:

PLO 1: Knowledge Base - Demonstrate comprehensive knowledge and understanding of food science, food processing techniques, food safety regulations, and the principles of food quality assurance.

PLO 2: Technical Proficiency - Apply practical skills in food processing, preservation, and analysis, utilizing modern technologies and equipment commonly used in the food industry.

PLO 3: Problem-Solving - Identify, analyze, and solve food-related problems using scientific methods and critical thinking skills, considering factors such as food safety, quality, and sustainability.

PLO 4: Communication - Effectively communicate food-related information to various stakeholders, both orally and in writing, with clarity and coherence.

PLO 5: Teamwork - Collaborate and work efficiently in interdisciplinary teams, demonstrating leadership qualities, effective communication, and the ability to adapt to diverse perspectives.

PLO 6: Ethical and Professional Responsibility - Recognize the ethical and societal implications of food technology, adhere to professional codes of conduct, and consider the environmental and social impact of food-related practices.

PLO 7: Lifelong Learning - Engage in continuous learning by staying updated with emerging food technologies and industry trends. Innovative approach towards any future opportunities, or endeavors.

These Program Education Objectives and Program Learning Outcomes will serve as guiding principles for the B.Sc. (Hons./ Hons. with Research) Food Technology Programme, ensuring that graduates are well-prepared to address the challenges and contribute effectively to the food industry.

MAPPING MATRIX OF PEOs & PLOs

PLOs PEOs	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7
PEO 1							
PEO 2							
PEO 3							
PEO 4							
PEO 5							
PEO 6							

**Four Year B.Sc. Food Technology Programme Structure in alignment with
NEP-**

2020 in the Department of Food Technology, SRMUH

w.e.f. Academic Year 2025-26

S. No.	Broad Category of Courses	No. of Courses	Credits	%
1	Major Course (Discipline Specific Course DSC)	24	$24 \times 4 = 96$	52.8
2	Interdisciplinary Course (IDC) / Minor Stream Course (MSC)	7	$7 \times 4 = 28$ $3 \times 4 = 12^*$	15.4
3	Multi-Disciplinary Course (MDC)	3	$3 \times 3 = 9$	5
4	Ability Enhancement course (AEC)	4	$2 \times 2 = 4$ $2 \times 2 = 4$	5.5
5	Skill Enhancement Course (SEC)	10	$10 \times 1 = 10$	5.5
6	Value Added Course (VAC)	4	$4 \times 2 = 8$	4.37
7	Project / Dissertation	3	$1 \times 2 + 1 \times 4 = 6 + 1 \times 6 = 12\#$	6.6
8	Live Projects/Vocational Courses/Summer Internship	3	$3 \times 4 = 12$	6.6
Total		57	183	100

**Four Year B.Sc. Food Technology Programme Structure component-wise
distribution in alignment with NEP-2020 in the Department of Food
Technology,
SRMUH w.e.f. Academic Year 2025-26.**

S. No.	Courses types	No. of Courses	Component	Credits	Total Credits	%
1	Major Course	24	Theory	$24 \times 3 = 72$	96	52.5
			Practical	$24 \times 1 = 24$		
2	Interdisciplinary Course (IDC) / Minor Stream Course (MSC)	7	Theory	$7 \times 4 = 28$	28	15.3
3	Multi-Disciplinary Course (MDC)	3	Theory	$3 \times 3 = 9$	9	5
4	Ability Enhancement course (AEC)	4	Theory	$2 \times 2 = 4$ $2 \times 2 = 4$	8	5.5
5	Skill Enhancement Course (SEC)	10	Soft SEC Practical	$5 \times 1 = 5$	10	5.5
			Tech. SEC Practical	$5 \times 1 = 5$		
6	Value Added Course (VAC)	4	Theory	$3 \times 2 = 6$	8	4.37
			Practical	$2 \times 1 = 2$		
7	Project / Dissertation	3*	Theory*	$3 \times 4 = 12^*$	12	6.6
		3#	Theory#	$2 \times 1 = 2$		
			Practical#	$1 \times 4 = 4$ $1 \times 6 = 6$		
8	Live Projects/Vocational Courses/Summer Internship	3	Practical	$3 \times 4 = 12$	12	6.6
Total		57	Theory	117=63.93%	183	100
			Practical	43=23.6%		
			Project	24=13.2%		

***Students pursuing Honours will do 4 courses for 12 Credit in lieu of a Research Project/Dissertation.**

#Students pursuing Honours with Research would complete 12 Credits of Research/Dissertation.

Semester	Broad Category of Courses								Total Credits	Remarks
	Major	Minor	Multidisciplinary	AEC	SEC	VAC	RP/Dissertation	Live Projects/Vocational Courses/Summer Internship		
I	8	4	3	2	2	2	-	-	21	Certificate: 46 Credits
II	8	4	3	2	2	2	-	4	25	
III	12	4	3	2	2	2	-	-	25	Diploma: 97 Credits
IV	12	4	-	2	2	2	-	4	26	
V	16	4	-	-	2	-	-	-	22	Degree: 147 Credits
VI	16	8	-	-	-	-	-	4	28	
VII	12	6*	-	-	-	-	6#	-	18	Honours / Honours with Research: 183 Credits
VIII	12	6*	-	-	-	-	6#	-	18	

3 Years	72	28	9	8	10	8	0	12	147
%	49.65	19.31	6.21	5.52	6.89	5.44	0.00	8.28	100.00
4 Years	96	28	9	8	10	8	12	12	183
%	53.04	15.30	4.92	4.42	5.52	4.37	6.63	6.63	100.00

*Students pursuing Honours will do 4 courses for 12 Credit in lieu of a Research Project/Dissertation.

#Students pursuing Honours with Research would complete 12 Credits of Research/Dissertation.

COURSE REVISION DETAILS

1. The course structure and syllabus are revised from four year B.Sc. (Honours / Honours with Research) Food Technology programme following the UGC frame work 2022 based on NEP 2020 to more specific for industrial subjects and research oriented. This four year under graduate Food Technology programme with be effective from the academic year 2025-26.
2. Course Objectives and Course Learning Outcomes are made more specific for all courses.
3. One new minor stream course is added in the curriculum 2025-26 (Food Laws and Standards)
4. One VAC course is added in the curriculum 2025-26 (Environmental Management & legislation)

B.Sc. Food Technology

Semester-I

CODE	CATEGORY	COURSE	L	T	P	C
25FTBS101	Major Course	Introduction to Food Science	3	0	0	3
25FTBS151	Major Course	Introduction to Food Science Lab	0	0	2	1
25FTBS102	Major Course	Fundamentals of Food Technology	3	0	0	3
25FTBS152	Major Course	Fundamentals of Food Technology Lab	0	0	2	1
	IDC/Minor Stream Course	IDC/MSC 1	3	1	0	4
	Multi Disciplinary Course	MDC 1	3	0	0	3
24AEC101	Ability Enhancement Course	Functional English-1	2	0	0	2
23SS101	Technical Skill Enhancement Course	Digital Literacy & IT Skills	0	0	2	1
23SS151	Soft Skill Enhancement Course	Effective Communication Skills	0	0	2	1
23VAC102	Value Added Course	Indian Constitution & Polity	2	0	0	2
Total			17	1	8	21

L-Lecture, T-Tutorial, P-Practical, C-Credits

B.Sc. Food Technology

Semester-II

CODE	CATEGORY	COURSE	L	T	P	C
25FTBS201	Major Course	Food and Nutrition	3	0	0	3
25FTBS251	Major Course	Food and Nutrition Lab	0	0	2	1
25FTBS202	Major Course	Food Preservation Technology	3	0	0	3
25FTBS252	Major Course	Food Preservation Technology Lab	0	0	2	1
	IDC/Minor Stream Course	IDC/MSC 2	3	1	0	4
	Multi Disciplinary Course	MDC 2	3	0	0	3
24AEC201	Ability Enhancement Course	Functional English-2	2	0	0	2
23SS202	Technical Skill Enhancement Course	Advanced Excel Skills	0	0	2	1
23SS252	Soft Skill Enhancement Course	Team Work & Interpersonal Skills	0	0	2	1
23VAC101	Value Added Course	Environmental Protection & Sustainable Development	2	0	0	2
25FTBS271	Live Projects/Vocational Courses/Summer Internship	Live Projects/Vocational Courses/Summer Internship				4
Total			17	1	8	25

L: Lecture; T: Tutorial; P: Practical; C: Credits

On Exit, students shall be awarded UG Certificate (Food Technology) on securing the requisite 46 Credits on completion of II-Semester.

B.Sc. Food Technology

Semester-III

CODE	CATEGORY	COURSE	L	T	P	C
25FTBS301	Major Course	Food Chemistry-I	3	0	0	3
25FTBS351	Major Course	Food Chemistry-I Lab	0	0	2	1
25FTBS302	Major Course	Technology of Fruits and Vegetables	3	0	0	3
25FTBS352	Major Course	Technology of Fruits and Vegetables Lab	0	0	2	1
25FTBS303	Major Course	Unit Operation in Food Processing	3	0	0	3
25FTBS353	Major Course	Unit Operation in Food Processing Lab	0	0	2	1
	IDC/Minor Stream Course	IDC/MSC 3	3	1	0	4
	Multi Disciplinary Course	MDC 3	3	0	0	3
23HIN101 I	Ability Enhancement Course	Hindi-I/French-I /German-I	2	0	0	2
23SS303	Technical Skill Enhancement Courses	Statistical Analysis with SPSS	0	0	2	1
23SS353	Soft Skill Enhancement Courses	Presentation Skills	0	0	2	1
25VAC201	Value Added Courses	Environmental Management & legislation	1	0	1	2
Total			19	1	13	25

L: Lecture; T: Tutorial; P: Practical; C: Credits

B.Sc. Food Technology

Semester-IV

CODE	CATEGORY	COURSE	L	T	P	C
25FTBS401	Major Course	Food Microbiology	3	0	0	3
25FTBS451	Major Course	Food Microbiology Lab	0	0	2	1
25FTBS402	Major Course	Technology of Cereals, Pulses and Oilseeds	3	0	0	3
25FTBS452	Major Course	Technology of Cereals, Pulses and Oilseeds Lab	0	0	2	1
25FTBS403	Major Course	Food Chemistry-II	3	0	0	3
25FTBS453	Major Course	Food Chemistry-II Lab	0	0	2	1
	IDC/Minor Stream Course	IDC/MS C 4	3	1	0	4
23SS404	Technical Skill Enhancement Courses	R Language Programming	0	0	2	1
23SS454	Soft Skill Enhancement Courses	Professional Writing Skills	0	0	2	1
23VAC103	Value Added Courses	Sports, Yoga & Fitness	0	0	4	2
23HIN101 II	Ability Enhancement Course	Hindi-II/French-II/German-II	2	0	0	2
25FTBS471	Live Projects/Vocational Courses/Summer Internship	Live Projects/Vocational Courses/Summer Internship				4
Total			12	0	16	26

L: Lecture; T: Tutorial; P: Practical; C: Credits

On Exit, students shall be awarded UG Diploma (Food Technology) on securing the requisite 97 Credits on completion of IV-Semester.

B.Sc. Food Technology

Semester-V

CODE	CATEGORY	COURSE	L	T	P	C
25FTBS501	Major Course	Emerging Technology in Food Processing	3	0	0	3
25FTBS551	Major Course	Emerging Technology in Food Processing Lab	0	0	2	1
25FTBS502	Major Course	Dairy Technology	3	0	0	3
25FTBS552	Major Course	Dairy Technology Lab	0	0	2	1
25FTBS503	Major Course	Spices and Plantation Crops Process Technology	3	0	0	3
25FTBS553	Major Course	Spices and Plantation Crops Process Technology Lab	0	0	2	1
25FTBS504	Major Course	Food Packaging	3	0	0	3
25FTBS554	Major Course	Food Packaging Lab	0	0	2	1
	Minor Stream Course	MSC 5	3	1	0	4
23SS505	Technical Skill Enhancement Courses	Programming with MATLAB	0	0	2	1
23AR555	Soft Skill Enhancement Courses	Aptitude & Reasoning	0	0	2	1
Total			15	1	12	22

L: Lecture; T: Tutorial; P: Practical; C: Credits

B.Sc. Food Technology

Semester-VI

CODE	CATEGORY	COURSE	L	T	P	C
25FTBS601	Major Course	Meat, Poultry and Egg Technology	3	0	0	3
25FTBS651	Major Course	Meat, Poultry and Egg Technology Lab	0	0	2	1
25FTBS602	Major Course	Fundamentals of Sensory Evaluation	3	0	0	3
25FTBS652	Major Course	Fundamentals of Sensory Evaluation Lab	0	0	2	1
25FTBS603	Major Course	Bakery & Confectionary Technology	3	0	0	3
25FTBS653	Major Course	Bakery & Confectionary Technology Lab	0	0	2	1
25FTBS604	Major Course	Food Fermentation Technology	3	0	0	3
25FTBS654	Major Course	Food Fermentation Technology Lab	0	0	2	1
	Minor Stream Course	MSC 6	3	1	0	4
	Minor Stream Course	MSC 7	3	1	0	4
25FTBS671	Summer Internship	Live Project/ Vocational Courses/ Summer Internship				4
Total			18	2	8	28

L: Lecture; T: Tutorial; P: Practical; C: Credits

On Exit, students shall be awarded UG Degree (Food Technology) on securing the requisite 147 Credits on completion of VI-Semester.

B.Sc. Food Technology

Semester-VII

CODE	CATEGORY	COURSE	L	T	P	C
25FTBS701	Major Course	Food Engineering	3	1	0	4
25FTBS702	Major Course	Nutraceutical and Functional Food	3	1	0	4
25FTBS703	Major Course	Flavour Technology	3	1	0	4
	Minor Stream Course*	MSC 8*	3	1	0	4
	Minor Stream Course*	MSC 9*	2	0	0	2
	Major/Minor Course for RP#	Research Methodology#	2	0	0	2
25FTBS771	Research Project/ Dissertation for RP#	Dissertation				4
Total			16	4	0	18

L: Lecture; T: Tutorial; P: Practical; C: Credits

* Students pursuing Honours will do 1 Courses of 4 Credits and 1 course of 2 credits in lieu of Research Project in 7th Semester

Students pursuing Honours with Research will do Research Methodology of 2 Credit and Research Project/Dissertation of 4 Credits.

B.Sc. Food Technology

Semester-VIII

CODE	CATEGORY	COURSE	L	T	P	C
25FTBS801	Major Course	Food Additive	3	1	0	4
25FTBS802	Major Course	Food Toxicology	3	1	0	4
25FTBS803	Major Course	Food Safety and Quality	3	1	0	4
	Minor Stream Course*	MSC 10*	2	0	0	2
25FTBS871	Minor Project*	Minor Project*				4
25FTBS872	Research Project/Dissertation#	Major Project/Major Dissertation#				6
Total			11	3	0	18

L: Lecture; T: Tutorial; P: Practical; C: Credits

* Students pursuing Honours will do 1 Course of 2 Credits and Minor Project of 4 credits in lieu of Research Project in VIII Semester

#Students pursuing Honours with Research will do Research Project/Dissertation of 6 Credits

On Exit, students shall be awarded B.Sc. (Food Technology) (Honours with Research) or (Honours) after securing the requisite 183 Credits on completion of VIII-Semester.

THE ASSESSMENT & EVALUATION OF CONTINUOUS AND END SEMESTER MARKS

Examination, Assessment & Evaluation System NEP-2020			
Course Type	Examination	Evaluation Details	
		Continuous	End Semester
Major Courses	Theory	40	60
	Practical	60	40
Minor Courses	Theory	40	60
	Practical	60	40
Multidiscipline Courses	Theory	40	60
	Practical	60	40
SEC	Practical	70	30
VAC	VAC	70	30
	Sports, Yoga & Fitness	80	20
Live Projects/Vocational Courses	Practical	60	40
Summer Internship Programme	Practical	70	30
Research Project/Dissertation	Practical	70	30

**List of Major Courses (MC) offered to
Four Year B.Sc. Food Technology Programme in the Department of Food Technology w.e.f.
Academic Year 2025-26**

S. No.	SEM	CODE	COURSE	L	T	P	C
1	I	25FTBS101	Introduction to Food Science	3	0	0	3
2	I	25FTBS151	Introduction to Food Science Lab	0	0	2	1
3	I	25FTBS102	Fundamentals of Food Technology	3	0	0	3
4	I	25FTBS152	Fundamentals of Food Technology Lab	0	0	2	1
5	II	25FTBS201	Food and Nutrition	3	0	0	3
6	II	25FTBS251	Food and Nutrition Lab	0	0	2	1
7	II	25FTBS202	Food Preservation Technology	3	0	0	3
8	II	25FTBS252	Food Preservation Technology Lab	0	0	2	1
9	III	25FTBS301	Food Chemistry-I	3	0	0	3
10	III	25FTBS351	Food Chemistry-I Lab	0	0	2	1
11	III	25FTBS302	Technology of Fruits and Vegetables	3	0	0	3

12	III	25FTBS352	Technology of Fruits and Vegetables Lab	0	0	2	1
13	III	25FTBS303	Unit Operation in Food Processing	3	0	0	3
14	III	25FTBS353	Unit Operation in Food Processing Lab	0	0	2	1
15	IV	25FTBS401	Food Microbiology	3	0	0	3
16	IV	25FTBS451	Food Microbiology Lab	0	0	2	1
17	IV	25FTBS402	Technology of Cereals, Pulses and Oilseeds	3	0	0	3
18	IV	25FTBS452	Technology of Cereals, Pulses and Oilseeds Lab	0	0	2	1
19	IV	25FTBS403	Food Chemistry-II	3	0	0	3
20	IV	25FTBS453	Food Chemistry-II Lab	0	0	2	1
21	V	25FTBS501	Emerging Technology in Food Processing	3	0	0	3
22	V	25FTBS551	Emerging Technology in Food Processing Lab	0	0	2	1
23	V	25FTBS502	Dairy Technology	3	0	0	3
24	V	25FTBS552	Dairy Technology Lab	0	0	2	1
25	V	25FTBS503	Spices and Plantation Crops Process Technology	3	0	0	3

26	V	25FTBS553	Spices and Plantation Crops Process Technology Lab	0	0	2	1
27	V	25FTBS504	Food Packaging	3	0	0	3
28	V	25FTBS554	Food Packaging Lab	0	0	2	1
29	VI	25FTBS601	Meat, Poultry and Egg Technology	3	0	0	3
30	VI	25FTBS651	Meat, Poultry and Egg Technology Lab	0	0	2	1
31	VI	25FTBS602	Fundamentals of Sensory Evaluation	3	0	0	3
32	VI	25FTBS652	Fundamentals of Sensory Evaluation Lab	0	0	2	1
33	VI	25FTBS603	Bakery & Confectionary Technology	3	0	0	3
34	VI	25FTBS653	Bakery & Confectionary Technology Lab	0	0	2	1
35	VI	25FTBS604	Food Fermentation Technology	3	0	0	3
36	VI	25FTBS654	Food Fermentation Technology Lab	0	0	2	1
37	VII	25FTBS701	Food Engineering	3	1	0	4
38	VII	25FTBS702	Nutraceutical and Functional Food	3	1	0	4

39	VII	25FTBS703	Food Analysis & Instrumentation	3	1	0	4
40	VIII	25FTBS801	Food Additive	3	1	0	4
41	VIII	25FTBS802	Food Toxicology	3	1	0	4
42	VIII	25FTBS803	Food Safety and Quality	3	1	0	4

**List of Inter Disciplinary Courses (IDC)/ Minor Stream Courses (MSC) offered to
Four Year B.Sc. Food Technology Programme in the Department of Food Technology w.e.f.
Academic Year 2025-26**

S. No.	Cat.	CODE	COURSE	L	T	P	C
1	IDC	21OEMA001	Introduction to Algebra	3	1	0	4
2		21OEMA002	Differential Calculus	3	1	0	4
3		21OEMA003	Differential Equations	3	1	0	4
4		21OEMA004	Statistical Methods and Probability	3	1	0	4
5		21OECY001	Physical Chemistry-I	3	1	0	4
6		21OECY003	Physical Chemistry-II	3	1	0	4
7		21OECY002	Inorganic Chemistry	3	1	0	4
8		21OECY004	Analytical Chemistry	3	1	0	4
1	MSC	24FTBS001	Principles of Food Processing	3	1	0	4
2		24FTBS002	Clinical Nutrition	3	1	0	4
3		24FTBS003	Community Nutrition	3	1	0	4
4		24FTBS004	Food Product Development	3	1	0	4
5		25FTBS005	Flavour Technology	3	1	0	4

6		24FTBS006	Food Supply Chain Management	3	1	0	4
7		24FTBS007	Food Biotechnology	3	1	0	4
8	MSC	24FTBS008	Beverage Technology	3	1	0	4
9		24FTBS009	Agri Business Management	2	0	0	2
10		24FTBS010	Waste Management & By Product Utilization	2	0	0	2
11		24FTBS011	Post Harvest Technology	3	1	0	4
12		24FTBS012	ICT Applications in Food Industry	3	1	0	4
13		24FTBS013	Food Plant Sanitation	3	1	0	4
14		24FTBS014	Introduction to Biosciences	3	1	0	4
15		24FTBS015	Food Biophysics	3	1	0	4
16		24FTBS016	Basic Chemistry	3	1	0	4
17		25FTBS0017	Food Laws and Standards	2	0	0	2
18		23RMBS710	Research Methodology	2	0	0	2

**List of Multidisciplinary Courses (MDC) offered to
Four Year B.Sc. Food Technology Programme in the Department of Food Technology w.e.f.
Academic Year 2025-26**

S. No.	Category	Course Name & Code	Credits
1	MDC I	Renewable Energy Source [23MDC201]	3
2		Electric Vehicle [23MDC202]	3
3		IPR in Business [23MDC301]	3
4		Library Information Science & Media Literacy [23MDC302]	3
5		Management Process & Organizational Behaviour [23MDC401]	3
6	MDC II	Introduction to Bio-engineering [23MDC203]	3
7		Introduction to Robotics [23MDC204]	3
8		Psychology and Emotional Intelligence [23MDC303]	3
9		Indian Economy [23MDC304]	3
10		Creating and Entrepreneurial Mind [23MDC402]	3
11	MDC III	Arduino based Programming [23MDC205]	3
12		Electoral Literacy in India [23MDC305]	3
13		Personal Financial Planning [23MDC403]	3

14		Interior Decoration [23MDC404]	3
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**List of Ability Enhancement Courses (AEC) offered to
Four Year B.Sc. Food Technology Programme in the Department of Food Technology w.e.f.
Academic Year 2025-26**

S. No.	Code	Course Name	L	T	P	C
1	24AEC101	Functional English-I	2	0	0	2
2	24AEC201	Functional English-II	2	0	0	2
3		Hindi-I/ German-I/ French-I	2	0	0	2
4		Hindi-II/ German-II/ French-II	2	0	0	2

**List of Value Added Courses (VAC) offered to
Four Year B.Sc. Food Technology Programme in the Department of Food Technology w.e.f.
Academic Year 2025-26**

S. No.	Code	Course Name	L	T	P	Credits
1	23VAC102	Indian Constitution & Polity	2	0	0	2
2	23VAC101	Environment Protection and Sustainable Development	2	0	0	2
3	23VAC103	Sports, Yoga and Fitness	2	0	0	2
4	25VAC201	Environmental Management & legislation	1	0	1	2

**List of Skill Enhancement Courses (SEC) offered to
Four Year B.Sc. Food Technology Programme in the Department of Food Technology w.e.f.
Academic Year 2025-26**

Courses on Soft Skills

S. No.	Code	Course Name	L	T	P	Credits
1	23SS151	Effective Communication Skills	0	0	2	1
2	23SS252	Teamwork & Interpersonal Skills	0	0	2	1
3	23SS353	Presentation Skills	0	0	2	1
4	23SS454	Professional Skills	0	0	2	1
5	23AR555	Aptitude & Reasoning	0	0	2	1

Courses on Technical Skills

S. No.	Code	Course Name	L	T	P	Credits
1	23SS101	Digital Literacy & IT Skills	0	0	2	1

2	23SS202	Advanced Excel Skills	0	0	2	1
3	23SS303	Statistical Analysis with SPSS	0	0	2	1
4	23SS404	R Language Programming	0	0	2	1
5	23SS505	Programming with MATLAB	0	0	2	1

**List of Major Courses (MC) offered to
Four Year B.Sc. Food Technology Programme in the Department of Food Technology w.e.f.
Academic Year 2025-26**

S. No.	SEM	CODE	COURSE	L	T	P	C
1	I	25FTBS101	Introduction to Food Science	3	0	0	3
2	I	25FTBS151	Introduction to Food Science Lab	0	0	2	1
3	I	25FTBS102	Fundamentals of Food Technology	3	0	0	3
4	I	25FTBS152	Fundamentals of Food Technology Lab	0	0	2	1
5	II	25FTBS201	Food and Nutrition	3	0	0	3
6	II	25FTBS251	Food and Nutrition Lab	0	0	2	1
7	II	25FTBS202	Food Preservation Technology	3	0	0	3
8	II	25FTBS252	Food Preservation Technology Lab	0	0	2	1
9	III	25FTBS301	Food Chemistry-I	3	0	0	3
10	III	25FTBS351	Food Chemistry-I Lab	0	0	2	1

11	III	25FTBS302	Technology of Fruits and Vegetables	3	0	0	3
12	III	25FTBS352	Technology of Fruits and Vegetables Lab	0	0	2	1
13	III	25FTBS303	Unit Operation in Food Processing	3	0	0	3
14	III	25FTBS353	Unit Operation in Food Processing Lab	0	0	2	1
15	IV	25FTBS401	Food Microbiology	3	0	0	3
16	IV	25FTBS451	Food Microbiology Lab	0	0	2	1
17	IV	25FTBS402	Technology of Cereals, Pulses and Oilseeds	3	0	0	3
18	IV	25FTBS452	Technology of Cereals, Pulses and Oilseeds Lab	0	0	2	1
19	IV	25FTBS403	Food Chemistry-II	3	0	0	3
20	IV	25FTBS453	Food Chemistry-II Lab	0	0	2	1
21	V	25FTBS501	Emerging Technology in Food Processing	3	0	0	3
22	V	25FTBS551	Emerging Technology in Food Processing Lab	0	0	2	1
23	V	25FTBS502	Dairy Technology	3	0	0	3
24	V	25FTBS552	Dairy Technology Lab	0	0	2	1

25	V	25FTBS503	Spices and Plantation Crops Process Technology	3	0	0	3
26	V	25FTBS553	Spices and Plantation Crops Process Technology Lab	0	0	2	1
27	V	25FTBS504	Food Packaging	3	0	0	3
28	V	25FTBS554	Food Packaging Lab	0	0	2	1
29	VI	25FTBS601	Meat, Poultry and Egg Technology	3	0	0	3
30	VI	25FTBS651	Meat, Poultry and Egg Technology Lab	0	0	2	1
31	VI	25FTBS602	Fundamentals of Sensory Evaluation	3	0	0	3
32	VI	25FTBS652	Fundamentals of Sensory Evaluation Lab	0	0	2	1
33	VI	25FTBS603	Bakery & Confectionary Technology	3	0	0	3
34	VI	25FTBS653	Bakery & Confectionary Technology Lab	0	0	2	1
35	VI	25FTBS604	Food Fermentation Technology	3	0	0	3
36	VI	25FTBS654	Food Fermentation Technology Lab	0	0	2	1
37	VII	25FTBS701	Food Engineering	3	1	0	4

38	VII	25FTBS702	Nutraceutical and Functional Food	3	1	0	4
39	VII	25FTBS703	Food Analysis & Instrumentation	3	1	0	4
40	VIII	25FTBS801	Food Additive	3	1	0	4
41	VIII	25FTBS802	Food Toxicology	3	1	0	4
42	VIII	25FTBS803	Food Safety and Quality	3	1	0	4

Year/Semester	1st Year/1st Semester	Course Category	Major Course
Course Code	25FTBS101	Course Title	Introduction to Food Science
Continuous Evaluation: 40		End Semester Examination :60	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. To comprehend the fundamentals of food science, and the various branches of food science.
2. To learn the global history of food processing.
3. To understand the basic forms, structures, composition, and nutritional value of plant and animal foods.
4. To analyse the changes that occur during storage, and processing.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Learn about some of the techniques used to prepare meals from plants and animals.
2. Recognise the background and development of food processing.
3. Recognise the makeup and structure of various animal meals.
4. Learn about the structure, content, nutritional value, and changes that occur after harvest in a variety of plant foods.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Introduction to Food Science

Definition of Food Science, Difference between food science and food technology, Roles and Responsibilities of Food Scientists, Interdisciplinary Nature of Food Science, Physical, thermal and rheological property of food.

Unit-II Fats and Oils

Classification of lipids, types of fatty acids - saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans-fatty acids. Methods of refining, Rancidity –Types- hydrolytic and oxidative rancidity.

Unit-III Composition and Nutritional aspects of Cereals, Millets, and Pulse

Structure and composition of cereals, millets and pulses. Malting, gelatinization of starch, Browning reactions, toxic(anti-nutritional) constituents of cereals, millets and pulses

Unit-IV Fruits and Vegetables

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

Unit-V Compositional, Nutritional and Processing Aspects of Animal Products and Sea food

Milk: Definition, chemical composition, spoilage and processing of milk. Meat: Definition of carcass, composition, rigor mortis, tenderization, spoilage and processing of meat. Fish: classification, composition, characteristics and spoilage and processing of fish, Nutritional aspects.

TEXT BOOKS

1. Potter, N. N., & Hotchkiss, J. H. (2012). Food science. Springer Science & Business Media.
2. Srilakshmi, B. (2003). Food science. New Age International.
3. Shewfelt, R. L., Orta-Ramirez, A., & Clarke, A. D. (2015). Introducing food science. CRC Press.

FURTHER SUGGESTED READINGS

1. Edelstein, S. (Ed.). (2014). Food science: An ecological approach. Jones & Bartlett Publishers.
2. Owusu-Apenten, R. K., & Vieira, E. R. (2023). Elementary food science (No. 303022). Springer.
3. Kan, J., & Chen, K. (Eds.). (2021). Essentials of food chemistry. Springer.

Year/Semester	1st Year/1st Semester	Course Category	Major Course
Course Code	25FTBS151	Course Title	Introduction to Food Science Lab
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P: 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. To evaluate and differentiate between enzymatic and non-enzymatic browning reactions in various food samples.
2. To compare and analyze the gelatinization behavior of different starches and its implications in food processing.
3. To examine and understand the concept of gluten formation in various flours and its role in determining food texture and structure.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Identify and separate enzymatic from non-enzymatic browning processes in various food samples.
2. Study different starches' gelatinization behaviour and analyse it.
3. Explain the principle of gluten production in different flours and demonstrate how it affects food preparation.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CO \ CLO	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

LIST OF EXPERIMENTS

A Student is supposed to complete/perform minimum 6 number of experiments.

1. To study different types of browning reactions: enzymatic and non-enzymatic.
2. To study gelatinization behaviour of various starches.
3. To study the concept of gluten formation of various flours.
4. To study germination and malting.
5. To study dextrinization in foods.
6. Identification of pigments in fruits and vegetables and influence of pH and heat on them.
7. Quality inspection of animal foods- egg, meat, fish etc.
8. Evaluation of Microbial Load in Milk Using Methylene Blue Reduction Test (MBRT).
9. To determine the free fatty acid (FFA) content in ghee using the titration method.
10. Estimation of Rancidity in Edible Oils Through Peroxide Value Measurement.

TEXT BOOKS

1. Potter, N. N., & Hotchkiss, J. H. (2012). Food science. Springer Science & Business Media.
2. Srilakshmi, B. (2003). Food science. New Age International.
3. Shewfelt, R. L., Orta-Ramirez, A., & Clarke, A. D. (2015). Introducing food science. CRC Press.
4. Horwitz, W. (2000). AOAC “Association of Official Analytical Chemists” Official Methods of Analysis. AOAC International: Rockville, MD, USA.
5. Nielsen, S. S. (Ed.). (2003). Food analysis laboratory manual (p. 557). New York, NY, USA: Kluwer Academic/Plenum Publishers.
6. Fellows, P.J. (2020). Food Processing Technology: Principles and Practice. Woodhead Publishing.

FURTHER SUGGESTED READINGS

1. Sehgal, S. (2016). A Laboratory Manual of Food Analysis. India: I K International Publishing House Pvt. Limited.
2. Owusu-Apenten, R. K., & Vieira, E. R. (2023). Elementary food science (No. 303022). Springer.
3. Kan, J., & Chen, K. (Eds.). (2021). Essentials of food chemistry. Springer.
4. Fellows, P.J. (2020). Food Processing Technology: Principles and Practice. Woodhead Publishing.
5. Hamid, F., & Hamid, F. H. (2015). Manual of methods of analysis of foods. Food safety and standards authority of India.

Year/Semester	1st Year/1st Semester	Course Category	Major Course
Course Code	25FTBS102	Course Title	Fundamentals of Food Technology
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. Understand colloidal systems in food and their stabilization techniques.
2. Explain microbial growth factors and hurdle tech in food preservation.
3. Assess minimal processing methods for fruits, vegetables, and seafood.
4. Compare packaging materials, their properties, and roles in food preservation.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Understand the colloidal system stabilisation techniques and their significance in food preparation.
2. Comprehend the idea of hurdle technology and how it may be used to assure food preservation and safety.
3. Arrange the many basic processing methods for food, including both thermal and non-thermal ones.
4. Recognise the various packaging materials used in the food business and assess their merits for maintaining food quality.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				

CO 3				
CO 4				

COURSE CONTENTS

Unit-I Food dispersions

Characteristics, sols, gels, pectin gels, colloidal sols, stabilization of colloidal system, syneresis, emulsions, properties of emulsions, formation of emulsion, emulsifying agent, food foams, formation stability and destruction of foam, Application of colloidal chemistry to food preparation.

Unit-II Growth of microorganisms in foods

Food as a substrate for microorganism, factors affecting growth of microbes: pH, water activity, O-R potential, nutrient contents, inhibitory substance and biological structure. Hurdle Technology, Hurdle effect in fermented foods, shelf stable products, intermediate moisture foods, application of hurdle technology.

Unit-III Minimal processing and sensory evaluation of food

Minimal processing of foods with thermal methods and non-thermal methods-safety Criteria in minimally processed foods. Principles, equipment and processing, effect on food. Sensory evaluation: Objectives, type of food panels, characteristics of panel member, layout of sensory evaluation laboratory, sensitivity tests

Unit-IV Packaging

Objectives of packaging, flexible packaging, properties of the following packaging materials-low density polyethylene, high density polyethylene, polypropylene, polyvinyl chloride, polyvinylidene chloride, ethylene vinyl alcohol, polystyrene, polyethylene, terephthalate, nylon, ethylene vinyl acetate, ethylene acrylic acid, ethylene methacrylic acid, ionomers.

Unit-V Water disposal and sanitation

Waste water, hardness of water, break point chlorination, physical and chemical of impurities, BOD, COD, waste water treatment, milk plant sanitation, CIP system, sanitizers used in food industry.

TEXT BOOKS

1. Fellows, P. J. (2009). Food Processing Technology: Principles and Practice. Elsevier.
2. Meghwal, M., Goyal, M. R., & Kaneria, M. J. (Eds.). (2017). Food technology: Applied research and production techniques. CRC Press.
3. Saha, N. C., Ghosh, A. K., Garg, M., & Sadhu, S. D. (2022). Food Packaging: Materials, Techniques and Environmental Issues. Springer Nature.

FURTHER SUGGESTED READINGS

1. Ranganna, S. (1986). Handbook of analysis and quality control for fruit and vegetable products. Tata McGraw-Hill Education. Ranganna, S. (1986). Handbook of analysis and quality control for fruit and vegetable products. Tata McGraw-Hill Education.
2. Gould, W. A. (2013). Fundamentals of food processing and technology. Elsevier.

- Fundamentals of Food Science and Technology by Dr. Manoj Tripathi, Dr. Avita Agarwal, AG PUBLISHING HOUSE (AGPH Books), 21-Sept-2022.
- Doyle, M. P., Diez-Gonzalez, F., & Hill, C. (Eds.). (2020). Food microbiology: fundamentals and frontiers. John Wiley & Sons.

Year/Semester	1st Year/1st Semester	Course Category	Major Course
Course Code	25FTBS152	Course Title	Fundamentals of Food Technology Lab
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P: 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

- To develop the practical abilities necessary to perform chemical analyses of dietary components, such as lowering sugar, salt level, and fat content.
- To get practical experience utilising laboratory tools and methods for analysing food, such as refractometry and the Soxhlet method.
- To use colloidal chemistry concepts while preparing meals and comprehend the stability and behaviour of emulsions.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

- Determine the salt content of butter and brine and recognise the value of salt in flavour and food preservation.
- Learn the processes for making Brix solutions, using a hand refractometer to determine their concentration, and using refractometry to determine the amount of sugar in food samples.
- Use the Fehling's approach to calculate the reducing sugar concentration of food samples and colloidal chemistry to comprehend its relevance for food quality and flavour.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO	CLO 1	CLO 2	CLO 3
CO				
CO 1				
CO 2				
CO 3				

LIST OF EXPERIMENTS

A Student is supposed to complete/perform minimum 6 number of experiments.

1. Estimation of reducing sugar by Fehling's procedure.
2. Estimation of salt content in brine and butter.
3. Preparation of brix solution and checking by hand refractometer.
4. Application of colloidal chemistry to food preparation.
5. Demonstration of the Soxhlet method for determination of fat content.
6. Determination of alkalinity/ hardness of water.
7. Demonstration of the Kjeldahl's method for estimation of protein content.
8. Prepare hand sanitizer at the laboratory.
9. Prepare emulsions using various emulsifying agents to observe their stability over time.
10. To determine acidity of fruit juice.

TEXT BOOKS

1. Sehgal, S. (2016). A Laboratory Manual of Food Analysis. India: I K International Publishing House Pvt. Limited.
2. S. Suzanne Nielsen. Food Analysis. (2017). Germany: Springer International Publishing.
3. TA, R. R., & Joy, P. P. A Food Technology Lab Manual (2014).

FURTHER SUGGESTED READINGS

1. Ranganna, S. (1986). Handbook of analysis and quality control for fruit and vegetable products. Tata McGraw-Hill Education.
2. Yousef, A. E., Waite-Cusic, J. G., & Perry, J. J. (2022). Analytical food microbiology: A laboratory manual. John Wiley & Sons.
3. Miller, D. D., & Yeung, C. K. (2022). Food chemistry: A laboratory manual. John Wiley & Sons.
4. Hamid, F., & Hamid, F. H. (2015). Manual of methods of analysis of foods. Food safety and standards authority of India.

