NEHRU INSTITUTE OF TECHNOLOGY

AUTONOMOUS

B. Tech.

FOOD TECHNOLOGY

Curriculum and Syllabi

Regulation 2023

Applicable for students admitted in 2023

VISION AND MISSION OF THE INSTITUTION

Vision

- To be leading Institution in Academic excellence, Multidisciplinary Research, Innovation, Entrepreneurship and Industry relation in order to mould true citizens of the country.

Mission

- To create innovative and vibrant young leaders in Engineering and Technology field for building India as a knowledge power by improving the teaching-learning process.
- To enhance employability, entrepreneurship and to improve the research competence to address Societal needs.
- To generate engineering graduates who use knowledge as a powerful tool to drive societal transformation and inculcate in them ethical and moral values.

VISION AND MISSION OF THE DEPARTMENT OF FOOD TECHNOLOGY

Vision

- To establish the department as a leader in shaping food technology graduates who excel in technical education, research, innovation, entrepreneurship, and industry development, committed to addressing societal challenges of the nation

Mission

- To cultivate dynamic and innovative young leaders in the field of Food Technology, contributing to the country's progress as a knowledge hub through improved teaching-learning approaches.
- To foster employability and research skills through multidisciplinary research and innovation, addressing the specific requirements of the food industry.
- To produce graduates who harness knowledge as a potent force for driving societal transformation, while instilling in them ethical and moral values, entrepreneurship, and industry engagement.

Program Specific Outcome (PSO)

PSO 1 The capability to comprehend, analyze, and devise innovative methods for advancing food processes and products using foundational principles from mathematics, science, and engineering. (PO 1,2,3,4)

PSO 2 To acquire interdisciplinary skills in addressing challenges within the food industry, employing modern tools and techniques to promote an ethical and sustainable society. (PO 5,6,7,8)

PSO 3 The ability to excel as a team player with strong leadership and communication skills, effectively managing projects in multidisciplinary environments and adapting to technological advancements. (PO 9,10,11,12)

PSO	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PSO 1	✓	✓	✓	✓	-	-	-	-	-	-	-	-
PSO 2	-	-	-	-	✓	✓	✓	✓	-	-	-	-
PSO 3	-	-	-	-	-	-	-	-	✓	✓	✓	✓

List of Program Outcome

1. ***Engineering knowledge:*** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.
2. ***Problem analysis:*** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. ***Design/development of solutions:*** Design solutions for complex engineering problems and design system components or processes that meet t h e specified needs with

appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

4. ***Conduct investigations of complex problems:*** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. ***Modern tool usage***: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.
6. ***The engineer and society:*** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. ***Environment and sustainability:*** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. ***Ethics:*** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. ***Individual and team work:*** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. ***Communication:*** Communicate effectively on complex engineering activities with the engineering community and with t h e society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
11. ***Project management and finance:*** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. ***Life-long learning:***Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

List of PEOs

PROGRAM EDUCATIONAL OBJECTIVES:

PEO1: Become competent food technologists, innovative food developers, and expert food scientists and researchers who provide solutions to human problems.

PEO2: Exhibit advanced technical expertise and leadership qualities to excel in the food industry and as entrepreneurs by effectively addressing industrial and societal challenges.

PEO3: Inculcate professional and ethical mindset, strong communication skills, effective teamwork, and a multidisciplinary approach relevant to food technology and engineering.

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B. TECH. FOOD TECHNOLOGY
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For the students admitted in the academic year 2023-2024

SEMESTER I

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
	U23IP101	Induction Program	MC	-	-	-	-	0
THEORY								
1	U23EN101	English for Engineers	HSMC	3	0	0	3	3
2	U23MA101	Calculus and Differential Equations	BSC	3	1	0	4	4
3	U23PH101	Engineering Physics	BSC	3	0	0	3	3
4	U23CY101	Engineering Chemistry	BSC	3	0	0	3	3
5	U23GE101	Engineering Graphics	ESC	3	0	2	5	4
6	U23HS101	Heritage of Tamils	HSMC	1	0	0	1	1
PRACTICALS								
7	U23BS111	Basic Science Laboratory	BSC	0	0	4	4	2
8	U23EN111	Communicative English Laboratory	HSMC	0	0	2	2	1
9	U23GE111	Engineering Practices Laboratory	ESC	0	0	4	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
10	U23EE101	Career Enhancement Training- I	EEC	3	0	0	3	1
11		Vocational Enhancement Training-1*	VEC	0	0	2	2	1*
TOTAL				**19**	**1**	**14**	**34**	**24**

*Vocational enhancement training is compulsory for all students.
The credit earned will be recorded in the grade sheet and included in academic criteria for continuation and not considered for SGPA / CGPA calculation.
Student shall select one of the courses from the list given under VEC

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B.TECH. FOOD TECHNOLOGY
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SEMESTER II

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23MA203	Design of Experiment and Numerical Methods	BSC	3	1	0	4	4
2	U23FT201	Fundamentals of Human Nutrition	PCC	3	0	0	3	3
3	U23FT202	Food Microbiology	PCC	3	0	0	3	3
4	U23FT203	Basic Mechanical Engineering	ESC	3	0	0	3	3
5	U23HS202	Tamil & Technology	HSMC	1	0	0	1	1
THEORY WITH LAB COMPONENT								
6	U23EN202	Proficiency in English	HSMC	2	0	2	4	3
7	U23GE202	Basics of Electrical, Electronics and Instrumentation Engineering	ESC	3	0	2	5	4
PRACTICALS								
8	U23FT211	Food Microbiology Laboratory	PCC	0	0	4	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
9	U23EE202	Career Enhancement Training – II	EEC	3	0	0	3	1
10		Vocational Enhancement Training II	VEC	0	0	2	2	1*
TOTAL				**21**	**1**	**10**	**32**	**24**

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B.TECH. FOOD TECHNOLOGY
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SEMESTER-III