Year/Semester	1st Year/2nd Semester	Course Category	Major Course
Course Code	25FTBS201	Course Title	Food and Nutrition
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. Understand basic nutrition concepts and methods to assess nutritional status.
2. Explain food functions and its link to nutrition, health, and well-being.
3. Describe nutrients' roles, sources, RDAs, and effects of deficiency/excess.
4. Evaluate vitamins and minerals, their sources, and health significance.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Apply key nutrition terms and assess individual nutritional status.
2. Know the link between diet, health, and overall well-being.
3. Identify roles of energy, carbs, fats, proteins, and effects of imbalance.
4. Identify sources and functions of essential vitamins and minerals.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				

COURSE CONTENTS

Unit-I Introduction to basic nutrition

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

Unit-II Nutrients

Classification, digestion, absorption, functions, dietary sources, RDA, clinical manifestations of deficiency and excess of the following in brief: Energy, Carbohydrates, lipids and proteins.

Unit-III Vitamins and Minerals

Definition and Classification for vitamins and minerals. Functions in the Body and Importance in Diet for vitamins and minerals. Deficiency & Toxicity for vitamins and minerals.

Unit-IV Planning balanced meals and selection of healthy foods

Food Groups. Concept of Balanced Diets. Healthy and Fad Diets. Factors affecting meal planning. Understanding specific considerations for planning meal for different groups of people. Nutrition labelling on foods (FSSAI).

Unit-V Methods of cooking and nutrient retention

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

TEXT BOOKS

1. Chadha, R. and Mathur, P. eds. (2015). Nutrition: A Lifecycle Approach. Hyderabad: Orient Blackswan.
2. Longvah, T., Ananthan, R., Bhaskarachary, K. and Venkaiah, K. (2017). Indian Food Composition Tables. Hyderabad: National Institute of Nutrition, Indian Council of Medical Research, Department of Health Research, Ministry of Health and Family Welfare, Government of India.
3. Seth, V., Singh, K. & Mathur, P. (2018). Diet Planning Through the Lifecycle Part I: Normal Nutrition- A Practical Manual. 6th Edition. Delhi: Elite Publishing House.
4. Srilakshmi, B. (2017). Nutrition Science. 6th edition. Delhi: New Age International Publishers.

FURTHER SUGGESTED READINGS

1. Sampson, S. (2018). Advances in food and nutrition research. Journal of Nutrition Education and Behavior, 50(2), 213.
2. Grover, A., Singh, A., & Singh, R. B. (Eds.). (2023). Sustainable Health Through Food, Nutrition, and Lifestyle. Springer Nature.
3. Bansal, R. (2021) Food, Nutrition and Hygiene. SBPD Publishing House.

Year/Semester	1st Year/2nd Semester	Course Category	Major Course
Course Code	25FTBS251	Course Title	Food and Nutrition Lab
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P: 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. To identify food sources for various nutrients using food composition tables and understand their importance in maintaining a balanced diet.
2. To plan one's own diet using a 24-hour dietary recall method and gain practical experience in dietary assessment.
3. To demonstrate the students to meal planning and the concept of food exchange system, allowing them to design balanced and nutritious meals.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Choose and pick the right food sources for different nutrients, allowing students to make educated dietary decisions.
2. Track their own diet using the 24-hour dietary recall approach, which will help them better understand their food preferences and nutrient consumption.
3. Arrange for the planning of well-balanced meals for people at various income and activity levels.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CO \ CLO	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

LIST OF EXPERIMENTS

A Student is supposed to complete/perform minimum 6 number of experiments.

1. Identification of food sources for various nutrients using food composition tables.
2. Record diet of self, using 24-hour dietary recall.
3. Introduction to meal planning, concept of food exchange system.
4. Planning of meals for adults of different activity levels for various income groups.
5. Planning of nutritious snacks for different age and income groups.
6. Preparation of nutritious snacks using various methods of cooking.
7. Critical examination of food product nutrition labeling practices.
8. To measure the waist-to-hip ratio (WHR) of a teenager, which is an indicator of body fat distribution and potential health risks.
9. To determine the Body Mass Index (BMI) of a teenager, which is a measure of body fat based on height and weight.
10. Effect of cooking methods on nutritional aspects.

TEXT BOOKS

1. Anantan, I., Venkaiah, K., Longvah, T., Bhaskarachary, K. (2017). Indian Food Composition Tables. India: National Institute of Nutrition, Indian Council of Medical Research.
2. Srilakshmi, B. (2011). Dietetics. India: New Age International Pub.
3. Gibson, R. S. (2005). Principles of nutritional assessment. Oxford university press, USA.

FURTHER SUGGESTED READINGS

1. Durrance, L. (2022). Nutrition Assessment Lab Manual.
2. Ranjani, T., Indra, N., Saranya, A., Selvi, P. (2023). Nutrition and Dietetics - Laboratory Manual for Undergraduate Students. SK Research Group of Companies.
3. McWilliams, M. (2017). Foods: experimental perspectives. MacMillian Publishing Company.

Year/Semester	1st Year/ 2nd Semester	Course Category	Major Course
Course Code	25FTBS202	Course Title	Food Preservation Technology
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. To recognise the tenets and techniques of food preservation, such as physical, chemical, biological.
2. To express the significance and need of food preservation, as well as the definitions of shelf life, perishable foods, semi-perishable foods, and shelf-stable foods.
3. To describe the concepts and procedures used in low-temperature food preservation techniques.
4. To examine the commercial heat preservation procedures for high-temperature food preservation.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Classify food preservation methods by temp, moisture, and irradiation.
2. Explain how preservation extends shelf life of perishable foods.
3. Distinguish between slow and fast freezing; apply preservation rules.
4. Describe high-temp preservation techniques used for food safety.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CLO CO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Introduction

Principles of food preservation-preservation by physical methods, chemical methods and biological methods, importance and need of food preservation; Historical developments; Definition of shelf life, perishable foods, semi perishable foods, shelf stable foods.

Unit-II Food preservation by low temperature

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

Unit-III Food Preservation by high temperature

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

Unit-IV Food preservation by irradiation and microwave

Introduction, units of radiation, kinds of ionizing radiations used in food irradiation, mechanism of action, uses of radiation processing in food industry, concept of cold sterilization; Microwave heating, mechanism and its application.

Unit-V Food Preservation by moisture control

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

TEXT BOOKS

1. Kumar, S., Mukherjee, A., Mitra, A., & Halder, D. (Eds.). (2023). *Emerging Technologies in Food Preservation* (1st ed.). CRC Press. <https://doi.org/10.1201/9781003147978>.
2. Potter, N. N., & Hotchkiss, J. H. (2012). *Food Science*. Springer Science & Business Media.
3. Goyal, M. R., Mishra, S. K., & Birwal, P. (Eds.). (2022). *Food Processing and Preservation Technology: Advances, Methods, and Applications*. CRC Press.
4. Fellows, P.J. (2020). *Food Processing Technology: Principles and Practice*. Woodhead Publishing.

FURTHER SUGGESTED READINGS

1. Col, B. G., Tuggum, S., & Yikmiş, S. (2020). Non-thermal food preservation methods in the meat industry. In *Technological Developments in Food Preservation, Processing, and Storage* (pp. 44-64). IGI Global.
2. Srivastava, U., Singh, Z., & Saini, P. (2020). Solid-State Fermentation: A Novel Approach in Food Processing Technology Using Food Industry Wastes. In *Technological Developments in Food Preservation, Processing, and Storage* (pp. 188-204). IGI Global.
3. Seydi Yikmis (2019). *Technological Developments in Food Preservation, Processing and Storage*. IGI Global

Year/Semester	1st Year/2nd Semester	Course Category	Major Course
Course Code	25FTBS252	Course Title	Food Preservation Technology Lab
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P: 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. Explain shelf life and its role in food quality and safety.
2. Discuss asepsis principles in food processing and preservation.
3. Understand sterilization and its use in extending food shelf life.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand shelf life and its impact on food quality and safety.
2. Apply aseptic techniques in food processing and preservation.
3. Explain sterilization and its role in food safety and shelf life.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CO \ CLO	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

LIST OF EXPERIMENTS

A Student is supposed to complete/perform minimum 5 number of experiments.

1. Learn about shelf life of different foods.
2. To study the self-life of perishable, semi-perishable and non-perishable foods.

3. To study the concept of Asepsis.
4. To study the concept of Sterilization.
5. Determination of pH of different foods using pH meter.
6. Comparative Study of Quality Characteristics in Foods Preserved by Various Preservation Techniques: Drying, Dehydration, and Freezing
7. To perform pasteurization of fluids using different methods.
8. To perform blanching of different plant foods.
9. To preserve fresh juice using hurdle technology
10. To preserve fruit by drying

TEXT BOOKS

1. Sehgal, S. (2016). A Laboratory Manual of Food Analysis. India: I K International Publishing House Pvt. Limited.
2. S. Suzanne Nielsen. Food Analysis. (2017). Germany: Springer International Publishing.
3. TA, R. R., & Joy, P. P. A Food Technology Lab Manual (2014).

FURTHER SUGGESTED READINGS

1. Srilakshmi, B. (2006). Nutrition Science. India: New Age International.
2. Ramli, S.S., Ismail, N., Azmi, A.F.MN., Bakar, S. (2019). Food Preservation and Manufacturing Laboratory Manual.
3. Sharma, M., Goyal, M. R., & Birwal, P. (Eds.). (2021). Handbook of Research on Food Processing and Preservation Technologies: Volume 5: Emerging Techniques for Food Processing, Quality, and Safety Assurance.

Year/Semester	2nd Year/3rd Semester	Course Category	Major Course
Course Code	25FTBS301	Course Title	Food Chemistry-I
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. To outline the discoveries about food chemistry.
2. To create a thorough understanding of food composition.
3. To highlight the functions of food ingredients.
4. To describe the function of food ingredients in food processing.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Adhere to the fundamental chemical compositions of dietary constituents.
2. Noted the physical characteristics and reactivity of significant dietary ingredients.
3. Determine if the processing circumstances will affect the reactivity of food ingredients.
4. Organise the modifications to the general composition are likely to modify the food's responsiveness.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Water

Definition of water in food. Structure of water and ice. Types of water. Sorption phenomenon. Water activity and packaging. Water activity and shelf-life.

Unit-II Lipid

Classification of lipids. Physical properties and Chemical properties. Effect of frying of fats. Changes in fats & oils- rancidity, lipolysis, flavour reversion. Auto oxidation and its prevention. Technology of edible fats and oils-Refining, Hydrogenation and Interesterification, Fat mimetics.

Unit-III Protein

Protein classification and structure. Nature of food proteins (plant and animal sources). Properties of proteins (electrophoresis, sedimentation, amphotericism and denaturation). Functional properties of proteins e.g. organoleptic, solubility, viscosity, binding, gelation/ texturization, emulsification, foaming)

Unit-IV Carbohydrate

Classification, Structure of important polysaccharides (Starch, glycogen, cellulose, pectin, hemicellulose, gum). Chemical reactions of carbohydrates-oxidation, reduction with acid and alkali. Modified cellulose and starches.

Unit-V Vitamins and Minerals

Structure, importance and stability of Vitamins. Major and minor minerals, Metal contamination in canned foods, Toxic metals in foods.

TEXT BOOKS

1. Alex V. Ramani. (2019). Food Chemistry. MJP Publisher
2. Vassilis Kontogiorgos. (2022). Introduction to Food Chemistry. Springer International Publishing.
3. Michael Zeece. (2020). Introduction to the Chemistry of Food. Elsevier Science .

FURTHER SUGGESTED READINGS

1. Food and Agriculture Organization of the United Nations. (2020). FAO/INFOODS Food Composition Table for Western Africa (2019) / Table de composition des aliments FAO/INFOODS pour l'Afrique de l'Ouest (2019) User Guide & Condensed Food Composition Table / Guide d'utilisation & table de composition des aliments condensée. Food & Agriculture Org.
2. Anil Kumar Siroha, Manoj Kumar, Sneha Punia. (2022). Handbook of Cereals, Pulses, Roots, and Tubers. Functionality, Health Benefits, and Applications. CRC Press
3. Dr. Abhijeet Arun Gatade. (2020) A Handbook on Oil And Fat Technology. Dr. Abhijeet Arun Gatade

Year/Semester	2nd Year/3rd Semester	Course Category	Major Course
Course Code	25FTBS351	Course Title	Food Chemistry-I Lab
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. To identify the students to concepts of food chemistry.
2. To explain the concepts surrounding chemistry and their influence on food product development.
3. To understand the importance different chemical reactions on food product development.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Identify the fundamentals of food chemistry.
2. Explain how food chemistry affects the creation of food products.
3. Decide on the fundamental estimation techniques for the examination of various parameters.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CO \ CLO	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

LIST OF EXPERIMENTS

A Student is supposed to complete/perform minimum 6 number of experiments.

1. Estimation of moisture content.
2. To measure the titratable acidity in different food products.

3. Determination of refractive index and specific gravity of fats and oils.
4. Determination of smoke point and percent fat absorption for different fat and oils.
5. Determination of percent free fatty acids.
6. Estimation of saponification value.
7. Estimation of reducing and non-reducing sugars using potassium ferricyanide method.
8. To study some simple tests of carbohydrates in the food sample (any one: Molisch's/ Benedict's/ Fehling's/Barfoed's/ Iodine/Seliwanoff's Tests).
9. To determine the protein content in a food sample.
10. To determine the fat content in a food sample.

TEXT BOOKS

1. Sehgal, S. (2016). A Laboratory Manual of Food Analysis. India: I K International Publishing House Pvt. Limited.
2. DeMan, J.M. (1980). Principles of Food Chemistry. New York: AVI.
3. Fennema, Owen R. (1996). Food Chemistry. 3rd Ed.. New York: Marcell Dekker.
4. Fellows, P.J. (2020). Food Processing Technology: Principles and Practice. Woodhead Publishing.

FURTHER SUGGESTED READINGS

1. Fidel Toldrá, Leo M.L. Nollet. (2021). Handbook of Dairy Foods Analysis. CRC Press
2. S. Suzanne Nielsen. (2017). Food Analysis Laboratory Manual. Springer International Publishing
3. Azor Thurston. (2022). Pharmaceutical and Food Analysis. Creative Media Partners, LLC

Year/Semester	2nd Year/3rd Semester	Course Category	Major Course
Course Code	25FTBS302	Course Title	Technology of Fruits and Vegetables
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. Understand the role of fruits, veggies, and preservation in human nutrition.
2. Evaluate preservation methods and chemical changes during maturation.
3. Explain canning/bottling processes and factors affecting preservation.
4. Examine fruit beverage processing and related preservation techniques.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Recognize nutrition and preservation importance of fruits and vegetables.
2. Identify suitable short- and long-term preservation methods.
3. Understand canning processes and spoilage prevention techniques.
4. Learn processing and preservation of fruit juices and concentrates.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Introduction

Importance of fruits and vegetable. History and need of preservation, reasons of spoilage. Method of preservation (short & long term). Fruit Maturity - Definition, methods of maturity determination, maturity indices for selected fruits and vegetables. Chemical changes during maturation.

Unit-II Canning and bottling of fruits and vegetables

Selection of fruits and vegetables. Process of canning, factors affecting the process- time and temperature. Containers of packing, lacquering. Syrups and brines for canning. Spoilage in canned foods.

Unit-III Fruit beverages

Introduction, reasons of spoilage. Processing of fruit juices- selection, juice extraction, de-aeration, straining, filtration and clarification. Preservation of fruit juices- pasteurization, chemically preserved with sugars, freezing, drying, tetra-packing, carbonation. Packaging of fruit beverages.

Unit-IV Jams, jellies and marmalades

Jam: Constituents, selection of fruits, processing & technology. Jelly: Essential constituents, Theory of jelly formation, Processing & technology, defects in jelly. Marmalade: Types, processing & technology, defects. Packaging of jams, jellies and marmalades.

Unit-V Pickles, tomato products

Pickles - Processing and Types, Causes of spoilage in pickling. Tomato products -Selection of tomatoes, pulping & processing of tomato juice. Tomato puree, paste, ketchup, sauce and soup. Packaging of pickles and tomato products. Processing of squashes, cordials, nectars, concentrates and powder.

TEXT BOOKS

1. Srivastava, R.P. and Kumar, S. (2006). Fruits and Vegetables Preservation- Principles and Practices. 3rd Ed. International Book Distributing Co.
2. Sehrawat, R., Khan, K. A., Goyal, M. R., & Paul, P. K. (Eds.). (2018). Technological interventions in the processing of fruits and vegetables. CRC Press.
3. Pace, B., & Cefola, M. (2021). Innovative preservation technology for the fresh fruit and vegetables. Foods, 10(4), 719.

FURTHER SUGGESTED READINGS

1. Ramaswamy, H. S. (2014). Post-harvest technologies of fruits & vegetables. DEStech Publications, Inc.
2. Houška, M., & da Silva, F. V. M. (Eds.). (2017). High pressure processing of fruit and vegetable products. CRC Press.
3. Sharma, S. (2010). Postharvest Management and Processing of Fruits and Vegetables: Instant Notes. New India Publishing Agency.

Year/Semester	2nd Year/3rd Semester	Course Category	Major Course
Course Code	25FTBS352	Course Title	Technology of Fruits and Vegetables Lab
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P: 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. To determine important quality parameters of food products, including total soluble solids (TSS), pH, acidity, and calculate the brix: acidity ratio for assessing product characteristics.
2. To understand the can making process, study the sequential steps involved, and gain insights into the packaging aspect of food preservation.
3. To explain and process fruit juices from different types of fruits, applying appropriate techniques such as de-aeration, straining, and filtration.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Learn the analytical instruments to calculate brix: acidity ratio, pH, TSS, and other parameters that allow users to evaluate and contrast product quality.
2. Understand the can-making process, get acquainted with the procedures, and comprehend the importance of appropriate packaging in food preservation.
3. Learn the fruit juice extraction and processing.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CO \ CLO	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

LIST OF EXPERIMENTS

A Student is supposed to complete/perform minimum 6 number of experiments.

1. Estimation of total soluble solids (TSS), pH, acidity and brix: acidity ratio of products.
2. To study the steps of can making process.
3. To extract and process fruit juices from different fruits.
4. To produce fruit beverages like squash or cordial using preservation methods.
5. To prepare jams from selected fruits
6. To prepare jellies form selected fruits
7. Preparation and evaluation of tomato products.
8. Dehydration and Rehydration of fruits and vegetables.
9. To prepare marmalades from selected fruits.
10. To pickle a variety of vegetables using different pickling solutions and methods.

TEXT BOOKS

1. Cruess, W. V., & Christie, A. W. (1922). Laboratory manual of fruit and vegetable products. McGraw-Hill.
2. Thompson, A.K., (2003). Fruits and vegetables; Harvesting, handling and storage. Blackwell Publishing.
3. Sehgal, S. (2016). A Laboratory Manual of Food Analysis. India: I K International Publishing House Pvt. Limited.

FURTHER SUGGESTED READINGS

1. Sharma, M., Goyal, M. R., & Birwal, P. (Eds.). (2021). Handbook of Research on Food Processing and Preservation Technologies: Volume 5: Emerging Techniques for Food Processing, Quality, and Safety Assurance.
2. Food Analysis. (2017). Germany: Springer International Publishing.
3. Hamid, F., & Hamid, F. H. (2015). Manual of methods of analysis of foods. Food safety and standards authority of India.

Year/Semester	2nd Year/3rd Semester	Course Category	Major Course
Course Code	25FTBS303	Course Title	Unit Operations in Food Technology
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. Understand food processing equipment and key unit operations.
2. Apply techniques in cleaning, size reduction, mixing, and drying.
3. Explore freeze drying and advanced food processing methods.
4. Gain insight into sustainable and efficient food production steps.

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, learners will be able to:

1. Understand material handling and advanced food processing techniques.
2. Apply and optimize equipment for key food processing operations.
3. Evaluate freeze drying benefits, challenges, and applications.
4. Demonstrate knowledge to enhance efficiency and innovation in food processing.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit I: Material Handling and Cleaning

Understanding material handling theories and classifications of equipment, Exploring various types of conveyors: Gravity, powered, elevators (bucket and screw), pneumatic conveyors, Methods of cleaning: Dry cleaning (screening, aspiration, magnetic, abrasive), wet cleaning (soaking, spray washing, flotation, ultrasonic), combination methods

Unit II: Sorting, Grading, and Size Reduction

Advantages and methods of sorting and grading in food processing, Analyzing size reduction equipment: Open and closed circuit grinding, free crushing, choke feeding, wet milling, Examining effects of size reduction on solid, fibrous, and liquid foods; sieving terminology, particle size analysis, fineness modulus, air classification

Unit III: Mixing and Filtration Processes

Understanding mixing terminology, equipment for low/moderate viscosity liquids (Paddle, turbine, propeller agitators), Exploring mixers for high viscosity pastes (pan mixer, horizontal mixer, dough mixer), Examining mixers for dry solids (tumbler mixer, vertical screw mixer), and their effects on food, Introducing filtration terminology, methods (pressure, vacuum, centrifugal), expression factors, liquid-solid separation techniques (hydraulic, roller, screw pressing)

Unit IV: Evaporation

Delving into evaporation functions and factors influencing heat transfer rate, Analyzing factors affecting the evaporation, equipment types (open pans, horizontal tube, vertical tube, plate evaporators).

Unit V: Dehydration Techniques

Exploring dehydration objectives, basic theory, drying curves, and different dehydration systems (tray dryer, tunnel dryer), Comparison of Conventional Drying and Freeze Drying Techniques with an Overview of Associated Equipment.

TEXT BOOKS

1. Fellows, P. J. (2022). Food processing technology: principles and practice. Woodhead publishing.
2. Sivasankar, B. (2002). Food processing and preservation. PHI Learning Pvt. Ltd.
3. Smith, P. G., & Smith, P. G. (2011). An introduction to food process engineering (pp. 1-3). Springer US.

FURTHER SUGGESTED READINGS

1. Sivasankar, B. (2002). Food processing and preservation. PHI Learning Pvt. Ltd.
2. Ahmed, J., & Rahman, M. S. (Eds.). (2012). Handbook of food process design, 2 Volume Set. John Wiley & Sons.
3. Brennan, J. G. (1994). Introduction to food engineering: By R. Paul Singh and Dennis R. Heldman. Academic Press Inc., London.

Year/Semester	2nd Year/3rd Semester	Course Category	Major Course
Course Code	25FTBS353	Course Title	Unit Operations in Food Technology Lab
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P : 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. To become proficient in a variety of dry cleaning techniques to efficiently remove pollutants and impurities from food products.
2. To be familiar with how size reduction equipment for processing and treating food particles works.
3. To improve the quality of the finished product, examine how various mixers affect the consistency and texture of food.

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, learners will be able to:

1. Learn a variety of dry cleaning techniques to effectively remove pollutants and impurities from food products.
2. Understanding of how size reduction machinery, which is crucial for processing and handling food particles, works.
3. Recognise the quality of the finished product.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (LCOs)

CO	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

LIST OF EXPERIMENTS

A Student is supposed to complete/perform a minimum 6 number of experiments.

1. To demonstrate methods of dry cleaning, such as screening, aspiration, magnetic separation, and abrasive cleaning.
2. To demonstrate size reduction equipments.
3. To observe the effects of different mixers on food consistency and texture.
4. To prepare fruit smoothies or vegetable soups using blending techniques.
5. To conduct an experiment to sterilize cans.
6. To develop a conveyor belt from house waste.
7. Drying fruits or vegetables using different drying methods.
8. To determine the drying rate of food products.
9. Separation of solid-liquid mixtures using a laboratory centrifuge.
10. Determining the Settling Velocity of Solid Particles in Suspension

TEXT BOOKS

1. Earle, R. L. (2013). Unit operations in food processing. Elsevier.
2. Potter, N. N., Hotchkiss, J. H., Potter, N. N., & Hotchkiss, J. H. (1995). Unit operations in food processing. Food Science: Fifth Edition, 69-89.
3. Singh, R. K., & Fernando, W. J. N. (2008). Food Process Engineering: Theory and Laboratory Experiments. Technomic Publishing.

FURTHER SUGGESTED READINGS

1. Jafari, S. M. (Ed.). (2021). Engineering Principles of Unit Operations in Food Processing: Unit Operations and Processing Equipment in the Food Industry. Woodhead Publishing.
2. Barbosa-Cánovas, G. V., & Juliano, P. (2012). Unit Operations in Food Engineering. CRC Press.
3. Saravacos, G. D., & Kostaropoulos, A. E. (2016). Handbook of Food Processing Equipment (2nd ed.). Springer.

Year/Semester	2nd Year/4th Semester	Course Category	Major Course
Course Code	25FTBS401	Course Title	Food Microbiology
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. To identify the fundamental food microbiology.
2. To describe the key genera of food-associated bacteria and their characteristics.
3. To summarise how bacteria play a part in food production.
4. To provide examples of food rotting and food-borne illnesses.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Learn the role that microorganisms play in food processing.
2. List the significant microbial species connected to food along with their traits, patterns of growth, and parameters.
3. Understand the positive effects of microorganisms and the various types of fermented foods.
4. State the function of microbes in food-borne illnesses and preventative methods.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Characteristics of microorganism

History and Development of Food Microbiology. Definition and Scope of food microbiology. Types of microorganisms associated with food, their morphology and characteristics. Microbial Growth in Food -Bacterial growth curve and factors affecting the growth of microorganisms in food.

Unit-II Microbial food spoilage

Sources of Microorganisms in foods, some important food spoilage microorganisms. Spoilage of Specific Food Groups- milk and dairy products, meat, poultry and seafood, cereal and cereal products, fruits and vegetables and canned products. Bio preservatives. Thermo bacteriology- Introduction, TDT CURVE, D, Z, F values and 12D concept.

Unit-III Food borne diseases

Types – food borne infections, food borne intoxications and toxi-infections. Origin and symptoms of common food borne diseases and their preventive measures. Recent outbreaks and emergence of pathogens.

Unit-IV Food fermentation

Fermentation –definition and types. Microorganisms used in food fermentations. Dairy Fermentations-starter cultures and their types, concept of probiotics. Fermented Foods-types, methods of manufacture for vinegar.

Unit-V Cultivation of microorganism

Pure culture technique. Methods of isolation and cultivation. Enumeration of microorganisms- Standard Plate Count (conventional and automated), Agar droplet, Direct Microscopic Count, Direct Epi Florescent Filtration Technique. Rapid Methods of Detection of microorganisms.

TEXT BOOKS

1. Frazier, W. C., & Westhoff, D. C. (2003). Food Microbiology. McGrawHill.
2. Ray, B. and Bhunia, A. (2013) Fundamental Food Microbiology ,5th Edition. US:CRC Press.
3. Ramesh, K. V. (2019). Food microbiology. MJP Publisher.

1. Matthews, K. R., Kniel, K. E., & Montville, T. J. (2017). Food microbiology: an introduction. John Wiley & Sons.
2. Doyle, M. P., Diez-Gonzalez, F., & Hill, C. (Eds.). (2020). Food microbiology: fundamentals and frontiers. John Wiley & Sons.
3. Dudley, E. G. (2022). Food microbiology: fundamentals and frontiers. Emerging Infectious Diseases, 28(1).

FURTHER SUGGESTED READINGS

Year/Semester	2nd Year/4th Semester	Course Category	Major Course
Course Code	25FTBS451	Course Title	Food Microbiology Lab
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P: 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. To discuss the concepts of food microbiology.
2. To describe the different methods of microbial detection.
3. To understand the importance of microorganism in food.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Classify the importance of food microbiology.
2. Illustrate the different methods of microbial detection.
3. Develop the fermented food.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

LLO	LLO 1	LLO 2	LLO 3
LO			
LO 1			
LO 2			
LO 3			

LIST OF EXPERIMENTS

A Student is supposed to complete/perform minimum 6 number of experiments.

1. Introduction to the Basic Microbiology Laboratory Practises and Equipments.
2. Functioning and use of compound microscope.

3. Preparation and sterilization of nutrient broth.
4. Cultivation and sub-culturing of microbes.
5. Preparation of slant, stab and plates using nutrient agar.
6. Morphological study of bacteria and fungi using permanent slides.
7. Perform simple staining.
8. Perform Gram's staining.
9. Perform Standard Plate Count Method.
10. Preparation of fermented food product.

TEXT BOOKS

1. Frazier, William.C. and Westhoff, Dennis, C. (2004) Food Microbiology. New Delhi: Tata McGraw-Hill Education.
2. Mukerji, K. G., Garg, N., Garg, K. L. (2010). Laboratory Manual of Food Microbiology. India: I.K. International Publishing House Pvt. Limited.
3. McLandsborough, L. (2004). Food microbiology laboratory. CRC press.

FURTHER SUGGESTED READINGS

1. Food Analysis. (2017). Germany: Springer International Publishing.
2. Sehgal, S. (2016). A Laboratory Manual of Food Analysis. India: I K International Publishing House Pvt. Limited.
3. Adams, M. R., & Moss, M. O. (2000). Food microbiology. Royal society of chemistry.

Year/Semester	2nd Year/4th Semester	Course Category	Major Course
Course Code	25FTBS402	Course Title	Technology of Cereal Pulses and Oilseeds
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. To identify the technology of milling of various cereals.
2. To explain the processing of pulses and oilseeds.
3. To understand the importance & processing of protein rich products.
4. To evaluate the different methods of preparation of alcoholic beverages.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Describe the fundamentals of milling processes.
2. Explain the fundamental makeup and structure of pulses and oilseeds.
3. Encourage the production of goods with added value from food grains.
4. Explain the brewing principle for alcoholic beverages.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Wheat and rice

Wheat -Structure, Composition, Types, milling, flour grade, flour treatments (bleaching, maturing), flour for various purposes, Products and By-products. Rice – Structure, Composition, milling, parboiling, ageing of rice, utilization of by- products.

Unit-II Corn, barley, oats and coarse grains

Corn – Milling (wet & dry), cornflakes, corn flour. Barley- Milling (pearl barley, barley flakes & flour). Oats – Milling (oatmeal, oat flour & oat flakes). Sorghum and millets – Traditional & commercial milling (dry & wet). Rye and triticale—milling (flour), uses.

Unit-III Pulses

Structure, Composition, Milling of pulses. Dry milling. Wet milling. Improved milling method: Pant nagar process (Chemical treatment), Pant nagar process (Enzymatic treatment), CIAE process, CFTRI process, Advantages and Disadvantages of Improved Methods of Milling, Effect on pulses.

Unit-IV Oilseeds

Introduction. Extraction of oil (Mechanical and Solvent) and refining process. Sources of protein (defatted flour, protein concentrates and isolates), Properties and Uses. Protein texturization. Fibre spinning. Mechanical Expression (Kachi Ghani, Blends of Oils)

Unit-V Cereal based beverage

Production, Principle and Properties of Beer, Sake, Handia, Cereals based milk (Oat milk, Malted beverage, Rice Milk, Kanji etc).

TEXT BOOKS

1. Barr, S. (2019). Technology of cereals, pulses and oilseeds. Scientific e-Resources.
2. Bangar, S. P., Siroha, A. K., & Kumar, M. (Eds.). (2021). Handbook of cereals, pulses, roots, and tubers: functionality, health benefits, and applications. CRC Press.
3. Manickavasagan, A., & Thirunathan, P. (Eds.). (2020). Pulses: processing and product development. Springer Nature.

FURTHER SUGGESTED READINGS

1. Rosentrater, K. A., & Evers, A. D. (2017). Kent's technology of cereals: An introduction for students of food science and agriculture. Woodhead Publishing.
2. Tyler, R., Wang, N., & Han, J. (2017). Composition, nutritional value, functionality, processing, and novel food uses of pulses and pulse ingredients. Cereal Chemistry, 94(1), 1-1.
3. Alvarez, M. M. (2019). Health benefits of pulses. W. J. Dahl (Ed.). Cham, Switzerland: Springer International Publishing.
4. Bangar, S. P., Siroha, A., & Kumar, M. (Eds.). (2021). Handbook of cereals, pulses, roots, and tubers: functionality, health benefits, and applications. CRC Press.

Year/Semester	2nd Year/4th Semester	Course Category	Major Course
Course Code	25FTBS452	Course Title	Technology of Cereal Pulses and Oilseeds Lab
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P: 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. To evaluate the technologies associated with processing of cereals and pulses.
2. To explain the different characteristics associated with cereals and pulses.
3. To understand quality characteristics associated with cereals and pulses.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to

1. Learn the various technologies that pertain to grains and pulses.
2. Recognise the qualitative traits connected to grains and pulses.
3. Understand the fundamental techniques for evaluating grains and pulses.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CO \ CLO	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

LIST OF EXPERIMENTS

A Student is supposed to complete/perform minimum 6 number of experiments.

1. Characterization of physical properties of Wheat.
2. Estimation of gluten content of flour.
3. Estimation of Pelshenke Value of flour.
4. Preparation of cereals-based product.
5. Fermenting power of yeast.
6. Check Physical characteristics of Rice.
7. Determination of Sedimentation power of flour.
8. Malting the coarse cereal grains.
9. Develop the millet based food.
10. Analysis of Popping Behavior and Expansion Properties of Coarse Cereals.

TEXT BOOKS

1. Sharma, G.K., Semwal, A.D., & Yadav, D.K. (Eds.). (2021). *Advances in Cereals Processing Technologies* (1st ed.). CRC Press. <https://doi.org/10.1201/9781003261124>
2. Kulp, K. (Ed.). (2000). *Handbook of Cereal Science and Technology*, revised and expanded. Crc Press.
3. Lasztity, R. (2017). *The chemistry of cereal proteins*. Routledge.

FURTHER SUGGESTED READINGS

1. Serna-Saldivar, S. O. (2012). *Cereal grains: laboratory reference and procedures manual*. CRC Press.
2. Shewry, P. R., Koxsel, H., & Taylor, J. R. (Eds.). (2023). *ICC Handbook of 21st Century Cereal Science and Technology*. Elsevier.
3. Rosentrater, K. A., & Evers, A. D. (2017). *Kent's technology of cereals: An introduction for students of food science and agriculture*. Woodhead Publishing.
4. Hamid, F., & Hamid, F. H. (2015). *Manual of methods of analysis of foods*. Food safety and standards authority of India.

Year/Semester	2nd Year/4th Semester	Course Category	Major Course
Course Code	25FTBS403	Course Title	Food Chemistry-II
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. Understand enzyme characteristics, kinetics, and industrial food applications.
2. Identify natural food pigments and phytochemicals with health benefits.
3. Analyze changes in food quality during various processing techniques.
4. Explain flavour principles and chemical reactions in food during storage and cooking.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Classify enzymes and explain their activity, inhibition, and immobilization.
2. Describe sources and roles of chlorophyll, carotenoids, and flavonoids.
3. Evaluate nutritional and chemical changes due to drying, freezing, and canning.
4. Explain browning reactions and oxidative changes in food components.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				

COURSE CONTENTS

Unit-I Enzymes

Introduction, classification, General characteristics of Enzymes. Nomenclature, specificity, catalytic regulations, kinetics factors influencing enzyme activity, controlling enzyme action. Immobilized enzymes. Enzyme added to food during processing, modification of food by endogenous enzyme. Enzyme inhibitors in food. Industrial Uses of Enzymes

Unit-II Natural Food Pigments

Phytochemicals: definition, Classification. Natural occurrence of certain photo-chemicals (Chlorophyll, carotenoids, anthocyanins, flavonoids, beet pigments, caramel). Antioxidants and flavonoids: omega – 3 fatty acids, carotenoids, dietary fiber, phytoestrogens.

Unit-III Physical, chemical, nutritional changes in food

Physico-chemical and nutritional changes occurring during food processing treatments: Drying and dehydration; Irradiation; Freezing; Canning

Unit-IV Flavour

Definition and basic tastes. Chemical structure and taste. Description of food flavours, flavour enhancers.

Unit-V Chemical Reaction in foods

Enzymatic and non-enzymatic browning in Foods, reactions of aldehydes and ketones with amino compounds, caramelization, oxidative changes of polyphenols and their applications in food products. Important chemical changes during storage and cooking of foods, with some suitable examples from cereals, pulses and fruits and vegetables.

TEXT BOOKS

1. Desrosier, Norman W. and Desrosier, James.N. (1977). The technology of food preservation, 4th Ed. Westport, Conn.: AVI Pub. Co.
2. C Egbuna, G D Tupas (2020) Functional Foods and Nutraceuticals: Bioactive Components, Formulations and Innovations. . Germany: Springer International Publishing.
3. Fennema, Owen. R. (1996). Food Chemistry, 3rd Ed., New York: Marcell Dekker.
4. M. Anandha Rao (2013). Rheology of Fluid, Semisolid, and Solid Foods- Principles and Applications, 3rd Ed, Springer

FURTHER SUGGESTED READINGS

1. De Man. & John, M. (1999). Principles of Food Chemistry.,3rd Ed.. Springer.
2. Sehgal, S.(2016) “A Laboratory Manual of Food Analysis” ISBN 978-93-84588-84- 7.India:IK International.
3. FSSAI website- Food Safety and Standards Regulations

Year/Semester	2nd Year/4th Semester	Course Category	Major Course
Course Code	25FTBS453	Course Title	Food Chemistry-II Lab
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P: 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. To examine the concepts of food chemistry.
2. To illustrate the concepts surrounding chemistry and their influence on food product development.
3. To estimate the importance different chemical reactions on food product development.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Learn the fundamentals of food chemistry.
2. Understand how food chemistry is applied to the creation of food products.
3. Learn the fundamental estimation techniques for the examination of various parameters.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CO \ CLO	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

LIST OF EXPERIMENTS

A Student is supposed to complete/perform minimum 6 number of experiments.

1. Estimation of total ash content.
2. Estimation of minerals.
3. Determination of thermal inactivation time of enzymes in fruits and vegetables.
4. Estimation of iodine value.
5. Estimation of peroxide value.
6. Determination of carotenoids w.r.t flour pigments.

7. Assessment of the Extent of Non-Enzymatic Browning Through Solvent Extraction Methods.
8. Introduction of the concept of new product.
9. Estimation of Crude Fibre.
10. Estimation of Carbohydrate or glucose or sucrose or reducing sugar.

TEXT BOOKS

1. Sehgal, S. (2016). A Laboratory Manual of Food Analysis. India: I K International Publishing House Pvt. Limited.
2. Fennema, Owen R. (1996). Food Chemistry. 3rd Ed..New York: Marcell Dekker.
3. Fellows, P.J. (2020). Food Processing Technology: Principles and Practice. Woodhead Publishing.

FURTHER SUGGESTED READINGS

1. Potter, N.H. (1998). Food Science. New Delhi: CBS Publication
2. Desrosier, Norman W. and Desrosier, James.N. (1977). The technology of food preservation, 4th Ed. Westport, Conn.: AVI Pub. Co.