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23MA305	Probability and Optimization Technique	BSC	3	1	0	4	4
2	U23FT301	Food Process Calculations	PCC	3	1	0	4	4
3	U23FT302	Post Harvest Engineering	PCC	3	0	0	3	3
4	U23FT303	Fluid Mechanics for Food Technologists	ESC	3	0	0	3	3
5	U23FT304	Food Chemistry	PCC	3	0	0	3	3
THEORY WITH LAB COMPONENT								
6	U23GE301	Problem Solving and Python Programming	ESC	2	0	2	4	3
PRACTICAL								
7	U23FT311	Food Chemistry Laboratory	PCC	0	0	4	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
8	U23EE313	Aptitude and Communication for Engineers-I	EEC	1	0	1	2	1
9		Vocational Enhancement Training III	VEC	0	0	2	2	1*
TOTAL				**19**	**2**	**9**	**29**	**23**

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B.TECH. FOOD TECHNOLOGY
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SEMESTER-IV

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23BS401	Environmental Sciences and Sustainability	BSC	2	0	0	2	0
2	U23FT401	Unit Operations in Food Processing	PCC	3	0	0	3	3
3	U23FT402	Food Additives	PCC	3	0	0	3	3
4	U23FT403	Thermodynamics in Food Processing	ESC	3	0	0	3	3
5	U23FT404	Food Biochemistry	PCC	3	0	0	3	3
THEORY WITHLAB COMPONENT								
6	U23FT405	Dairy Process Technology	PCC	2	0	2	4	3
PRACTICALS								
7	U23FT411	Food Biochemistry Laboratory	PCC	0	0	4	4	2
8	U23FT412	Unit Operations in Food Processing Laboratory	PCC	0	0	4	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
9	U23EE415	Aptitude and Communication for Engineers II	EEC	1	0	1	2	1
10		Vocational Enhancement Training IV	VEC	0	0	2	2	1*
TOTAL				**17**	**0**	**13**	**30**	**20**

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B.TECH. FOOD TECHNOLOGY
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SEMESTER-V

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23FT501	Food Packaging Technology	PCC	3	0	0	3	3
2	U23FT502	Livestock and Fish Processing Technology	PCC	3	0	0	3	3
3		Professional Elective-I	PEC-I	3	0	0	3	3
4		Mandatory -I	MC	2	0	0	2	0
5		Mandatory -II	MC	2	0	0	2	0
THEORY WITH LAB COMPONENT								
6	U23FT503	Fruits and Vegetables Processing Technology	PCC	3	0	2	5	4
PRACTICALS								
7	U23FT511	Food Packaging and Testing Laboratory	PCC	0	0	4	4	2
8	U23FT512	Food Product Development Laboratory	PCC	0	0	4	4	2
9	U23EE513	Internship I **	EEC	0	0	0	0	1
EMPLOYABILITY ENHANCEMENT COURSES								
10	U23EE517	Campus to Corporate	EEC	0	0	1	2	1
11		Vocational Enhancement Training V	VEC	0	0	2	2	1*
TOTAL				**16**	**0**	**13**	**30**	**19**

* Internship carries one credit. Internship during IV Semester Vacation (15 DAYS) will be evaluated in V Semester

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B.TECH. FOOD TECHNOLOGY
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SEMESTER VI

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23FT601	Food Analysis and Quality Control	PCC	3	0	0	3	3
2	U23FT602	Heat and Mass Transfer in Food Processes	PCC	3	0	0	3	3
3		Professional Elective-II	PEC	3	0	0	3	3
4		Professional Elective-III	PEC	3	0	0	3	3
5		Open Elective- I	OEC	3	0	0	3	3
6		Open Elective –II	OEC	3	0	0	3	3
7		Mandatory -III	MC	2	0	0	2	0
THEORY WITH LAB COMPONENT								
8	U23FT603	Food Processing and Preservation	PCC	2	0	2	4	3
PRACTICAL								
9	U23FT611	Food Analysis Testing Laboratory	PCC	0	0	4	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
10	U23EE617	Corporate Readiness Program	EEC	0	0	1	3	1
11		Vocational Enhancement Training VI	VEC	0	0	2	2	1*
TOTAL				**22**	**0**	**9**	**33**	**24**

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SEMESTER VII

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23FT701	Food Safety, Standards and Regulations	PCC	3	0	0	3	3
2	U23FT702	Food Plant Layout and Equipment Design	PCC	3	0	0	3	3
3	U23HS703	Intellectual Property Rights	HSMC	2	0	0	2	2
4		Professional Elective-IV	PEC	3	0	0	3	3
5		Professional Elective-V	PEC	3	0	0	3	3
6		Open Elective – III	OEC	3	0	0	3	3
7		Open elective –IV	OEC	3	0	0	3	3
PRACTICAL								
8	U23EE718	Internship II *	EEC	0	0	0	0	1
TOTAL				**20**	**0**	**0**	**20**	**21**

* Internship carries one credit. Internship/during VI Semester Summer Vacation (30 DAYS) will be evaluated in VII semester

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SEMESTER VIII

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23EE819	Project Work / Internship*	EEC	0	0	20	20	10
TOTAL				**0**	**0**	**20**	**20**	**10**

*15weeks of continuous Internship in an organization carries10 credits.

Total credit: 165

PROFESSIONAL ELECTIVECOURSES: VERTICALS

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
NEW PRODUCT DEVEL OPMENT -VERTICAL I								
1.	U23FTP11	Beverage Technology	PEC	3	0	0	3	3
2.	U23FTP12	Snack Foods Technology	PEC	3	0	0	3	3
3.	U23FTP13	Extrusion Technology	PEC	3	0	0	3	3
4.	U23FTP14	Bakery and Confectionery Technology	PEC	3	0	0	3	3
FOOD PROCESSING TECHNOLOGY - VERTICAL II								
5.	U23FTP21	Food Product Design and Development	PEC	3	0	0	3	3
6.	U23FTP22	Spices and Plantation Crops Processing Technology	PEC	3	0	0	3	3
7.	U23FTP23	Fat and Oil Processing Technology	PEC	3	0	0	3	3
8.	U23FTP24	Nutraceuticals and Functional Foods	PEC	3	0	0	3	3
EMERGING TECHNOLOGIES IN FOOD - VERTICAL III								
9.	U23FTP31	Non-thermal Techniques in Food	PEC	3	0	0	3	3
10.	U23FTP32	Refrigeration and Cold Chain Management	PEC	3	0	0	3	3
11.	U23FTP33	Thermal Processing Technologies	PEC	3	0	0	3	3
12.	U23FTP34	Smart Technologies in Food Processing	PEC	3	0	0	3	3
FOOD INDUSTRY WASTE MANAGEMENT - VERTICAL IV								
13.	U23FTP41	Green Technology in Waste Management	PEC	3	0	0	3	3
14.	U23FTP42	Industrial Food Waste Management	PEC	3	0	0	3	3
15.	U23FTP43	Waste Water Treatment Technologies	PEC	3	0	0	3	3
16.	U23FTP44	Renewable Energy Resources in Food Waste	PEC	3	0	0	3	3
FOOD SAFETY - VERTICAL V								
17.	U23FTP51	HACCP in Food Processing and Preservation	PEC	3	0	0	3	3
18.	U23FTP52	FSMS & Food Product and Supply Chain Management	PEC	3	0	0	3	3
19.	U23FTP53	Food laws – Indian and International	PEC	3	0	0	3	3
20.	U23FTP54	Food Analysis, Testing & Microbial Safety Analysis	PEC	3	0	0	3	3

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. Enrollment for B.E. / B. Tech. (Honours) / Minor degree (Optional). A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E./B.Tech. (Honours) Minor degree. For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

MANDATORY COURSES

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	U23MC401	Disaster Risk Reduction and Management	MC	2	0	0	2	0
2.	U23MC404	Well, Being with Traditional Practices - Yoga, Ayurveda and Siddha	MC	2	0	0	2	0
3.	U23MC501	History of Science and Technology in India	MC	2	0	0	2	0
4.	U23MC504	Entrepreneurship and Innovation	MC	2	0	0	2	0
5.	U23MC601	Industrial Safety	MC	2	0	0	2	0
6.	U23MC602	Introduction to Women and Gender Studies	MC	2	0	0	2	0

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OPEN ELECTIVE COURSES
OFFERED BY FOOD TECHNOLOGY

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	U23FTO11	Traditional Indian Foods	OEC	3	0	0	3	3
2.	U23FTO12	Food, Nutrition and Health	OEC	3	0	0	3	3
3.	U23FTO13	Introduction to Food Processing	OEC	3	0	0	3	3
4.	U23FTO14	Fundamentals of Food Engineering	OEC	3	0	0	3	3
5.	U23FTO15	Food safety and Quality Regulations	OEC	3	0	0	3	3
6.	U23FTO16	Nutraceuticals	OEC	3	0	0	3	3

CREDIT SUMMARY

S.No.	Category	Semester								Total Credits	
		I	II	III	IV	V	VI	VII	VIII	NIT	ANNA UNIVERSITY
1	Humanities and Management Courses (HSMC)	5	4	-	-	-	-	2	-	**11**	**12**
2	Basic Science Course (BSC)	12	4	4	0	-	-	-	-	**20**	**29**
3	Engineering Science Course (ESC)	6	7	6	3	-	-	-	-	**22**	**18**
4	Professional Core Course (PCC)	-	8	12	16	14	11	6	-	**67**	**58**
5	Professional Elective Course (PEC)	-	-	-	-	3	6	6	-	**15**	**21**
6	Open Elective Course (OEC)						6	6	-	**12**	**12**
7	Employability Enhancement Skills/Internship/Project (EEC)	1	1	1	1	2	1	1	10	**18**	**17**
8	Mandatory Course (MC)	0	0	0	0	✓	✓	0	0	**-**	--
9	Vocational Enhancement Course (VEC)	✓	✓	✓	✓	✓	✓	--	--	**0**	--
Total		**24**	**24**	**23**	**20**	**19**	**24**	**21**	**10**	**165**	**167**

SEMESTER I

U23EN101 **ENGLISH FOR ENGINEERS** **Category: HSMC**
SDG: 4 **(Common to all Branches)**

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

1. To enable learners of engineering and technology to develop their basic communication skills in English.
2. To acquire, command in both the respective skills (listening and reading) and the productive skills (writing and speaking) of the English language.
3. To understand the key concepts of values, life skills and business communication and motivate students to look within and create a better version of themselves.
4. To focus on the development of basic fluency in English, usage of vocabulary in the technical field, and strengthening reading and official written communication skills.
5. To use language efficiently in expressing their opinions via various media.

UNIT 1 **INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION** **9**

Listening– listening to Audio/video(formal & informal);Telephonic conversation (Activity) Speaking- Self Introduction; Introducing a friend (Activity);Conversation-politeness strategies; Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts-Writing-Writing on self, Writing Definition; Jumbled sentence Grammar – Simple present tense, Present continuous, Present perfect, Present perfect continuous; Question types: Wh/ Yes or No/ and Tags; Word formation, One-word substitution.

UNIT 2 **NARRATION AND SUMMATION** **9**

Listening- Listening to the podcast, anecdotes/stories/event narration; documentaries and interviews with celebrities (Activity). Speaking-Narrating personal experiences/events; interviewing a celebrity (Activity). Reading- Reading biographies, travelogues, newspaper reports, Writing- Guided Writing- Paragraph writing, Short Report on an event (field trip etc.) - Grammar– Simple past tense, Past continuous, Past perfect, Past perfect continuous; Subject- Verb Agreement; Prepositions, Word forms (prefixes & suffixes); Error Correction.

UNIT 3 **DESCRIPTION OF PROCESS/PRODUCT** **9**

Listening – Listening to specific audio tracks (Activity) Speaking – Picture description; giving instruction to use the product; presenting a product; Role play (Activity) -Reading – Reading advertisements, gadget reviews; finding key information from a given text- Writing - Instructions; Process description; Grammar - Simple future tense, Future continuous, Future perfect, Future perfect continuous; Imperatives; Adjectives; Degrees of comparison; Compound Words.

UNIT 4 CLASSIFICATION AND RECOMMENDATIONS 9

Listening – watching videos/ documentaries and responding to the questions based on them, Scientific lectures; and educational videos. Speaking – Small Talk; Mini presentations (Activity) - Reading – Journal reports, predicting content of reading habits, Reading articles (Activity)- Writing –Memos to colleagues or friends; Opinion Blogs; Grammar – Articles; Pronouns - Possessive & Relative pronouns, Cause and Effect.

UNIT 5 EXPRESSION 9

Listening – Listening to different accent, Listening to speeches or presentation- Speaking – Debates and Expressing opinions through Simulations, exchanging personal information - (Activity)- Reading– Reading editorials; Poster making (Activity)- Writing – Creative Writing, Checklist- Grammar –Punctuation; Compound Nouns, Homonyms; and Homophones, Simple, Compound & Complex Sentences.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Listen and comprehend complex academic texts.