Year/Semester	3rd Year/5th Semester	Course Category	Major Course
Course Code	25FTBS501	Course Title	Emerging Technology in Food Processing
Continuous Evaluation 40		End Semester Examination 60	
Prerequisite: Nil		L T P : 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. To understand emerging food technologies and their implications.
2. To explore innovative food production, including plant-based foods, precision agriculture, and personalized nutrition.
3. To analyze food safety, sustainability, and ethical considerations.
4. To apply data-driven solutions, AI, and predict future industry trends.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Point out and assess emerging food technologies and their ethical aspects.
2. Apply innovative food production methods.
3. Understand the food safety, sustainability, and propose waste reduction strategies.
4. Apply data-driven solutions to food challenges, predict trends, and anticipate industry impacts.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit I: Introduction to Emerging Food Technologies

Overview of emerging technologies in the food industry, Ethical, social, and environmental considerations, Health-conscious and functional food innovations.

Unit II: Innovative Food Production and Processing

Plant-based and cell-based foods, Space foods, Precision agriculture and smart farming, 3D printing and personalized nutrition.

Unit III: Nanotechnology in Food

Nanotechnology in food science, Edible packaging and sustainable materials.

Unit IV: Data-Driven Solutions

Artificial intelligence and machine learning in food, Data driven decision making in food service industry and its applications

Unit V: Sensory Enhancement, Waste Reduction, and Future Trends

Flavour Innovation, Role of encapsulation in preserving and releasing flavours, Food waste reduction technologies, Smart packaging for extending shelf life and reducing spoilage, Future trends, implications, and global Impact.

TEXT BOOKS

1. Kumar, S., Mukherjee, A., Mitra, A., & Halder, D. (Eds.). (2023). *Emerging Technologies in Food Preservation*.
2. Thakur, M., & Modi, V. (2020). *Emerging Technologies in Food Science*.
3. Smetana, S., Terjung, N., Aganovic, K., Alahakoon, A. U., Oey, I., & Heinz, V. (2019). Emerging technologies of meat processing. In *Sustainable meat production and processing* (pp. 181-205). Academic Press.

FURTHER SUGGESTED READINGS

1. Nedović, V., Raspor, P., Lević, J., Šaponjac, V. T., & Barbosa-Cánovas, G. V. (Eds.). (2016). *Emerging and traditional technologies for safe, healthy and quality food* (pp. 257-268). New York, NY, USA:: Springer International Publishing.
2. Roohinejad, S., Koubaa, M., Greiner, R., & Mallikarjunan, K. (Eds.). (2019). *Effect of Emerging Processing Methods on the Food Quality: Advantages and Challenges*. Springer.
3. Meghwal, M., & Goyal, M. R. (Eds.). (2017). *Developing technologies in food science: status, applications, and challenges*.

Year/Semester	3rd Year/5th Semester	Course Category	Major Course
Course Code	25FTBS551	Course Title	Emerging Technology in Food Processing Lab
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P : 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. Develop unique snack flavours by experimenting with seasonings and ingredients.
2. Survey peers to gather data on flavour and dietary preferences for product design.
3. Create mock meat using innovative food production methods and ingredients.

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, learners will be able to:

1. Learn the different spices and flavours to create flavoured popcorn and unusual snack alternatives.
2. Understand designing and executing surveys to gather information on food preferences of peers and obtain knowledge for next food product development.
3. Understand new strategies for producing food, especially for imitation meat and meat replacements, while looking into alternate components and procedures.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLO	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

LIST OF EXPERIMENTS

A Student is supposed to complete/perform a minimum 6 number of experiments.

1. To develop flavoured popcorn.
2. To assess individual dietary intake and nutritional status in order to develop a basic personalized diet plan.
3. To explore innovative food production methods for mock meat.
4. To make fiber-enriched food.
5. To develop a probiotic-incorporated protein bar.
6. To prepare a ready to use therapeutic food.
7. To develop smart food packaging.
8. To prepare a food product from fruits and vegetables waste utilization.
9. To prepare the space food.
10. To develop edible packaging film

TEXT BOOKS

1. Sun, D. W. (2014). Emerging technologies for food processing.
2. Nielsen, S. S., & Nielsen, S. S. (2017). Total carbohydrate by phenol-sulfuric acid method. Food analysis laboratory manual, 137-141.
3. Miller, D. D., & Yeung, C. K. (2022). Food chemistry: A laboratory manual. John Wiley & Sons.

FURTHER SUGGESTED READINGS

2. Sharma, M., Goyal, M. R., & Birwal, P. (Eds.). (2021). Handbook of Research on Food Processing and Preservation Technologies: Volume 5: Emerging Techniques for Food Processing, Quality, and Safety Assurance.
3. Ranganna, S. (1986). Handbook of analysis and quality control for fruit and vegetable products. Tata McGraw-Hill Education. Ranganna, S. (1986). Handbook of analysis and quality control for fruit and vegetable products. Tata McGraw-Hill Education.
4. Owusu-Apenten, R. K., & Vieira, E. R. (2023). Elementary food science (No. 303022). Springer.

Year/Semester	3rd Year/5th Semester	Course Category	Major Course
Course Code	25FTBS502	Course Title	Dairy Technology
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. To understand the milk production and milk products.
2. To highlight the characteristics and makeup of milk as well as the operation of some dairy equipment.
3. To classify the technologies used to produce dairy products.
4. To use the value-adding process for dairy products.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the platform tests of the dairy industry.
2. List the numerous attributes and components of milk.
3. Understand the production processes for a variety of goods, including cheese, condensed milk, milk powder, flavoured milk, yoghurt, dahi, and paneer.
4. Learn the production processes that may be utilised to create various dairy products with added value.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Milk composition

Introduction to milk composition. Color, taste, pH and buffering capacity, refractive index, viscosity, surface tension, freezing, boiling point, specific heat, OR, electrical conductivity. Lactose (alpha and beta forms and their differences). Significances of lactose in dairy industry. Milk fat composition and structure, factors affecting melting point, boiling point, solubility. Chemical reactions of fat (hydrolysis, auto-oxidation), condition favouring autooxidation, prevention, measurement of auto-oxidation.

Unit-II Milk protein and enzymes

General structure, amphoteric nature, difference between casein and serum protein, different types of casein (acid and rennet), uses of casein, fractionation of protein. Enzymes- catalase, alkaline phosphatase, lipases and proteases. Industrial Significance.

Unit-III Milk test

Systems of collection of milk Reception, Platform testing various stages of processing: Filtration, Clarification, Homogenization, Pasteurization. Description and working of clarifier, cream separator, homogenizer and plate heat exchanger. Refractive Index, fat constants (saponification value, iodine value, RM value, Polenske value, peroxide value).

Unit-IV Packaging of milk

Desirable characters and types of packaging materials; Forms of packaging. Disposal of dairy effluents: Sources of dairy waste; Necessity of treatment of dairy waste; Methods of treatment: Low cost methods and Conventional methods - Activated sludge process and trickling filters.

Unit-V Milk products

Milk products -Butter, ghee, flavoured milk, yoghurt, dahi, shrikhand, ice-cream, condensed milk, milk powder, channa, paneer, cheese (cheddar).

TEXT BOOKS

1. De, Sukumar. (2007). Outlines of Dairy Technology. Oxford: Oxford University Press.
2. Spreer, E. (2017). Milk and dairy product technology. Routledge.
3. Deeth, H., & Kelly, P. (2020). Processing and Technology of Dairy Products: A Special Issue. Foods, 9(3), 272.

FURTHER SUGGESTED READINGS

1. Paul L. H. Mc Sweeney Patrick F. Fox (Eds.). (2012). Advanced dairy chemistry volume 1 a: Lipids (4 th ed). Springer Science & Business Median.
2. McSweeney, P. L., Fox, P. F., & O'Mahony, J. A. (Eds.). (2020). Advanced Dairy Chemistry, Volume 2: Lipids. Springer International Publishing.
3. Anandha Rama Krishnan, C. (Ed.). (2017). Handbook of drying for dairy products. John Wiley & Sons.

Year/Semester	3rd Year/5th Semester	Course Category	Major Course
Course Code	25FTBS552	Course Title	Dairy Technology Lab
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P: 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. To describe the basic ideas behind dairy technology.
2. To consider the ideas related to dairy food processing and preservation.
3. To stress the significance of dairy product quality standards.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Learn the dairy products' fundamental analysis.
2. Understand the idea behind various dairy product processing techniques.
3. Suggest the fundamental dairy products.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CO \ CLO	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

LIST OF EXPERIMENTS

A Student is supposed to complete/perform minimum 6 number of experiments.

1. To perform platform tests in milk. (Acidity, COB, specific gravity, SNF).
2. To estimate milk protein by Folin method.
3. To estimate milk fat by Gerber method.
4. Preparation of flavoured milk/ Pasteurization of milk.

5. To prepare casein and calculate its yield.
6. Cut out examination of canned Milk Products (Condensed Milk)
7. To calculate the quantity of high-fat milk or cream and low-fat milk or skim milk required to make milk containing 5% fat using Pearson's square method (assume: cream 25% fat; skim milk 0%; 1L milk of 5% fat).
8. Prepare different types of fermented dairy products.
9. Preparation of ice-cream
10. Preparation of granular Ghee.

TEXT BOOKS

1. Sehgal, S. (2016). A Laboratory Manual of Food Analysis. India: I K International Publishing House Pvt. Limited.
2. De, Sukumar. (2007). Outlines of Dairy Technology. Oxford: Oxford University Press.
3. Chandan, R. C. (2015). Dairy processing and quality assurance: an overview. Dairy processing and quality assurance, 1-40.

FURTHER SUGGESTED READINGS

1. Nollet, L. M., & Toldrá, F. (Eds.). (2015). Handbook of food analysis-two volume Set. CRC Press.
2. Meghwal, M., Goyal, M. R., & Chavan, R. S. (Eds.). (2017). Dairy engineering: Advanced technologies and their applications. CRC Press.
3. Wehr, H. M., & Frank, J. F. (Eds.). (2018). Standard methods for the examination of dairy products. American Public Health Association.
4. Hamid, F., & Hamid, F. H. (2015). Manual of methods of analysis of foods. Food safety and standards authority of India.

Year/Semester	3rd Year/5th Semester	Course Category	Major Course
Course Code	25FTBS503	Course Title	Spices and Plantation Crops Process Technology
Continuous Evaluation 40		End Semester Examination 60	
Prerequisite: Nil		L T P : 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. To discover the production of main and minor spices as well as plantation crops including tea, coffee, cocoa, coconut, and cashew.
2. To maintain quality, learn how to extract and use oleoresins, essential oils, and other flavouring ingredients.
3. To learn quality assurance techniques for safe products and the health advantages of spice use.
4. To recognise the manufacture, production, and chemical makeup of goods like chocolate and coffee.

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, learners will be able to:

1. Identify various spice varieties and divide them into major and minor spices.
2. Use techniques for drying, storing, and packing to maintain quality.
3. Analyse the health benefits of eating spices and certain foods.
4. Apply practical knowledge to the processing of coconut, cashew, cocoa, tea, and coffee.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO	CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1					
CO 2					
CO 3					
CO 4					

COURSE CONTENT

Unit-I Introduction to spices:

Types of spices; Products and processing-spice powder and paste, their processing, quality, storage, flavouring components: Spice-based food additives volatiles, essential oils, and oleoresins; Extraction and utilization of essential oils, Standards and specifications of spices.

Unit-II Postharvest Handling of Major Spices:

Post-harvest processing of major spices-turmeric, pepper, onion, chill including, introduction, harvesting, production status, health benefits, post-harvest technology, and treatments; Processing into marketed products; Adulteration: Specifications for marketed products, Packaging and different grades, Processing of oleoresin from the major spices

Unit-III Postharvest Handling of Minor Spice:

Post-harvest processing of minor spice-cardamom ginger, coriander, cumin, garlic, saffron, vanilla, clove, and nutmeg including, Introduction, and harvesting. Post-harvest technology and treatments, processing into marketed products, adulteration, specifications for marketed products, packaging, and different grades, Processing of oleoresin from the minor spices: Health benefits of minor spices.

Unit-IV Processing of Tea and Coffee

Types of tea, Chemistry of tea manufacturing, Tea quality-tea aroma precursors, tea flavour, grades of tea, storage of tea, instant tea, and processed tea products Processing of coffee cherries by wet and dry methods to obtain coffee beans-grinding, storage, and preparation of brew soluble/instant coffee, use of chicory in coffee, decaffeinated coffee.

Unit-V Processing of Plantation Crops:

Processing of Cocoa chemical composition of cocoa beans, cocoa processes, leaning, roasting. Processing of Coconut & Cashew. Health benefits of plantation crops, Pre and post-harvest problems in the processing of crops, Different by-products obtained from coconut and cashew, processing of by-products

TEXTBOOKS

1. Tainter, D. R., & Grenis, A. T. (2001). Spices and seasonings: a food technology handbook. John Wiley & Sons.
2. Florkowski, W. J., Banks, N. H., Shewfelt, R. L., & Prussia, S. E. (Eds.). (2021). Postharvest handling: a systems approach. Academic press.
3. Zhen, Y. S. (Ed.). (2002). Tea: bioactivity and therapeutic potential. CRC Press.

FURTHER SUGGESTED READINGS

1. Peter, K. V. (Ed.). (2006). Handbook of herbs and spices: volume 3. Woodhead publishing.
2. Rao, S. (2014). The coffee roaster's companion. Scott Rao.
3. Afoakwa, E. O. (2014). Cocoa production and processing technology. CRC Press.

Year/Semester	3rd Year/5th Semester	Course Category	Major Course
Course Code	25FTBS553	Course Title	Spices and Plantation Crops Process Technology Lab
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P : 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. To identify spices, sauces, and plantation crops by recognising the unique chemicals they contain.
2. To develop abilities to spot adulteration to guarantee product quality and originality.
3. To develop hands-on experience using the Soxhlet apparatus to extract oleoresin from diverse sources, and exhibit innovation by creating new coconut-based goods.

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, learners will be able to:

1. Understand products made from spices and plantation crops.
2. Detect adulteration using analytical methods for quality assurance.
3. Use Soxhlet extraction and create innovative plantation-based products.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CO	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

LIST OF EXPERIMENTS

A Student is supposed to complete/perform a minimum 6 number of experiments.

1. Identification of spices, condiments and plantation crops and their flavouring or bioactive compounds.
2. To identify the Adulteration in spices
3. To extract the oleoresin from pepper and cloves by using Soxhlet apparatus
4. Extraction of Oleoresin from Cardamom and chili powder.
5. Determination of moisture content in spices.
6. Preparation of different spice powders.
7. Drying and roasting of coffee beans.
8. New-product development from coconut.
9. Formulation of health drinks using plantation crops.
10. Shelf-life study of ground spices under different storage conditions.

TEXT BOOKS

1. Peter, K. V. (Ed.). (2006). Handbook of herbs and spices: volume 3. Woodhead publishing.
2. Pruthi, J. S. (1980). Spices and condiments: chemistry, microbiology, technology. Advances in Food Research. Supplement, 4, 1-449.
3. Naik, B., Tarai, R.K., Sahoo, A.K., Sethy, B.K., Samal, S. (2023). A Textbook of Plantation Crops. ISBN: 9789391383206

FURTHER SUGGESTED READINGS

2. Peter, K. V. (Ed.). (2006). Handbook of herbs and spices: volume 3. Woodhead publishing.
3. Thurston, R. W., Morris, J., & Steiman, S. (Eds.). (2013). Coffee: A comprehensive guide to the bean, the beverage, and the industry. Rowman & Littlefield Publishers.
4. https://fssai.gov.in/upload/uploadfiles/files/Manual_Revised_Spices_Herbs_22_06_2021.pdf

Year/Semester	3rd Year/5th Semester	Course Category	Major Course
Course Code	25FTBS504	Course Title	Food Packaging
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. To identify fundamentals of packaging.
2. To design the broad overview of the scientific and technical aspects of food packaging.
3. To illustrate the packaging machinery systems.
4. To state the testing and regulations of food packaging.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Interpret the technical and scientific overview of food packaging.
2. Choose the packing equipment systems, test,
3. Learn about various packing materials.
4. Understand the general laws and rules governing food packing.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Introduction

Definitions, status of packaging industry in India and globally. Packaging functions. Barcodes & RFID. Environment concerns (RRRR), LCA and method of its estimation. Food Packaging and Labelling Laws (FSSAI).

Unit-II Food Packaging Materials

Manufacturing of paper, types of paper and corrugated fiber board (CFB). Food grade plastics, properties, methods of manufacturing (Injection molding and Blow molding) Biodegradable plastics, edible packaging. Metals, Tinline, tin free can (TFC), types of can. Glass: Composition, Properties, methods of bottle making, types of closures.

Unit-III Packaging Machinery

Cartooning systems. Form, Fill and Sealing machine (FFS). Vacuum, Controlled and Modified atmosphere packaging systems. Aseptic packaging systems. Retort packaging. Active and Intelligent packaging systems.

Unit-IV Testing of Packaging Materials

Testing Procedures for Packaging Materials- thickness, tensile properties, puncture resistance, bursting strength, seal strength, water vapor permeability, gas transmission rate (CO₂ and O₂ permeability), grease resistance. Compatibility and shelf life studies. Evaluation of transport worthiness of filled packages.

Unit-V Package Design for Food

Factors affecting spoilage, package requirement and package designing for: Fresh horticultural produce, Animal foods, Dry and moisture sensitive foods, frozen foods, Fats and oils, thermally processed foods, Milk, Meat products.

TEXT BOOKS

1. N. C. Saha, Anup K. Ghosh, Meenakshi Garg, Susmita Dey Sadhu, Deepak Manchanda, Subramoni Chidambar. (2022). Food Packaging Materials, Techniques and Environmental Issues. Springer Nature Singapore
2. Ashutosh Kumar Shukla. (2022). Food Packaging: The Smarter Way. Springer Nature Singapore
3. Cornelia Vasile and Morten Sivertsvik. (2019). Food Packaging Materials and Technologies MDPI AG

FURTHER SUGGESTED READINGS

1. Han, J. W., Ruiz-Garcia, L., Qian, J. P., & Yang, X. T. (2018). Food packaging: A comprehensive review and future trends. *Comprehensive Reviews in Food Science and Food Safety*, 17(4), 860-877.
2. Majid, I., Nayik, G. A., Dar, S. M., & Nanda, V. (2018). Novel food packaging technologies: Innovations and future prospective. *Journal of the Saudi Society of Agricultural Sciences*, 17(4), 454-462.
3. Petkoska, A. T., Daniloski, D., D'Cunha, N. M., Naumovski, N., & Broach, A. T. (2021). Edible packaging: Sustainable solutions and novel trends in food packaging. *Food Research International*, 140, 109981.

Year/Semester	3rd Year/5th Semester	Course Category	Major Course
Course Code	25FTBS554	Course Title	Food Packaging Lab
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. To explain the overview of the scientific and technical aspects of food packaging.
2. To analyze the packaging requirement and packaging designing of food.
3. To state the packaging machinery systems.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Learn the technical and scientific elements of food packing.
2. Understand the science underlying the various specifications for food packaging.
3. List fundamental material evaluations for food packaging.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CO \ CLO	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

LIST OF EXPERIMENTS

A Student is supposed to complete/perform minimum 6 number of experiments.

1. Identification of plastic using floatation method.
2. To measure the thickness of paper and paperboard.
3. To measure the basic weight of paper and paperboard.
4. To measure the water absorption capacity of paper.
5. Determination of grease resistance of paper.
6. Vacuum packaging of foods and shelf life study.
7. Development of biodegradable film.

8. To examine the impact of light exposure on the quality and stability of packaged foods.
9. Porosity of tinplate.
10. To study the operation of FFS machine.

TEXT BOOKS

1. Robertson, G.L.(2012) Food Packaging – Principles and Practice. CRC Press Taylor and Francis Group
2. Narendra K. Jain & Sagar Madhukar Chavan Nikita Wadhawan (2020) Packaging Technology and Equipment (Practical Manual). Lucky Publication House
3. Rangappa, S. M., Parameswaranpillai, J., Thiagamani, S. M. K., Krishnasamy, S., & Siengchin, S. (Eds.). (2020). Food packaging: Advanced materials, technologies, and innovations. CRC Press.

FURTHER SUGGESTED READINGS

2. Han, J. W., Ruiz-Garcia, L., Qian, J. P., & Yang, X. T. (2018). Food packaging: A comprehensive review and future trends. *Comprehensive Reviews in Food Science and Food Safety*, 17(4), 860-877.
3. Majid, I., Nayik, G. A., Dar, S. M., & Nanda, V. (2018). Novel food packaging technologies: Innovations and future prospective. *Journal of the Saudi Society of Agricultural Sciences*, 17(4), 454-462.
4. Petkoska, A. T., Daniloski, D., D'Cunha, N. M., Naumovski, N., & Broach, A. T. (2021). Edible packaging: Sustainable solutions and novel trends in food packaging. *Food Research International*, 140, 109981.

Year/Semester	3rd Year/6th Semester	Course Category	Major Course
Course Code	25FTBS601	Course Title	Meat, Poultry and Egg Technology
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. To illustrate the meat and poultry sector.
2. To express the methods used to kill meat animals and poultry, as well as the quality of the flesh.
3. To describe techniques for animal food processing, preservation, and by-product utilisation.
4. To investigate the methods used for egg production, egg preservation, variables affecting egg quality, and egg quality indicators.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Learn the demand for and significance of the cattle, egg, and poultry industries.
2. Recognise the technologies involved in the production of various animal feeding items and the use of byproducts.
3. Understand the procedures for egg production and egg preservation into practise.
4. List the variables that impact egg quality and the metrics used to determine it.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Introduction

Livestock and poultry population in India, Development of meat and poultry industry in India and its need in nation's economy, Terminology used for animals and birds based on age, sex, cuts, use. Effects of feed breed and stress on production of meat animals and their quality. Structure of muscle in meat, Meat Quality-colour, flavour, texture, Water-Holding Capacity (WHC), Emulsification capacity of meat, Enzymes used for meat tenderization.

Unit-II Slaughter Process and by-products

Layout of abattoir, Slaughter, Ante mortem examination of meat animals, slaughter of buffalo, sheep/ goat, poultry, pig. A Generic HACCP model for poultry slaughter, post-mortem examination of meat, Grading, Post-mortem changes of meat. Importance of by-products utilization, classification and uses of by-products, Manufacture of Natural casings.

Unit-III Preservation of meat

Refrigeration and freezing, thermal processing- canning of meat, retort pouch, dehydration, irradiation, meat curing, Sausages-processing, types and defects, Packaging of meat.

Unit-IV Egg

The egg industry, its techniques of working, general management of poultry farm. Factors affecting egg quality and measures of egg quality.

Unit-V Preservation of Egg

Refrigeration and freezing of eggs, egg powder manufacture, egg coatings.

TEXT BOOKS

1. Toldrá, F. (Ed.). (2022). Lawrie's meat science. Woodhead Publishing.
2. Scanes, C. G., & Christensen, K. D. (2019). Poultry science. Waveland Press.
3. Mountney, V. (2017). Poultry products technology. Routledge.

FURTHER SUGGESTED READINGS

1. Devine, C., & Dikeman, M. (Eds.). (2014). Encyclopedia of meat sciences. Elsevier.
2. Scanes, C. G., & Christensen, K. D. (2019). Poultry science. Waveland Press.
3. Burnham, G. P. (2023). Burnham's new poultry book. BoD–Books on Demand.
4. Deshpande, A. (2025). Meat Technology and Processing. Educohack Press.

Year/Semester	3rd Year/6th Semester	Course Category	Major Course
Course Code	23FTBS651	Course Title	Meat, Poultry and Egg Technology Lab
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P: 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. To explain the terms "meat," "poultry," and "technology."
2. To describe the ideas involved in the preservation and processing of meat, poultry, and eggs.
3. To provide examples of the significance of animal product quality standards.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Highlight the fundamental evaluation of animal products.
2. Understand the rationale behind various animal product processing techniques.
3. Summarise the scientific rationale for animal product manufacturing.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CO \ CLO	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

LIST OF EXPERIMENTS

A Student is supposed to complete/perform minimum 5 number of experiments.

1. Estimation of moisture content of meat.
2. Cut-out analysis of canned meats/retort pouches.
3. Estimation of protein content of meat.
4. To determine the water holding capacity of a given meat sample using the filter paper press method.
5. To study shelf-life of eggs by different methods of preservation.
6. Evaluation of eggs for quality parameters (market eggs, branded eggs).
7. To perform freezing of yolk/albumen.
8. Meat-product formulation.

9. Investigate how pounding affects the absorption of marinades (brine) in meat.
10. Egg product formulation

TEXT BOOKS

1. Toldrá, F. (Ed.). (2022). *Lawrie's meat science*. Woodhead Publishing.
2. Scanes, C. G., & Christensen, K. D. (2019). *Poultry science*. Waveland Press.
3. Mountney, V. (2017). *Poultry products technology*. Routledge.

FURTHER SUGGESTED READINGS

1. Devine, C., & Dikeman, M. (Eds.). (2014). *Encyclopedia of meat sciences*. Elsevier.
2. Scanes, C. G., & Christensen, K. D. (2019). *Poultry science*. Waveland Press.
3. Burnham, G. P. (2023). *Burnham's new poultry book*. BoD–Books on Demand.

Year/Semester	1st Year/2nd Semester	Course Category	Major Course
Course Code	25FTBS602	Course Title	Fundamentals of Sensory Evaluation
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. To describe the fundamental and derivative flavours found in food.
2. To describe the fundamental sensory characteristics of both raw and processed foods.
3. To discuss the objective and subjective methods of sensory evaluation.
4. To exhibit how sensory assessment is used in food industry.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Utilise sensory science principles.
2. Examine the food's sensory and physical attributes.
3. Ensure food quality, evaluate the colour, taste, texture, and other sensory qualities.
4. Assess how consumers feel about and accept food goods.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Introduction

Introduction to Sensory Quality Attributes of Food-Appearance, flavour, textural factors and additional quality factors. Discriminative tests, Descriptive tests.

Unit-II Taste

Introduction and importance of gustation. Structure and physiology of taste organs- tongue, papillae, taste buds, salivary glands. 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. Recent advances in Taste measurement- Electronic Tongue. Taste abnormalities.

Unit-III Odour

Introduction, definition and importance of odour and flavour. Anatomy of nose, physiology of odour perception. Mechanism of odour perception Theories of odour classification, chemical specificity of odour. Recent advances in olfaction measurement – Electronic Nose, GC Mass Spectroscopy. Olfactory abnormalities.

Unit-IV Colour

Introduction and importance of colour. Dimensions of colour and attributes of colour; gloss etc. Perception of colour. Colour Measurement: Munsell colour system, CIE colour system, Hunter colour system, Tintometer. Colour abnormalities.

Unit-V Texture

Introduction, definition and importance of texture. Significance of sound in texture evaluation. 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.

TEXT BOOKS

1. Herbert Stone, Rebecca N. Bleibaum, Heather A. Thomas. (2020). Sensory Evaluation Practices. Elsevier Science
2. Cecilia Y. Saint-Denis (2018). Consumer and Sensory Evaluation Techniques How to Sense Successful Products. Wiley
3. Rao, E. S. (2014). Food Quality Testing and Evaluation: Sensory Tests and Instrumental Techniques (1st ed.). New Delhi. Variety Book Publishers.

FURTHER SUGGESTED READINGS

1. Stone, H. (2018). Example food: What are its sensory properties and why is that important. *npj Science of Food*, 2(1), 11.
2. Carabante, K. M., & Prinyawiwatkul, W. (2018). Data analyses of a multiple-samples sensory ranking test and its duplicated test: A review. *Journal of Sensory Studies*, 33(4), e12435.
3. Lesschaeve, I., & Noble, A. C. (2022). Sensory analysis of wine. *Managing wine quality*, 243-277.

Year/Semester	1st Year/2nd Semester	Course Category	Major Course
Course Code	25FTBS652	Course Title	Fundamentals of Sensory Evaluation Lab
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P: 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. To state the concepts of sensory evaluation.
2. To express the different sensory evaluation tests.
3. To illustrate the importance of objective sensory evaluation methods.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Enumerate the subjective and sensory techniques of sensory evaluation.
2. Learn the idea underlying sensory evaluation for affective and discriminative tests.
3. Understand the fundamental sensory assessment tests, such as an investigation of texture, colour, and viscosity.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CO \ CLO	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

LIST OF EXPERIMENTS

A Student is supposed to complete/perform minimum 6 number of experiments.

1. Training of sensory panel.
2. To perform recognition tests for basic tastes.
3. To perform discriminative Tests: Simple and directional Difference tests, Ranking and Rating Tests.
4. To perform Sensitivity Tests: Threshold / Dilution for basic tastes.
5. To perform Descriptive Tests: Category Scaling (structured and unstructured) Quantitative Descriptive Analysis.
6. To perform paired comparison, Duo Trio, and Triangle test.
7. To perform Affective Tests (Preference and Acceptance Tests) Part 1- Hedonic Scale (verbal, facial)
8. To perform Affective Tests (Preference and Acceptance Tests) Part 2 - Food Action Scale
9. Perform sensory evaluation of any dairy product-market milk/cheese/butter/ice cream
10. To identify and analyze common flavour defects in milk, ice cream, and butter samples.

TEXT BOOKS

1. Herbert Stone, Rebecca N. Bleibaum, Heather A. Thomas. (2020). *Sensory Evaluation Practices*. Elsevier Science
2. Cecilia Y. Saint-Denis (2018). *Consumer and Sensory Evaluation Techniques How to Sense Successful Products*. Wiley
3. Rao, E. S. (2014). *Food Quality Testing and Evaluation: Sensory Tests and Instrumental Techniques (1st ed.)*. New Delhi. Variety Book Publishers.

FURTHER SUGGESTED READINGS

1. Yang, J., & Lee, J. (2020). Current research related to wine sensory perception since 2010. *Beverages*, 6(3), 47.
2. Bamidele, O. P., Adebawale, O. J., & Feng, X. (2023). Sensory perspectives into indigenous fermented foods in the tropics: challenges and opportunities. *Indigenous Fermented Foods for the Tropics*, 483-502.
3. Marcazzan, G. L., Mucignat-Caretta, C., Marina Marchese, C., & Piana, M. L. (2018). A review of methods for honey sensory analysis. *Journal of Apicultural Research*, 57(1), 75-87.

Year/Semester	3rd Year/6th Semester	Course Category	Major Course
Course Code	25FTBS603	Course Title	Bakery & Confectionary Technology
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. To understand the fundamentals of baking.
2. To comprehend technology behind various bakery products.
3. To understand technology used in modified bakery products.
4. To learn the technologies used in preparation of confectionery products.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Apply the fundamentals of baking.
2. Acquire the knowledge of the technologies behind bakery products.
3. Recognise the technologies for confectionary product preparations.
4. Understand different innovations and trends in baking and confectionery industry.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CLO CO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Introduction to Bakery Technology

Introduction to bakery technology, current status, and growth rate of bakery Industry in India. Types of bakery products, nutritional quality and safety, pertinent standards & regulations, safety concerns related to additives used in bakery products.

Unit-II Baking Science of Bread and Biscuits

Ingredients & processes for breads, changes taking place during baking, equipment used, product quality characteristics. Biscuits, Cookies & Crackers- Ingredients & processes, equipment used, product quality characteristics.

Unit-III Baking Science of Cake & Pastry

Ingredients & processes for cakes and pastry, equipment used, product quality characteristics, faults and corrective measures.

Unit-IV Introduction to Confectionary Industry

Current status and economic importance of Confectionary Industry in India. Confectionery product types and their pertinent standards & regulations. Sugars- Types and sources. Principles of sugar cookery, crystalline and non-crystalline candies.

Unit-V Confectionary Products

Confectionary Products: Cake icings, hard-boiled candies, chocolates and other confections- ingredients, equipment's & processes, product quality parameters, faults and corrective measures.

TEXT BOOKS

1. Corke, H., De Leyn, I., Nip, W.K. and Cross, N.A., 2008. Bakery products: Science and Technology. John Wiley & Sons.
2. Dubey, S.C. (2007). Basic Baking 5th Ed. Chanakya Mudrak Pvt. Ltd.
3. Manay, N.S.O., 2001. Food: facts and principles. New Age International.
4. NIIR. (2014). The Complete Technology Book on Bakery Products (Baking Science and Formulations). NIIR Project Consultancy Services.
5. Raina. et.al. (2003). Basic Food Preparation-A complete Manual. 3rd Ed. Orient Longman Pvt. Ltd.
6. Beckette, S.T. (2009). Industrial Chocolate Manufacture. Blackwell Publishing Ltd.
7. Minifie, B.W. (1999). Chocolate, Cocoa and Confectionary. Aspen Publication.
8. Mohini, Sethi. & Eram, Rao. (2011). Food science- Experiments and applications, 2nd ed., CBS publishers & Distributors Pvt Ltd.

FURTHER SUGGESTED READINGS

1. Barndt, R. L. (1993). Fat & Calorie – Modified Bakery Products. US: Springer.
2. Bennion, E.B. and Bamford, G.S.T.(1997). The technology of cake making. Springer Science & Business Media.
3. Faridi, Faubion. (1997). Dough Rheology and Baked Product Texture. CBS Publications.
4. Manley, D. (2011). ed. Manley's technology of biscuits, crackers and cookies. Elsevier.
5. Samuel, A. Matz (1992). Cookies & Cracker Technology. Van Nostrand Reinhold.
6. Samuel, A. Matz (1999). Bakery Technology and Engineering. PAN-TECH International Incorporated.
7. Edwards, William. P. (2000). The Science of Sugar Confectionery, The Royal society of Chemistry.
8. Geoff, Talbot. (2009). Science and Technology of Enrobed and Filled Chocolate, Confectionery and bakery products. CRC.
9. Lees, R. & Jackson, EB. (1992). Sugar Confectionery and Chocolate Manufacture. Springer

Year/Semester	3rd Year/6th Semester	Course Category	Major Stream Course
Course Code	25FTBS653	Course Title	Bakery & Confectionary Technology Lab
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P : 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. Create fermented goods using bakery tools and mixing techniques.
2. Optimize dough properties and innovate diverse bread recipes.
3. Make breads, cookies, and desserts with creative toppings and frostings.

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, learners will be able to:

1. Apply mixing methods and identify equipment for bakery preparation.
2. Prepare fermented products, cakes, and specialty breads effectively.
3. Create cookies, biscuits, and pastries with creative frosting and toppings.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLO	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

LIST OF EXPERIMENTS

A Student is supposed to complete/perform a minimum 6 number of experiments.

1. Identification and uses of bakery equipments.
2. To determine the dough raising capacity.
3. To find the water absorption capacity in dough.
4. To demonstrate the basic mixing techniques.
5. To prepare simple yeast fermented products.
6. To prepare chocolate.
7. To develop burger/pizza/bun/ breads.
8. To learn the basic concept to prepare biscuits and cookies.
9. To prepare cake/ pastries with icing and toppings.

10. To master the intricate process of making toffees/ lollipops/ gummies.

TEXT BOOKS

1. Nielsen, S. S. (Ed.). (2003). Food analysis laboratory manual (p. 557). New York, NY, USA:: Kluwer Academic/Plenum Publishers.
2. Board, E. (2012). Hand Book of Confectionery with Formulations. Engineers India Research Institute: New Delhi, India.

FURTHER SUGGESTED READINGS

1. Qian, M., Liu, D., Zhang, X., Yin, Z., Ismail, B. B., Ye, X., & Guo, M. (2021). A review of active packaging in bakery products: Applications and future trends. *Trends in Food Science & Technology*, 114, 459-471.
2. Gunes, R., Palabiyik, I., Konar, N., & Toker, O. S. (2022). Soft confectionery products: Quality parameters, interactions with processing and ingredients. *Food Chemistry*, 385, 132735.
3. Efe, N., & Dawson, P. (2022). A Review: Sugar-Based Confectionery and the Importance of Ingredients. *European Journal of Agriculture and Food Sciences*, 4(5), 1-8.

Year/Semester	3rd Year/6th Semester	Course Category	Major Course
Course Code	25FTBS604	Course Title	Food Fermentation Technology
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. To state the basics of fermentation.
2. To discuss the design of various reactors used in Industries.
3. To describe the basis of criteria for selection of media for microbial growth.
4. To classify the fermented food products.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Learn the fundamentals of fermentation.
2. Understand the reactor design's underlying idea.
3. Choose a variety of medium for microbial growth.
4. Learn how the various products made from fermentation are made.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I

History, Scope and Development of Fermentation technology; Isolation and screening of industrially important microorganisms – primary and secondary screening; Maintenance of Strains; Strain improvement.

Unit-II

Natural and Synthetic media; Basic components of an media (Carbon sources; Nitrogen sources; Vitamins; Minerals; Anti-foaming agents); Role of buffers in media; Process of aeration, and agitation. Gaden's Fermentation classification. Basic designs of Fermenter; Type of fermenters: Waldhof, Tower, Deepjet, Cyclone column, Packed tower and airlift fermenter; Scale up study and Product development; Down-stream processing and Product recovery; Regulation and safety.

Unit-III

Food Production- Production of alcohol-wine, cider, fermented vegetables, production of cheese, yoghurt, fermented milk and oriental fermented food.

Unit-IV

Food and enzymes from microorganism. Microbial biomass: single cell proteins and myco-proteins. Production of Amino Acids. Production of Enzymes.

Unit-V

Benefits of Fermentation. Microbial Activities in fermented foods. Control of microbial activities in fermented food. Shelf life of fermented foods. Market of Fermented food

TEXT BOOKS

1. Brian, J. Wood. (1997). Microbiology of Fermented Foods. Volume II and I. Elsevier Applied Science Publication.
2. Joshi, V.K. & Pandey. A. (2009). Biotechnology: Food Fermentation Microbiology, Biochemistry and Technology. Volume I and II. Asiatech Publishers Inc.
3. Stanbury, P.F., Whitekar A. and Hall (2013). Principles of Fermentation Technology. Reed Elsevier India Pvt.Ltd.

FURTHER SUGGESTED READINGS

1. Adams, M. & Moss, M. (2008). Food Microbiology. 2nd Edition. RSC Publishing.
2. John, Garbutt. (1997). Essentials of Food Microbiology. Arnold International Students Edition.
3. T. El-Mansi, C. Bryce, Arnold L. Demain, A.R. Allman. Fermentation Microbiology and Biotechnology. Second Edition. (2006). CRC Press, USA.
4. Hongzhang Chen. Modern Solid State Fermentation: Theory and Practice. (2013). Springer Press, Germany.
5. John E. Smith. Biotechnology. (2009). Cambridge University Press.UK.
6. Celeste M. Todaro, Henry C. Vogel. Fermentation and Biochemical Engineering Handbook. (2014). William Andrew Press. Norwich, NY.
7. G. Lancini, R. Lorenzetti. Biotechnology of Antibiotics and other Bioactive Microbial Metabolites. (2014). Springer publications, Germany.

Year/Semester	3rd Year/6th Semester	Course Category	Major Course
Course Code	25FTBS654	Course Title	Food Fermentation Technology Lab
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P: 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. To state the important of food fermentation.
2. To discuss the principles behind creation of certain fermented food product.
3. To describe the importance microorganisms in preparation of fermented food products.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Prepare basic fermented food products.
2. Select the concept behind different fermented food products.
3. Recognize role of microorganisms in preparation of fermented food products.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CO \ CLO	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

LIST OF EXPERIMENTS

A Student is supposed to complete/perform minimum 6 number of experiments.

1. Part 1- Study of a Bio-fermenter- Design and Operation.
2. Part 2 - Study of a Bio-fermenter- Downstream Processing and product recovery.
3. Fermentation of sugars by yeasts
4. Production of Yogurt using microbial cultures.
5. Development of a fermented food drink
6. Study utilization of plant products/animal products or by-products as substrate.
7. Comprehensive Study of available fermented food products and highlight the strains used for the preparation.
8. Production of alcohol beverage from fruits.
9. Production of oriented fermented food (like idli).
10. To determine the Brix level of an alcoholic beverage sample.

TEXT BOOKS

1. Brian, J. Wood. (1997). *Microbiology of Fermented Foods*. Volume II and I. Elsevier Applied Science Publication.
2. Joshi, V.K. & Pandey. A. (2009). *Biotechnology: Food Fermentation Microbiology, Biochemistry and Technology*. Volume I and II. Asiatech Publishers Inc.

FURTHER SUGGESTED READINGS

1. Sharma, R., Garg, P., Kumar, P., Bhatia, S. K., & Kulshrestha, S. (2020). Microbial fermentation and its role in quality improvement of fermented foods. *Fermentation*, 6(4), 106.
2. Xiang, H., Sun-Waterhouse, D., Waterhouse, G. I., Cui, C., & Ruan, Z. (2019). Fermentation-enabled wellness foods: A fresh perspective. *Food Science and Human Wellness*, 8(3), 203-243.
3. Melini, F., Melini, V., Luziatelli, F., Ficca, A. G., & Ruzzi, M. (2019). Health-promoting components in fermented foods: an up-to-date systematic review. *Nutrients*, 11(5), 1189.

Year/Semester	4th Year/7th Semester	Course Category	Major Course
Course Code	25FTBS701	Course Title	Food Engineering
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. To list the basics of food production unit.
2. To describe the principle of Unit Operation.
3. To apply the principles and methods of food engineering.
4. To develop the fundamentals of food plant and system design.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Understand the fundamentals of developing a food processing and storage facility.
2. Learn the unit operations principle.
3. Use fundamental concepts in steam, psychrometrics, fluid movement, freezing, and heat and mass transfer.
4. Practise at solving numerical and system and food plant difficulties.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Fluid Flow in Food Processing

Newton's law of viscosity. Principle of capillary tube and rotational viscometer. Properties of Non-Newtonian fluids. Flow characteristics, Reynolds number, Bernoulli's equation. Concept of flow measurement devices. Food rheology. Related numerical

Unit-II Design of Food Plant

Important considerations for designing of food plants. Types of layout. Design and layout of storage (warehouse). Principle and equipment used in grinding & mixing in food industry

Unit-III Refrigeration and Freezing

Concept and selection of a refrigerant. Description of a refrigeration cycle. Pressure enthalpy charts and tables. Mathematical expressions useful in analysis vapour compression refrigeration cycle. Numerical on VCR system using R-134a, R-717 including super heating and sub cooling. Freezing time calculation using plank equation. Frozen food storage. Related basic numerical.

Unit-IV Heat and Mass Transfer

Systems for heating and cooling food products. Thermal properties of food. Modes of heat transfer. Application of steady state heat transfer- estimation of conductive heat transfer coefficient, convective heat transfer, overall heat transfer coefficient and design of tubular heat transfer, related basic numerical. Fick's law of diffusion.

Unit-V Psychrometric and Steam

Properties of dry air, water vapour, air vapour mixture. Psychrometric chart and its application. Generation of steam. Construction and functions of fire tube and water tube boilers. Thermodynamics of phase change. Steam tables. Boiling point elevation.

TEXT BOOKS

1. Fellows, P. (2009). Food processing technology. Woodhead publication, 3rd edition
2. Rao, D.G. (2010). Fundamentals of food engineering. PHI learning private ltd.
3. Singh, R.P. and Heldman, D.R. (2009) Introduction to food engineering 4th edition Academic press.

FURTHER SUGGESTED READINGS

1. Earle, R.L. (1983). Unit Operations in Food Processing, 2nd edition. Pergamon press.
2. Singh, R.P and Heldman DR. (2014). Introduction to food engineering 5th edition. Academic press.
3. Toledo Romeo T. (1999). Fundamentals of Food Process Engineering. Aspen Publishers

Year/Semester	4th Year/7th Semester	Course Category	Major Course
Course Code	25FTBS702	Course Title	Nutraceuticals and Functional Foods
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. To state the types of nutraceutical and functional foods.
2. To illustrate the potential of various nutraceuticals and functional foods in promoting human health.
3. To describe the safety issues and consumer acceptance of nutraceutical and functional foods.
4. To develop the concepts of labelling, marketing and regulatory issues related to nutraceutical and functional foods.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Understand the many categories of functional and nutraceutical foods.
2. Learn which nutraceuticals and functional foods have the most potential to promote health.
3. Understand the market for functional foods and nutraceuticals.
4. Learn the consumer adoption of nutraceuticals and functional foods and safety concerns.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Introduction

Definitions and history. Difference between nutraceuticals and functional foods. Basic Introduction. Current status of nutraceuticals and functional foods in India. Market trends of nutraceuticals and functional food

Unit-II Nutraceuticals

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

Unit-III Functional Foods

Types of functional foods - Cereal and cereal products, milk and milk products, egg, oils, meat and products, sea foods, nuts and oilseeds, functional fruits and vegetables, herbs and spices, beverages (tea, wine), fermented foods. Development, formulation and fabrication of functional foods. Functions and uses of nutrient supplements in formulations.

Unit-IV Health Benefits

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

Unit-V Regulations as per FSSAI

Safety of nutraceuticals and functional foods. Consumer acceptance, Assessment of health claims, Labelling, marketing and regulatory issues; Future prospects.

TEXT BOOKS

1. Galanakis, C. M. (Ed.). (2021). Nutraceutical and functional food components: Effects of innovative processing techniques. Academic Press.
2. Singh, R. B. (Ed.). (2021). Functional foods and nutraceuticals in metabolic and non-communicable diseases. Academic Press.
3. Gopi, S., & Balakrishnan, P. (Eds.). (2022). Advances in Nutraceuticals and Functional Foods: Concepts and Applications.

FURTHER SUGGESTED READINGS

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

Year/Semester	4th Year/ 7th Semester	Course Category	Minor Stream Course
Course Code	25FTBS703	Course Title	Food Analysis and Instrumentation
Continuous Evaluation 40		End Semester Examination 60	
Prerequisite: Nil		L T P : 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. Understand sampling techniques and their role in analytical chemistry.
2. Learn carbohydrate analysis using chemical and enzymatic methods.
3. Apply spectro and colorimetric methods for protein analysis.
4. Understand lipid analysis and chromatography for composition study.

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, learners will be able to:

1. Understand sampling and key concepts in analytical chemistry.
2. Perform carbohydrate analysis using various analytical methods.
3. Analyze proteins using Kjeldahl, UV-Vis, and colorimetric techniques.
4. Conduct lipid analysis and compare extraction and chromatography methods.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENT

Unit I: Sampling and Instrumentation

Introduction to Sampling, Definitions of Population, Laboratory Sample, Sample Precision, Accuracy, Sensitivity, Reproducibility of Analysis, Basic Principles of Spectrophotometer and Colorimeter, Applications of Spectrophotometer and Colorimeter, Mass spectrometry, Basic Principles of Chromatography, Types of Chromatography (HPLC, GC) and Their Applications

Unit II: Carbohydrate Analysis

Introduction to Carbohydrate Analysis, Methods of Carbohydrate Analysis, Sample Preparation for Carbohydrate Analysis, Extraction of Monosaccharides and Oligosaccharide, Chemical and Colorimetric Methods for Carbohydrate Analysis, Analysis of Starch and Crude Fiber

Unit III: Protein Analysis

Introduction to Protein Analysis, Protein Determination: Kjeldahl Method, Enhanced Dumas, UV-Visible Spectroscopy: Direct Measurement at 280 nm, Biuret Method, Lowry Method

Unit IV: Lipid Analysis

Introduction and Importance of Lipid Analysis, Solvent and Non-Solvent Extraction Methods for Lipid Analysis, Determination of Lipid Composition, Separation and Analysis by Chromatography, Lipid Fractions Analysis using TLC.

Unit V: Chemical Techniques

Analysis of Minerals: Introduction and Importance, Dry Ashing, Wet Ashing, AAS, ICP-OES.

TEXTBOOKS

1. Harris, D. C. (2010). Quantitative chemical analysis. Macmillan.
2. Skoog, D. A., Holler, F. J., & Crouch, S. R. (2017). Principles of instrumental analysis. Cengage learning.
3. Skoog, D. A., West, D. M., & Holler, F. J. (2013). Analytical chemistry: An introduction (9th ed.). Cengage Learning.

FURTHER SUGGESTED READINGS

1. Harvey, D. (2000). Modern analytical chemistry. McGraw Hill.
2. Pavia, D. L., Lampman, G. M., Kriz, G. S., & Vyvyan, J. A. (2014). Introduction to spectroscopy. Cengage learning.
3. Poole, C. F. (2010). Chromatography: Concepts and Contrasts: by James M. Miller: Wiley, Hoboken, NJ, USA, 2009, pp xxvi+ 490, ISBN 978-0471-47207-0.

Year/Semester	4th Year/8th Semester	Course Category	Major Course
Course Code	25FTBS801	Course Title	Food Additive
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. Understand classification, use, and regulation of food additives.
2. Explore flavouring agents, sweeteners, and flour improvers.
3. Study functions of emulsifiers, thickeners, and supplements.
4. Evaluate dosage, safety, and health impact of food additives.

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, learners will be able to:

1. Identify food additives, their categories, and regulatory guidelines.
2. Distinguish sweeteners, flour improvers, and flavouring agents.
3. Understand roles of emulsifiers, thickeners, and supplements.
4. Assess dosage, safety, and health effects of food additives.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO	CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1					
CO 2					
CO 3					
CO 4					

COURSE CONTENTS

Unit I: Food Additives and Preservatives

Definitions, classification, and applications of food additives, Classification of food preservatives and antimicrobial agents, Mechanism of action and safety concerns of antimicrobial agents, Antioxidants: Synthetic and natural types, inhibition of oxidation, Chelating agents: Types, uses, and mode of action, Coloring agents: Retention, natural sources, extraction techniques, stabilization

Unit II: Flavouring Agents and Flour Improvers

Natural and synthetic flavours, flavour enhancers, and encapsulation, Stabilization and retention of flavours, Flour improvers: Leavening agents, humectants, hydrocolloids, acidulants, pH control agents, buffering salts, anticaking agents

Unit III: Sweeteners and Emulsifiers

Natural and artificial sweeteners: Nutritive and non-nutritive types, Properties and uses of saccharin, acesulfame-K, aspartame, and others, Emulsifiers: Types, selection, stability, functions, and mechanisms

Unit IV: Food Additives in Formulations and Thickeners,

Polysaccharides, bulking agents, antifoaming agents, synergists, antagonists, Application and functions of additives in food formulations, indirect food additives

Unit V: Regulations, Dosage and Safety as per FSSAI

Permitted dosages and regulations, Regulatory issues in India and international legal considerations, Examination of harmful effects and side effects associated with additives, Link between additives and various diseases

TEXT BOOKS

1. Preetha Balakrishnan and Sreerag Gopi. (2022) Flavours and Fragrances in Food Processing: Preparation and Characterization Methods. ACS Publication
2. Azza El Amir (2019) Food Additives. LAMBART Publishing
3. German Ayala Valencia (2022) Natural Additives in Foods. Springer

FURTHER SUGGESTED READINGS

1. Cox, S., Sandall, A., Smith, L., Rossi, M., & Whelan, K. (2021). Food additive emulsifiers: a review of their role in foods, legislation and classifications, presence in food supply, dietary exposure, and safety assessment. *Nutrition reviews*, 79(6), 726-741.
2. Martins, F. C., Sentanin, M. A., & De Souza, D. (2019). Analytical methods in food additives determination: Compounds with functional applications. *Food chemistry*, 272, 732-750.
3. Batiha, G. E. S., Hussein, D. E., Algammal, A. M., George, T. T., Jeandet, P., Al-Snafi, A. E., ... & Cruz-Martins, N. (2021). Application of natural antimicrobials in food preservation: Recent views. *Food Control*, 126, 108066.

Year/Semester	4th Year/8th Semester	Course Category	Major Course
Course Code	25FTBS802	Course Title	Food Toxicology
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. Understand food toxicants and how diet influences toxicity.
2. Learn toxicity phases, dose-response, and risk assessment basics.
3. Evaluate how nutrients and biotransformation affect toxicity.
4. Identify food poisoning causes and apply regulatory knowledge.

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, learners will be able to:

1. Understand principles of nutritional toxicology and toxicant sources.
2. Analyze toxicity phases, dose-response, and risk assessment.
3. Evaluate how nutrients, age, and gender influence toxic effects.
4. Identify foodborne toxins and apply risk analysis for safety solutions.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO				
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit 1: Fundamentals of Food and Nutritional Toxicology

Defining Food and Nutritional Toxicology: Scope and Concepts, Types of Toxicants in Foods: Natural, Additive, and Contaminant Sources, Diet and its Influence on Toxicant Effects

Unit 2: Principles of Toxicological Effects and Dose-Response

Phases of Toxicological Effects, Understanding Dose-Response Relationships: Explanation and Factors, Categories of Toxicity: Reversibility, Hypersensitivity vs. Hyposensitivity

Unit 3: Nutritional Factors and their Impact on Toxicity

Role of Diet in Toxicity, Effects of Macronutrients: Proteins, Lipids, and Carbohydrates, Effects of Micronutrients: Changes, Vitamins, and Minerals, Influence of Gender, Age, and Species on Toxicity

Unit – 4: Derived food toxicants during food processing and packaging

Toxicants derived from plants, Marine toxins, carcinogens in smoked foods.

Unit 5 – Safety to Food

Methods Used to Evaluate the Safety of Foods, Ingredients, and Contaminants Exposure, The Estimated Daily Intake, Safety Determination of Indirect Food Additives, Safety Requirements for GRAS Substances, GRAS Concept, Safety Requirements for Dietary Supplements, Risk assessment

TEXT BOOKS

1. Debasis Bagchi, Anand Swaroop (2016). Food Toxicology. CRC Press
2. Ashish Sachan and Suzanne Hen(2022) drich Food toxicology : current advances and future challenges Apple Academic Press
3. Debasis Bagchi, Anand Swaroop (2017) Food toxicology CRC Press

FURTHER SUGGESTED READINGS

1. Rifai, L., & Saleh, F. A. (2020). A review on acrylamide in food: Occurrence, toxicity, and mitigation strategies. *International Journal of Toxicology*, 39(2), 93-102.
2. Dietrich, R., Jessberger, N., Ehling-Schulz, M., Märtlbauer, E., & Granum, P. E. (2021). The food poisoning toxins of *Bacillus cereus*. *Toxins*, 13(2), 98.
3. Lokesh Kumar Mishra (2018) Introductory Food Toxicology Daya Publishing House

Year/Semester	4th Year/8th Semester	Course Category	Major Course
Course Code	24FTBS803	Course Title	Food Safety and Quality
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. To state the concept of food safety, types of hazards and their control measures.
2. To discuss about Food Safety Management tools.
3. To describe the need and importance of quality management in food production chain.
4. To explain the chemical, technological and toxicological aspects of food additives.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Learn the threats and difficulties with food safety.
2. Use principles of food safety management in practical contexts.
3. Understand the requirement for a quality management system.
4. Understand the importance of food additives are necessary and important.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Importance of Food Safety

Definition of safe food. Types of hazards. Factors affecting Food Safety Importance of Safe Foods. Role of communication and training in food safety. Mode of entry of hazards in food. Quality control and quality assurance.

Unit-II Role of Food Safety Practices in Food Industry

Prerequisite programs, HACCP, VACCP, TACCP, ISO series, TQM - components of TQM, Risk Analysis, Accreditation and Auditing. FSSAI, BIS, APEDA. International regulatory scenario and role of organizations - Codex, WHO, FAO, ICMSF.

Unit-III Food Plant Lay Out Design

Need of controlling of critical parameters -Design of food plant, Temperature Danger Zone and Storage of Food, Role of Handler, Personnel Hygiene, Quality of Water and its analysis, Hygiene and Sanitation in Food Service Establishments.

Unit-IV Role of FSMS in Food Industry

Introduction to food quality management – Definition, quality concepts, quality, quality perception, quality attributes. Concepts of quality management- Objectives, importance and functions of quality control and quality assurance

Unit-V Adulteration in Food and its Safety

Food adulteration, nature of adulterants, methods of evaluation of food adulterants and toxic constituents. Food inspection and safety measurements, food regulations and grades. Statistical analysis in quality control-sampling design of experiments and evaluation of results.

TEXT BOOKS

1. Forsythe, S.J. (2010). The Microbiology of Safe Food, 2nd edition. UK: Willey-Blackwell.
2. Lawley, R., Curtis L. and Davis, J. (2012) The Food Safety Hazard Guidebook. London: RSC.
3. Mathur, P. (2018). Food Safety and Quality Control. Hyderabad: Orient BlackSwan Pvt. Ltd.
4. Brannen, D. and Salminen, T. (2002). Food Additives. 2nd edition. New York: Marcel Dekker, Inc.
5. Pieternel A, Luning. & Willem, J. Marcelis. (2009). Food Quality Management Technological and Managerial principles and practices. Wageningen.

FURTHER SUGGESTED READINGS

1. FSSAI OFFICIAL WEBSITE.
2. Carol, E., Steinhart, M. and Ellin, D. (1995). Food Safety, Food Research Institute. New York: Marcel Dekker, Inc
3. Shapton, D.A. and Shapton, N.F. (1998). Principles and Practices for the safe processing of Foods. CRC Press.
4. DeMan. (2007). Principles of Food Chemistry. Springer, 3rd edition.
5. Blackburn, C.D.W. and Mc Clure, P.J. (2005). Food borne pathogens. Hazards, risk analysis & control. Washington, US: CRC Press.
6. De Vries. (1997). Food Safety and Toxicity. New York: CRC.
7. Marriott, Norman G. (1985). Principles of Food Sanitation. New York: AVI.
8. Mortimore S. and Wallace C. (1995). HACCP-A Practical Approach. London: Chapman and Hill

LIST OF MINOR STREAM COURSE offered to
Four Year B.Sc. Food Technology programme in the Department of Food Technology
w.e.f. Academic Year 2025-26

S. No.	Cat.	CODE	COURSE	L	T	P	C
1	IDC	21OEMA001	Introduction to Algebra	3	1	0	4
2		21OEMA002	Differential Calculus	3	1	0	4
3		21OEMA003	Differential Equations	3	1	0	4
4		21OEMA004	Statistical Methods and Probability	3	1	0	4
5		21OECY0001	Physical Chemistry-I	3	1	0	4
6		21OECY003	Physical Chemistry-II	3	1	0	4
7		21OECY002	Inorganic Chemistry	3	1	0	4
8		21OECY004	Analytical Chemistry	3	1	0	4
1	MSC	24FTBS001	Principles of Food Processing	3	1	0	4
2		24FTBS002	Clinical Nutrition	3	1	0	4
3		24FTBS003	Community Nutrition	3	1	0	4
4		24FTBS004	Food Product Development	3	1	0	4
5		25FTBS005	Flavour Technology	3	1	0	4
6		24FTBS006	Food Supply Chain Management	3	1	0	4

7		24FTBS007	Food Biotechnology	3	1	0	4
8	MSC	24FTBS008	Beverage Technology	3	1	0	4
9		24FTBS009	Post Harvest Technology	3	1	0	4
10		24FTBS010	Agri Business Management	2	0	0	2
11		24FTBS011	Waste Management & By Product Utilization	2	0	0	2
12		24FTBS012	ICT Applications in Food Industry	3	1	0	4
13		24FTBS013	Food Plant Sanitation	3	1	0	4
14		24FTBS014	Introduction to Biosciences	3	1	0	4
15		24FTBS015	Food Biophysics	3	1	0	4
16		24FTBS016	Basic Chemistry	3	1	0	4
17		25FTBS0017	Food Laws and Standards	2	0	0	2
18		23RMBS710	Research Methodology	2	0	0	2

Year/Semester	Year/Semester	Course Category	Minor Stream Course
Course Code	24FTBS001	Course Title	Principles of Food Processing
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. Explain freezing and drying methods and their impact on food quality.
2. Emphasize thermal processing principles for food safety.
3. Understand packaging requirements for various processed foods.
4. Compare separation methods for ingredient purification in processing.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Explain freezing and drying methods and their effects on food quality.
2. Apply thermal processing and heat data for food safety.
3. Identify packaging needs to maintain quality and shelf life.
4. Understand separation techniques used in food processing.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CCO	CCO 1	CCO 2	CCO 3	CCO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Freezing

Freeze drying- equipment, mechanism, applications, effect on foods. Freeze concentration-equipment, mechanism, applications, effect on foods.

Unit-II Drying

Changes in food during drying, drying methods and equipments air convection dryer, tray dryer, tunnel dryer, continuous belt dryer, fluidized bed dryer, spray dryer, drum dryer, vacuum dryer, freeze drying, foam mat drying.

Unit-III Thermal processing

Principles of thermal processing, Thermal resistance of microorganisms, Thermal Death Time, Lethality concept, characterization of heat penetration data, Thermal process Calculations.

Unit-IV Packaging of processed food

Factors determining the packaging requirements of various foods and brief description of packaging of frozen products, dried products, fats and oils and thermally processed foods.

Unit-V Separation process

Distillation principles and methods: steam, batch, continuous distillation with rectification and stripping. Extraction: Hildebrandt, Bollman, SCF extraction. Filtration: Plate and frame, pressure leaf, continuous rotary Vacuum, batch and continuous filtration. Centrifugation: Tubular, disc bowl and basket centrifuge. Sieving: stationary and vibratory sieving. Sedimentation: continuous thickener.

TEXT BOOKS

1. Ramaswamy, H. and Marcott, M. (2006). Food Processing Principles and Applications. CRC Press.
2. Fellows, P. J. (2016). Food Processing Technology: Principles and Practice (4th ed.). Woodhead Publishing. ISBN: 978-0081019078
3. Heldman, D. R., & Hartel, R. W. (2019). Principles of Food Processing (3rd ed.). Springer. ISBN: 978-3319448350
4. Potter, N. N., & Hotchkiss, J. H. (1999). Food Science (5th ed.). Springer.

FURTHER SUGGESTED READINGS

1. Rao, P.G. (2010). Fundamentals of Food Engineering. New Delhi: PHI Learning Pvt Ltd.
2. Toledo, R. T., Singh, R. K., & Rizvi, S. S. H. (2018). Fundamentals of Food Process Engineering (4th ed.). Springer. ISBN: 978-3319457574
3. Heldman, D. R., & Hartel, R. W. (2019). Principles of Food Processing (3rd ed.). Springer. ISBN: 978-3319448350

Year/Semester	Year/ Semester	Course Category	Minor Stream Course
Course Code	24FTBS002	Course Title	Clinical Nutrition
Continuous Evaluation 40		End Semester Examination 60	
Prerequisite: Nil		L T P: 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. Describe nutrition assessment and planning for patients of all backgrounds.
2. Apply evidence-based MNT for degenerative and metabolic diseases.
3. Examine diet's impact on GI and heart health; apply effective therapies.
4. Demonstrate ethics and address challenges in holistic nutrition care.

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, learners will be able to:

1. Recall and use appropriate nutritional evaluation techniques for a range of patient demographics.
2. Use medical nutrition therapy strategies for disorders including diabetes, cardiovascular disease, and others.
3. Create and carry out tailored nutritional treatments for individuals with certain medical requirements.
4. Learn ethical issues and include them into nutritional care procedures.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit I: Nutritional Assessment and Care of Patients

Nutritional Care Process Overview, Nutritional Screening and Assessment, Screening Tools for Outpatients, Screening Tools for Hospitalized Patients, Interpreting Medical and Laboratory Data, Nutrition Care Planning and Implementation, Monitoring and Follow-up Procedures, Addressing Ethical Issues in Nutrition Care

Unit II: Medical Nutrition Therapy in Metabolic Diseases

Introduction to Metabolic Diseases and Medical Nutrition Therapy, Diabetes Mellitus Types (Type 1, Type 2, Gestational), Medical Nutrition Therapy for Diabetes, Endocrine Disorders Overview, Polycystic Ovary Disease: Etiology, MNT, and Advances, Thyroid Disorders: Etiology, MNT, and Advances

Unit III: Cardiovascular Health and Diseases

Coronary Heart Diseases: Introduction and Pathophysiology, Metabolic and Clinical Aberrations in Coronary Heart Diseases, Diagnosis and Complications of Coronary Heart Diseases, Treatment Approaches and Medical Nutrition Therapy, Recent Advances in Coronary Heart Disease Management

Unit IV: Gastrointestinal Tract Disorders

Overview of Gastrointestinal Tract Disorders, Common Gastroesophageal Disorders: GERD and Dyspepsia, Peptic Ulcer Disease: Etiology, MNT, and Complications, Celiac Disease and Inflammatory Bowel Disease: Nutrition Management, Other GI Disorders: Flatulence, Diverticular Disease, Hernia, Hemorrhoids, Nutrition Considerations for Oral and Dental Health, Nutritional Aspects of Intestinal and Bariatric Surgery

Unit V: Nutrition and Degenerative Disorders

Introduction to Degenerative Disorders and Nutrition, Cancer and Nutrition: Impact, Etiology, and Management, Cancer Therapy Effects and Nutritional Support, Role of Diet in Etiology and Management of Degenerative Disorders, Nutrition for Chronic Obstructive Pulmonary Disease, Nutrition Management in Systemic Lupus Erythematosus, Promoting Bone Health through Nutrition

TEXT BOOKS

1. Sardesai, V. (2011). Introduction to clinical nutrition. CRC press.
2. Rolfes, S. R., Pinna, K., & Whitney, E. (2014). Understanding normal and clinical nutrition. Cengage learning.
3. Liska, D., Quinn, S., Lukaczer, D., Jones, D. S., Lerman, R. H., Bland, J. S., ... & Schmidt, M. A. (2004). Clinical nutrition: a functional approach. Institute for Functional Medicine: Gig Harbor, WA, 237-258.

FURTHER SUGGESTED READINGS

1. Srilakshmi, B. (2007). Dietetics. New Age International.
2. Srilakshmi, B. (2006). Nutrition Science. New Age International.
3. Webster-Gandy, J., Madden, A., & Holdsworth, M. (Eds.). (2020). Oxford handbook of nutrition and dietetics. Oxford University Press.

Year/Semester	Year/ Semester	Course Category	Minor Stream Course
Course Code	24FTBS003	Course Title	Community Nutrition
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. Explain links between nutrition, public health, and community factors.
2. Assess impact of malnutrition and deficiencies on community health.
3. Use data to plan interventions for specific nutrition needs.
4. Evaluate and improve nutrition programs at national/international levels.

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, learners will be able to:

1. Understand how community nutrition impacts public health and development.
2. Identify key community nutrition issues like PEM and deficiencies.
3. Apply data skills to design and implement nutrition programs.
4. Evaluate success of programs to improve public health outcomes.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
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COURSE CONTENTS

Unit I: Fundamentals of Community Nutrition and Public Health

Concept of Community and its Types, Factors Affecting Community Health, Nutrition and Health in National Development, Nutritional Challenges in the Country, Balancing Nutrition Programs with Population Growth.

Unit II: Nutritional Status, Education, and Protein Energy Malnutrition

Understanding Nutritional Status & Surveillance, Importance of Nutrition Education, Imparting Nutrition Education: Individual and Group Methods, Protein Energy Malnutrition (PEM): Symptoms and Predisposing Factors, Impact of PEM on the Community and Prevention Measures.

Unit III: Micronutrient Deficiencies and National Programs

Clinical Assessment of Micronutrient Deficiencies: Anaemia and Iron Deficiency, Iodine Deficiency and National Iodine Deficiency Disorders Control Programme (NIDDCP), Vitamin A, Folic Acid, and Vitamin D Deficiencies, National Nutritional Anaemia Prophylaxis Programme (NNAPP) and Other National Programs.

Unit IV: Community Nutrition Planning and Interventions

Dietary Surveys and Importance of Dietary Diversification, Sources of Secondary Data in Community Health, Indirect Assessment of Nutritional Status, Community Nutrition Programme Planning Steps, Community-Based Nutritional Interventions: India and International Programs.

Unit V: Integrated Approaches and Public Health Organizations

Integrated Child Development Scheme (ICDS) and Mid-Day Meal Programme, Zinc Deficiency and its Relationship with PEM, Community Diagnosis and Impact of Nutritional Deficiencies, International Organizations' Role in Community-Based Programs, Importance of Evaluation in Community Nutrition Programs.

TEXT BOOKS

1. Boyle, M. A., & Holben, D. H. (2006). Community nutrition in action: An entrepreneurial approach. Thomson Wadsworth Learning.
2. Contento, I. R. (2007). Nutrition education: linking research, theory, and practice.
3. Alloway, B. J. (Ed.). (2008). Micronutrient deficiencies in global crop production. Springer Science & Business Media.

FURTHER SUGGESTED READINGS

1. Nnakwe, N. (2012). Community Nutrition: Planning Health Promotion and Disease Prevention-BOOK ONLY. Jones & Bartlett Publishers.
2. Wham, C. (2007). Nutrition in Public Health: Handbook for Developing Programs and Services.
3. Gibney, M. J., Lanham-New, S. A., Cassidy, A., & Vorster, H. H. (Eds.). (2013). Introduction to human nutrition. John Wiley & Sons.

Year/Semester	Year/ Semester	Course Category	Minor Stream Course
Course Code	24FTBS004	Course Title	Food Product Development
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. To show that you understand the principles of new product development.
2. To use imagination and market research to develop product concepts
3. To create and improve food product formulas
4. To use successful product launch and marketing techniques

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, learners will be able to:

1. Learn the steps involved and the significance of new product development.
2. Incorporate Market Research and Creative Ideation into NPD
3. Create and improve food product formulas
4. Understand the efficient marketing and product launch plans

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CCO	CLO 1	CLO 2	CLO 3	CLO 4
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COURSE CONTENTS

Unit I: Introduction to New Product Development

Definition, significance, and challenges of new product development (NPD), Historical examples of successful and unsuccessful product launches, Understanding consumer preferences and changing food trends, Role of innovation in NPD and its impact on food industry growth.

Unit II: Ideation, Concept Generation, and Market Research

Techniques for generating creative product ideas: Brainstorming, mind mapping; Utilizing market research to identify gaps and opportunities, Developing and refining product concepts based on consumer needs, Importance of aligning product concepts with brand identity and market positioning.

Unit III: Formulation, Sensory Evaluation, and Prototyping

Formulation techniques for achieving desired taste, texture, and nutritional profile, Sensory evaluation methods: Discrimination, descriptive, and consumer testing, Prototyping and refining product formulations based on sensory feedback, Addressing technical challenges in scaling up from lab to pilot production.

Unit IV: Quality Control, Packaging, and Regulatory Compliance

Quality control processes for ensuring consistency and safety of the final product, Packaging design considerations: Materials, sustainability, and shelf life extension, Regulatory requirements and labeling standards for food products, Intellectual property protection, and patent considerations.

Unit V: Product Launch, Marketing, and Sustainability

Developing a comprehensive product launch strategy: Pricing, distribution, promotion, Marketing tactics: Social media, influencer collaborations, experiential events, Post-launch monitoring and adapting to consumer feedback, Sustainable practices in NPD: Packaging, sourcing, waste reduction.

TEXT BOOKS

1. Fuller, G. W. (2016). *New food product development: from concept to marketplace*. CRC Press.
2. O'sullivan, M. (2016). *A handbook for sensory and consumer-driven new product development: innovative technologies for the food and beverage industry*. Woodhead Publishing.
3. Bagchi, D., & Nair, S. (Eds.). (2016). *Developing new functional food and nutraceutical products*. Academic Press.

FURTHER SUGGESTED READINGS

1. Earle, R., & Anderson, A. (Eds.). (2001). *Food product development: Maximizing success*. CRC press.
2. Side, R. J., & Doran, J. L. (2023). *Food Product Development: From Concept to Marketplace* (4th ed.). Springer.
3. Brody, A. L., & Lord, J. B. (2023). *Developing New Food Products for a Changing Marketplace* (3rd ed.). CRC Press.

Year/Semester	Year/Semester	Course Category	Major Course
Course Code	25FTBS005	Course Title	Flavour Technology
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. To state basics of flavour technology.
2. To discuss the chemical stimuli involved in flavour perception.
3. To explain the flavour-ingredient interactions, mechanisms of flavour release and industrial methods of flavour production.
4. To describe the analytical methods of flavour analysis and different manufacturing processes.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Use the fundamentals of taste technology.
2. Select the sense of taste.
3. Set up the systems responsible for flavour generation.
4. Analyse various flavour profiles.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

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COURSE CONTENTS

Unit-I: Introduction to Flavour and Its Chemical Basis

Definition and description of flavour, flavour profile and its principal chemical constituents. Sensation of flavour vs taste odour/smell, and mouth feel, influence of chemical constituents on flavour and their interaction with flavour characteristics.

Unit-II: Factors Influencing Flavour and Its Measurement

Factors that affect the flavour and control of flavour in processed foods. Measurement of flavour, particularly for wine, tea, coffee, species and condiments.

Unit-III: Natural and Synthetic Flavour Compounds

Natural and synthetic flavouring substances and their chemical characteristics. Flavour components / constituents of fruit and vegetables, coffee, tea and cocoa bean, spices and condiments. Changes in flavouring components and characteristics during cooking/processing of various foods. Effects of storage, processing, transportation and environmental conditions on flavour components/constituents.

Unit-IV: Flavour Extraction, Processing, and Applications

Processing (industrial / commercial) technologies/methods of flavouring compounds of plant foods and their utilization and applications. Recent developments in flavour research, processing and technology.

Unit-V: Flavour Enhancers and Their Chemistry

Flavour intensifier and their effects. Chemistry and technology (commercial preparations) of various flavour intensifiers.

TEXT BOOKS

1. M. Selvamuthukumar, Yashwant V Pathak. (2019) Flavour Development for Functional Foods and Nutraceuticals CRC PRESS
2. Jacqueline B. Marcus. (2019) Aging, Nutrition and Taste Nutrition, Food Science and Culinary Perspectives for Aging Tastefully. Academic Press
3. Laurence Melton, Fereidoon Shahidi and Peter Varelis. (2019) Encyclopedia of Food Chemistry Elsevier

FURTHER SUGGESTED READINGS

1. Khattab, A. R., Guirguis, H. A., Tawfik, S. M., & Farag, M. A. (2019). Cheese ripening: A review on modern technologies towards flavor enhancement, process acceleration and improved quality assessment. *Trends in Food Science & Technology*, 88, 343-360.
2. Yang, Y., Zhao, X., & Wang, R. (2022). Research progress on the formation mechanism and detection technology of bread flavor. *Journal of Food Science*, 87(9), 3724-3736.
3. Menis-Henrique, M. E. C. (2020). Methodologies to advance the understanding of flavor chemistry. *Current Opinion in Food Science*, 33, 131-135.

Year/Semester	Year/ Semester	Course Category	Minor Stream Course
Course Code	24FTBS006	Course Title	Food Supply Chain Management
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. To Identify the fundamentals of food supply chain.
2. To describe the supply chain as a strategic tool.
3. To recognise different factors influencing the supply chain.
4. To organize and appreciate logistics.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Select the basics of food supply chain.
2. Understand the strategic advantages of well- developed food supply chain.
3. Apply basics to real life situation.
4. Learn the need of a well-defined supply chain network.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

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COURSE CONTENTS

Unit-I

Introduction to supply chain management. Inbound and Outbound Logistics. Supply Chain as a strategic advantage tool.

Unit-II

Inventory Management. EOQ and its derivative models. Bullwhip effect. Supply Chain Integration
Push vs Pull Systems. Retailer-Supplier Partnerships. Buyer-Vendor Coordination. Vendor Development and Evaluation.

Unit-III

Designing Supply Chain network. Distribution Strategies. Case Study.

Unit-IV

System view of logistics- 1. Coordination 2. Management of transportation (Inter-Model and Third Party Transportation)

Unit-V

Buy-Make Decisions. Procurement Strategy. Framework of e-Procurement. Porters Industry Analysis. Value Chain Models. Reverse Logistics.

TEXT BOOKS

1. Bourlakis, M. A., & Weightman, P. W. (Eds.). (2008). Food supply chain management. John Wiley & Sons.
2. Rossetti, C. L. (2023). Managing the Food Supply Chain: Sustainable Practices and Innovations. Wiley.

FURTHER SUGGESTED READINGS

1. Pullman, M., & Wu, Z. (2021). Food supply chain management: building a sustainable future. Routledge.
2. Eastham, J., Sharples, L., & Ball, S. (Eds.). (2007). Food supply chain management. Taylor & Francis.

Year/Semester	Year/ Semester	Course Category	Minor Stream Course
Course Code	24FTBS007	Course Title	Food Biotechnology
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. Understand food biotechnology, its history, and industrial applications.
2. Learn cell structure, DNA/RNA, and genetic engineering in food biotech.
3. Explore probiotics, fermentation, and foodborne pathogens in biotech.
4. Study genetic variation, GMOs, and gene editing in food crops.

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, learners will be able to:

1. Understand food biotech principles, history, and industrial applications.
2. Learn cell structure, DNA/RNA, and genetic engineering in food biotech.
3. Explore microbes' role in spoilage and pathogens in food biotechnology.
4. Study crop genetics, GMOs, and gene editing in food biotechnology.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO	CLO	CLO 1	CLO 2	CLO 3	CLO 4
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COURSE CONTENTS

Unit-I Introduction to Food Biotechnology

Definition and scope of food biotechnology, Historical development and milestones, Applications in the food industry

Unit-II Cell Biology and Molecular Biology Basics

Cell structure and function, DNA, RNA, and protein synthesis, Genetic engineering techniques

Unit-III Microorganisms in Food Biotechnology

Beneficial microorganisms (probiotics), Fermentation processes in food production, Food spoilage and foodborne pathogens

Unit-IV Food Genetics and Genomics

Genetic variation in food crops, Genetically modified organisms (GMOs) in the food industry, Gene editing technologies and their applications

Unit-V Enzymes in Food Biotechnology

Types and functions of enzymes, Enzyme applications in food processing, Enzyme engineering and optimization

TEXT BOOKS

1. Pometto, A., Shetty, K., Paliyath, G., & Levin, R. E. (Eds.). (2005). Food biotechnology. CRC Press."Food Biotechnology, Second Edition" by S. Suzanne Nielsen
2. Johnson-Green, P. (2018). Introduction to food biotechnology.
3. Bagchi, D., Lau, F. C., & Ghosh, D. K. (Eds.). (2010). Biotechnology in functional foods and nutraceuticals. CRC press.