CO2: Understand the denotative and connotative meanings of technical texts.

CO3: Identify definitions, descriptions, narrations and essays on various topics.

CO4: Apply different methods of integration in solving practical problems.

CO5: Express their opinions effectively in both oral and written medium of communication.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University (2020 edition).

2. English for Science & Technology Cambridge University Press, 2021. Authored by Dr.VeenaSelvam, Dr.Sujatha Priyadarshini, Dr.Deepa Mary Francis, Dr.KN.Shoba and Dr.Lourdes Joevani, Department of English, Anna University.

REFERENCES:

1. Technical Communication – Principles and Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.

2. A Course Book on Technical English by Lakshmi Narayanan, Scitech Publications (India)Pvt.Ltd.

3. English for Technical Communication (with CD) by Aysha Viswamohan, Mc-graw HillEducation, ISBN:0070264244

4. Effective Communication Skill, KulbhusanKumar, RS Salaria, Khanna Publishing House.

5. Learning to Communicate–Dr.V.Chellammal, Allied Publishing House, NewDelhi, 2003.

CO's-PO's & PSO's MAPPING															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	-	-	-	1	1	-	3	1	-	2	-	-	-
CO2	-	-	-	-	-	1	1	-	3	-	-	2	-	-	-
CO3	-	-	-	-	-	1	1	-	3	2	-	3	-	-	-
CO4	-	-	-	-	-	1	2	-	3	1	-	2	-	-	-
CO5	-	-	-	-	-	1	2	-	3	2	-	3	-	-	-
Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation															

U23MA101	CALCULUS AND DIFFERENTIAL EQUATIONS (Common to all Branches)	Category: BSC			
		L	T	P	C
SDG: 4		3	1	0	4

COURSE OBJECTIVE:

1. To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
2. To familiarize the students with differential calculus.
3. To enlighten the students with functions of several variables. This is needed in many branches of engineering.
4. To make the students acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
5. To acquaint the students with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT 1 MATRICES 9+3

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigenvalues and Eigen vectors (without proof) – Cayley – Hamilton theorem (Statement and applications. only) - Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Nature of Quadratic forms - Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT 2 DIFFERENTIAL CALCULUS 9+3

Representation of functions - Limit of a function - Continuity - Derivatives -Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation - Applications: Maxima and Minima of functions of one variable.

UNIT 3 MULTIVARIABLE CALCULUS 9 + 3

Functions of two variables – Partial derivatives – Total differential – Taylor's series for functions of two variables – Jacobian's – Constrained maxima and minima – Lagrange's multiplier and its applications

UNIT 4 ORDINARY DIFFERENTIAL EQUATIONS OF SECOND ORDER 9 + 3

Linear differential equations of second order with constant coefficients. Linear differential

Equations of second order with variable coefficients: Cauchy's linear differential equation - Method of variation of parameters for second order differential equations

UNIT 5 MULTIPLE INTEGRALS 9 + 3

Double integration with constant and variable limits - Region of integration - Area as double integral in Cartesian coordinates. Triple integral in Cartesian coordinates. Application of integration – Volume of Solids

COURSE OUTCOMES:

At the end of the course, students will be able to:

CO1: Comprehend the concepts of Eigen values, Eigen vectors, limits, continuity, functions of several variables, double integration and region of integration for solving complex problems.

CO2: Use rules of differentiation to solve maxima and minima problems.

CO3: Apply various techniques in solving ordinary and partial differential equations for practical applications.

CO4: Apply differential and integral calculus tools in modeling problems.

CO5: Evaluate integrals to compute area, volume and other practical problems.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Grewal.B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 44th Edition2018.
2. James Stewart, "Calculus : Early Transcendentals", Cengage Learning, 8th Edition, New Delhi,2015.
3. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New delhi,2016.

REFERENCES:

1. Bali. N., Goyal. M. and Watkins. C., “Advanced Engineering Mathematics”, Firewall Media (Animprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009
2. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, Newdelhi,2016
3. Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
4. Narayanan. S. and Manicavachagom Pillai. T. K., “Calculus" Volume I and II, S.ViswanathanPublishers Pvt. Ltd., Chennai, 2009.
5. Jain. R.K. and Iyengar. S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, NewDelhi, 5th Edition, 2016.
6. Srimantha Pal and Bhunia. S.C, " Engineering Mathematics " Oxford University Press, 2015

CO’s-PO’s & PSO’s MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	1	3	-	-	-	-	-	-	-	-	-
CO2	3	3	1	-	-	3	-	-	-	-	-	-	-	-	-

CO3	3	3	2	-	1	3	-	-	-	-	-	-	-	-	-
CO4	3	3	3	-	-	3	-	-	-	-	-	-	-	-	-
CO5	3	3	2	1	-	3	-	-	-	-	-	-	-	-	-
Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation															

U23PH101

SDG: 4 **ENGINEERING PHYSICS** ***Category: BSC***

COURSE OBJECTIVE:

L	T	P	C
3	0	0	3

1. Understand the basics of Properties of Matter and apply them to Engineering.
2. Explore the applications of Lasers and Fiber optics in engineering contexts.
3. Apply principles of Ultrasonics and Thermal Physics to Engineering challenges.
4. Grasp foundational Quantum Physics concepts and their modern applications.
5. Analyze Crystal systems and their structures in Engineering and Technology.

UNIT 1 **PROPERTIES OF MATTER** **9**

Elasticity – Stress-strain diagram and its uses - Factors affecting elastic modulus – Torsional stress and deformations –Torsion pendulum: theory and experiment - Bending of beams - Bending moment – Cantilever: theory and experiment – Uniform and non-uniform bending: theory and experiment - I-shaped girders - Applications. – Basic Solved Problems.

UNIT 2 **LASER AND FIBER OPTICS** **9**

Introduction – Principle of Spontaneous emission and stimulated emission. Population inversion, pumping- Einstein's A and B coefficients: derivation. Types of lasers – Nd-YAG, CO_2- Industrial Applications of Lasers –Fiber Optics: Principle and propagation of light – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – Temperature and displacement sensors.