FURTHER SUGGESTED READINGS

1. De Vrese, M., Schrezenmeir, J., Stahl, U., Donalies, U. E., & Nevoigt, E. (2008). Food Biotechnology. Advances in Biochemical Engineering/Biotechnology.
2. Lee, B. H. (2014). Fundamentals of food biotechnology. John Wiley & Sons.
3. Khan, F. A. (2020). Biotechnology Fundamentals Third Edition. CRC Press.

Year/Semester	Year/ Semester	Course Category	Minor Course
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Course Code	24FTBS008	Course Title	Beverage Technology
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite:		L T P : 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. Understand drink technologies and importance of water treatment.
2. Learn juice production, preservation, packaging, and clarification.
3. Study carbonation tech and quality standards for soft drinks, water.
4. Operate machinery to produce specialty drinks with sweeteners.

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, learners will be able to:

1. Analyse beverage importance and effects of water treatment on safety.
2. Apply manufacturing and preservation methods for various drinks.
3. Implement carbonation and ensure soft drink quality standards.
4. Operate equipment to produce specialty and fortified beverages.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CLO	CLO 1	CLO 2	CLO 3	CLO 4
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COURSE CONTENT

Unit I: Introduction to Beverages and Water Treatment

Importance of beverages in the diet, Water treatment for the food industry, Technology of alcoholic beverages: wine, cider, brandy, perry, toddy, Technology of non-alcoholic beverages: fruit juice beverages, Methods of production, preservation, and packaging, Physiological aspects of fruit juice production, Methods of fruit juice clarification

Unit II: Technology of Soft Drinks and Mineral Water

Ingredients and additives in soft drink production, Manufacturing of carbonated and non-carbonated beverages, Technology of carbonation and its application in juice preservation, Production of mineral water, Quality standards and specifications

Unit III: Specialty Beverages and Sweeteners

Citrus beverages: production and processing, Whey beverages and utilization in fortified drinks, low-calorie sweeteners in beverages, Juice pressing equipment and bottling methods, Enzymatic clarification and debittering of juices

Unit IV: Tea, Coffee, and Cocoa Beverages

Production and processing of tea, Tea products: soluble tea, tea concentrate, flavoured tea

Roasting and brewing of coffee Soluble coffee manufacture, Standards and specifications of coffee products, Production and processing of cocoa, Cocoa beverages: processing and chemistry

Unit V: Beverage Innovations and Trends

Emerging trends in beverage industry, Innovative beverage products and formulations, Functional beverages and health implications, Sustainable packaging and processing practices, Consumer preferences and market demands in beverages

TEXTBOOKS

5. Small, R. W., Couturier, M., & Godfrey, M. (2011). Beverage basics: understanding and appreciating wine, beer, and spirits. Beverage basics: understanding and appreciating wine, beer, and spirits.
6. Block, S. S. (Ed.). (2001). Disinfection, sterilization, and preservation. Lippincott Williams & Wilkins.
7. Paquin, P. (Ed.). (2009). Functional and speciality beverage technology. Elsevier.

FURTHER SUGGESTED READINGS

1. Ashurst, P., Hargitt, R., & Palmer, F. (2017). Soft drink and fruit juice problems solved. Woodhead Publishing.
2. Clarke, R., & Vitzthum, O. G. (2008). Coffee: recent developments. John Wiley & Sons.
3. Uhl, J. W. (2015). The art and craft of tea: An enthusiast's guide to selecting, brewing, and serving exquisite tea. Quarry Books.

Year/Semester	Year/ Semester	Course Category	Minor Stream Course
Course Code	24FTBS009	Course Title	Agri Business Management
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 2 0 0	Credits: 2

COURSE OBJECTIVES (CO)

1. Understand agri-business history, economy, and global significance.
2. Develop entrepreneurial skills and explore agri-business incentives.
3. Learn marketing and management of agricultural products.
4. Analyze trade deals, export scope, and consumer behavior trends.

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, learners will be able to:

1. Understand agribusiness history, goals, and global significance.
2. Evaluate incentives, market SWOT, and entrepreneurial skills.
3. Assess agri-marketing strategies and conduct market research.
4. Analyze trade deals, export potential, and consumer trends.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CLO	CLO 1	CLO 2	CLO 3	CLO 4
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COURSE CONTENTS

UNIT-I Introduction

Introduction, definition, history, objectives, importance with respect to Indian economy and globalization. Agricultural and food policy, rural management. Management of agri-business.

UNIT-II Entrepreneurship Development Programs (EDP)

Introduction, importance, characteristics and functions of an entrepreneur, SWOT analysis of new industries and products.

UNIT-III Marketing management

Role of management in agri-business, attributes and responsibility of manager. Marketing of agricultural produce. Market research for agri-business. Different types of management in agri-business: production, retail and supply chain and inventory management (introduction, need, attributes and function).

UNIT-IV Agreements

World trade agreements related with food business, export and prospects of food products in India.

Consumer behaviour towards food consumption, consumer surveys by various institutes and agencies.

TEXT BOOKS

1. Thakur, M. N. (2017). Textbook of Agribusiness Management, Rajat Publication.
2. Kotler, P., & Keller, K. L. (2022). Marketing management (16th ed.). Pearson.
3. Khanka, S. S. (2021). Entrepreneurial Development (5th ed.). New Delhi, India: S. Chand Publishing.

FURTHER SUGGESTED READINGS

1. Jakobsen, G. & Torp, J. E. (2001). Understanding business systems in developing countries.
2. Ahmad, S. M. (2000). Management Info Guide.

Year/Semester	Year/ Semester	Course Category	Minor Stream Course
Course Code	24FTBS010	Course Title	Waste Management and By-Product Utilization
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 2 0 0	Credits: 2

COURSE OBJECTIVES (CO)

1. Understand and utilize food processing by-products sustainably.
2. Learn to treat food industry effluents to meet environmental norms.
3. Assess treatment impact on effluent and pollution reduction.
4. Ensure regulatory compliance in effluent handling and disposal.

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, learners will be able to:

1. Learn waste management and by-product use in food processing.
2. Apply treatment methods for various food industry effluents.
3. Assess impacts and ensure regulatory compliance in waste treatment.
4. Develop sustainable solutions for effluent handling and disposal.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CLO	CLO 1	CLO 2	CLO 3	CLO 4
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COURSE CONTENTS

Unit 1: Characterization and Utilization of Food Industry By-Products

Characterization and utilization of by-products from various food processing industries (cereals, pulses, oilseeds, fruits, vegetables, dairy, eggs, meat, fish, and poultry).

Unit 2: Primary Treatment of Food Industry Effluents

Introduction to primary treatment concepts: Screening, sedimentation, and floatation. Biological oxidation processes: Objectives, organisms, reactions, and oxygen requirements. Aeration devices for enhancing biological treatment efficiency.

Unit 3: Advanced Wastewater Treatment Systems

Overview of physical, physicochemical, and chemical treatment methods. Coagulation and flocculation techniques for effluent treatment. Disinfection methods to ensure treated effluents meet regulatory standards. Handling and proper disposal of sludge and treated effluents in compliance with EPA provisions.

Unit 4: Regulatory Compliance and Environmental Impact

Standards and regulations for environmental emissions and discharge from food processing industries. Case studies highlighting successful waste management and compliance practices.

TEXT BOOKS

1. Anal, A. K. (2017). Food processing by-products and their utilization: Introduction. Food processing by-products and their utilization, 1-10.
2. Kosseva, M. R., & Webb, C. (Eds.). (2020). Food industry wastes: assessment and recuperation of commodities. Academic Press.
3. Yadav, J., & Gupta, R. K. (2017). Dynamics of nutrient profile during vermicomposting. Ecology, Environment and Conservation, 23(1), 515-520.

FURTHER SUGGESTED READINGS

1. Ravindra, P. (Ed.). (2015). Advances in bioprocess technology. Cham, Switzerland: Springer International Publishing.
2. Soderquist, M. R. (1972). Waste Management in the food processing industry. Journal of Environmental Quality, 1(1), 81-85.

Year/Semester	Year/ Semester	Course Category	Minor Stream Course
Course Code	24FTBS011	Course Title	Post Harvest Technology
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P : 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. To thorough comprehension of post-harvest management.
2. To use of food additives and plant growth regulators effectively.
3. To reduce food grain losses and pest control.
4. The preparation and preservation of spices, fruits, and vegetables.

COURSE LEARNING OUTCOMES (CLO)

After successful completion of this Course, students will be able to:

1. Learn the need for preservation, canning, and bottling of produce.
2. Understand drying and processing to enhance quality and shelf life.
3. Assess changes in fruits, vegetables, liquids, and spices during processing.
4. Apply preservation methods to extend crop use and versatility.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CLO	CLO 1	CLO 2	CLO 3	CLO 4
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COURSE CONTENT

Unit I Introduction

Importance of post harvest management, Fruits and vegetables as living products: Chemical composition, pre and post harvest changes, causes for post harvest losses- Pre-harvest Factors in Post-harvest losses, improper harvesting, post harvest physiology, biological factors, environmental factors, improper handling, storage and transportation.

Unit II Plant regulators & hormones

Plant growth regulators and hormones: Role in relation with storage, physical and chemical treatment to increase shelf life conditions.

Unit III Grains

Production of food grain and post harvest losses in India, General problems of storage of food grains, Factors responsible for the storage losses at commercial and farm level. Role of Moisture in spoilage of stored grain, moisture migration, measurement of moistures content in food grain and milled products.

Unit IV Pest Management

Mode of Action of insecticides, rodenticides & fungicides. Tolerance limit of pesticide residues, antidotes and precautions and safe handling of pesticides. Insects and pests of stored grain and milled products, Integrated Insect Pest Management, Sources and detection of infestation in stored food grains.

Unit V Pest Management Act in India

Insecticide Act, Consumer protection Act & Stress Management. Role and function of Warehousing Development and Regulatory Authority and negotiability of Warehouse Receipt.

TEXTBOOKS

1. Girdharilal, Siddappaa, G.S and Tandon, G.L. Preservation of fruits & Vegetables, ICAR, New Delhi, 1998.
2. Manay, S. & Shadaksharaswami, M. Foods: Facts and Principles, New Age Publishers, 2004
3. Sudheer, K. P., & Indira, V. (2007). Post harvest technology of horticultural crops (Vol. 7). New India Publishing.

FURTHER SUGGESTED READINGS

1. Srivastava, R.P., & Kumar, S. (2006). Fruits and Vegetables Preservation- Principles and Practices. 3rd Ed. International Book Distributing Co.
2. Gopal, J., & Khurana, S. M. (2006). Handbook of potato production, improvement, and postharvest management. CRC Press.
3. Verma, L. R. (2000). Postharvest Technology of Fruits and Vegetables: General concepts and principles.

Year/Semester		Course Category	Minor Course
Course Code	24FTBS012	Course Title	ICT Applications in Food Industry
Continuous Evaluation: 40		End Semester Examination :60	
Prerequisite: Nil		L T P: 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. Understand computerization and information systems in the food industry.
2. Learn about SCADA systems, spreadsheet applications, and their uses.
3. Master control of food processing lines and web technologies.
4. Gain skills in optimization techniques and use of Design Expert software.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Explain the importance and types of computer systems in the food industry.
2. Use SCADA systems and spreadsheets for data analysis and problem-solving.
3. Design web pages and implement online process control.
4. Apply optimization methods and software tools to improve food industry processes.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

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COURSE CONTENTS

Unit-I Computer and Artificial Intelligence (AI) in Food Industry

Importance of computerization in food industry, operating environments and information systems for various types of food industries. Application of AI- in food process automation, AI in food process improvement, AI in cost reduction, AI in food supply chain process. Overview of IoT, IIoT, Robotics in relation to food industry.

Unit II-Hardware and software systems in food industry

Supervisory control and data acquisition (SCADA); SCADA systems hardware, firmware, software and protocols, landlines, local area network systems, modems; Spreadsheet applications: Data interpretation and solving problems, preparation of charts, use of macros to solve engineering problems, use of add-ins, use of solver.

Unit III-Controlling of processing line using computer system

Web hosting and webpage design; file transfer protocol (FTP), on-line food process control from centralized server system in processing plant.

Unit IV-Optimization of process in food industry

Optimization: Introduction, optimization theory, optimization methods, Graphical and numerical methods of optimization, Unconstrained optimization, Constrained optimization, Programming optimization, experimental optimization, Response surface methodology (RSM).

Unit V-Optimization using Design Expert

Practice on process optimization software i.e. Design Expert.

Text Book

1. Singh, R. P. (1996). Computer Applications in Food Technology: Use of Spreadsheets in Graphical, Statistical, and Process Analysis. Elsevier.
2. Bailey, D., & Wright, E. (2003). Practical SCADA for industry. Elsevier.
3. Chapman, N. P., & Chapman, J. (2006). Web design: a complete introduction. John Wiley & Sons.

Further Suggested Readings

1. Das, H. (1900). Food processing operations analysis. Global Media.
2. Luyben, W. L. (1989). Process modeling, simulation and control for chemical engineers. McGraw-Hill Higher Education.
3. Kakani, V., Nguyen, V. H., Kumar, B. P., Kim, H., & Pasupuleti, V. R. (2020). A critical review on computer vision and artificial intelligence in food industry. *Journal of Agriculture and Food Research*, 2, 100033.
4. Mavani, N. R., Ali, J. M., Othman, S., Hussain, M. A., Hashim, H., & Rahman, N. A. (2022). Application of artificial intelligence in food industry—a guideline. *Food Engineering Reviews*, 14(1), 134-175.

Year/Semester		Course Category	Minor Course
Course Code	24FTBS013	Course Title	Food Plant Sanitation
Continuous Evaluation: 40		End Semester Examination :60	
Prerequisite: Nil		L T P: 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. Understand the role of sanitation in food industry.
2. Learn about relationship between microorganisms and sanitation.
3. Analyse the quality assurance for plant sanitation and types.
4. Describe the process to remove the insect infestation in plant.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Learn the concept of food plant sanitaiton.
2. Understand the relation of microorganism for sanitation.
3. Learn the quality safety concept for sanitation and types.
4. Understand the measurements to make food plant free from pests.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

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CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Sanitation in Food Industry

GMP, Sanitation and the food industry- sanitation, sanitation laws and regulations and guidelines, establishment of sanitary, potential risks of food borne bioterrorism, bioterrorism protection measures.

Unit II Sanitation and Microorganisms

Relationship of microorganisms to sanitation, Food Contamination and protection against contamination

Unit III Quality assurance for sanitation

Personal hygiene and sanitary food handling: Role of HACCP, VACCP, TACCP in sanitation, quality assurance for sanitation cleaning compounds, handling and storage precautions.

Unit IV Sanitizers for sanitation

Sanitizers, sanitizing methods, sanitation equipment, waste product handling, solid waste disposal and liquid waste disposal, properties of cleaning agents.

Unit V Pest control

Insect infestation, cockroaches, insect destruction, rodents, birds, use of pesticides and integrated pest management.

Text Book

1. Marriott, N. G., Gravani, R. B., & Schilling, M. W. (2006). Principles of food sanitation (Vol. 22). USA: Springer.
2. Roday, S. (2011). Food Hygiene and Sanitation. Mc Graw Hill Education
3. Troller, J. A. (2012). Sanitation in food processing. Academic Press.

Reference Book

1. Lelieveld, H. L., Holah, J., & Napper, D. (Eds.). (2014). Hygiene in food processing: principles and practice. Elsevier.
2. Hui, Y. H., Bruinsma, L. B., Gorham, J. R., Nip, W. K., Tong, P. S., & Ventresca, P. (Eds.). (2002). Food plant sanitation. CRC Press.

Year/Semester		Course Category	Minor Course
Course Code	24FTBS014	Course Title	Introduction to Biosciences
Continuous Evaluation: 40	End Semester Examination :60		
Prerequisite: Nil	L T P: 3 1 0	Credits: 4	

COURSE OBJECTIVES (CO)

1. Understand the classification of plant and animal kingdom.
2. Learn about cell biology of living organisms.
3. Analyse the physiology of plant system.
4. Describe the use of microbes for human welfare and study the human physiology.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Learn the concept of plant and animal kingdom.
2. Understand the role of cell molecules in the living organism.
3. Learn the metabolic activity in plant cells.
4. Apply the role of microbes in human welfare with understanding of human physiology.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Classification of Plant and Animal

Diversity of Living world: Classification of organism-Five kingdoms classification, Plant kingdom, Animal kingdom.

Unit II Cell Biology

Cell Biology: Structure of cell wall, Bacterial cell wall, Plant cell wall, Nucleus- structure of interphase nucleus-nuclear membrane, nucleolus, nucleosome model, Ribosomes, Endoplasmic reticulum, Golgi apparatus, Cell cycle, cell division, mitosis, meiosis.

Unit III Plant Physiology

Plant physiology- Nutrient transport in plants, growth and development, respiration and photosynthesis

Unit IV Human Physiology

Human physiology- Digestive system, digestion of food, absorption, circulatory system, excretory system, endocrine system

Unit V Microbes in Human Welfare

Microbes in household, industrial products, sewage treatment, biogas production, biocontrol agents

Text Book

1. Enger Ross, Concepts in Biology (10th Ed.) (2002). McGraw Hill company, New York.
2. Textbook of Biology Class XI, XII. (2013). NCERT, New Delhi.
3. Campbell, N. A., & Reece, J. B. (2005). Biology. Pearson Education India.

Reference Book

1. Kierszenbaum, A. L., & Tres, L. (2015). Histology and Cell Biology: an introduction to pathology E-Book. Elsevier Health Sciences.
2. Kaneko, K. (2006). Life: an introduction to complex systems biology. Springer.

Year/Semester		Course Category	Minor Course
Course Code	24FTBS015	Course Title	Food Biophysics
Continuous Evaluation: 40		End Semester Examination :60	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. To define and explain the scope and significance of food biophysics.
2. To describe the historical development of food biophysics and its impact on food science.
3. To understand and apply fundamental biophysical concepts to food systems.
4. To explore the various applications of biophysics in food science and technology.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Learn about key techniques used in food biophysics.
2. Recognise the historical background and development of food biophysics.
3. Recognise the composition and structure of food biophysics.
4. Develop proficiency in spectroscopic methods (UV-Vis, FTIR, NMR, and Raman spectroscopy), thermal analysis techniques (DSC, TGA), rheometry, and calorimetry, and their application in food science.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Introduction to Food Biophysics

Definition and scope of food biophysics. Historical development and importance in food science. Fundamental concepts of biophysics and their application in food systems.

Unit-II Physical Properties of Food Materials

Mechanical properties: texture, rheology, and deformation. Thermal properties: specific heat, thermal conductivity, and diffusivity. Electrical properties: conductivity, dielectric properties, and their applications. Optical properties: light scattering, absorption, and color measurement.

Unit-III Food Microstructure

Microscopy techniques: light microscopy, electron microscopy, confocal microscopy. Image analysis and interpretation of food microstructures. Microstructural changes during food processing and storage. Relationship between microstructure and food properties.

Unit-IV Biophysical Techniques in Food Analysis

Spectroscopic methods: UV-Vis, FTIR, NMR, and Raman spectroscopy. Thermal analysis: DSC, TGA, and their applications in food science. Rheometry: measurement of viscoelastic properties of food materials. Calorimetry: principles and applications in food science.

Unit-V Innovations in Food Biophysics

Advances in nanotechnology and its applications in food science. Biophysical aspects of functional foods and nutraceuticals. Smart packaging technologies and their biophysical principles. Future trends and emerging research areas in food biophysics.

TEXT BOOKS

1. Figura, L., & Teixeira, A. A. (2007). Food physics: physical properties-measurement and applications. Springer Science & Business Media.
2. Arana, I. (Ed.). (2012). Physical properties of foods: novel measurement techniques and applications. CRC Press.
3. Singh, R. P., & Heldman, D. R. (2001). Introduction to food engineering. Gulf Professional Publishing.
4. Su, W. H., Arvanitoyannis, I. S., & Sun, D. W. (2018). Trends in food authentication. In *Modern Techniques for Food Authentication* (pp. 731-758). Academic Press.
5. Sun, D. W. (Ed.). (2016). Computer vision technology for food quality evaluation. Academic Press.

FURTHER SUGGESTED READINGS

1. Leistner, L., & Gould, G. W. (2002). Hurdle Technologies: Combination Treatments for Food Stability, Safety and Quality: Combination Treatments for Food Stability, Safety, and Quality. Springer Science & Business Media.
2. Semenova, M. G., & Dickinson, E. (2010). Biopolymers in food colloids: Thermodynamics and molecular interactions. CRC Press.
3. Rao, M. A. (2010). Rheology of fluid and semisolid foods: principles and applications. Springer Science & Business Media.
4. Chung, C., & McClements, D. J. (2014). Structure–function relationships in food emulsions: Improving food quality and sensory perception. *Food Structure*, 1(2), 106-126.
5. Ma, J., Sun, D. W., Pu, H., Cheng, J. H., & Wei, Q. (2019). Advanced techniques for hyperspectral imaging in the food industry: Principles and recent applications. *Annual review of food science and technology*, 10, 197-220.

Year/Semester		Course Category	Minor Course
Course Code	24FTBS016	Course Title	Basic Chemistry
Continuous Evaluation: 40		End Semester Examination :60	
Prerequisite: Nil		L T P: 3 1 0	Credits: 4

COURSE OBJECTIVES (CO)

1. Understand reaction rates, enzyme catalysis, and inhibition.
2. Learn principles of colligative properties and colloid chemistry.
3. Grasp solubility and acid-base equilibria concepts.
4. Analyze chemical reactions based on structure and reactivity principles.

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Understand rate constants and determine reaction order and activation energy.
2. Learn properties like vapor pressure lowering and boiling point elevation.
3. Perform solubility product, pH, and buffer capacity calculations.
4. Learn reactivity and mechanisms based on electronic and steric effects.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit-I Reaction Kinetics

Rate constant, order of reaction, molecularity, activation energy, zero, first and second order kinetics, catalysis and elementary enzyme reactions. Reversible and irreversible inhibition of enzymes.

Unit-II Properties of Solutions: Colligative Properties and Colloids

Dilute solutions- Colligative properties, lowering of vapour pressure of solution, elevation of boiling point, freezing point depression, definition, principles, and laws of osmotic pressure. Colloid chemistry: Definition of colloid, principle of colloid formation, types of colloid, colloid preparation, stability of colloid, association of colloid and emulsion.

Unit-III Chemical Equilibrium: Solubility Equilibria and Acid-Base Equilibria

Ionic equilibrium: Solubility and solubility product, common ion effect, ionic product of water, pH, pOH, hydrolysis of salt solutions: Strong acid and weak base, weak acid and strong base, weak acid and weak base, concepts of buffer.

Unit-IV Structure-Reactivity Correlations

Acids and bases, electronic and steric effects, Stereochemistry, optical and geometrical isomerism, tautomerism, conformers and concept of aromaticity. Elementary treatment of SN1, SN2, E1, E2 and radical reactions, Hoffmann/Saytzeff rules, addition reactions, Markownikoff rule and Kharasch effect.

Unit-V Thermodynamics

Qualitative treatment of state and path functions, First Law, reversible and irreversible processes, internal energy, enthalpy, Kirchoff equation, Hess's law, heat of formation. Second law, entropy and free energy.

TEXT BOOKS

1. Brown, T. L., LeMay, H. E., Bursten, B. E., Murphy, C., & Woodward, P. (2017). Chemistry: The Central Science (14th ed.). Pearson.
2. Silberberg, M. S. (2017). Principles of General Chemistry (4th ed.). McGraw-Hill Education.
3. Petrucci, R. H., Harwood, W. S., Herring, G., & Madura, J. (2016). General Chemistry: Principles and Modern Applications (11th ed.). Pearson.

FURTHER SUGGESTED READINGS

1. Chang, R., & Goldsby, K. A. (2016). Chemistry (12th ed.). McGraw-Hill Education.
2. Ebbing, D., & Gammon, S. D. (2016). General Chemistry (11th ed.). Cengage Learning.

Course Code	25FTBS017	Course Title	Food Laws and Standards
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 2 0 0	Credits: 2

COURSE OBJECTIVES (CO)

1. Understand the principles and importance of food safety and hygiene in food systems.
2. Explain the structure, objectives, and provisions of FSSA, 2006 and its associated regulations.
3. Interpret and compare national and international food standards and regulatory bodies.
4. Analyze legal and procedural requirements for food import/export and allied food laws in India.

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, learners will be able to:

1. Identify the causes and control of foodborne hazards using basic food microbiology and safety principles.
2. Apply regulatory requirements for licensing, labelling, and product standards under FSSAI.
3. Evaluate international standards such as Codex, HACCP, and ISO in ensuring food quality and safety.
4. Demonstrate awareness of legal frameworks for food trade, inspection, and consumer protection in India.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

UNIT-I Basics of Food Safety and Regulatory Framework

Introduction to food science and microbiology; Basics of food safety, hygiene, and sanitation; Overview of Indian food laws and their evolution; Repealed laws: PFA, Essential Commodities Act Orders

UNIT-II Food Safety and Standards Act (FSSA), 2006 and Related Regulations

Key provisions of FSSA, 2006; Licensing & Registration of Food Businesses; Packaging, Labelling, Contaminants, Food Additives; Role and structure of FSSAI

UNIT-III Global Food Safety and Quality Standards

Codex Alimentarius Commission (CAC); WTO Agreements: SPS and TBT; Other international bodies: ISO, AOAC, EU, USFDA; Global certifications: HACCP, ISO 22000, GFSI, BRC

UNIT-IV Export, Import, and Other Related Food Laws

Export-Import regulations and Foreign Trade Policy; Export Inspection Council, APEDA, MPEDA; Plant and Animal Quarantine, Customs Act; Legal Metrology, BIS, AGMARK, Environment & Consumer Acts

TEXT BOOKS

4. Fortin, N. D. (2022). Food regulation: law, science, policy, and practice. John Wiley & Sons.
5. Schultz, H. (2012). Food law handbook. Springer Science & Business Media.
6. Mathur, P. (2018). Food Safety and Quality Control. Hyderabad: Orient BlackSwan Pvt. Ltd.

FURTHER SUGGESTED READINGS

1. Course MVP-002: Food Laws and Standards of “PG Diploma in Food Safety and Quality Management” programme being offered by School of Agriculture, IGNOU.
2. Food Safety and Standards Act 2006 and Regulations 2011. <https://www.fssai.gov.in/home>
3. Codex e-Learning Centre (http://www.fao.org/ag/agn/agns/capacity_elearning_codex_en.asp)
4. Custom Act

Year/Semester	4th Year/7th Semester	Course Category	Minor Course
Course Code	23RMBS710	Course Title	Research Methodology
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite:		L T P: 1 0 2	Credits: 2

COURSE OBJECTIVES (CO)

1. Provide necessary background on research methodology to undergraduate students
2. Give understanding of hypothesis testing
3. Give understanding of different types sampling techniques.
4. Explain the concept of data and data types and Know about the Formats of Reports, introduction, and different parts of a report

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. have an idea about research methodology
2. understand the applications of sampling schemes and data types and data analysis
3. know how to write a report for a particular type of research work
4. understand the presentations method

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO				
CO 1	✓			
CO 2		✓		
CO 3			✓	
CO 4				✓

COURSE CONTENTS

Unit-I

Meaning of research; objectives of research; basic steps of research; criteria of good research; types of research. Meaning of research problem; selection of research problem. Review of related literature- Meaning, necessity and sources.

Unit-II

Hypothesis- Meaning, function and types of hypotheses; Null/Alternative hypothesis, Variables- Meaning and types. Research design: Types of research design- exploratory, descriptive, diagnostic, and experimental.

Unit-III

Sampling- Meaning and types of sampling; Probability and Non-Probability. Tools and techniques of data collection- questionnaire, schedule, interview, observation, case study, survey etc. Statistics and its significance in research

Unit-IV

Research reports: Writing preliminaries, main body of research, references, and bibliography; Meaning and importance of workshop, seminar, conference, symposium etc. in research. Plagiarism- Concept and significance of plagiarism

Practical/Lab Work to be performed in Computer Lab

The practical will be taught using Excel software and/or using some statistical software like R /SPSS. Students are encouraged to use resources available on open sources.

TEXT BOOKS

1. Kothari, C.R Research Methodology: Methods and Techniques, 2nd Revised Ed. Reprint, New Age International Publishers, 2009

REFERENCE BOOKS

1. Lilien, Gary L. and Philip Kotler, Marketing Decision Making; A Model Building Approach, Harper & Row, New York, 1983.

2. Shenoy, GVS, et al., Quantitative Techniques for Managerial Decision Making, Wiley Eastern, 1983.

Year/Semester	Year/ Semester	Course Category	Inter disciplinary Course
Course Code	21OEMA001	Course Title	Introduction to Algebra
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 3 1 0	Credits: 4

COURSE OBJECTIVE (CO)

1. To introduce the basics of relations and functions.
2. To understand the basics of set theory and set algebra.
3. To equip the students with basics of matrix and applications.
4. To introduce the solutions of system of equations.
5. To learn the concept of vector identities.

COURSE LEARNING OUTCOMES (CCO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Identify and develop concept of mapping and relations.
2. Solve the basics problems of set theory.
3. Well versed with different type of matrices.
4. Apply matrix method solving system of equations problems.
5. Solve vector identities.

MAPPING COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

CLO CO	CLO 01	CLO 02	CLO 03	CLO 04	CLO 05
CO 01	✓				
CO 02		✓			
CO 03			✓		
CO 04				✓	
CO 05					✓

COURE CONTENTS

Unit-I

Types of relations: reflexive, symmetric, transitive, equivalence relations and partitions, Definition of function, One to one and onto functions.

Unit-II

The concept of set, some basic notations and definitions subsets, equality of sets, empty set, algebra of sets special sets, ordered Pairs, Cartesian products.

Unit-III

Definitions of matrix, Addition, subtraction and multiplications of matrices, Types of Matrices -Symmetric, Skew symmetric, Hermitian, Skew Hermitian, Orthogonal, Unitary and Normal matrices Elementary Properties of Matrices, Inverse of Matrices, Rank of Matrix, System of Linear Equations, Characteristic Equation, Eigenvalues and properties, Eigen vectors and properties, Cayley-Hamilton Theorem, Diagonalization.

Unit-IV

Vectors and scalars, magnitude and direction of a vector. Types of vectors (equal, unit, zero, parallel and collinear vectors), vector, addition of vectors, multiplication of a vector by a scalar, properties and application of scalar (dot) product of vectors, vector (cross) product of vectors, Divergence, Curl, Solenoidal and irrotational vectors, Vector identities.

TEXT BOOK

1. Jain R. K., Iyengar S. R. K., Advanced Engineering Mathematics, 6 th edition, Narosa Publishing House, 2019.
2. Dass H. K., Advanced Engineering Mathematics, Sultan Chand Publication, Delhi, 2018.

FURTHER SUGGESTED READINGS

1. Kreyszig, E, Advanced Engineering Mathematics 10th edition, John Wiley & Sons, 2015.
2. Gilbert Strang and Kunze, Linear Algebra, Pearson, 5th edition, 2016.

Year/Semester	Year/ Semester	Course Category	Inter disciplinary Course
Course Code	21OEMA002	Course Title	Differential Calculus
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 3 1 0	Credits: 4

COURSE OBJECTIVE (CO)

1. To make students aware of different type function and mapping.
2. To understand the limit continuity of functions.
3. To equip the students with differentiability of functions.
4. To introduce the topic of tangent normal and curvature.
5. To learn polar coordinate and curve tracing of curve.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Identify and develop concept of mapping of functions.
2. Solve the limit continuity problems of functions.
3. Apply graphical method for test differentiability of function.
4. Well versed with tangent normal and curvature.
5. Solve problems of polar coordinate and curve tracing of curve.

MAPPING COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

CLO CO	CLO 01	CLO 02	CLO 03	CLO 04	CLO 05
CO 01	✓				
CO 02		✓			
CO 03			✓		
CO 04				✓	
CO 05					✓

COURE CONTENTS

Unit-I

Different types of functions and their graphical representation viz. **Identity function, linear function, Constant function, Polynomial function, trigonometrical functions, modulus function, signum function, greatest integer function.**

Unit-II

Limit and Continuity, Types of discontinuities, continuity and discontinuities by graphs, Limit and Continuity of different type of function viz. **modulus function, signum function, greatest integer function, monotonic functions.**

Unit-III

Differentiability of functions, differentiability by graphs, Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions.

Unit-IV

Tangents and normals, Curvature, Asymptotes, Singular points, Tracing of curves. Parametric representation of curves and tracing of parametric curves, Polar coordinates and tracing of curves in polar coordinates.

TEXT BOOK

1. Shanti Narayan and P.K. Mittal, Differential Calculus, S. Chand & Company, Revised Edition, 2018.
2. Sudhir K Pundir, Bhupendra Singh and Sivraj Pundir, Calculus, Pragti Prakashan, 2nd Edition, 2003.

FURTHER SUGGESTED READINGS

1. G.V. Thomas and R.L. Finney, Calculus, Pearson Education, 9th Edition, 2006.
2. Robert T Smith and Roland Minton, Calculus: Early Transcendental Functions, 4th Edition,

Year/Semester	Year/ Semester	Course Category	Inter disciplinary Course
Course Code	21OEMA003	Course Title	Differential Equations
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 3 1 0	Credits: 4

COURSE OBJECTIVE (CO)

1. To make students aware of the ordinary differential equations.
2. To understand the linear differential equations.
3. To equip the students with Cauchy-Euler equation
4. To introduce the total differential equations
5. To learn classification of second order partial differential equations

COURSE LEARNING OUTCOMES (CCO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Identify ordinary differential equations.
2. Solve the linear differential equations by various methods.
3. Well versed with Cauchy-Euler equation.
4. Apply the concept of total differential equations.
5. Identify classification of second order partial differential equations.

MAPPING COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

CLO CO	CLO 01	CLO 02	CLO 03	CLO 04	CLO 05
CO 01	✓				
CO 02		✓			
CO 03			✓		
CO 04				✓	
CO 05					✓

COURE CONTENTS

Unit-I

First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher degree equations solvable for x, y, p. Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order

Unit-II

Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.

Unit-III

Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

Unit-IV

Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only.

TEXT BOOK

1. M D Raisinghania: Differential Equations, S. Chand Publishing, 2020.
2. Shepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.

FURTHER SUGGESTED READINGS

1. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, International Edition, 1967.
2. George F Simmons: Differential Equations, McGraw Hill Education. 2 nd edition Edition, 2017.

Year/Semester	Year/ Semester	Course Category	Inter disciplinary Course
Course Code	21OEMA004	Course Title	Statistical Methods and Probability
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 3 1 0	Credits: 4

COURSE OBJECTIVE (CO)

1. To make students aware of the basics and importance of statistics
2. To understand the Concept of central tendency
3. To equip the students with random experiment, definition of probability
4. To introduce the Bayes theorem and its applications
5. To learn random variable and Concept of discrete random variable

COURSE LEARNING OUTCOMES (CCO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Identify and develop knowledge of basics and importance of statistics.
2. Solve the problems based on concept of central tendency.
3. Apply the concept of random experiment, definition of probability.
4. Well versed with Bayes theorem and its applications.
5. Solve problems of concept of discrete random variables.

MAPPING COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

CO \ CL	CL 01	CL 02	CL 03	CL 04	CL 05
CO 01	✓				
CO 02		✓			
CO 03			✓		
CO 04				✓	
CO 05					✓

COURE CONTENTS

Unit-I

Importance of statistics, concepts of statistical population and a sample – quantitative and qualitative data – Collection of primary and secondary data. Designing a questionnaire and a schedule. Classification and tabulation of data. Measurement scales –nominal, ordinal, interval and ratio. Diagrammatic and Graphical representation of data. Construction of univariate and bivariate frequency distributions. Stem and leaf plot.

Unit-II

Concept of central tendency, Partition values and dispersion, Box plot. Measures of inequality – Gini's Coefficient and Lorenz curve. Skew-ness, kurtosis and their measures based on quartiles and moments.

Unit-III

Random experiment, definition of probability, classical and relative frequency approach to probability, axiomatic approach to probability and its properties, merits and demerits of these approaches, total and compound probability, conditional probability theorems, independence of events, Bayes theorem and its applications.

Unit-IV

Random Variable: Concept of discrete random variable, probability mass function and distribution function, joint probability mass function of several discrete random variables, marginal and conditional probability mass functions. Continuous random variable: Probability density function, distribution function.

TEXT BOOK

1. S.C Gupta & V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th edition, Sultan Chand & sons, reprint, 2007.

FURTHER SUGGESTED READINGS

1. Mood A.M., Greybill F.A. and Bose D.C., Introduction to the Theory of Statistics, McGraw Hill, 3th Edition, 1974.
2. Goon A.M., Gupta M.K. and Das Gupta B., Fundamental of Statistics, Vol. I, World Press Private Ltd, 2013.
3. P. R. Vittal, Mathematical Statistics, Margham Publications, Chennai, 2013

Year/Semester	Year/ Semester	Course Category	Inter disciplinary Course
Course Code	21OECY001	Course Title	Physical Chemistry-I
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 3 1 0	Credits: 4

COURSE OBJECTIVES:

- To be familiar with the terminologies of thermodynamics and the concept of heat, work and internal energy.
- To understand the concept of kinetic theory of gases, behaviour of real gases.
- To discuss the fundamental of radioactivity, radioactive decay and radioactive measurement.
- To be familiar with the concept of Miller indices, symmetry element, and X-ray diffraction in solids.

COURSE OUTCOMES: The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Calculate the heat flow into and work done by a system and how that is constrained by the first law of thermodynamics.
- Explain the behaviour of ideal and real gases.
- Describe various radioactive decay process, decay kinetics and to measure the radioactivity.
- Demonstrate the symmetry elements and symmetry operation, lattice parameters using the X-ray diffraction pattern.

MAPPING COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

Course Objectives (COs)	Course Learning Outcomes (CLOs)			
	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

UNIT-I

Thermodynamics: Intensive and extensive variables; state and path functions; isolated, closed and open systems. Concept of heat Q, work W, internal energy U, and statement of first law; enthalpy H, relation between heat capacities, Concept of entropy; Calculation of entropy change for reversible and irreversible processes, Statement of third law.

UNIT-II

Kinetic Theory of Gases: Kinetic theory of gases, deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases, Boyle's temperature, critical constants and their calculation from van der Waals equation, critical phenomenon, Andrew's isotherms of CO₂, Maxwell-Boltzmann distribution laws of molecular velocities and molecular energies and their importance, most probable, average and root mean square velocities.