UNIT 3 **ULTRASONICS AND THERMAL PHYSICS** **9**

Introduction – Piezoelectric effect - piezoelectric generator - Velocity measurement – Acoustic grating – Ultrasonic Medical applications - Introduction to heat - Transfer of heat energy: Thermal conduction, convection and radiation –Thermal conductivity - Forbe's and Lee's disc method: theory and experiment – Applications: heat exchangers, refrigerators, ovens and solar water heaters.

UNIT 4 **QUANTUM PHYSICS** **9**

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh-Jeans' Law from Planck's theory – Compton effect: Theory and experimental verification – Matter waves – Schrödinger's wave equation: Time independent and time dependent equations – Physical significance of wave function – Particle in a one-dimensional box - Microscope: Scanning Tunnelling microscope.

UNIT 5 **CRYSTAL PHYSICS** **9**

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – 'd' spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures – Polymorphism and allotropy - Crystal defects – Point, line and surface defects-Burger vector.

7

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, students would

CO1: Realize the fundamental engineering ideas of matter, optics, heat, sound, and quantum theory.

CO2: Demonstrate a solid understanding of fundamental matter properties, Laser and Fiber optics classification, Quantum concepts and apply them successfully to solve practical engineering problems.

CO3: Apply the elastic modulus theory, Fiber Optic Sensors, Ultrasonics and thermal applications to integrate knowledge and problem solve at an advanced level.

CO4: Categorize the Elastic moduli concepts, Fiber optic lasers and Crystal structures to implement in Engineer problems in Material Science and electronics.

CO5: Analyze the foundational Quantum and Crystal Physics concepts to implement solutions for modern engineering problems.

TEXT BOOKS:

1. Bhattacharya, D.K. & Poonam, T. “Engineering Physics”. Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. “Engineering Physics”. Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. &Chaturvedi, S. “Engineering Physics”. Cengage Learning India, 2012

REFERENCES:

1. Halliday, D., Resnick, R. & Walker, J. “Principles of Physics”. Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. “Physics for Scientists and Engineers”. Cengage Learning, 2010.
3. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011.
4. Kittle,C,: Introduction to solid state Physics:, Wiley, 2005.
5. Mani P. Engineering Physics I. Dhanam Publications, 2011.
6. Senthilkumar G. Engineering Physics I. VRB Publishers, 2011.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	1	-	1	-	1	-	-	1	-	1	-	-	-
CO2	3	3	1	-	1	-	1	-	1	-	-	1	-	-	-
CO3	3	3	1	-	1	-	1	-	1	-	-	1	-	-	-
CO4	3	2	1	-	1	-	-	-	-	1	-	1	-	-	-
CO5	3	3	1	-	-	-	1	-	1	-	-	1	-	-	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23CY101 **ENGINEERING CHEMISTRY** **Category: BSC**

(Common to all Branches)

L	T	P	C
3	0	0	3

SDG: 9

COURSE OBJECTIVE:

1. Learn boiler feed water requirements, and water treatment techniques.
2. To acquire knowledge about the preparation, properties and applications of polymers.
3. Understand the basic concepts of electrochemistry and its applications.
4. Learn corrosion control and protective techniques.
5. Acquire the knowledge about the fuels and properties of energy storage devices.

UNIT 1 WATER TECHNOLOGY 9

Introduction - Sources of water - Impurities in water - Types of water –Hardness of water - Expression of hardness - Units of hardness - Estimation of hardness of water by EDTA method - Disadvantages of using hard water - Boiler troubles - Scale and sludge - Softening of water - External treatment method - Demineralization process - Internal treatment process – Carbonate, Phosphate and Calgon conditioning - Desalination by reverse osmosis method.

UNIT 2 POLYMERS 9

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types: Addition, condensation and copolymerization and mechanism of Addition polymerization (Free Radical); Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon (6,6 and 11) and Epoxy resin. Engineering application of plastics- PVC, PTFE and Bakelite. Types of compounding of plastics- Moulding, injection moulding.

UNIT 3 ELECTRO CHEMISTRY 9

Electrochemistry**:** Introduction - Cells - Representation of a galvanic cell - Reversible and irreversible cells - Electrode potential - Nernst equation - Reference electrode (Calomel electrode) - Standard hydrogen electrode - Glass electrode - Electrochemical series and its applications – Battery: Introduction, Types of batteries- alkaline battery- lead storage battery - H_2 -O_2 fuel cell- applications. Construction of solar cells and E-Vehicle.

UNIT 4 CORROSION AND ITS CONTROL 9

Introduction - Chemical corrosion and Wet corrosion - Galvanic and differential aeration (Pitting, Crevice and Pipeline) - Factors influencing rate of corrosion - Corrosion- causes- factors- corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method- Cathodic protection method.

UNIT 5 FUELS AND COMBUSTION 9

Introduction - Classification of fuels - Requirements of a good fuel – Combustion: Principle of combustion - Calorific value - Gross and net calorific values - Explosive range - Spontaneous ignition temperature. Fuels: Solid fuels - Coal and its varieties - Proximate analysis - Significance - Metallurgical coke - Otto-Hoffman byproduct method - Liquid fuel: Manufacture of synthetic petrol - Bergius method - Knocking - Octane number - Cetane number - Gaseous fuel: Liquefied petroleum gas (LPG), Compressed natural gas (CNG).

COURSE OUTCOMES:

At the end of the course, students would

CO1: Recall the concept about water technology, engineering polymers, electrodes, corrosion and combustion of fuels.

CO2: Understand the boiler problems and categorize the polymers.

CO3: Classify plastics, batteries, corrosion, and the calorific value of fuels.

CO4: Apply enough knowledge of contemporary water softening, polymerization, fuel cell, electrochemical protection, and fuel manufacturing procedures.

CO5: Analyze the hardness of water using the EDTA technique and characterization of coal.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jain P C and Monica Jain, “Engineering Chemistry”, 17th Edition, Dhanpat Rai Publishing Co.,2018.

2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, NewDelhi, 2017.

REFERENCES:

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, “Textbook of nanoscienceand nanotechnology”, Universities Press-IIM Series in Metallurgy and Materials Science, 2018.

2. O.G. Palanna, “Engineering Chemistry” McGraw Hill Education (India) Private Limited, 2ndEdition, 2017.

3. Friedrich Emich, “Engineering Chemistry”, Scientific International Pvt, Ltd, New Delhi, 2017.

4. Shikha Agarwal, “Engineering Chemistry-Fundamentals and Applications”, CambridgeUniversity Press, Delhi, Second Edition, 2019.

5. R.D. Madan, “Modern Inorganic Chemistry”, S. Chand, New Delhi, 2012

6. S.S. Dara, “A Textbook of Engineering Chemistry”, S. Chand Publishing, 12th Edition, 2018.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	-	-	2	-	-	2	-	-	-	-	1	-	-	-
CO2	3	-	-	2	2	-	2	-	-	-	-	2	-	-	-
CO3	3	-	-	2	2	-	2	-	-	-	-	2	-	-	-
CO4	3	-	-	2	3	-	2	-	-	-	-	3	-	-	-
CO5	3	-	-	2	3	-	2	-	-	-	-	3	-	-	-
CO6	3	-	-	2	2	-	2	-	-	-	-	2	-	-	-

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23HS101 **HERITAGE OF TAMIL (Common to all Branches)** **Category: HSMC**

L	T	P	C
1	0	0	1

COURSE OBJECTIVE:

1. To learn the extensive literature of classical tamil
2. To review the fine arts heritage of tamil culture
3. To realize the contribution in Indian freedom struggle

UNIT 1 LANGUAGE AND LITERATURE 3

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT 2 HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT 3 FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT 4 THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Portsof Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT 5 CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Remember the extensive literature of tamil and its classical nature, musical instruments, Folk,thinai concept, Indian Freedom Struggle& Aham, Puram and Aram Concept.

CO2: Remember the principles in Thirukural, Bakthi Literature Azhwars and Nayanmars , heritageof

sculpture, painting and musical instruments of ancient people, victory of chozha dynasty.

CO3: Understand on folk and martial arts of tamil people, Justice in Sangam Literature,Development of Modern literature in Tamil, Making of musical instruments.

CO4: Understand the role of Temples in Social and Economic Life of Tamils, Ancient Cities andPorts of Sangam Age, Conquest of Cholas.

CO5: Understand the Cultural Influence of Tamils over the other parts of India, contribution oftamils self-esteem movement and siddha medicine, Print History of Tamil Books.

TOTAL: 15 PERIODS

TEXT BOOKS:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – .கக. கக பிள்ளள (வளியீடு):

தமிழ்நாடுபாடநூல் மற்றும் கல்ைியியல் பணிகள்கழகம்

2. கணினித்தமிழ் – முளனவர் இல. சுந்தரம் . (ைிகடன்பிரசுரம்).
3. கீழடி – ளவளக நதிக்களரயில் சங்ககால நகர நாகரிகம் (வதால்லியல் துளள (வளியீடு)

REFERENCES:

1. Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Historical Heritage of the Tamils (Dr .S. V. Subaramanian, Dr .K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
3. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies)
4. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
CO2	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
CO3	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
CO4	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
CO5	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
	Correlation levels:		**1 – low**			**2 – medium**			**3 – high**			**"-"- no correlation**			

U23BS111 **Category: BSC**
SDG:4 **BASIC SCIENCE LABORATORY**

L	T	P	C
0	0	4	2

COURSE OBJECTIVE:

1. Realize the fundamental engineering ideas of matter, optics, heat, sound, and quantum theory.
2. Demonstrate a solid understanding of fundamental matter properties, Laser and Fiber optics classification, Quantum concepts and apply them successfully to solve practical engineering problems.
3. Apply the elastic modulus theory, Fiber Optic Sensors, Ultrasonics and thermal applications to integrate knowledge and problem solve at an advanced level.
4. Categorize the Elastic moduli concepts, Fiber optic lasers and Crystal structures to implement in Engineer problems in Material Science and electronics.
5. Analyse the foundational Quantum and Crystal Physics concepts to implement solutions for modern engineering problems.

PHYSICS - LIST OF EXPERIMENTS (Any 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus - Non uniform bending method.
3. Determination of Young's modulus - Uniform bending method.
4. Determination of thickness of a thin wire – Air wedge method.
5. Determination of the wavelength of the laser using grating .
6. Determination of Numerical Aperture and acceptance angle using Optical fibre.
7. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
8. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
9. Melde's string experiment.
10. Determination of Band gap of a semiconductor.

CHEMISTRY- LIST OF EXPERIMENTS (Any 5 Experiments)

1. Estimation of total, temporary and permanent hardness of water by EDTA method.
2. Estimation of alkalinity of the given water sample.
3. Determination of chloride content of water sample by Argentometric method.
4. Determination of strength of given hydrochloride acid using pH meter
5. Determination of DO content of water sample by Winkler's method.
6. Conduct metric titration strong acid Vs Strong Base.
7. Estimation of BOD of the given water sample.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of Iron content by spectrophotometer.
10. Estimation of sodium present in water using flame photometer.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Apply Physics principles of elasticity to evaluate engineering properties of materials.

CO2: Analyze the physical principle involved in various instruments in acoustics, optics andthermal physics.

CO3: Characterize the quality of water samples with respect to their acidity, alkalinity and hardness.

CO4: Apply chemistry principles to evaluate DO, BOD, Iron content of the given samples.

CO5: Analyze the strength and amount of acids using pH, potentiometer, conductivity meter and the amount of chloride, sodium iron using Argentometric method and flame photometer for thegiven solution.

TOTAL: 60 PERIODS

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	1	-	1	-	-	-	-	-	-
CO2	3	2	1	1	-	-	1	-	1	-	-	1	-	-	-
CO3	3	2	1	1	-	-	1	-	1	-	-	-	-	-	-
CO4	3	2	1	1	-	-	1	-	1	-	-	1	-	-	-
CO5	3	2	-	1	-	-	1	-	1	-	-	1	-	-	-

Correlation levels: 1 – low 2 – medium 3 –high "-"- no correlation

U23EN111 **COMMUNICATIVE ENGLISH LABORATORY** **Category : HSMC**
SDG : 4 **(Common to all Branches)**

L	T	P	C
0	0	2	1

COURSE OBJECTIVE:

1. To enable learners of engineering and technology to develop their basic communication skills in English.
2. To acquire, command in both the respective skills (listening and reading) and the productive skills (writing and speaking) of the English language.
3. To understand the key concepts of values, life skills and business communication and motivate students to look within and create a better version of themselves.
4. To focus on the development of basic fluency in English, usage of vocabulary in the technical field, and strengthening reading and official written communication skills.
5. To use language efficiently in expressing their opinions via various media.