UNIT-III

Nuclear Chemistry: Fundamentals of radioactivity and decay, Radioactive decay, decay kinetics, parent daughter decay growth relationship, concepts of transient and secular equilibrium, alpha, beta and gamma decay, artificial radioactivity.

UNIT-IV

Solid State Chemistry: Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method.

TEXT BOOKS

1. Kapoor, K. L. (Vol. 1 to 5) *Physical Chemistry*, MacGraw Hill Publications.
2. A. R. West, *Solid state chemistry and its applications*, John Wiley & Sons, 1989.
3. *Essentials of Nuclear Chemistry* by H. J. Arnikar, New Age International Publishers
4. N. R. Rao and J. Gopalkrishnan, *New directions in solid state chemistry*, Cambridge Univ. Press, 1997.

FURTHER SUGGESTED READINGS

1. L. Smart and E. Moore, *Solid State Chemistry*, Chapman and Hall, 1992.
2. K. Cheetham and P. Day, *Solid state chemistry compounds*, Clarendon Press, Oxford 1992.
3. Atkins, P.; Paula, J.P. *Physical Chemistry*, Oxford University Press

Year/Semester	Year/ Semester	Course Category	Inter disciplinary Course
Course Code	21OECY002	Course Title	Inorganic Chemistry
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 3 1 0	Credits: 4

COURSE OBJECTIVES

- To describe the atomic structure and shape of orbitals.
- To be familiar explain the concept of ionic bonding.
- To be familiar explain the concept of covalent bonding.
- To demonstrate the structure and properties of important coordination compounds.

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Describe the atomic structure and shape of orbitals.
- Explain the concept of concept of ionic bonding.
- Explain the concept of concept of covalent bonding
- Demonstrate the structure and properties of important coordination compounds.

MAPPING COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

Course Objectives (COs)	Course Learning Outcomes (CLOs)			
	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURE CONTENTS

Unit-I

Atomic Structure: Review of Bohr's theory and its limitations, Heisenberg Uncertainty principle. Dual behaviour of matter and radiation, de-Broglie's relation. Hydrogen atom spectra. Quantum mechanics: Time independent Schrodinger equation significance of ψ and ψ^2 , Schrödinger equation for hydrogen atom. Radial and angular parts of the hydrogenic wavefunctions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable

distance with special reference to 1s and 2s atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s . Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (m_s). Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals.

Unit II

Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy (no derivation), Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Unit III

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR (H_2O , NH_3 , PCl_5 , SF_6 , ClF_3 , SF_4) and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. Concept of resonance and resonating structures in various inorganic and organic compounds. MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO^+

Unit IV

Structure and Properties of Few important Compounds: A study of the following compounds (including preparation, Bonding and important properties); Peroxo compounds of Cr, $K_2Cr_2O_7$, $KMnO_4$, $K_4[Fe(CN)_6]$, $K_3[Fe(CN)_6]$, sodium nitroprusside, $[Co(NH_3)_6]Cl_3$, $Na_3[Co(NO_2)_6]$, Borazine, boranes, oxoacids of sulphur & phosphorus, pseudohalogen, phosphazene, silicates & silicones.

TEXT BOOKS

1. J. D. Lee: A New Concise Inorganic Chemistry, 5th Edition, Blackwell Science.
2. F. A. Cotton & G. Wilkinson: Basic Inorganic Chemistry, 3rd Edition, 1994, Wiley.

FURTHER SUGGESTED READINGS

1. Douglas, McDaniel and Alexander: Concepts and Models in Inorganic Chemistry, 3rd Edition, 1994, John Wiley & Sons

Year/Semester	Year/ Semester	Course Category	Inter disciplinary Course
Course Code	21OECY003	Course Title	Physical Chemistry-II
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 3 1 0	Credits: 4

COURSE OBJECTIVES:

- To be familiar with the postulates of quantum chemistry and its application to simple system.
- To describe the concept and application of rotational spectroscopy.
- To explain the concept application of vibrational spectroscopy.
- To demonstrate the structure and properties of compounds using electronic spectroscopy.

COURSE LEARNING OUTCOMES: The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Apply the postulates of quantum chemistry and to simple system.
- Describe the applications of rotational spectroscopy.
- Explain vibrational energy and transitions in molecules.
- Demonstrate the structure and properties of compounds using electronic spectroscopy.

MAPPING COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

Course Objectives (COs)	Course Learning Outcomes (CLOs)			
	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit -I

Quantum Chemistry: Postulates of quantum mechanics, Born Interpretation, quantum mechanical operators; linear and Hermitian operator, Free particle, Particle in a 1-D box (complete solution),

quantization, normalization of wavefunctions, concept of zero-point energy, extension to particle in two-D and three-D box.

Unit -II

Rotational Spectroscopy: Schrödinger equation of a rigid rotator and brief discussion of its results (solution not required). Wave function of rigid rotator, Quantization of rotational energy levels. Microwave (pure rotational), spectra of diatomic molecules. Effect of isotopic substitution on spectra, Selection rules. Structural information derived from rotational spectroscopy.

Unit -III

Vibrational Spectroscopy: Schrödinger equation of a linear harmonic oscillator and brief discussion of its results (solution not required). Quantization of vibrational energy levels. Wave function of simple harmonic oscillator, Selection rules, IR spectra of diatomic molecules. Structural information derived from vibrational spectra. Normal modes of vibrations. Vibrations of poly atomic molecules. Group frequencies.

Unit -IV

Electronic Spectroscopy: Electronic excited states. Selection rules, Free Electron model and its application to electronic spectra of polyenes. Energy levels in organic compounds, Colour and constitution, chromophores, auxochromes, bathochromic and hypsochromic shifts. Lambert-Beer's law. Fluorescence and phosphorescence. Quantum efficiency and reasons for high and low quantum yields.

TEXT BOOKS

1. B. R. Puri, L. R. Sharma & M.S. Pathania, Principles of Physical Chemistry, 47th Edition, Vishal Pub. Co.
2. P.W. Atkins, Physical Chemistry, 1997, Oxford University Press Oxford University Press.
3. A.K. Chandra, Introductory Quantum Chemistry, 1994, Tata McGraw Hill.
4. C. N. Banwell, Fundamentals of molecular spectroscopy, 4th Edition.

FURTHER SUGGESTED READINGS

1. G. M. Barrow, Physical Chemistry, 2007, Tata McGraw -Hill.
2. I. M. Levine, Quantum Chemistry, 7th Edition, Prentice Hall.
3. P.W. Atkins & R.S. Friedman, Molecular Quantum Mechanics, 3rd Ed., 1997, Oxford University Press.

Year/Semester	Year/ Semester	Course Category	Inter disciplinary Course
Course Code	21OECY004	Course Title	Analytical Chemistry
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 3 1 0	Credits: 4

COURSE OBJECTIVES

4. To understand the qualitative and quantitative aspects of analysis.
5. To be familiar explain the thermal methods of analysis.
6. To understand the different electroanalytical techniques.
7. To demonstrate the use of various separation methods.

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Apply the data analysis in qualitative and quantitative estimation.
- Explain the principle and applications of thermal methods of analysis.
- Illustrate principle and applications of different electroanalytical methods.
- Demonstrate various techniques in separation of different compounds.

MAPPING COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

Course Objectives (COs)	Course Learning Outcomes (CLOs)			
	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COUSRE CONTENTS

Unit-I

Qualitative and quantitative aspects of analysis: Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution of indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

Unit II

Thermal methods of analysis: Theory of thermogravimetry (TG), Techniques: TGA, DTA, DSC, their basic principle & instrumentation. Quantitative estimation of Ca and Mg from their mixture.

Unit III

Electroanalytical methods: Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pK_a values.

Unit IV

Separation techniques:

Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation. Technique of extraction: batch, continuous and counter current extractions.

Chromatography: Classification types based on interactions, stationary phase, mobile phase. Principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods.

TEXT BOOKS

1. D.A. Skoog, F.J. Holler and T.A. Nieman, Principles of Instrumental Analysis, Thomson Asia Pvt. Ltd. Singapore.
2. O. Mikes, and R.A. Chalmers, Ed. Laboratory Hand Book of Chromatographic and Allied Methods, Elles Horwood Ltd. London.
3. R.V. Dilts Analytical Chemistry – Methods of separation, 1974, Van Nostrand Reinhold Company.

FURTHER SUGGESTED READINGS

1. Vogel, I. Arthur: A Text book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed. The English Language Book Society of Longman.
2. Willard, H. Hobart: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA.
3. Gary D. Christian, Analytical Chemistry, 6th Ed. John Wiley & Sons, New York.
4. Daniel C. Harris, Exploring Chemical Analysis, 5th Ed. New York, W.H. Freeman.
5. S.M. Khopkar, Basic Concepts of Analytical Chemistry, 2008, New Age International Publisher.

**List of Multidisciplinary Courses (MDC) offered to
Four Year B.Sc. Food Technology programme in the Department of Food Technology
w.e.f. Academic Year 2024-25**

Cat.	Code	Course Name	L	T	P	Credits
MDC I	23MDC201	Renewable Energy Sources	3	0	0	3
	23MDC201	Electric Vehicle	3	0	0	3
	23MDC301	IPR in Business	3	0	0	3
	23MDC302	Library Information Sciences & Media Literacy	3	0	0	3
	23MDC401	Management Process & Organizational Behaviour	3	0	0	3
MDC II	23MDC203	Introduction to Bio-engineering	3	0	0	3
	23MDC204	Introduction to Robotics	3	0	0	3
	23MDC302	Psychology and Emotional Intelligence	3	0	0	3
	23MDC304	Indian Economy	3	0	0	3
	23MDC402	Creating an Entrepreneurial Mind	3	0	0	3
MDC III	23MDC205	Arduino based programming	3	0	0	3
	23MDC305	Electoral Literacy in India	3	0	0	3
	23MDC403	Personal Financial Planning	3	0	0	3
	23MDC404	Interior Design	3	0	0	3

Year/Semester		Course Category	Multidisciplinary Course
Course Code	23MDC201	Course Title	Renewable Energy Sources
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Nil		L T P : 3 0 0	Credits: 3

COURSE OBJECTIVES

1. To create awareness about sources of energy and able to estimate how long the available conventional fuel reserves will last.
2. To learn the fundamental concepts about solar energy systems and devices.
3. To design wind turbine blades and know about applications of wind energy for waterpumping and Electricity generation.
4. To understand the working of OTEC system and different possible ways of extracting energy from Ocean, know about Biomass energy, mini-micro hydro systems and geothermal energy system.

COURSE LEARNING OUTCOMES (CLO) : At the end of the course, the student will be able to

1. Analyze the energy scenario of the world and nation.
2. Carry out a comparative analysis of different types of coal, including their treatment, Liquefaction and gasification.
3. Compare the liquid and gaseous fuels sourced from petroleum including their characterization.
4. Analyze the potential of alternate energy sources and their scope and limitations.

Mapping Matrix between Course Objectives and Course Learning Outcomes:

Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4
CO1	x			
CO2		x		
CO3			x	
CO4				x

COURSE CONTENTS:

UNIT	COURSE CONTENTS	HOURS
UNIT-I	<p>Introduction to Energy Sources: World energy futures, Conventional energy sources, Nonconventional energy sources, Prospects of Renewable energy sources.</p> <p>Environmental Aspects of Electric Energy Generation: Introduction Thermal pollution, Atmospheric pollution, Effects of Hydroelectric projects, Nuclear power generation and environment, Green House Gas Effects, Global Environmental awareness, Energy options for Indian Economy.</p>	8
UNIT-II	<p>Solar Energy: Introduction to solar radiation and its measurement, Introduction to Solar energy Collectors and Storage, Solar thermal electric conversion, Thermal electric conversion systems, Solar electric power generation, Solar photo-voltaic, Solar Cell principle, Semiconductor junctions, Conversion efficiency and power output, Basic photovoltaic system for power generation.</p>	8
UNIT-III	<p>Wind Energy and Wind Energy Conversion: Introduction to wind energy conversion, the nature of the wind, Power in the wind, Wind data and energy estimation, Site Selection considerations, basic Components of a Wind energy conversion system, Classification of WEC Systems, Schemes for electric generation using synchronous generator and induction generator, wind energy storage.</p>	8
UNIT-IV	<p>BIOMASS ENERGY</p> <p>Biomass conversion biomass generation, classification of Bio Gas Plants material used in Bio Gas Plants., Selection of site & applications.</p> <p>MHD & Hydrogen Energy: Basic Principle MHD SYSTEM, advantages, Power OUTPUT of MHD Generation, future Prospects. Principle and classification of fuel cell energy, hydrogen as alternative fuel for Generation of Electrical Energy & applications.</p> <p>Fuel Cell: Fuel Cell, Management of Fuel, Thermonic power generation.</p>	8
UNIT-V	<p>HYDRO POWER AND OTHER RENEWABLE ENERGY SOURCES</p> <p>Hydropower: Introduction, Capacity and Potential, Small hydro, Environmental and social impacts. Tidal Energy: Introduction, Capacity and Potential, Principle of Tidal Power, Components of Tidal Power Plant, Classification of Tidal Power Plants. Ocean Thermal Energy: Introduction, Ocean Thermal Energy Conversion (OTEC), Principle of OTEC system, Methods of OTEC power generation. Geothermal Energy: Introduction, Capacity and Potential, Resources of geothermal energy.</p>	8

TEXT BOOKS

1. Sukhatme. S.P., Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
2. B. H. Khan, Non-Conventional Energy Resources, , The McGraw Hill
3. Twidell, J.W. & Weir, A. Renewable Energy Sources, EFN Spon Ltd., UK, 2006.
4. S. P. Sukhatme and J.K. Nayak, Solar Energy – Principles of Thermal Collection and Storage, Tata McGraw-Hill, New Delhi.
5. Garg, Prakash, Solar Energy, Fundamentals and Applications, Tata McGraw Hill.

FURTHER SUGGESTED READINGS

1. G.D. Rai, Non-Conventional Energy Sources, Khanna Publications, New Delhi, 2011.
2. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K., 1996.
3. Khandelwal, K.C., Mahdi, S.S., Biogas Technology – A Practical Handbook, Tata McGraw- Hill, 1986.
4. Tiwari. G.N., Solar Energy – “Fundamentals Design, Modeling & Applications”, Narosa Publishing House, New Delhi, 2002.
5. Freris. L.L., “Wind Energy Conversion Systems”, Prentice Hall, UK, 1990.
6. Frank Krieth& John F Kreider ,Principles of Solar Energy, John Wiley, New York

Year/Semester		Course Category	Multidisciplinary Course
Course Code	23MDC202	Course Title	Electric Vehicles
Continuous Evaluation: 40	End Semester Examination:60		
Prerequisite: Nil	L T P : 3 0 0		Credits: 3

COURSE OBJECTIVES

1. To acquire knowledge on the fundamental concepts, principles, and analysis of hybrid electric vehicles.
2. To understand the concept of electrical vehicles and its operations.
3. To understand the need for energy storage in hybrid vehicles.
4. To provide knowledge about various possible emerging technologies that can be used in electric vehicles.

COURSE LEARNING OUTCOMES (CLO): At the end of the course, the student will be able to

1. Realize the importance of electric transportation systems.
2. Understand the basics of electric vehicle components and configuration.
3. Understand the various charging types, comfort and safety methods.
4. Understand the application of electric vehicle in Smart grid.

Mapping Matrix between Course Objectives and Course Learning Outcomes:

Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4
CO1	X	X	X	X
CO2	X	X	X	
CO3	X			
CO4				X

COURSE CONTENTS:

UNIT	COURSE CONTENTS	HOURS
UNIT-I	ELECTRIC VEHICLES History of Modern Transportation, Importance of Different Transportation Development Strategies to Future Oil Supply, Introduction to Electric Vehicles, History of hybrid and electric vehicles, Social, environmental importance and key challenges of hybrid and electric vehicles, Specifications of PHEVs, BEVs, EVs, Plug-in Hybrid Vehicle characteristics, The future of electric vehicles.	8
UNIT-II	ENERGY STORAGE AND BATTERY TECHNOLOGY Introduction to Energy Storage system, Battery Requirements for HEVs, PHEVs, and EVs, Types of batteries, Properties of batteries, Working principle and construction of lead-acid, nickel cadmium, nickel metal hydride, lithium ion batteries, Maintenance and charging of batteries, Diagnosing lead-acid battery faults, Advanced battery technology, Developments in electrical storage, Case studies	8
UNIT-III	CHARGING AND STARTING SYSTEMS Requirements of the charging system, Charging system principles, Alternators and charging circuits, Diagnosing charging system faults, Advanced charging system technology, New developments in charging systems, Requirements of the starting system, Starter motors and circuits, Types of starter motor, Diagnosing starting system faults, Advanced starting system technology, New developments in starting systems, Case studies.	8
UNIT-IV	HYBRID ELECTRIC VEHICLE DRIVE TRAIN AND SAFETY Requirement of drive train, Architecture of hybrid drive train, Sizing of components, Series configuration, Parallel configuration, parallel and series configuration, Security, Airbags and belt tensioners, Diagnosing comfort and safety system faults, Advanced comfort and safety systems technology, New developments in comfort and safety systems.	8
UNIT-V	PERIPHERAL INTERFACES EMERGING TECHNOLOGIES Introduction, Electric Vehicle Supply Equipments, Smart vehicles in smart grid, Vehicle-to-grid technologies: Unidirectional and Bidirectional, Need of Charging Station Selection (CSS) server, Smart grid technologies: Applications / Benefits, Smart meter, Smart charger: Purpose and benefits.	8

TEXT BOOKS

1. M. Ehsani, Y. Gao, and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design" Second Edition, CRC Press, ISBN: 978-1-4200-5398-2, Aug. 2009.
2. Tom Denton, "Automobile Electrical and Electronic Systems" Elsevier Butterworth-Heinemann, Third edition, 2004.
3. A. Emadi, "Advanced Electric Drive Vehicles, CRC Press, ISBN: 978-1-4665-9769-3, Oct. 2014.

FURTHER SUGGESTED READINGS

1. Iqbal Hussain, "Electric & Hybrid Vehicles – Design Fundamentals", Second Edition, CRC Press, 2011.
2. James Larminie, "Electric Vehicle Technology Explained", John Wiley & Sons, 2003.
3. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley & sons inc, 2012.

DEPARTMENT OF LAW			
Year/Semester		Course Category	Multidisciplinary Course (MDC)
Course Code	23MDC301	Course Title	IPR for Business
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

COURSE OBJECTIVES:

The objective of this Multidisciplinary Course (MDC) is to familiarize the students with various types of IPR and its relevance to the businesses and their respective streams.

CO 1: To provide students with a basic understanding of various types of IPR and its relevance for business.

CO 2: To acquaint students with the strategies and management techniques associated with intellectual property assets, and the legal considerations and challenges involved.

CO 3: To familiarize the students with the challenges and legal considerations related to intellectual property disputes.

CO 4 To develop skills related to management of intellectual property in business.

COURSE LEARNING OUTCOMES

At the end of this course, the students would be able to:

CLO1: Define and discuss about the various types of IPR and its relevance for business

CLO2: Discuss the adjudicating bodies and mechanisms under each of these IPRs

CLO3: Analyze and resolve business disputes relating to IPR

CLO4: Apply the learning to the real-life situations in business

MAPPING COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES(CCOs)

COURSE OBJECTIVES (COs)	COURSE LEARNING OUTCOMES (CLOs)			
	CLO1	CLO2	CLO3	CLO4
CO1	√			
CO2		√		
CO3			√	
CO4				√

COURSE CONTENT

UNIT 1

INTRODUCTION TO INTELLECTUAL PROPERTY AND BUSINESS

- Concept of IPR in business and its types
- International Context - Introduction to the leading International Instruments concerning Intellectual Property Rights: the Berne Convention, Universal Copyright Convention, The Paris Convention, Patent Co-operation Treaty, TRIPS, The World Intellectual Property Organization (WIPO), World Trade Organization (WTO) and the UNESCO

- Innovation as a Business Strategy and relevance of protecting the ideas legally
- National IPR Policy

UNIT 2: COPYRIGHT

- Concept of Copyright and importance for businesses
- Media business – protecting performer’s rights
- Performers’ and Broadcasters’ Rights Law
- Assignment, Transmission, Licensing of Copyrights
- Infringement of Copyrights and remedies

UNIT 3: TRADEMARKS

- Trademark – value of and relevance for businesses
- Protecting brand value- acquiring trademark nationally and internationally
- Trade mark disputes – case studies

UNIT 4: PATENTS

- Protecting innovation – acquiring patents nationally and internationally
- Product and process patents
- Assigning patents and its commercialization
- Patent Disputes

UNIT 5: INDUSTRIAL PROPERTIES

- Industrial designs – protection - Procedure for Registration of Designs •
Copyright under Design
- Semiconductor Integrated Circuits Layout-Designs
- Plant varieties – commercialization - Monsanto cases
- Geographical Indications
- Biotechnology and IPR

UNIT 6: REGISTRATION AND ENFORCEMENT MECHANISMS

- Registration authorities of various IPRs
- IP Management and assertion of rights through declarations – use of copyright, trademark signs
- IP Litigation – Approach of courts – landmark cases

TEXT BOOKS:

- WIPO DL-101 General Course on Intellectual Property (online)
- Elizabeth Verkey and Jithin Saji Issac, *Intellectual Property*, Eastern Book Company 2021
- Anurag K. Agarwal, *Business and Intellectual Property: Protect your Ideas*, IIM Ahmedabad. Random House India (2016)
- *Handbook on IP Commercialisation - Strategies for Managing IPRs and Maximising Value* Jakarta: ASEAN Secretariat, November 2019

REFERENCES BOOKS:

- ICSI Study Material, Intellectual Property Rights: Law and Practice, A. Ramaiya,

Guide to the Companies Act, LexisNexis, 19th Ed. 2020 (in 6 volumes)

- WIPO, *Enterprising Ideas A Guide to Intellectual Property for Startups*, 2023
- Manuals published by Office of the Controller General of Patents, Designs & Trade (CGPDTM), available at <https://ipindia.gov.in/> Guide Books by WIPO –Intellectual Property for Business, available at <https://www.wipo.int/publications/en/series/index.jsp?id=181>

Department of Library & Information Science			
Year/Semester		Course Category	MDC
Course Code	23MDC302	Course Title	Library Information Science & Media Literacy
Continuous Evaluation: 40	End Semester Examination:60		
Prerequisite: Nil	L T P : 3 0 0	Credits: 3	

Course Objectives (CO) - The Course is designed with the following objectives:

CO-1: To know the library collection and their classifications.

CO-2: To discuss the library information services.

CO-3: To understand the importance of media

CO-4: To grasp the significance of motive of media

Course Learning Outcomes (CLO) – The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

CLO-1: Explain the library collection and their classifications.

CLO-2: Analyse the library information services.

CLO-3: Analyse the media roles.

CLO-4: Analyse the motive of media.

Mapping Matrix between Course Objectives and Course Learning Outcomes:

	CO-1	CO-2	CO-3	CO-4
CLO-1	√			
CLO-2		√		
CLO-3			√	
CLO-4				√

COURSE CONTENTS:

UNIT-1: Library Collection

- Type of Information Sources : Primary, Secondary and Tertiary
- Reference Collection: Type of reference sources
- Indexing and Abstracting Journals
- Multimedia Collection
- Arrangement of Information Sources : Classification

UNIT-2: Information Services

- Bibliography: Type of Bibliography
- Reviews Literature
- Citation Style
- Citation Analysis: Web of Science and Scopus
- Online Databases : Structure and Retrieval

UNIT-3: Media Literacy

- Introduction to Media Literacy
- Type of media: Traditional versus social media
- Bias in media

UNIT-4: Motive of Media

- Media tycoons and conditions in which media works
- Research and Publication ethics

Recommended Books:

1. Richard E. Rubin & Rachel G. Rubin ,Foundations of Library and Information Science, 5th Edition. ISBN-9781783304776, Facet Publication, UK
2. <https://en.unesco.org/themes/media-and-information-literacy/resources>

Management Process & Organizational Behaviour	
Course Code: 23MDC401	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
Prerequisite: NIL	Course Category: Multidisciplinary

COURSE OBJECTIVES

1. To understand the functions and responsibilities of managers.
2. To acquaint the students with the fundamentals of managing business.
3. To understand individual and group behaviour at work place so as to improve the effectiveness of an organization.
4. To analyse human behaviour in the organization setting in order to manage it in accordance to the intentions.

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Demonstrate the roles, skills and functions of management.
2. Analyse the causes and consequences of applying different business strategies.
3. Analyse and compare individual behaviour related to motivation and rewards.
4. Identify group behaviour, leadership styles and the role of leaders in a decisionmaking process.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

Course Objectives (COs)	Course Learning Outcomes (CLOs)			
	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO 4				

COURSE CONTENTS

Unit 1: Introduction to the management

Management Concept, Nature, Process and significance, levels of management, managerial skills, functions of management, management and administration, evolution of management, Role of management and insights from Indian practices and ethos.

Unit 2: Functions of the management

Planning: Types of Plans & The planning process; Organizing: Common organisational structures; Staffing: features and necessity; Leading: types of leaders; Controlling: functions and types

Unit 3: Introduction to Organizational Behaviour

Meaning, importance and scope of OB; abilities: meaning and forms, attitudes: framework, work related attitudes, personality: types, assessment, perception: process, factors influencing perception, perceptual errors

Unit 4: Foundation of Group Behaviour

Defining and classifying groups; need to join groups, stages of group development; group dynamics: group properties as roles, norms and size; group decision making techniques, conflict management

TEXT BOOKS

1. Stephen Robbins, Organizational Behavior, 16th edition (2012), Pearson Education.
2. K. Aswathappa, Organizational Behaviour, 13th edition (2016), Himalaya Publishing House.
3. Fred Luthans, Organizational Behavior, 14th edition (2017), McGraw-Hill.

SUGGESTED READINGS

1. Gregory Moorhead & Ricky W. Griffin, Organizational Behaviour, 11th edition (2009), Jaico Publication.
2. Tripathy PC and Reddy PN, Principles of Management, 6th edition (2011), McGraw-Hill.

Department of Mechanical Engineering			
Year/Semester	1st Year/1st Semester	Course Category	Multidisciplinary Course
Course Code	23MDC204	Course Title	Introduction to Robotics
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Nil		L T P : 3 0 0	Credits: 3

COURSE OBJECTIVES (CO)

1. Review of Industrial Control Devices and Circuits; Basic Ladder COgic and Control
2. Programmable COgic Controllers and Applications;
3. Robot Fundamentals; Mechanisms and Actuators, Sensors and Detectors;
4. Modeling and Control of Manipulators; Robot Applications and Programming.

COURSE LEARNING OUTCOMES (CLO) : At the end of the course, the student will be able to

1. Explain basic concepts of Programmable logic Controller (PLC) and Industrial automation.
2. Determine basic programming languages and instructions of a PLC and Use a particular Programmable logic Controller (PLC) for various applications.
3. Design an automated system for industrial derive to meet defined operational specifications.
4. Explain basic concept, type and components of Robotic system and Define the principles and benefits of the various actuators, drives and sensors. Solve forward kinematics of any serial robot, compute position and orientation of end effectors as a function to joint variables.

Mapping Matrix between Course Objectives and Course Learning Outcomes:

Course Objectives	CLO1	CLO2	CLO3	CLO4
CO1	x			
CO2		x		
CO3			x	
CO4				x

COURSE CONTENTS:

UNIT	COURSE CONTENTS	HOURS
UNIT-I	Introduction to Industrial Automation : Introduction to Industrial Automation Review of industrial control devices I/O devices (Electronics Circuit breakers, timers, relays)	8
UNIT-II	Programmable logic controllers (PLC) 2.1 Introduction to Programmable CLogic controllers <ul style="list-style-type: none"> ➤ Introduction to PLCs ➤ Overview of number systems and logic concepts ➤ PLC Programming Procedures and Devices ➤ Inputs (sensors) and Outputs (actuators) connected to PLC ➤ PLC and DCS programming software 2.2 Input/output and Memory Interaction <ul style="list-style-type: none"> ➤ PLC input/output systems and programming devices ➤ PLC Memory and Input/output Interaction ➤ Discrete input/output system ➤ AnaCOg input/output system ➤ Special input/output modules: PID, Fuzzy-logic.... 2.3 Programming a PLC <ul style="list-style-type: none"> ➤ Programming languages and instructions ➤ Programming ON/OFF Inputs ➤ Creating Ladder diagrams ➤ Register Basics ➤ PLC Timers and Counters ➤ PLC Arithmetic functions ➤ Number comparison functions ➤ Data handling Functions ➤ PLC functions with BITS ➤ System programming and implementation: Control task definitions, strategies, program organization and implementations ➤ Programming practice: Siemens“ PLC S7-300, S7-400 (practice onavailable PLC type) 	8
UNIT-III	Introduction, Fundamentals of Robotics <ul style="list-style-type: none"> ➤ Introduction ➤ Types of Robots ➤ Robot Anatomy and Key Components ➤ Sensors and Actuators in robots ➤ Position, Velocity, Acceleration, Force and Torque ➤ Touch and Tactile sensors ➤ Proximity and Range Sensors ➤ Hydraulic and Pneumatic Actuation systems Robot Applications	8
UNIT-IV	Robot Motion Analysis (Kinematics) <ul style="list-style-type: none"> ➤ Representation of Rigid body motion ➤ Transformation of Coordinates ➤ Homogenous Transformation ➤ Forward Kinematics Inverse Kinematics	8
UNIT-V	Dynamics, Mechanism & Actuation 5.1. Dynamic Models of Rigid-Body Systems <ul style="list-style-type: none"> ➤ Euler Lagrange Equations ➤ Newton Euler formulation 5.2 Mechanical Structure (Links, Joints, Actuators, transmissions), Joint Mechanisms.	8

TEXT BOOKS

1. J. J. Craig, Introduction to robotics ,3rd edition, Pearson Education,2005
2. Herman Bruyninckx, Robot Kinematics and Dynamics, August 21, 2010

FURTHER SUGGESTED READINGS

1. B. Siciliano, L. Sciavicco, et al, Robotics modeling planning and control, Springer, 2009

Department of Psychology			
Programme: B.A. (H) Psychology			
Year/Semester	Year /Semester	Course Category	MDC-
Course Code	23MDC303	Course Title	Psychology and Emotional Intelligence
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite:		L T P : 3 0 0	Credits:3

COURSE OBJECTIVES COs

The Course is designed with the following objectives to:

- Learn the concepts of emotional intelligence and learn ways of developing it.
- different models of Emotional Intelligence
- expressions of perceiving emotions.
- different techniques of emotional intelligence

Identify the

View the

Find the

COURSE LEARNING OUTCOMES CLOs :

After this, the students should be able to:

- Classify the concepts of emotional intelligence and learn ways of developing it.
- different models of Emotional Intelligence
- expressions of perceiving emotions.
- techniques of emotional intelligence in different domains of life.

Demonstrate

Recognize the

Apply different

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

Course Objectives (COs)	Course Learning Outcomes (CLOs)			
	CLO 1	CLO2	CLO3	CLO4
CO1				
CO2				
CO3				
CO4				

Unit 1:

Introduction: Emotional Intelligence; Models of Emotional Intelligence; EQ competencies: self-awareness, self-regulation, motivation, empathy, and interpersonal skills; Importance of Emotional Intelligence

Unit 2:

Knowing One's And Others' Emotions: Levels of emotional awareness; Recognizing emotions in oneself; The universality of emotional expression; Perceiving emotions accurately in others

Unit 3:

Managing Emotions: The relationship between emotions, thought and behaviour; Techniques to manage emotions

Unit 4:

Applications: Workplace; Relationships; Conflict Management; Effective Leadership

Readings:

- 1) Bar-On, R., & Parker, J.D.A.(Eds.) (2000). *The handbook of emotional intelligence*. San Francisco, California: Jossey Bros.
- 2) Goleman, D. (1995). *Emotional Intelligence*. New York: Bantam Book.
- 3) Goleman, D. (1998). *Working with Emotional Intelligence*. New York: Bantam Books. Singh, D. (2003). *Emotional intelligence at work (2 nded.)* New Delhi: Response Books.

Department of Economics			
Year/Semester		Course Category	Multidisciplinary Course
Course Code	23MDC304	Course Title	Indian Economy
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Nil		L T P : 3 0 0	Credits: 3

COURSE OBJECTIVES

1. To introduce about different demography terms and trends.
2. To make students familiar with growth and its distribution.
3. To discuss the major changes in agriculture sector over-time.

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. review major demographic indicators
2. comprehend the concept of inequality
3. analyse agriculture sector

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

Course Objectives (COs)	Course Learning Outcomes (CLOs)		
	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

COURE CONTENTS

Unit-I

Population and Human Development

Demographic trends and issues; education; health and malnutrition. Demographic features of India's population.

Unit-II

Growth and Distribution

Trends and policies in poverty; inequality and unemployment.

Unit-III

Agriculture

Importance of Agriculture; Causes of backwardness and low productivity; Land Reforms: Need, Implementation and Critical Evaluation

TEXT BOOKS

1. Jean Dreze and Amartya Sen, 2013. *An Uncertain Glory: India and its Contradictions*, Princeton University Press.
2. Pulapre Balakrishnan, 2007, The Recovery of India: Economic Growth in the Nehru Era, *Economic and Political Weekly*, November.
3. Rakesh Mohan, 2008,—Growth Record of Indian Economy: 1950-2008. A Story of Sustained Savings and Investment, *Economic and Political Weekly*, May.
4. S.L. Shetty, 2007,—India's Savings Performances since the Advent of Planning, in K.L. Krishna and A. Vaidyanathan, editors, *Institutions and Markets in India's Development*.
5. Himanshu, 2010,—Towards New Poverty Lines for India, *Economic and Political Weekly*, January.

Department of Political Science			
Year/Semester	1 st Year/2 nd Semester	Course Category	MDC
Course Code	23MDC305	Course Title	Electoral Literacy in India
Continuous Evaluation : 40		End Semester Examination : 60	
Prerequisite: Nil		L T P : 3 0 0	Credits: 3

Course Objectives (CO) - The Course is designed with the following objectives:

1. To know the meaning and nature of the electoral democracy in India
2. To discuss electoral institutions in India
3. To understand the procedural aspect of elections in India
4. To grasp the significance of elections and electoral aspects of democracy, the electoral model code of conduct, issues, and challenges in India's democracy.

Course Learning Outcomes (CLO) – The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

1. The student shall be able to understand the meaning, definition, and significance of elections in India.
2. The course will help the students to analyse and understand electoral institutions, and their role and functions in the conduct of free and fair elections.
3. The student shall be able to know the party system of India.
4. The course will help the student understand issues and challenges in conducting free and fair elections in India.

Mapping Matrix between Course Objectives and Course Learning Outcomes:

Course Learning Objectives (Cos)	Course Learning Outcome (CLOs)				
	CLO1	CLO2	CLO3	CLO4	CLO5
CO1					
CO2					
CO3					
CO4					

COURSE CONTENTS:

UNIT-1: Elections in India

- Suffrage, Types, and Methods of Elections
- Parliamentary elections: COk Sabha & Rajya Sabha
- Presidential Elections
- State Legislative Assembly Elections
- Local Body Elections

UNIT-2: Electoral Institutions

- Election Commission (EC)

- State Election Commission
- Constitution: Part-15

UNIT-3: Political Parties in India

- One-party, Two Party, Multi-party system
- Model Code of Conduct, Party Funding, and Campaign

UNIT-4: Elections: Issues and Challenges

RECOMMENDED TEXTBOOKS:

1. Subhash C. Kashyap, Our Political System, 2nd, National Book Trust, India, 2008, ISBN: 8123752520
2. D. D. Basu, Introduction to The Constitution Of India, 26th Edition, Lexis Nexis, ISBN: 978-9388548861
3. Bidyut Chakrabarty, Rajendra Kumar Pandey, Indian Government and Politics, Sage Text, ISBN: 8132100581

FURTHER SUGGESTED READINGS:

1. Sanjay Kumar, Elections in India: An Overview, 1st, Routledge, ISBN: 9781032033136
2. <https://eci.gov.in/>
3. <https://www.COkniti.org/>
4. Websites of State Election Commission
5. NCERT, Chapter-3 Indian Constitution at Wor

Interior Design	
Course Code: 23MDC404	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P: 3 0 0	Course Title: Interior Decoration
Prerequisite: NIL	

Course Objectives: -

- CO 1: To explain and introduce to basics of Interior design and décor.**
- CO 2: To explain and inform about elements and principles of design.**
- CO 3: To explain the Importance of window and lightings in enhancing décor of the interiors.**
- CO 4: To introduce and explain about the use of furniture and accessories in Interior décor and design.**
- CO 5: To explain the use of different wall and floor finishes in enhancing the décor and design.**

Course Outcomes: -

- CLO 1: At the end of the first unit students would be able to understand the basics of Interior design and décor.**
- CLO 2: At the end of the Second unit students would be able to utilize elements and principles of design in décor enhancement.**
- CLO 3: At the end of the third unit students would be able to understand the Importance of window and lightings in enhancing décor of the interiors.**
- CLO 4: At the end of the fourth unit students would be able to explain and use furniture and accessories in Interior décor and design.**
- CLO 5: At the end of the fifth unit students would be able to use different wall and floor finishes in enhancing the décor and design**

MAPPING MATRIX OF COURSE OBJECTIVES (COs') AND COURSE LEARNING OUTCOMES (CLOs)

CLO	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5
CO 1					
CO 2					
CO 3					
CO 4					
CO 5					

COURSE CONTENTS

➤ Unit-1

INTRODUCTION TO INTERIOR DESIGN AND DÉCOR: Beauty, Expensiveness, Functionalism, Common terms used in décor

➤ Unit - 2

ELEMENTS AND PRINCIPLES OF DESIGN: Line, form, texture and colour (basic elements), The concept of light, space and pattern as elements, Colour Associations, Understanding colour, The colour wheel, Properties of colour –Warm /Cool, Advancing/Receding, Heavy/Light, Earthy /Acid, Additive and Subtractive colour, Colour Perception, Physical and psychological effect of colour, Colour Balance, Colour Emphasis, Colour Contrast, Effect of light on colour, Choice of colours, Planning a colour scheme of a room, Harmony, Balance, Scale and Proportion, Rhythm, Emphasis

➤ Unit- 3

WINDOW AND LIGHTINGS: The purpose of a window, Types of windows, The importance of suitable window treatments, Selecting fabrics for curtains (practical and visual), Curtain headings, Calculating fabric requirements, Types of window treatments. LIGHTINGS: Introduction to lighting Lighting, Levels- Lux and Lumen, Categories- Ambient, Task, Accent, Exterior and Emergency, The importance of a good lighting system, Artificial lighting -Tungsten, Fluorescent, Discharge, CFL, Halogen., Types of light distribution-direct, semi direct, indirect, diffused, Methods of lighting- architectural and non-architectural, Lighting in various areas of the hotels, Light fittings, Selection of lighting systems and energy check list

➤ Unit- 4:

FURNITURE AND ASSESSORIES: The functional aspect-furniture elements, structure, finish, upholstery, The decorative aspects- styles of furniture, Furniture items placed in the guestrooms, Standard sizes of furniture, Furniture arrangement—Guidelines. ACCESSORIES: Various types of accessories and their guidelines, Flower Arrangement as an accessory Indoor Plants as an accessory.