LIST OF EXPERIMENTS

1. Conversation: Introduction to Classmates-Audio/Video (formal & informal)
2. Self-Introduction
3. Telephone Conversation
4. Listening to voicemail & messages
5. Listening and filling a form
6. Debate
7. Group Discussion
8. Exchanging personal Information
9. Introducing a friend politeness strategy
10. Essay Writing

COURSE OUTCOMES:

At the end of the course, students would

CO1: Listen and comprehend complex academic texts.

CO2: Understand the denotative and connotative meanings of technical texts.

CO3: Identify definitions, descriptions, narrations and essays on various topics.

CO4: Apply different methods of integration in solving practical problems.

TOTAL: 30 PERIODS

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	1	1	-	-	2	-	2	2	2	2	-
CO2	3	2	2	2	1	1	-	-	2	-	2	2	3	3	-
CO3	3	2	3	2	1	2	-	-	2	-	2	2	2	2	-
CO4	3	2	2	2	1	2	-	-	3	-	2	3	3	3	-
CO5	3	2	3	1	1	2	-	-	3	-	2	3	2	3	-

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23GE101
SDG: 4

ENGINEERING GRAPHICS
(Common to all Branches)

Category: ESC

L	T	P	C
3	0	2	4

COURSE OBJECTIVE:

1. Draw engineering curves of simple objects.
2. Draw the orthographic projection of solids and section of solids.
3. Draw the development of surfaces.
4. Draw the isometric projections of simple solids.
5. Model a simple object using a CAD software

CONCEPTS AND CONVENTIONS (Not for Examination) **02**

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications — Size, layout and folding of drawing sheets - Lettering and dimensioning.

UNIT 1 **PLANE CURVES** **10**

Basic Geometrical constructions, Curves used in engineering practices: Conics - Construction of ellipse, parabola and hyperbola by eccentricity method - Construction of cycloid - Construction of involutes of circle - Drawing of tangents and normal to the above curves

UNIT 2 **PROJECTION OF POINTS, LINES AND PLANES** **10**

Orthographic projection - principles - Principal planes - First angle projection - projection of points. Projection of straight lines - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces)

UNIT 3 **DESCRIPTION OF PROCESS/PRODUCT** **10**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids by rotating object method.

UNIT 4 **PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES** **10**

Sectioning of solids in simple vertical position - obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids - Prisms, pyramids cylinders and cones

UNIT 5 **ISOMETRIC PROJECTIONS** **10**

Principles of isometric projection - isometric scale - lsometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders and cones.

MODELING OF SIMPLE OBJECTS (Not for Examination) **8**

Practicing three-dimensional modeling of simple objects by CAD Software

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1: Understand the engineering curves of simple objects.
CO2: Create drawings on orthographic views.
CO3: Use the knowledge of orthographic Projections of simple solids.
CO4: Draw the development of lateral surface of simple Solids.
CO5: Draw the isometric projection of simple plans and solids
CO6: Model a simple object using a CAD software.

TOTAL PERIODS: 60

TEXT BOOKS:

1. Venugopal K. and Prabhu Raja V., “Engineering Graphics", New Age International (P) Limited, 2008.
2. Natrajan K.V., “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2018.
3. Jeyapoovan T., “Engineering Graphics", Newdelhi Vikas Publishing House, 2007.

REFERENCE BOOKS:

1. Parthasarathy N. S. and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
2. Kulkarni D; Rastogi; Sarkar, “Engineering Graphics with AUTOCAD”, Newdelhi Prentice Hall of India, 2009.

CO’s-PO’s & PSO’s MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
CO2	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
CO3	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
CO4	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
CO5	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-

Correlation levels: 1 – low 2 – medium 3 – high “-“- no correlation

U23 GE111 **Category : ESC**

SDG:4

ENGINEERING PRACTICES LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVE:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
2. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts.
3. Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Wiring various electrical joints in common household electrical wire work.
5. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components.

S. NO

LIST OF EXPERIMENTS

GROUP A (CIVIL & MECHANICAL)

PART I CIVIL ENGINEERING PRACTICES

PLUMBING WORK:

1 Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.

2 Preparing plumbing line sketches.

3 Basic pipe connections – Mixed pipe material connection – Pipe connections with different joiningcomponents.

WOOD WORK:

4 Sawing,

5 Planing and

6 Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

PART II MECHANICAL ENGINEERING PRACTICES

WELDING WORK:

7 Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.

8 Practicing gas welding.

BASIC MACHINING WORK:

9 (simple)Turning

10 (simple)Drilling.

11 (simple)Tapping.

MACHINE ASSEMBLY PRACTICE:

12 Study of centrifugal pump

13 Study of air conditioner

SHEET METAL WORK:

14 Making of a square tray

GROUP B (ELECTRICAL & ELECTRONICS)

PART I ELECTRICAL ENGINEERING PRACTICES

1 Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin sockets.

2 Staircase wiring.

3 Fluorescent Lamp wiring with introduction LED types.

4 Energy meter wiring and related calculations/ calibration

5 Study of Iron Box wiring and assembly

PART II ELECTRONIC ENGINEERING PRACTICES

6 Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.

7 Study of logic gates AND, OR, EX-OR and NOT.

8 Generation of Clock Signal.

9 Soldering simple electronic circuits and checking continuity.

10 Assembly and dismantle of LED TV.

Contact Periods:60

COURSE OUTCOMES:

At the end of the course, students would

CO1: Fabricate carpentry components and pipe connections including plumbing works.

CO2: Use welding equipments to join the structures.

CO3: Carry out the basic assembling and machining operations; Make the models using sheet metal works.

CO4: Carry out basic home electrical works and appliances and to measure the electrical quantities.

CO5: Soldering the simple electronic circuits; Assemble the simple electronic devices..

TOTAL: 60 PERIODS

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
CO2	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
CO3	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
CO4	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
CO5	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1

Correlation levels: **1 – low** **2 – medium correlation** **3 – high** **"-"- no**

Category : EEC

U23EE101	**CAREER ENHANCEMENT TRAINING I**				
SDG: 17	**(Common to all Branches)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**1**

COURSE OBJECTIVE:

1. To improve mathematical and analytical abilities of students, particularly in the context of comprehending engineering concepts and making data-driven decision.
2. To develop critical thinking skills including problem solving, logic, patterns, and reasoning.
3. To Comprehend and appreciate mathematical terminologies and concepts in order to understand, interpret, and represent science and technology.