➤ Unit- 5:

WALL AND FLOOR FINISHES:

WALL FINISHES: Paint, Wallpaper, Fabric, Laminates Wood panelling, Ceramic Tiles, Glass, Textured.

FLOOR FINISHES: Ceramic, Marble Terrazzo, Granite, Concrete, Wood, Resilient (Vinyl, Asphalt, Rubber, Linoleum), Carpets (Types and Maintenance)

TEXT BOOK:

The Handbook of Interior Design by Jo Ann Asher Thompson, Nancy H.

REFERENCE BOOKS:

The Interior Design Reference & Specification Book: Everything Interior Designers Need to Know Every Day, by Chris Grimley, Linda O'Shea, and Mimi Love

The Interior Design Handbook by Frida Ramstedt

Residential Interior Design: A Guide To Planning Spaces by Courtney Nystuen and Maureen Mitton

ARDUINO BASED PROGRAMMING	
Course Code: 23MDC205	Internal Examination: -- marks
Credits: 3	External Examination: -- marks
L T P : 3 0 0	Course Category: Multi-Disciplinary Course
Prerequisite:	

Course Objectives (CO) - The Course is designed with the following objectives:

1. Provide students with a comprehensive understanding of the Arduino platform, its components, and its applications in various fields.
2. Introduce students to programming using the Arduino IDE, covering topics like variables, data types, control structures, functions, and basic debugging.
3. Teach students how to interface various sensors with Arduino, enabling them to gather real-world data.
4. Enable students to control output devices such as LEDs, motors, and servos using Arduino, expanding their ability to create interactive projects.
5. Guide students through the process of conceptualizing, designing, and implementing Arduino-based projects, fostering creativity and problem-solving skills.

Course Learning Outcomes (CLO) – The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to

1. Demonstrate a clear understanding of Arduino's architecture, components, and capabilities.
2. Write, upload, and debug Arduino sketches using the Arduino IDE.
3. Integrate various sensors and retrieve data from the physical world.
4. Control actuators to produce desired physical effects or actions.
5. Design and complete Arduino-based projects from ideation to implementation.

Mapping Matrix between Course Objectives and Course Learning Outcomes:

	CO1	CO2	CO3	CO4	CO5
CLO1	●				
CLO2		●			
CLO3			●		
CLO4				●	
CLO5					●

COURSE CONTENTS:

Unit -1: Introduction

Brief introduction on embedded system, what is Arduino, types of Arduino and their strengths, installation of Arduino IDE and its interface with hardware, Arduino circuit, First program on LED Blinking: debug the code, restart the program in different ways, basic simulation.

UNIT-3: Programming Basics for Arduino

Introduction to IDE, Variables, Data Types, Functions, Scope, Conditions, Loops, Arrays, Various programming languages, selection of programming language, need of Flow Diagram.

UNIT-3: Sensors

Basic working techniques of following sensors: Infra-Red sensor, Ultrasonic sensor, Color sensor, Light sensor, Sound sensor, DTMH module, DHT module, Selection of sensor, how to interface with sensors, how to design analog/digital sensors, applications of sensors.

Unit -4: Interfacing to Actuators

What are Actuators, DC Motor, DC geared Motor, Stepper Motor, Servo Motor, Driving system, types of driving system, H-Bridge Motor Driver, Advanced Motor Driver, Push Button, Potentiometer, RGB.

Unit -5: Project

LED Blinking, Running LEDs, Sand Glass filling of LEDs, Seven segment display, DC motor driving, Blue-tooth based remote control car, Line follower, obstacle avoider/path finder etc.

RECOMMENDED TEXT BOOKS:

1. Exploring Arduino: Tools and techniques for Engineering wizardry by Jeremy Blum, 2nd edition, Wiley.
2. Make: Getting Started with Arduino, 3e: The Open Source Electronics Prototyping Platform, by Massimo Banzi and Michael Shiloh, 3rd edition.

REFERENCE BOOKS:

1. Arduino for Dummies by John Nussey, 2nd edition.
2. Arduino Cookbook: Recipes to Begin, Expand, and Enhance Your Projects, Brian Jepson, Michael Margolis and Nicholas Robert Weldin, 3rd edition, O'Reilly publisher.

Introduction to Bioengineering

Total Contact Hours - 30

Credit: 2

Prerequisite: Nil

Subject code: 23MDC203

AIM:

To engage and motivate outstanding engineering students to build their career in interdisciplinary areas. To utilize the technologies in solving healthcare problems.

COURSE OBJECTIVES (CO):

1. To familiarize the students with the different biological concepts.
2. To impart an understanding about bioengineering.
3. To gain a better understanding of different imaging systems and AI
4. To comprehend the significance of the bioengineering application in various fields.
- 5.

COURSE LEARNING OUTCOMES (CLO):

1. Improve biological concepts using an engineering approach.
2. Explain the importance of biological phenomenon in bioengineering.
3. Learn to understand the different imaging system and applications of AI.
4. Able to understand the application of living organisms in various fields.

MAPPING MATRIX:

CO's \ CLO's	01	02	03	04
01	✓			
02	✓	✓		
03			✓	
04				✓

Unit 1: Human Physiology & Biomolecules: Biomolecules: Molecules of the life – Monomeric unit and polymeric structure – sugar, starch and cellulose, Amino acid and proteins; Nucleotides and DNA/RNA; introduction to organ systems.

Unit 2: Introduction to Bioengineering: Fundamental similarities and difference between science and engineering- human as the best machines, comparison between eye camera, flying of a bird and aircraft. Bioengineering (production of artificial limbs, joints and other parts of body).

Unit 3: Basic Medical Imaging & Data Science: MRI, Ultrasound, application of AI in health care. Biological concepts applied in data science.

Unit 4: Application of Bioengineering: Applications of bioengineering in Agriculture, Medicine (vaccine production), Environment (sewage treatment), superbug, Basics of biosensors and biochips.

TEXT BOOKS:

1. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
2. Biology : a Gopal approach Campbell , N.A Reece, J.B Urry ,Lisa; Cain M.L Wasserman , S.A Minorsky,P.VJackson, R.B Person Education ltd.

REFERENCE BOOKS:

1. Joseph Bronzino, "Biomedical Engineering and Instrumentation", PWS Engg . , Boston.
2. Principles of Biochemistry(V Edition) by Nelson, D.L; and Cox, M.M.W.H Freeman and company.
3. J.Webster, "Bioinstrumentation", Wiley & Sons. 3. Joseph D.Bronzino, "The Biomedical Engineering handbook", CRC Press.
4. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd.,1991.

**List of Ability Enhancement Courses (AEC) offered to
Four Year B.Sc. Food Technology programme in the Department of Food
Technology w.e.f. Academic Year 2024-25**

S. No.	Code	Course Name	L	T	P	Credits
1	24AEC101	Functional English I	2	0	0	2
2	24AEC201	Functional English II	2	0	0	2
3		Hindi-I [23HIN101 I]/ German-I / French-I	2	0	0	2
4		Hindi-II [23HIN101 II]/ German- II / French-II	2	0	0	2

Department of English			
Year/Semester		Course Category	AEC
Course Code	24AEC101	Course Title	Functional English-I
Continuous Evaluation : 40		End Semester Examination : 60	
Prerequisite: Nil		L T P : 2 0 0	Credits: 2

Course Objectives (CO) - The Course is designed with the following objectives:

1. To enhance and strength communication skills in English Language
2. To facilitate holistic and integrated development of LSRW skills - Listening, Speaking, Reading Writing abilities
3. To understand a wide range of lexical and prosodic features of the language.
4. To grasp the significance of critical reading-writing capacities and professional communication skills in the students.

Course Learning Outcomes (CLO) – The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

1. Demonstrate comprehensive and fluent communication in standard English – written & spoken
2. Apply the skills to engage in group discussions, debate, deliver speeches and suchothers.
3. Analyse texts on various parameters expected/demanded during different situationsand circumstances
4. Integrate the knowledge and skills to prepare basic/preliminary research documents,official documents and deliver presentations on a given topic

Mapping Matrix between Course Objectives and Course Learning Outcomes:

Course Educational Objectives (CEOs)	Course Learning Outcomes (CLOs)			
	CLO 1	CLO 2	CLO 3	CLO 4
CEO 1	√			
CEO 2		√		√
CEO 3			√	√
CEO 4	√	√	√	√

COURSE CONTENTS:

Unit – I : Speaking Skills

English Communication - Aims & Objectives - Basics of Communication - Barriers to Communication - Non-Verbal Communication - Active Listening - Effective Speaking – Speech - Art of Public Speaking – Pronunciation - Stress & Intonation in English – Debate

– Conversations-Presentation Skills- Group Discussions – Interviews - Formal Presentations

Unit-II : Listening Skills-

Types of Listening-Top Down and Bottom-Up Approach- Signposting in Listening-Global listening Vs local Listening - Interpreting information over spoken language-Understanding tone and intention in spoken language-Listening to understand information and responding to questions asked

Unit – III: Effective Reading

Reading strategies (Skimming, Scanning, Inferring) –Predicting and responding to content – Speed Reading – Note Making – Use of Extensive reading texts – Vocabulary Extension - Guessing from Context –

Unit – IV: Writing Skills

Formal Letters, Memos & Email – Discourse Markers- - Art of Condensation - Report Writing - Article Writing - Writing Proposals – Preparing Minutes of Meeting.

TEXT BOOK

1. Swan, Michael. *Practical English Usage*. New Delhi: Oxford University Press, 2005.
2. Murphy, Herta A. *Effective Business Communication*, New Delhi: McGraw Hill, 2008.

REFERENCE BOOK AND OTHER MATERIALS

1. Koneru, Aruna. *Professional Speaking Skills*. New Delhi: Oxford University Press, 2015.
2. Sanjay Kumar and Pushp Lata. *Technical Communication*, New Delhi: Oxford University Press, 2008.
3. Koneru, Anuna. *Professional Communication*, New Delhi: McGraw Hill Pvt. Ltd, 200.
4. Rizvi, M. Ashraf. *Effective Technical Communication*, New Delhi: McGraw Hill, 2018.
5. Barun K. Mitra, *Personality Development and Soft Skills*, Oxford University Press, New Delhi, 2011.

Department of English			
Year/Semester		Course Category	AEC
Course Code	24AEC201	Course Title	Functional English-II
Continuous Evaluation : 40		End Semester Examination : 60	
Prerequisite: Nil		L T P : 2 0 0	Credits: 2

Course Objectives (CO) - The Course is designed with the following objectives:

1. To know the use of descriptive, narrative, and expository modes of writing.
2. To discuss how to recognize and correct basic grammatical errors, specifically errors of subject/verb agreement, verb tense, pronoun agreement, usage of prepositions and articles.
3. To grasp the significance of academic and idiomatic vocabulary.
4. To understand, read, analyze, and respond to assigned readings with an understanding of structure and mechanics.

Course Learning Outcomes (CLO) – The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

5. Illustrate the stylistic conventions of academic writing.
6. Analyse readings critically by evaluating the various contexts (social, historical, or personal) surrounding and underpinning each text.
7. Evaluate various texts while identifying and highlighting their main ideas and messages.
8. Develop independent perspectives and arguments via persuasive support and successful incorporation of research thus developing their own voice and creating a balance between their own voice and source summaries.
9. Assess counter arguments in order to present a more compelling argument.

Mapping Matrix between Course Objectives and Course Learning Outcomes:

Course Objectives (COs)	Course Learning Outcomes (CLOs)				
	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5
CO 1	✓				
CO 2			✓	✓	
CO 3		✓			
CO 4				✓	✓

CONTENTS

Unit 1: Reading strategies

Understanding the basic elements of academic writing: summary, analysis, close reading, claim, evidence and argument, Types of academic writing (descriptive, analytical, persuasive, and critical), Skimming, Scanning and Note Making for Academic Writing

Unit 2: Paragraph Writing

Structure of the paragraph, Use of coherence and cohesion-topic sentence for paragraph
Abstract Writing, Fine tuning title and finalizing keywords, The art of summarizing

Unit 3: Writing Research Proposal

Selecting Research topic, Framing research problem and literature review
Writing Research Proposal – Writing Research questions and Hypothesis
Review of Research paper -Writing Research Proposal – Methodology and conclusion
Critical Review, Conclusions, and Implications -Paraphrasing and Explaining -Finalizing and reviewing Research proposal -Controlling language

Unit 4: Referencing, Citation and Proof Reading

Bringing it all together

TEXT BOOKS

1. Nzanmongi Jasmine Patton et al. *A Handbook For Academic Writing and Composition*. New Delhi: Pinnacle Learning, 2014.
2. Christine Raisanen and Lennart A. Bjork. *Academic Writing: A University Writing Course*. Lund: Studentlitteratur, 2003.
3. Janet Giltrow, Richard Gooding, & Daniel Burgoyne et al. *Academic Writing: An Introduction*. Peterborough, Ontario: Broadview Press, 2005.

FURTHER SUGGESTED READINGS AND OTHER RESOURCES

1. Liz Hamp-Lyons and Ben Heasley. *Study Writing: A Course in Writing Skills for Academic Purposes*. Cambridge: CUP, 2006.
2. Renu Gupta. *A Course in Academic Writing*. New Delhi: Orient Black Swan, 2010.
3. Ilona Leki. *Academic Writing: Exploring Processes and Strategies* (2nd Ed.). New York: CUP, 1998.
4. Gerald Graff and Cathy Birkenstein. *They Say/I Say: The Moves That Matter in Academic Writing*. New York: Norton, 2009.
5. John Eastwood. *Oxford Practice Grammar*. Oxford: OUP, 2005.
6. Michael Wallace. *Study Skills*. Cambridge: CUP, 2004.

GERMAN LANGUAGE-I	
Course Code: 24FLGR301	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination: 60 Marks
L T P: 2 0 0	Course Type: AEC
Prerequisite: Nil	

COURSE OBJECTIVE (CO)

The objective of this course is to impart basic knowledge of German language to the students. The course intends to develop an ability for discussions, debates etc. Overall, the objective is to facilitate comprehension of the legal concepts better and develop the ability to write effective propositions in legal contexts.

CO1: To develop oral and written skills of understanding, expressing and exchanging information in German language.

CO2: To develop awareness of the nature of language and language learning.

CO3: To develop the ability to construct sentences and frame questions.

CO4: To provide German language as a competitive edge in career choices.

CO5: To know some of the aspects of the culture of the countries where German language is spoken.

COURSE LEARNING OUTCOMES (CLO)

After completion of the course the students will have the ability to:

CLO1: Read and write short, simple texts.

CLO2: Understand and take part in short, simple conversations using the skills acquired.

CLO3: Know some aspects of the culture of the countries where the German language is spoken.

CLO4: Read a text and/or e-mail during any employment.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE LEARNING OUTCOME COURSE OBJECTIVES	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓	✓		
CO02	✓			
CO 03		✓		
CO 04				✓
CO5			✓	

COURSE CONTENTS

UNIT 1

- Informationen über Deutschland
- Buchstaben, die Aussprache, Wochentage, Monate
- Begrüßung, Wie geht's?, sich vorstellen, Zahlen, W-Familie

UNIT 2

- Über Personen sprechen (Name, Herkunft, Adresse, Telefonnummer, Alter, Beruf, Familie),
- Länder und Sprachen, Berufe, Satzstruktur, Familienmitglieder, Farben, Wetter
- Personalpronomen, Konjugation von Verben (sein, haben, heißen, wohnen, kommen, machen, lernen, arbeiten, studieren)

UNIT 3

- Nomen (Genus, Singular-Plural), Bestimmter Artikel, Unbestimmter Artikel, Negation, W-Frage, Ja-Nein- Frage
- Über Sachen sprechen
- Sachen des Alltagslebens(Obst und Gemüse, Schulsachen), Haushaltswaren, Adjektive

UNIT 4

- Akkusativ, Artikel und Personalpronomen im Akkusativ
- Unregelmäßige Verben
- Kleidung, Lebensmittel
- Leseverstehen

TEXTBOOKS:

- Netzwerk Neu A1 (Kursbuch+Arbeitsbuch)

Dengler, Stefanie, et al. Netzwerk neu: A1. Ernst Klett Sprachen., 2019.

REFERENCE BOOKS:

- Rusch, Paul, Helen Schmitz, and Humorvolle Zeichnungen. "Einfach Grammatik." *Übungsgrammatik Deutsch A1 bis B 1* (2012): 329-330. Einfach Gramatik, Paul Rusch
- Carlson, Antje. "Lemcke, Christiane, Lutz Rohrmann, and Theo Scherling. Berliner Platz 1 Neu--German for Beginners." *Die Unterrichtspraxis/Teaching German* 44.1 (2011): 46-49.
- Dallapiazza, Rosa-Maria, Eduard Von Jan, and Sabine Dinsel. *Tangram: Deutsch als Fremdsprache. Lehrerbuch*. Vol. 1. Hueber Verlag, 1998.
- Wolfgang Hieber: Lernziel Deutsch, Teil 1, Max Hueber Verlag, 1984.

WEBSITE PAGES:

- <https://www.nthuleen.com/teach.html>

GERMAN LANGUAGE-II	
Course Code: 23FLGR401	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination: 60 Marks
L T P: 2 0 0	Course Type: AEC
Prerequisite: German-I	

COURSE OBJECTIVE (CO)

The objective of this course is to impart basic knowledge of German language to the students. The course intends to develop an ability for discussions, debates etc. Overall, the objective is to facilitate comprehension of the legal concepts better and develop the ability to write effective propositions in legal contexts.

CO1: To develop oral and written skills of understanding, expressing and exchanging information in German language.

CO2: To develop awareness of the nature of language and language learning.

CO3: To develop the ability to construct sentences and frame questions.

CO4: To provide German language as a competitive edge in career choices.

CO5: To know some of the aspects of the culture of the countries where German language is spoken.

COURSE LEARNING OUTCOMES (CLO)

After completion of the course the students will have the ability to:

CLO1: Read and write short, simple texts.

CLO2: Understand and take part in short, simple conversations using the skills acquired.

CLO3: Know some aspects of the culture of the countries where the German language is spoken.

CLO4: Read a text and/or e-mail during any employment.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE LEARNING OUTCOME CLO 01	CLO 02	CLO 03	CLO 04	
COURSE OBJECTIVES	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓	✓		
CO02	✓			
CO 03		✓		
CO 04				✓
CO 05			✓	

COURSE CONTENTS

UNIT 1

- Zeitangabe, Tageszeit, Uhrzeit, der Tagesablauf

- Präpositionen mit Akkusativ, Ordinalzahlen
- Wegbeschreibung, die Himmelsrichtungen
- Die Gebäude, Verkehrsmittel

UNIT 2

- Das Haus
- Modalverben
- Essen und Trinken, Maßeinheiten, Einkaufen
- Körperteile und Krankheiten

- Futur

UNIT 3

- Dativ, Artikel und Personalpronomen im Dativ
- Präpositionen mit Dativ, die Wechselpräpositionen
- Possessiv-Artikel, die Konnektoren
- Schreiben Teil 1

- Trennbare Verben,

UNIT 4

- Schreiben Teil 2 (E-Mail Schreiben)
- Perfekt
- Vergangenheit erzählen, Das Wochenende, Lebenslauf

TEXTBOOKS:

- Netzwerk Neu A1 (Kursbuch+Arbeitsbuch)

Dengler, Stefanie, et al. Netzwerk neu: A1. Ernst Klett Sprachen., 2019.

REFERENCE BOOKS:

- Rusch, Paul, Helen Schmitz, and Humorvolle Zeichnungen. "Einfach

Grammatik." *Übungsgrammatik Deutsch A1 bis B 1* (2012): 329-330. Einfach Grammatik, Paul Rusch

- Carlson, Antje. "Lemcke, Christiane, Lutz Rohrmann, and Theo Scherling. Berliner Platz 1 Neu--German for Beginners." *Die Unterrichtspraxis/Teaching German* 44.1 (2011): 46-49.

● Dallapiazza, Rosa-Maria, Eduard Von Jan, and Sabine Dinsel. *Tangram: Deutsch als Fremdsprache. Lehrerbuch*. Vol. 1. Hueber Verlag, 1998.

- Wolfgang Hieber: Lernziel Deutsch, Teil 1, Max Hueber Verlag, 1984.

WEBSITE PAGES:

- <https://www.nthuleen.com/teach.html>

FRENCH LANGUAGE -I

Course Code: 24FLFR301	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination: 60 Marks
LTP: 2 0 0	Course Type: AEC
Prerequisite: Basic of English Language	

COURSE OBJECTIVE (CO)

1. To develop the ability to construct short and simple sentences.
2. To prepare the students to identify themselves with the culture of the Francophone world.
3. To develop in students a good degree of understanding of syntactic, lexical, grammatical and stylistic features of the French language.
4. To demonstrate differences and diversity of the French speaking world with their own.

COURSE LEARNING OUTCOMES (CLO)

1. After completion of this course, the student will be able to express themselves in French used in daily conversations.
2. The student will be able to recognise and explain cultural artefacts, practices and perspectives of the French speaking world.
3. The student will be able to apply linguistic knowledge to analyse a simple text, identifying its salient features, and thus express themselves effectively in French.
4. The student can contrast the culture of the French speaking world with their own, and hence demonstrate an increased awareness towards its key practices and perspectives.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSELEARNING OUTCOMES (CLOs)

COURSE OBJECTIVES	COURSE LEARNING OUTCOMES			
	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓		✓	
CO 02		✓		✓
CO 03			✓	
CO 04				✓

Course Contents

S. No	Unités	Objectifs de Communication	Grammaire	Lexique
1	La Salutation et l'Introduction	Saluer. Entrer en Contact. S'Excuser. Remercier. Se Présenter/Présenter Quelqu'un.	Pronoms Personnels Sujets. L'Alphabet. Les Articles Indéfinis. Les Verbes en -ER au Présent.	Salutations, Les Nombres. Les Objets de la Classe. La Nationalité.
2	On Partage des Renseignements	Demander de Se Présenter. Donner des Renseignements Personnels.	Etre et Avoir au Présent. Les Verbes en -ER au Présent. Adjectifs de Nationalités. L'Interrogation.	Adjectifs de Nationalité, Métiers et Secteurs Professionnels, Goûts et Intérêts
3	Ma Ville et Mon Quartier	Décrire et Qualifier Ville ou Quartier. Localiser. Demander et Donner Directions.	Verbe Vivre. Articles Définis (Le, la, les). Il y a/ Il n'y a pas. Prépositions. Adjectifs Qualificatifs. Impératif.	Prépositions de lieux. Vocabulaire des Sites. Etablissements et Service de Ville
4	Mes Intérêts et Goûts	Parler de Ses Goûts et de Ses Loisirs. Donner Son Impression sur le Caractère de Quelqu'un.	Présent des Verbes en -ER, et du Verbe Faire. Négation, Adjectifs Possessifs.	Avoir l'air. Loisirs. L'Expression des Goûts. Faire du/ de la. Ma Famille.

a. FRENCH LANGUAGE-II

Course Code: 24FLFR401	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination: 60 Marks
LTP: 2 0 0	Course Type: AEC
Prerequisite: French-I	

COURSE OBJECTIVE (CO)

1. To develop the ability to construct short and simple sentences
2. To prepare the students to identify themselves with the culture of the Francophone world.
3. To develop in students a good degree of understanding of syntactic, lexical, grammatical and stylistic features of the French language.
4. To demonstrate differences and diversity of the French speaking world with their own.

COURSE LEARNING OUTCOMES (CLO)

1. After completion of this course, the student will be able to express themselves in French used in daily conversations.
2. The student will be able to recognise and explain cultural artefacts, practices and perspectives of the French speaking world.
3. The student will be able to apply linguistic knowledge to analyse a simple text, identifying its salient features, and thus express themselves effectively in French.
4. The student can contrast the culture of the French speaking world with their own, and hence demonstrate an increased awareness towards its key practices and perspectives.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE OBJECTIVES	COURSE LEARNING OUTCOMES			
	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓		✓	
CO 02		✓		✓
CO 03			✓	
CO 04				✓

Contents

S. No	Unités	Objectifs de Communication	Grammaire	Lexique
1	Journée Typique	Parler d'habitudes, Exprimer l'Heure, S'Informer sur l'Heure, Moment et Fréquence.	Verbes Pronominaux au Présent. Verbes Aller et Sortir	Heure, Moments de la Journée. Activités Quotidiennes. Adverbs. Météo.
2	Achats	S'informer sur un Produit. Acheter et Vendre un Produit. Donner Son Avis. Parler du temps.	Adjectifs Interrogatifs. Adjectifs Démonstratifs(Ce, cette, ces). Genre et Nombre. Verbe Prendre.	Vêtements. Couleurs. Fruits et Légumes.
3	Alimentation	Parler des Plats et des Aliments. Commander un Menu dans un Restaurant. Situer une Action dans le Futur	Future Proche: Aller +Infinitif. Articles Partitifs(du/de la/des/d'). Pronoms COD. Future.	Aliments. Vocabulaire des Quantités.
4	Expérience Vécue	Parler du Passé. Parler d'Expériences. Parler de Ce que Nous Savons Faire.	Passé Composé. Imparfait	Verbes Savoir, Pouvoir et Connaitre. Adjectifs Qualificatifs. Vocabulaire des Savoirs et Compétences. Récit de Vie.

TEXT BOOK

- Version Originale 1, Livre de l'élève: Denyer M. & Agustin Garmendia A. & Olivieri M L L., éd. Maisons des Langues, Paris. 2013.

REFERENCE BOOKS

- Alter Ego 1, Livre d'élève, Berthet A. & Hugo C. & Kizirian M. V. & Sampsonis B. & Waendendries M., éd Hachette, Paris, 2006.
- Connexions 1, Loiseau Y. & Mérieux R., éd. Didier, Paris, 2004.
- Le Nouveau Sans Frontiers, Vol. 1, P. Dominique, J. Girardet et al, CLE International, Paris, 2013.
- Le Robert & Nathan Conjugation, Paperback, Le Robert Nathan, 2011.

**List of Value Added Courses (VAC) offered to
Four Year B.Sc. Food Technology programme in the Department of Food
Technology w.e.f. Academic Year 2024-25**

S. No.	Code	Course Name	L	T	P	Credits
1	23VAC102	Indian Constitution & Polity	2	0	0	2
2	23VAC101	Environment Protection & Sustainable Development	2	0	0	2
3	23VAC103	Sports, Yoga & Fitness	0	0	4	2
4	25VAC201	Environmental Management & legislation	1	0	1	2

DEPARTMENT OF LAW			
Programme: Undergraduate program			
Year/Semester		Course Category	Value Added Course (VAC)
Course Code	23VAC102	Course Title	Indian Constitution & Polity
Continuous Evaluation: 30		End Semester Examination: 70	
Prerequisite: Nil		L T P : 2 0 0	Credits: 2

Course Objectives (CO) - The Course is designed with the following objectives:

1. To acquaint the students with the fundamental concepts of democracy, diversity and the Constitution.
2. To make students understand the functioning of the three wings of the State
3. To make the students appreciate the purpose of decentralised administration under the Constitution and its functioning
4. To make students analyse and discuss various rights and duties under the Constitution of India

Course Learning Outcomes (CLO) – At the end of this course, the learners are expected to:

1. Explain the concept of democracy, diversity and the Constitutional Values
2. Describe the functioning of the three wings of the State
3. Sketch the functioning of decentralised administration under the Constitution of India and appreciate the political dimensions.
4. Examine the scope of various rights and duties under the Constitution of India.

MAPPING COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE OBJECTIVES (COs)	COURSE LEARNING OUTCOMES (CLOs)			
	CLO1	CLO2	CLO3	CLO4
CO1	√			
CO2		√		
CO3			√	
CO4				√

COURSE CONTENT

UNIT 1

DEMOCRACY, DIVERSITY AND THE CONSTITUTION

- Concept of democracy and importance of right to vote
- Electoral Politics
- Concepts of diversity and discrimination on the grounds of gender, religion and caste
- Concept of democratic government
- Constitution design and salient features

- Preamble to the Constitution of India

UNIT 2

THE THREE WINGS OF THE STATE

- The definition of State in Constitution of India
- Parliament, the State legislature and the making of laws
- Concept of cooperative federalism
- The Executive and Administration
- Role of Governor and the President of India
- The Judiciary

UNIT 3

LOCAL GOVERNMENT AND ADMINISTRATION

- Panchayati Raj System
- Rural and Urban administration
- Social and Economic Justice for the marginalised
- Directive Principles of State Policy

UNIT 4

RIGHTS AND DUTIES

- Fundamental Rights (Part III of the Constitution)
- Protection of Fundamental Rights – Writ petitions in High Court and Supreme Court of India
- Fundamental Duties
- The concept of Fraternity and secularism
- Public utilities and privatization

RECOMMENDED TEXT BOOKS:

1. J.N. Pandey, *Constitutional Law of India*, 59th Ed. (2022) Central Law Agency
2. *The Constitution of India*, Eastern Book Company (2022) – Bare Act with complete legislative history

FURTHER SUGGESTED READINGS:

1. M.P. Jain, *Indian Constitutional Law* (8th Ed.) 2018 Lexis Nexis
2. M.P. Singh, *V.N. Shukla's Constitution of India*, 14th Ed (2022), reprint 2023
3. H.M. Seervai, *Constitutional Law of India* (4th Ed., 2008), latest reprint 2023 Law & Justice Publishing

Department of Environmental Sciences			
Programme: Undergraduate program			
Year/Semester		Course Category	Value Added Course (VAC)
Course Code	25VAC101	Course Title	Environmental Protection & Sustainable development
Continuous Evaluation:40		End Semester Examination:60	
Prerequisite: Nil		L T P :2 0 0	Credits:2

COURSE EDUCATIONAL OBJECTIVES (CEOs)

The Course is designed with the following objectives:

1. To know about historical context of man environmental Interactions
2. To understand the concept of natural resources and sustainable development
3. To develop deep understanding regarding environmental issues
4. To develop deep understanding of biodiversity and its conservation
5. To develop the understanding of pollution, its causes, and their effects

COURSE LEARNING OUTCOMES (CLOs)

The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

1. Appreciate the historical context of human interaction with environment .
2. Gain comprehensive knowledge regarding natural resources, sustainable development, challenges, and global strategies.
3. Develop a critical understanding of environmental issues of concern
4. Gain comprehensive knowledge about biodiversity and its conservation
5. Analyse the environmental pollution and sensitize themselves to adverse health impacts of pollution.

MAPPING BETWEEN COURSE EDUCATIONAL OBJECTIVES (CEOs) AND COURSE LEARNING OUTCOMES (CLOs)

CEO \ CLO	CLO-01	CLO-02	CLO-03	CLO-04	CLO-05
CEO-01	✓				
CEO-02		✓			
CEO-03			✓		
CEO-04				✓	
CEO-05					✓

COURSE CONTENTS

Unit-1

Humans And Environment

(6 Hours)

The man-environment interaction: Humans as hunter-gatherers; Mastery of fire; Origin of agriculture; Industrial revolution and its impact on the environment; Population growth and natural resource exploitation; Global environmental change.

Environmental Ethics and emergence of environmentalism: Anthropocentric and eco-centric perspectives (Major thinkers); The Club of Rome- Limits to Growth; UN Conference on Human Environment 1972; World Commission on Environment and Development and the concept of sustainable development; Rio Summit and subsequent international efforts.

Unit-2

Natural Resources & Sustainable Development

(6 Hours)

Natural Resources and their classification. Resources: Forests, Wetlands and their Status and challenges.

Water resources: Types of water resources, issues and challenges; Soil and mineral resources: Important minerals; Environmental problems due to extraction of minerals, Soil as a resource and its degradation. Energy resources: renewable and non-renewable sources of energy.

Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges, and strategies for SDGs. Various ways to live in sustainable manner.

Unit 3

Environmental Issues: Local, Regional and Global

(6 hours)

Environmental issues and scales: Concepts of micro-, meso-, synoptic and planetary scales; Temporal and spatial extents of local, regional, and global phenomena.

Pollution: Impact of sectoral processes on Environment; Types of Pollution- air, noise, water, soil, thermal, radioactive ;municipal solid waste, hazardous waste; transboundary air pollution; acid rain; smog.

Land use and Land cover change: land degradation, deforestation, desertification, urbanization.

Biodiversity loss: past and current trends, impact.

Global change: Ozone layer depletion; Climate change. Disasters – Natural and Man-made (Anthropogenic)

Unit-4

Conservation of Biodiversity and Ecosystems

(6 Hours)

Introduction: Definition, History, Components and importance of Biodiversity, Levels (alpha, beta and gamma) and types of biodiversity (species, genetic and ecosystem); Biodiversity in India and the world; Biodiversity hotspots; Threats to loss of biodiversity (natural and anthropogenic)

Ecosystem, Major ecosystem types in India and their basic characteristics; Ecosystem services- classification and their significance, Ecosystem restoration.

Major biodiversity conservation approaches: in-situ and ex-situ conservation.

Environmental conservation organization (CITIES, IUCN, WWF, MAB), Bioprospecting.

Convention on Biological Diversity (CBD); The Biological Diversity Act, 2002.

Unit-5

Environmental Pollution and Health

(6 Hours)

Air pollution: Types, Sources and classification of air pollution; Effects of air pollution on plants, animals and humans, National Ambient Air Quality Standards (NAAQS) and Criteria pollutants.

Water pollution: Types, Sources and classification of water pollution; Effects of water pollution on plants, animals and humans, National Water Quality Standards.

Soil pollution: Types and sources of pollution; Effects of soil pollution on plants, animals and humans.

Noise pollution: Definition of noise; Unit of measurement of noise pollution; Sources of noise pollution; Noise standards; adverse impacts of noise on human health.

RECOMMENDED TEXTBOOKS:

1. Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.
2. Headrick, Daniel R. (2020) Humans versus Nature- A Global Environmental History, Oxford University Press.
3. Masters, G. M., & Ela, W. P. (2008). Introduction to environmental engineering and science Englewood Cliffs, NJ: Prentice Hall.
4. Singh, J.S., Singh, S.P. & Gupta, S.R. 2006. Ecology, Environment and Resource Conservation. Anamaya Publications <https://sdgs.un.org/goals>
5. Jackson, A. R., & Jackson, J. M. (2000). Environmental Science: The Natural Environment and Human Impact. Pearson Education.
6. Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press
7. Bhagwat, Shonil (Editor) (2018) Conservation and Development in India: Reimagining Wilderness, Earthscan Conservation and Development, Routledge.
8. Environmental Studies for Undergraduate Courses by Erach Bharucha, UGC New Delhi
9. Biodiversity: Perception, peril and preservation, Maiti and Maiti

REFERENCE BOOKS:

1. A.K De Environmental Chemistry New age Publisher, 2016.
2. "Ecology & Environment" P D Sharma, Rastogi Publications, 2009.
3. www.ipcc.org; <https://www.ipcc.ch/report/sixth-assessment-report-cycle/>.
4. Central Pollution Control Board Web page for various pollution standards. <https://cpcb.nic.in/standards/>

Department of Environmental Sciences			
Programme: Undergraduate program			
Year/Semester		Course Category	Value Added Course (VAC)
Course Code	25VAC201	Course Title	Environmental Management & legislation
Continuous Evaluation:40		End Semester Examination:60	
Prerequisite: Nil		L T P :1 0 1	Credits:2

COURSE

EDUCATIONAL OBJECTIVES (CEOs)

The Course is designed with the following objectives:

1. To know about climate change and its impact.
2. To develop a critical understanding of the complexity of environmental management.
3. To develop deep understanding how the nations of the world work together for the environment.
4. To Engage students in sustainable and ecofriendly practices

COURSE LEARNING OUTCOMES (CLOs)

The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

1. Gain a comprehensive knowledge of climate change, its science and response measures.
2. Gain comprehensive knowledge regarding environmental management systems.
3. Learn about the major international treaties and our country's stand on and responses to the major international agreements.
4. Gain knowledge regarding the individual role in conservation

MAPPING BETWEEN COURSE EDUCATIONAL OBJECTIVES (CEOs) AND COURSE LEARNING OUTCOMES (CLOs)

CLO \ CEO	CLO-01	CLO-02	CLO-03	CLO-04
CEO-01	✓			
CEO-02		✓		
CEO-03			✓	
CEO-04				✓

COURSE CONTENTS

Unit-1

Climate Change: Impacts, Adaptation and Mitigation

(6 Hours)

Basics of Climate change, Observed climate change over India and Globe (Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Impacts on animal species, agriculture, health).

Natural variations in climate, Anthropogenic climate change from greenhouse gas emissions—past, present and future.

Concept of carbon neutrality, Carbon footprints, Carbon capture and storage, National Clean Air Programme (NCAP), Lifestyle for Environment (LiFE)

Unit-2

Environmental Management

(6 Hours)

Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control.

Environmental management system: ISO 14001

Concept of Circular Economy, Life cycle analysis; Cost-benefit analysis

Environmental audit and impact assessment; Environmental risk assessment Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling /Ecomark scheme

Unit 3

Environmental treaties and legislation

(6 hours)

Major International Environmental Agreements: Convention on Biological Diversity (CBD); Cartagena Protocol on Biosafety; Nagoya Protocol on Access and Benefit-sharing; Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); Ramsar Convention on Wetlands. Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement; India's status as a party to major conventions

Wildlife protection act 1972, Air and water Act. Environmental Protection Act (EPA) 1986. Noise Pollution (Regulation and Control) Rules, 2000; Soil waste management rules ;2016, E-waste management rules;2016, Biomedical Waste Management Rules,2016, National Environmental policy 2006

Unit-4

Case Studies and field Work

(12 Hours)

The students are expected to be engaged in one of the following or similar identified activities.

Field visits to identify local issues, make observations including data collection and prepare a brief report

- Documentation of campus biodiversity or Campus
- Campus environmental management activities such as solid waste disposal, water Management and sanitation, and sewage treatment.
- Participation in plantation drive and nature camps.

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RECOMMENDED TEXTBOOKS:

1. Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.
2. Headrick, Daniel R. (2020) Humans versus Nature- A Global Environmental History, Oxford University Press.
3. Masters, G. M., & Ela, W. P. (2008). Introduction to environmental engineering and science Englewood Cliffs, NJ: Prentice Hall.
4. Singh, J.S., Singh, S.P. & Gupta, S.R. 2006. Ecology, Environment and Resource Conservation. Anamaya Publications <https://sdgs.un.org/goals>
5. Jørgensen, Sven Marques, Erik João Carlos and Nielsen, Søren Nors (2016) Integrated Environmental Management, A transdisciplinary Approach. CRC Press.
6. Jackson, A. R., & Jackson, J. M. (2000). Environmental Science: The Natural Environment and Human Impact. Pearson Education.
7. Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press
8. Environmental law by Dr. P.S. Jaswal Edition: 2021. Reprint:2024
9. Ministry of Environment, Forest and Climate Change (2019) A Handbook on International Environment Conventions & Programmes. <https://moef.gov.in/wp-content/uploads/2020/02/convention-V-16-CURVE-web.pdf>
10. Environmental Studies for Undergraduate Courses by Erach Bharucha, UGC New Delhi

REFERENCE BOOKS:

1. "Ecology & Environment" P D Sharma, Rastogi Publications, 2009.
2. Environmental law by Dr. P.S. Jaswal Edition: 2021. Reprint:2024
3. www.ipcc.org; <https://www.ipcc.ch/report/sixth-assessment-report-cycle/>.
4. Central Pollution Control Board Web page for various pollution standards. <https://cpcb.nic.in/standards/>

Department of Physical Education & Sports			
Programme: Undergraduate program			
Year/Semester		Course Category	Value Added Course (VAC)
Course Code	23VAC103	Course Title	Sports, Yoga & Fitness
Continuous Evaluation: 80		End Semester Examination: 20	
Prerequisite: Nil		L T P : 0 0.4	Credits: 2

Course Objectives (CO) - The Course is designed with the following objectives:

1. To know about the physical body
2. To discuss about improve range of motion, mobility and coordination in body
3. To understand the ways to improve strength, balance and flexibility.
4. To grasp the significance of yoga and sports in fitness
5. To construct environment for individual and community health.

Course Learning Outcomes (CLO)–The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to : (**BLOOM’S TEXONOMY**)

1. Explain the role of yoga and fitness in life.
2. Apply the rules of healthy and fit life
3. Analyse the ways and methods of yoga and sports
4. Recommend the practices of Asanas and different sports
5. Integrate the concept of yoga and sports in all round development of students and beings.

Mapping Matrix between Course Objectives and Course Learning Outcomes: COURSE CONTENTS:

COURSE OBJECTIVES (COs)	COURSE LEARNING OUTCOMES (CLOs)				
	CLO1	CLO2	CO3	CLO4	CLO5
CO1	√				
CO2		√			
CO3			√		
CO4				√	
CO5					√

UNIT-I: Health and Wellness

- Meaning Definition and Importance of Health and Wellness • Dimensions of Health and Wellness
- Role of Exercise in maintaining Health and Wellness
- Stress and Its management through Exercise
- Nutrition for Health and Wellness
- Practical-Exercise for Health and Wellness
 - Warming –Up

- Stretching Exercises
- Strengthening Exercises

- Cardiovascular Exercises
- Flexibility and Agility Exercises → Limbering Down
- Relaxation Techniques (IRT, QRT, DRT etc.)

UNIT-II Yoga and Fitness

- Importance of Yoga and Fitness
- Types and Principles of Asanas
- Fitness Components
- Specific Exercises for Strength, Flexibility, Speed, Agility & Coordinative Abilities
- Yoga, Fitness and Personality
- General Specific Warm up • Aerobics / Zumba Dance
- Asanas
- Recreation for Fitness
- Report preparation, Records and PPT

UNIT-III Sports and Psychology

- Definition of Sports Psychology
- Adolescence-Problems related with Adolescence i.e. physical problems, Peer group Relationship, Career Selection, Drug Abuse, Psychological and Emotion problems
- Importance of Sports Psychology

UNIT-IV Sports and Recreation

- Meaning Definition and Concept of Sports Fitness and Recreation
- Objectives, Characteristics and principles of Sports Fitness and Recreation
- Importance, Purpose, Benefits of Fitness and Recreation
- Types of Recreation
- Recreation through Sports and Games
- Use of Leisure Time Activities and their educational values
- Traditional, Folk and Indigenous Games
- Three Days outdoor camp and Hiking
- Cycling, tie up with District/State Associations
- Visits to Recreational Clubs

TEXT BOOKS:

1. Foundations of Physical Education, Chales A. Bucher
2. Foundations of Physical Eduction, M.L.Kamlesh
3. History and Principles in Physical Education, Dr. Karan Singh
4. Essentials of Physical Education, Dr. Ajmer Singh
5. Foundations of Physical Education, Dr. A.K.Uppal

FURTHER SUGGESTED READINGS:

1. Physical Education, Manu Sood, New SP Books
2. Health the basis of life: Dr. John Maclay
3. Natural Health & Yoga, Brij Bhushan

4. Health Education, S.K.Mangal
5. Essential of Physical Education, Dr. Ajmer Singh & Dr. Bains

**List of Skill Enhancement Courses (SEC) offered to
Four Year B.Sc. Food Technology programme in the Department of Food Technology
w.e.f. Academic Year 2023-24**

Courses on Soft Skills

S. No.	Code	Course Name	L	T	P	Credits
1	23SS151	Effective Communication Skills	0	0	2	1
2	23SS252	Teamwork & Interpersonal Skills	0	0	2	1
3	23SS353	Presentation Skills	0	0	2	1
4	23SS454	Professional Skills	0	0	2	1
5	23AR555	Aptitude & Reasoning	0	0	2	1

Courses on Technical Skills

S. No.	Code	Course Name	L	T	P	Credits
1	23SS101	Digital Literacy & IT Skills	0	0	2	1
2	23SS202	Advanced Excel Skills	0	0	2	1
3	23SS303	Statistical Analysis with SPSS	0	0	2	1
4	23SS404	R language programming	0	0	2	1
5	23SS505	Programming with MATLAB	0	0	2	1

**SOFT SKILLS TRAINING MODULES/COURSES STRUCTURE SEMESTER
WISE IN FACULTY OF SCIENCE & HUMANITIES (UG COURSES)**

SEMESTER – I

Department Of Training & Placement			
Training Cell			
Programme	Faculty of Science & Humanities		
Year / Semester	1 / 1	Course Category	SEC
Course Code	23SS151	Course Title	Effective Communication Skills
Continuous Evaluation: 70	End Term Examination: 30		
Prerequisite: Nil	L T P: 0 0 2	Credits: 1	

Training Objectives (TO): -

- TO1. To define and understand communication and its process.
- TO2. To make student practice on communication skills via LSRW approach via instructing, engaging, assessing and re engaging.
- TO3. To enhance the confidence and motivation of a student by honing his communication skills.

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

- TLO1. To communicate effectively and interact with people with confidence.
- TLO2. To demonstrate and differentiate between various forms of communication.
- TLO3. To apply effective communication skills confidently which a student need to get ahead in job and life.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)			
TRAINING LEARNING OUTCOMES (TLO) → TRAINING OBJECTIVES (TO) ↓	TLO1	TLO2	TLO3
TO1			
TO2			
TO3			

Unit	Course Contents	Student Engagement Activity
Unit-I	Verbal Communication Skills <ul style="list-style-type: none"> • Communication Process & its importance • 7 C's of Communication • Formal & Informal Conversation 	Conversation Cards Activity

	<ul style="list-style-type: none"> Requirements of effective verbal communication 	
Unit-II	Nonverbal Communication Skills <ul style="list-style-type: none"> Importance of nonverbal skills in effective communication Types of nonverbal (body language) skills Barriers to nonverbal communication 	Power of Body Language Activity
Unit-III	Listening Skills <ul style="list-style-type: none"> Role of listening skills in effective communication Barriers to listening Overcoming listening barriers Empathetic listening & avoiding selective listening 	Chinese Whisper Activity
Unit-IV	Reading & Writing Skills <ul style="list-style-type: none"> Types of reading strategies to enhance improve reading skills Types of written communication 	The What IF Activity
Unit- V	Visual Communication <ul style="list-style-type: none"> Types of visual communication Importance of visual communication Picture narration/description technique 	Interpret The Picture Activity

Learning Resources	
Text Book	<i>Communication Skills</i> by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	<i>Personality Development & Communication Skills-1</i> by C B Gupta: Scholar Tech Press,2019.

Pedagogy

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student's engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Effective Communication Skills Course

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Verbal Communication Skills	Speech Activity	15	Written Test	10
II	Non Verbal Communication Skills	Role Play	15		
III	Listening Skills	Oral Assessment / Written Assessment	10		
IV	Reading & Writing Skills		20	Viva	20
V	Visual Communication		10		

SEMESTER –II

Department Of Training & Placement			
Training Cell			
Programme	Faculty of Science & Humanities		
Year / Semester	1 / 2	Course Category	SEC
Course Code	23SS252	Course Title	Teamwork & Interpersonal Skills
Continuous Evaluation: 70		End Term Examination: 30	
Prerequisite: Nil		L T P: 0 0 2	Credits: 1

Training Objectives (TO): -

- TO1. To make the students learn & demonstrate effective teamwork, leadership & interpersonal skills.
- TO2. To equip the students with capability of handling stress and utilization of work time effectively.
- TO3. To make the students understand the importance and application of Emotional Quotient, Critical Thinking & Problem Solving Skills.

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

- TLO1. To be confident working in a team and leading it as well.
- TLO2. To categorize the work and achieve expected performance within the time frame & will be able to adapt himself to work under various kinds of stress and re-energies himself to bounce back from such situations.
- TLO3. To get benefitted from Emotional Quotient in building stronger professional relationships and achieving career and personal goals.
- TLO4. To face complex problems and effectively deal with it in the job due to Critical Thinking & Problem Solving Skills.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)				
Training Learning Outcomes (TLO)→ Training Objectives(TO)↓	TLO1	TLO2	TLO3	TLO4
TO1				
TO2				
TO3				

Unit	Course Contents	Student Engagement Activity
Unit - I	Team Management <ul style="list-style-type: none"> • Team communication & team conflict resolution • Role of a team leader • Team goal setting & understanding team development • Team dynamics & multicultural team activity • Johari Window Model 	Collaborative Working Game Activity
Unit-II	Time Management <ul style="list-style-type: none"> • Time management matrix • Pareto Principle (80/20 rule) • Development process of plan of action 	What You Did Yesterday Activity
Unit-III	Leadership <ul style="list-style-type: none"> • Difference between leadership & management • Types of leadership style • Core leadership skills 	Lead The Blindfolded Activity
Unit-IV	Stress Management <ul style="list-style-type: none"> • Sign of stress & its impact • Types of stress • Techniques of handling stress 	Keeping Cool Activity
Unit - V	Emotional Intelligence <ul style="list-style-type: none"> • Emotional intelligence & emotional competence • Components & behavioral skills of emotional intelligence 	Guess The Emotion Game Activity
Unit - VI	Critical Thinking <ul style="list-style-type: none"> • Types of thinking & Characteristics • Critical thinking standards • Barriers to critical thinking 	Think Pair Share Activity

Learning Resources	
Text Book	<i>Communication Skills</i> by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	<i>Personality Development & Communication Skills-I</i> by C B Gupta: Scholar Tech Press, 2019.(ISBN No. – 9382209131)

Pedagogy

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student's engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Teamwork & Interpersonal Skills

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Team Management	Role Play / Group Activity	10	Written Test	10
II	Time Management		10		
III	Leadership		10		
IV	Stress Management	Assignment	10	Viva	20
V	Emotional Intelligence	Written Test	10		
VI	Critical Thinking		20		

SEMESTER – III

Department Of Training & Placement			
Training Cell			
Programme	Faculty of Science & Humanities		
Year / Semester	2 / 3	Course Category	SEC
Course Code	23SS353	Course Title	Presentation Skills
Continuous Evaluation: 70	End Term Examination: 30		
Prerequisite: Nil	L T P: 0 0 2	Credits: 1	

Training Objectives (TO):-

- TO1. To develop the public speaking skills in the student.
- TO2. To make the students learn and adapt to the necessary etiquettes required working and growing in corporate culture.
- TO3. To make the students learn to speak in a debate session by putting his arguments and making others accept his viewpoint convincingly.

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

- TLO1. To be confident in presenting himself in front of audience.
- TLO2. To become professional in his approach towards work culture.
- TLO3. To enhance the level communication skills while interacting with others.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)			
Training Learning Outcomes (TLO)→ Training Objectives(TO)↓	TLO1	TLO2	TLO3
TO1			
TO2			
TO3			

Unit	Course Contents	Student Engagement Activity
Unit-I	Importance of Presentation Skills <ul style="list-style-type: none"> 4 P's of presentation skills – plan, prepare, practice & present Guidelines for effective presentation 	PPT Presentation Activity
Unit-II	Storytelling Skills <ul style="list-style-type: none"> 4 P's of storytelling skills – people, place, plot & purpose Types of storytelling techniques Importance of storytelling skills 	Start From Where I Stopped Activity
Unit-III	Corporate Culture Etiquettes <ul style="list-style-type: none"> Importance of professional behavior at work place Understand & implementation of etiquettes at work place Importance of values & ethics Types of professional / corporate etiquettes 	Etiquettes Role Play Activity
Unit-IV	Debate / Extempore <ul style="list-style-type: none"> Difference between debate, extempore & group discussion Learning argument /counter argument in debate 	Current Affair Topic Speech Activity
Unit-V	Art of Creating Impression <ul style="list-style-type: none"> Importance of creating first impression 6 ways to master the art of creating impression 	Speech Activity
Unit-VI	Problem Solving <ul style="list-style-type: none"> Types of problems & its solutions Problem solving process & tools 	Think Pair Share Activity

Learning Resources	
Text Book	<i>Communication Skills</i> by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	<i>Personality Development & Communication Skills-I</i> by C B Gupta: Scholar Tech Press, 2019.(ISBN No. – 9382209131)

Pedagogy

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student's engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

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Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Presentation Skills

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Importance of Presentation Skills	Presentation Activity	20	Written Test	10
II	Storytelling Skills	Speech Activity	15		
III	Corporate Culture Etiquettes	Assignment	10		
IV	Debate/Extempore	Speech Activity / Written Activity	15	Viva	20
V	Art of Creating Impression		10		
VI	Problem Solving				

SEMESTER – IV

Department Of Training & Placement			
Training Cell			
Programme	Faculty of Science & Humanities		
Year / Semester	2 / 4	Course Category	SEC
Course Code	23SS454	Course Title	Professional Skills
Continuous Evaluation: 70		End Term Examination: 30	
Prerequisite: Nil		L T P: 0 0 2	Credits: 1

Training Objectives (TO): -

- TO1. To encourage students to learn and apply the effective writing skills.
- TO2. To make the students learn various types of business correspondence letters, cover letters & resume.
- TO3. To encourage students to learn as to how to talk and convince people in GD & interview.
- TO4. To make the students learn to build rapport for building positive relationships professionally at workplace.

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

- TLO1. To understand the importance of professional writing required in workplace.
- TLO2. To explore different formats in resume, cover letters & other business related letters.
- TLO3. To develop knowledge, skills and understanding people in-group and individually.
- TLO4. To apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)				
Training Learning Outcomes (TLO) → Training Objectives(TO)↓	TLO1	TLO2	TLO3	TLO4
TO1				
TO2				
TO3				
TO4.				

Unit	Course Contents	Student Engagement Activity
Unit-I	Email Writing <ul style="list-style-type: none"> • Importance of email communication skills • Basic rules of effective email writing • Structure of email – address, subject, message text, attachments, signature 	Email Practice Activity
Unit-II	Resume Writing <ul style="list-style-type: none"> • Difference between Resume, CV & Bio data • Guidelines of resume writing • Resume preparation of the student 	Resume Making Activity
Unit-III	Letter Writing <ul style="list-style-type: none"> • Types of Letter Writing – Application, Leave, etc. • Cover letter 	Letter Writing Activity
Unit--IV	Group Discussion (GD) <ul style="list-style-type: none"> • Characteristics of GD & subject knowledge • Do's & Don'ts in GD • Strategies of GD • Types of GD 	Group Discussion Practice Activity

Unit-V	Interview Skills <ul style="list-style-type: none"> • Preparation of the interview & company details information • Do's & Don'ts in interview • Types of Interviews • Strategies of interview 	Mock Interview Practice Activity
Unit-VI	Negotiation Skills <ul style="list-style-type: none"> • Importance of negotiation skills • Four phases of negotiation skills • Barriers to negotiation & overcoming it • Win-win negotiation 	Win-Win Activity

Learning Resources	
Text Book	<i>Communication Skills</i> by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	<i>Personality Development & Communication Skills-I</i> by C B Gupta: Scholar Tech Press, 2019.(ISBN No. – 9382209131)

Pedagogy

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student's engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Professional Skills

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Email Writing	Written Assignment	10	Written Test	10
II	Resume Writing		10		
III	Letter Writing		10		
IV	Group Discussion	Group Discussion Activity	15	Viva	20
V	Interview Skills	Mock Interview Activity	15		
VI	Negotiation Skills	Role Play	10		

SEMESTER – V

Department Of Training & Placement			
Training Cell			
Programme	Faculty of Science & Humanities		
Year / Semester	3 / 5	Course Category	SEC
Course Code	23AR555	Course Title	Aptitude & Reasoning
Continuous Evaluation: 70	End Term Examination: 30		
Prerequisite: Nil	L T P: 0 0 2	Credits: 1	

Training Objectives (TO): -

- TO1. To understand the basic concepts of quantitative ability and logical reasoning.
- TO2. To make student practice on the concepts of quantitative ability and logical reasoning.
- TO3. To prepare the students for aptitude and reasoning round in placement selection process & other competitive exams.

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

- TLO1. To understand the basic concepts of quantitative ability.
- TLO2. To solve campus placements aptitude papers covering Quantitative Ability.
- TLO3. To Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)			
TRAINING LEARNING OUTCOMES (TLO) →	TLO1	TLO2	TLO3
TRAINING OBJECTIVES (TO) ↓			
TO1			
TO2			
TO3			

A-Quantitative Ability

UNIT - I

- Number System
- Percentage
- Profit, Loss and Discount
- Simple Interest and Compound Interest

UNIT – II

- Allegation and Mixture
- Average
- Ratio, Proportion and Variation, Problem on Ages and Numbers
- Time and Work
- Time, Speed and Distance

UNIT – III

- Permutation and Combination
- Probability
- Data Interpretation
- Geometry and Mensurations
- Sequence, Series & Progression and Logarithmic

B- Logical Reasoning

UNIT - IV

- Number Series and Alphabet Series
- Direction Sense Test
- Coding -Decoding
- Blood Relation

UNIT – V

- Syllogism
- Dice, Cube and Cuboids
- Seating Arrangement

UNIT – VI

- Clock and Calendar
- Critical Reasoning
- Order and Ranking, Ven diagram, Analogy

Learning Resources	
Text Books	<i>Quantitative Aptitude for Competitive Examinations</i> by R S Aggarwal: S Chand Publishing, 2022.
	<i>A Modern Approach to Logical Reasoning</i> by R S Aggarwal: S Chand Publishing, 2022.

Pedagogy-

- The training will be based on the concept of learning by doing and practice.
- The training will involve 50% of the training time on teaching the concepts and the remaining 50% will be focusing on practice.
- The training will follow a circular approach where students are taught, evaluated and given the feedback.

Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Aptitude & Reasoning

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Quantitative Ability	Written Assignment	10	Written Test	30
II			10		
III			10		
IV	Logical Reasoning		15		
V			15		
VI			10		

Department of Mathematics			
Year/Semester	Year/ Semester	Course Category	Skill enhancement course (SEC)
Course Code	23SS404	Course Title	R language Programming
Continuous Evaluation: 80		End Semester Examination: 20	
Prerequisite: Nil		L T P : 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. To have an idea about the introduction in R language
2. To know about the basics of R
3. To understand the analysis part in excel

COURSE LEARNING OUTCOMES (CLO)

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

1. Develop an R script and execute it
2. Install, load and deploy the required packages, and build new packages for sharing and reusability
3. Extract data from different sources using API and use it for data analysis

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNINGOUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3
CO 1	✓		
CO 2		✓	
CO 3			✓

COURSE CONTENTS

Unit I

Introduction: R interpreter, Introduction to major R data structures like vectors, matrices, arrays, list and data frames, Control Structures, vectorized if and multiple selection, functions.

Unit II

Installing, loading and using packages: Read/write data from/in files, extracting data from web-sites, clean data, transform data by sorting, adding/removing new/existing columns, centring, scaling and normalizing the data values, converting types of values, using string in-built functions

Unit III

Statistical analysis of data for summarizing and understanding data, Visualizing data using scatter plot, line plot, bar chart, histogram, and box plot.

TEXT BOOKS/ REFERENCES BOOKS

1. Cotton, R., Learning R: a step-by-step function guide to data analysis. 1st edition. O'reilly Media Inc. Additional Resources:
2. Gardener, M. (2017). Beginning R: The statistical programming language, WILEY.
3. Lawrence, M., & Verzani, J. (2016). Programming Graphical User Interfaces in R. CRC press. (ebook)

Department of Mathematics			
Year/Semester	Year/ Semester	Course Category	Skill enhancement course (SEC)
Course Code	23SS202	Course Title	Advance Excel Skills
Continuous Evaluation: 80		End Semester Examination: 20	
Prerequisite: Nil		L T P : 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. To develop understanding of excel
2. To apply different formulae
3. To understand the making of different charts in excel

COURSE LEARNING OUTCOMES (CLO)

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

1. To optimize the use of MS-Excel for powerful data analysis.
2. To apply correct data visualization technique to gain optimal presentation of data.
3. To apply enhanced features of MS-Excel

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3
CO 1	✓		
CO 2		✓	
CO 3			✓

COURSE CONTENTS

Unit I

Workbook and worksheets- Navigation with keyboard, Tabs and ribbons, file menu, quick access toolbar, create print and save workbook, worksheet basics, protecting excel workbook and worksheet, importing and exporting data, co-authoring; Data and Formatting-Adding Data ,Cut Copy Paste , Data fill ,Data Movement , Cell Formatting ,Conditional Formatting, Cell Operations , Reusable Lists , Data Validation , Sorting And Filtering , Tables.

Unit II

Understanding formulas; operators in formula; named ranges; calculations; functions in formulas; relative and absolute addressing; referencing cells outside the worksheet and workbook; functions - logical, summarizing, text, lookup, reference, data and time, math functions; error handling, formula auditing

Unit III

Charts types and uses, Chart depiction – column, line, pie, bar, bubble, histogram Analysis - Pivot Table, Pivot

Charts, What If Analysis

TEXT BOOKS/ REFERENCES BOOKS

1. Manisha Nigam, "Data Analysis with Excel", BPP publications, 2019.
2. Paul McFedries, Excel Data Analysis for Dummies, 5th Edition, 2022.

Department of Mathematics			
Year/Semester	Year/ Semester	Course Category	Skill enhancement course (SEC)
Course Code	23SS505	Course Title	Programming with MATLAB
Continuous Evaluation: 80		End Semester Examination: 20	
Prerequisite: Nil		L T P : 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

- To introduce the software MATLAB for numerical simulation and scientific computation
- To enable students to make use of symbol tools of this computer algebra system
- To introduce MATLAB programming

COURSE LEARNING OUTCOMES (CLO)

- Understand the basics of MATLAB.
- Apply MATLAB software for basic matrix computation problems through loops.
- Demonstrate MATLAB software to solve various mathematical problems numerically.

MAPPING MATRIX OF COURSE OBJECTIVES (CO) & COURSE LEARNING OUTCOMES (CLO)

Course Learning outcome Course objectives	CLO 1	CLO 2	CLO 3
CO 1	✓		✓
CO 2	✓	✓	
CO 3			✓

COURSE CONTENTS

Unit I

Practicing MATLAB environment with simple exercises to familiarize Command Window, History, Workspace, Current Directory, Figure window, Edit window, Shortcuts, Help files. Data types, Constants and Variables, Character constants, operators, Assignment statements. Control Structures: For loops, While, If control structures, Switch, Break, Continue statements.

Unit II

Input-Output functions, Reading and Storing, Data, Vectors and Matrices, commands to operate on vectors and matrices, matrix Manipulations. Arithmetic operations on Matrices, Relational operations on Matrices, Logical operations on Matrices.

Unit III

Polynomial Evaluation, Roots of Polynomial, Arithmetic operations on Polynomials, Graphics: 2D plots, Printing labels, Grid & Axes box, Text in plot, Bar and Pie chart. Linear equations.

TEXT BOOKS/RECOMMENDED BOOKS

1. Stephen J.Chapman, "Programming in MATLAB for Engineers", Cengage Learning, 2011.
2. Pratap R., Getting started with MATLAB: A Quick introduction for Scientists & Engineers, Oxford University Press, 2010.
3. Bansal R.K, Goel A.K., Sharma M.K., "MATLAB and its Applications in Engineering", Pearson Education, 2012.
4. Amos Gilat, "MATLAB-An Introduction with Applications", Wiley India, 2009.

Department of Mathematics			
Year/Semester	Year/ Semester	Course Category	Skill enhancement course (SEC)
Course Code	23SS303	Course Title	Statistical Analysis with SPSS
Continuous Evaluation: 80		End Semester Examination: 20	
Prerequisite: Nil		L T P : 0 0 2	Credits: 1

COURSE OBJECTIVES (CO)

1. To train students in SPSS Software
2. To know about the data handling in SPSS
3. To understand about the diagrammatic representation of data

COURSE LEARNING OUTCOMES (CLO)

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

1. Basics of SPSS
2. Understanding of data handling in SPSS
3. Diagrammatic representation of data

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CO \ CLO	CLO 1	CLO 2	CLO 3
CO 1	✓		
CO 2		✓	
CO 3			✓

COURSE CONTENTS

Unit I

Data handling: open SPSS data file – save – import from other data source – data entry – labeling for dummy numbers - recode in to same variable – recode in to different variable – transpose of data – insert variables and cases – merge variables and cases.

Unit II

Data handling: Split – select cases – compute total scores – table looks – Changing column - font style and sizes

Unit III

Diagrammatic representation: Simple Bar diagram – Multiple bar diagram – Sub-divided Bar diagram - Percentage diagram - Pie Diagram – Frequency Table – Histogram – Scatter diagram – Box plot.

TEXT BOOKS/ REFERENCES BOOKS

1. Clifford E. Lunneborg (2000). Data analysis by resampling: concepts and applications. Dusbury Thomson learning. Australia.
2. Everitt, B.S and Dunn, G (2001). Applied multivariate data analysis. Arnold London.
3. Jeremy J. Foster (2001). Data analysis using SPSS for windows. New edition. Versions 8-10. Sage publications. London.
4. Michael S. Louis – Beck (1995). Data analysis an introduction, Series: quantitative applications in the social sciences. Sage. Publications. London.

Department of Computer Science			
Year/Semester	Year/ Semester	Course Category	Skill enhancement course (SEC)
Course Code	23SS101	Course Title	Digital Literacy & IT Skills
Continuous Evaluation: 70		End Semester Examination: 30	
Prerequisite: Nil		L T P : 0 0 2	Credits: 1

Course Objectives (CO) - The Course is designed with the following objectives:

6. To know a comprehensive understanding of digital literacy and essential IT skills
7. To discuss and develop critical thinking abilities
8. To understand practical skills required to navigate the digital world effectively
9. To grasp the significance of aspects of our personal and professional lives
10. To construct and utilize technology to enhance productivity and creativity

Course Learning Outcomes (CLO) – The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

6. Explain and understand the concept of digital literacy and its importance in contemporary society.
7. To apply and develop proficiency in using computer hardware, operating systems, and software applications.
8. To analyse foster critical thinking and problem-solving skills when working with digital tools and information.
9. Promote responsible and ethical use of digital technologies
10. Enhance communication and collaboration skills using digital platforms and explore emerging trends and technologies in the digital landscape.

Mapping Matrix between Course Objectives and Course Learning Outcomes:

	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5
CO 1	----				
CO 2		----			
CO 3			----		
CO 4				----	
CO 5					----

COURSE CONTENTS

UNIT-1

Introduction to Digital Literacy, Definition and importance of digital literacy, Understanding the digital divide, Ethical considerations and digital citizenship, Computer Basics, Computer hardware components and their functions, Operating systems and their features, File management and organization.

UNIT-2

Productivity Tools, Word processing applications, Spreadsheet applications, Presentation software Note-taking and organization tools, Internet and Web Literacy, Internet fundamentals and terminology Web browsing and search strategies, Evaluating online information, Online safety and privacy

UNIT-3

Communication and Collaboration, Email communication and etiquette, Instant messaging and video conferencing tools, Social media platforms and their uses, Online collaboration and project management tools, Digital Media and Information Literacy, Understanding digital media formats, Digital media creation and editing tools, Copyright and intellectual property considerations, Information evaluation and critical thinking

UNIT-4

Data Management and Security, Basics of data management and storage, Backup and recovery strategies, Online security best practices, Introduction to cybersecurity awareness, Emerging Technologies, Cloud computing and storage, Internet of Things (IoT), Artificial intelligence and machine learning, Virtual reality and augmented reality

RECOMMENDED TEXT BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Edition: 3rd Edition, the MIT Press, and ISBN: 978-0262033848
2. Stuart Russell, Peter Norvig , "Artificial Intelligence: A Modern Approach", 3rd Edition, Pearson Publisher, ISBN: 978-0136042594

REFERENCE BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan,"Database System Concepts", 7th Edition, McGraw-Hill Education, ISBN: 978-0078022159
2. Abraham Silberschatz, Greg Gagne, Peter B. Galvin, "Operating System Concepts", 10th Edition, John Wiley & Sons Publication, ISBN: 978-1119320913.
3. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufmann publication, ISBN: 978-0123850591

LIVE PROJECT/ VOCATIONAL COURSES/ SUMMER INTERNSHIP

Year/Semester	Year/ Semester	Course Category	Live Project
Course Code	25FTBS271 / 25FTBS471	Course Title	Live Project
Continuous Evaluation: 60		End Semester Examination: 40	
Prerequisite: Nil		L T P : 0 0 8	Credits: 4

COURSE OBJECTIVES

1. To provide qualitative enhancements to the UG students of FSH.
2. Offered live projects serve to enhance student's employability attributes to make them job-ready.
3. To provide experiential learning to students for an ability to work in a real-life work situation.
4. To provide a learning ground for students to get an opportunity to apply what they have learned in classes to real-world scenarios. An opportunity to work in real constraints of resources, people factors and other organizational constraints. Classroom projects are primarily focused on singular concepts whereas live projects allow integrating knowledge across various functions.

COURSE LEARNING OUTCOMES

On completion of the live project(s), students will be

1. Capable enough to exhibit strong foundation knowledge of domain area.
2. Students can take a challenge and place better career development scenario in professional life.
3. It gives a strong boost for experienced to take their career into next stage.
4. Successfully completion of live projects shows a better stand and technical expertise in domain area.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO				
CO 1				
CO 2				
CO 3				
CO 4				

ASSESSMENT DETAILS

Assessment of Live Project(s) & Industrial visit include the following:

- Formative & submissive assessment.
- During the final assessment students have to submit a hard copy of the project, the presentation has to be given by the students.
- Prototype or Working Model, in case of Live Project is taken up for it.

- Report on Project.
- Viva Voce.
- Final Presentation in front evaluation team.

PERIODIC MONITORING

DURATION→	Continuous Monitoring throughout the Project
EVALUATION PROCESS	<ol style="list-style-type: none"> 1. Student will prepare the report on the work done. 2. Student will prepare the presentation on the learning outcomes. 3. Student will give presentation about the learning achieved.
EVALUATION	<ul style="list-style-type: none"> ❖ Formative/Continuous Evaluation: 60 % ❖ End Semester Evaluation : 40 %

SIGNIFICANCE OF LIVE PROJECTS

Live projects play a significant role in providing real-time education to the students. During live projects, students are encouraged to identify the domain they want to work in and select the relevant project. They also get to meet working professionals or organizations and discuss with them about the project. In some institutions, live projects are considered as assignments and students get points for it. This is important as it helps the students during their placements.

Year/Semester	Year/ Semester	Course Category	Summer Internship
Course Code	25FTBS671	Course Title	Summer Internship
Continuous Evaluation: 70		End Semester Examination: 30	
Prerequisite: Nil		L T P : 0 0 8	Credits: 4

COURSE OBJECTIVES

1. To have qualitative improvements in the UG students of FSH.
2. To provide experiential learning to students to work in the real life situation.
3. Expose the student to professional role models or mentors who will provide the student with support in the early stages of the internship and provide an example of the behaviours expected in the intern's workplace.
4. Assist the student's development of employer-valued skills such as teamwork, communications and attention to detail.

COURSE LEARNING OUTCOMES

On completion of course, students will be

1. Able to demonstrate various aspects of theory as well as practical.
2. Able to build and expand network of professional relationships and contacts.
3. Develop a solid work ethic and professional demeanour, as well as a commitment to ethical conduct and social responsibility.
4. At the end of the course, a student will be competent in their domain area.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO				
CO 1				
CO 2				
CO 3				
CO 4				

Introduction:

The “Summer Internship Programme” of all the Departments of Faculty of Science & Humanities is structured in a manner that all the students will go just after 4th Semester. The SIP will be 3 to 4 weeks, in a special case (approval from the Hon’ble VC) it may be of 5 weeks maximum.

Responsibility Centre:

- Head of the concern Department

- A person from T & P
- Dean-Faculty of Science & Humanities – overall in-charge

Objectives of SIP:

5. To have qualitative improvements in the UG students of FSH.
6. To provide experiential learning to students to work in the real life situation.
7. To enhance students' knowledge in the domain specific.

Outcomes:

5. Enhance competency of FSH students of SRM University on completion of course.
6. Students will learn about various aspects of theory as well as practical.
7. At the end of the course, a student will be competent in their domain area.

Project Identification:

- The internships will be conducted across 4 semesters.
- All the Internships will be of 1 credit only.
- Projects will be undertaken by the students in collaboration with Student-Faculty, NGO, Government Departments and Industries.
- Projects will be identified keeping in mind application of knowledge & skills, relevance of project in terms of expectation of society.
- Allocation of the project to the students with active participation of students, faculty and concern authorities.

Monitoring of the Projects

- Project should be supervised by faculty mentor and place where students is undertaking the project.
- Effective monitoring of project progress undertaken by the students through by digital technologies.
- Active involvement of industry & faculty supervisor.
- Weekly monitoring of the project through Faculty mentor & Industry person.
- All the project have to analyze in-depth and the outcome of the project should be identified

Assessment Details:

Assessment of SIP include the following:

- Formative & submissive assessment three times during the internship.
- During the final assessment students have to submit a hard copy of the project, the presentation has to be given by the students.
- Report on Project taken up.

- Viva Voce.
- Final Presentation in front of the industry experts and Faculty mentor.

Periodic Monitoring:

Student will be monitored on periodic basis, both by the In-charge at the Industry and the Faculty In-charge. The Industry In-charge will submit the Mid-Term and End-Term Evaluation report. However, the faculty In-charge will take periodic presentation to keep a check on the progress.

DURATION	3 to 4 Weeks (After 4th End Semester Examination)
EVALUATION PROCESS	4. Student will prepare the report on the work done. 5. Student will prepare the presentation on the learning outcomes. 6. Student will give presentation about the learning achieved.

EVALUATION	Continuous Evaluation : 70 % End Semester Evaluation : 30 %
	To be evaluated three weeks
EVALUATION (Faculty Coordinator & Industry Coordinator)	Presentation 1: (Weeks 1st & 2nd) (15 + 15 Marks) ➤ Summative Exam – 10 Marks ➤ Formative Exam – 5 Marks Final Presentation: (3rd Week) (40 Marks) ➤ Project Report – 15 Marks ➤ Presentation – 10 Marks ➤ Viva-Voce – 15 Marks

Template for Weekly Monitoring of SIP
(to be filled by Faculty Mentor & Industry Person)

Faculty of Science & Humanities
Department Of

Subject Code:	Subject Name:
Year :	Faculty Mentor:
Semester:	Industry Mentor:
Group :	
Duration of Evaluation:	Type of Evaluation: Summative/Formative
Project Name :	
Location :	

RESEARCH PROJECT/ DISSERTATION

Year/Semester	Year/ Semester	Course Category	Research Project/ Dissertation
Course Code	25FTBS771	Course Title	Research Project/ Dissertation
Continuous Evaluation: 70		End Semester Examination: 30	
Prerequisite: Nil		L T P : 0 0 12	Credits: 6

COURSE OBJECTIVES

1. Research Skills Development: Enhance students' ability to design, plan, and execute research projects in the field of food technology. Provide them with the necessary tools to conduct independent and systematic investigations
2. Application of Theoretical Knowledge: Apply theoretical concepts and principles learned throughout the food technology program to real-world research scenarios.
3. Develop a deeper understanding of how these concepts are practically employed in solving industry-related problems.
4. Critical Thinking and Problem Solving: Cultivate critical thinking skills by identifying research gaps, formulating research questions, and developing innovative approaches to address challenges within the food technology domain.

COURSE LEARNING OUTCOMES

1. Research Design and Planning: Students will be able to develop well-structured research proposals, including clear objectives, hypotheses, methodologies, and ethical considerations, demonstrating their ability to design a comprehensive research project.
2. Data Collection and Analysis: Through hands-on research experience, students will acquire skills in data collection, analysis, and interpretation using appropriate techniques. They will be capable of drawing meaningful conclusions from research results.
3. Innovation and Problem Solving: Students will demonstrate the capacity to identify research problems, critically evaluate existing knowledge, and propose innovative solutions or approaches within the realm of food technology.
4. Effective Presentation and Communication: Upon completion of the research project, students will be proficient in presenting their research findings through well-organized written reports and oral presentations. They will effectively communicate complex scientific information to both peers and professionals.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES

CLO	CLO 1	CLO 2	CLO 3	CLO 4
CO				
CO 1				
CO 2				

CO 3				
CO 4				

ASSESSMENT DETAILS

Assessment of Research Project(s) & Dissertation include the following:

- Formative & submissive assessment.
- During the final assessment students have to submit a hard copy of the project, the presentation has to be given by the students.
- Prototype or Working Model, in case of Research Project is taken up for it.
- Report on Project.
- Viva Voce.
- Final Presentation in front evaluation team.

PERIODIC MONITORING

DURATION→	Continuous Monitoring throughout the Project
EVALUATION PROCESS	<ol style="list-style-type: none"> 1. Student will prepare the report on the work done. 2. Student will prepare the presentation on the learning outcomes. 3. Student will give presentation about the learning achieved.

EVALUATION	<ul style="list-style-type: none"> ❖ Formative/Continuous Evaluation: 70 % ❖ End Semester Evaluation : 30 %
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SIGNIFICANCE OF RESEARCH PROJECTS

Live projects play a significant role in providing real-time education to the students. During live projects, students are encouraged to identify the domain they want to work in and select the relevant project. They also get to meet working professionals or organizations and discuss with them about the project. In some institutions, live projects are considered as assignments and students get points for it. This is important as it helps the students during their placements.