UNIT 1 FUNDAMENTALS 6

Divisibility Test - Square root and Cube roots – HCF & LCM - problems on Numbers

UNIT 2 ALGEBRA 5

Simplification – Surds & Indices – Linear & Quadratic Equations

UNIT 3 BANKING ESSENTIALS 8

Average – Percentage – Profit & Loss – Simple Interest – Compound Interest

UNIT 4 TIME AND EFFICIENCY 8

Time Speed Distance – Problems on Trains – Boats & Streams – Time & Work – Pipes & Cisterns

UNIT 5 LOGICAL REASONING 3

Number & letter series – Analogy– Pattern classification – Coding & Decoding

COURSE OUTCOMES:

At the end of the course, students would

CO1: Exhibit a clear understanding of fundamental concepts of aptitude for engineering.
CO2: Demonstrate problem-solving skills and critical thinking abilities in the context of recruitment aptitude tests.
CO3: To use appropriate strategies and shortcuts to improve speed and accuracy in solving aptitude problems during recruitment processes.
CO4: Evaluate and interpret aptitude test results to identify areas of improvement and develop apersonalized study plan for further enhancement.

TOTAL: 30 PERIODS

TEXT BOOKS:

1. The Pearson Guide to Quantitative Aptitude For Competitive Examinations, Dinesh Khattar .Pearson

2. Quantitative Aptitude Dr. R.S. Aggarwal S. Chand Publication.
3. A modern Approach to Verbal and Non-Verbal Reasoning R.s. Aggarwal.

REFERENCES:

1. Quantitative Aptitude for CAT, Arun Sharma.
2. Fast Track Objective Arithmetic, Rajesh Verma, Arihant Publication.
3. Quantitative Aptitude Quantum CAT Common Admission Tests for Admission into IIMs,Sarvesh K. Verma.
4. Effective Communication Skill,Kulbhusan Kumar,R S Salaria,Khanna Publishing House.
5. Wiley's Exam Expert Quantitative Ability for CAT, 2ed, Ashu Jain.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	1	1	2	-	-	-	-	-	-	-	-	-	-	-
CO4	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

SEMESTER II

U23MA203 SDG: 4	DESIGN OF EXPERIMENT AND NUMERICAL METHODS	Category: BSC L T P C 3 1 0 4

COURSE OBJECTIVE:

1. Learn basic concepts of statistical and numerical methods as well as numerical problem-solving procedure for planning marketing strategies
2. Gain the knowledge of testing of hypothesis for samples and design of experiments
3. Understand the basic concepts in solving algebraic and transcendental equations
4. Adopt the numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines
5. Develop the various techniques and methods of solving ordinary differential equations

UNIT 1 TESTING OF HYPOTHESIS 9+3

Large Sample Test: Single Mean and Difference of two Means. Small Sample Test - Student's t Test - Single Mean-Difference of Two Means-F Test- Chi Square Test-Goodness of Fit - Test of Independence Attributes – Application- Comparative Analysis - Quality Testing.

UNIT 2 DESIGN OF EXPERIMENTS 9+3

Analysis of Variance: One way and two-way classifications - Completely randomized design – Randomized block design – Latin square design. Application: Response Surface Methodology.

UNIT 3 ALGEBRAIC AND TRANSCENDENTAL EQUATIONS 9+3

Solution of algebraic and transcendental equations–Newton Raphson method - Gauss elimination method – Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel Method. Application: System of Communications

UNIT 4 NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3

Interpolation Using Newton's Forward and Backward Difference Formulae – Numerical Integration: Trapezoidal Rule and Simpson's 1/3rd and 3/8 Rules. Application: The determination of discontinuous points in Image processing.

UNIT 5 SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

Taylor's series method - Euler's method - Modified Euler's method – Fourth orders Runge-Kutta method for solving first order differential equations. Application: Electrical circuits, Chemical reactions and Mechanical system.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Comprehend the concepts of Independence of attributes, One way and two way classifications, Solution of algebraic and transcendental equations for solving complex problems.

CO2: Tests for single mean, Equality of variance, Chi square test for goodness of fit and Solution of linear equations

CO3: Apply the numerical techniques of differentiation and integration for engineering problems and solving Ordinary Differential Equations.

CO4: Analyze the concepts of classifications of design of experiments and linear equations in the field of Engineering and Technology.

CO5: Evaluate integrals to compute area, volume and other practical problems.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Johnson, R.A., Miller, I and Freund J., “Miller and Freund’s Probability and Statistics forEngineers", Pearson Education, Asia, 8th Edition, 2015.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015

REFERENCES:

1. Burden, R.L and Faires, J.D, "Numerical Analysis”, 9th Edition, Cengage Learning, 2016
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences”, Cengage Learning, New Delhi, 8th Edition, 2014
3. Gupta S.C. and Kapoor V. K., “Fundamentals of Mathematical Statistics”, Sultan Chand &Sons, New Delhi, 12th Edition, 2020
4. Devore. J.L., "Probability and Statistics for Engineering and the Sciences”, Cengage Learning, New Delhi, 8th Edition, 2014

CO’s-PO’s & PSO’s MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO3
CO1	3	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	2	-	-	-	-	-	-	-	-	-	-	-
Correlation levels:	**1 – low**		**2 – medium**			**3 – high**			**“-“- no correlation**						

U23FT201 SDG: 4	FUNDAMENTALS OF HUMAN NUTRITION	Category: PCC L T P C 3 0 0 3

COURSE OBJECTIVE:

1. To understand about fundamentals of food and its nutritional benefits
2. To learn about macronutrient in the food and its functions
3. To learn about micronutrient in the food and its functions
4. To acquire knowledge on nutritional management
5. To know about various nutritional policies

UNIT 1 **DEFINITION OF FOOD, NUTRITION AND HEALTH** **9**

Introduction – Food & its relation to health – Objectives in the study of nutrition – Energy – Definition – forms of energy – units of measurement – physiological fuel vales of energy – determination of energy value of foods BMR – definition –Determination and factors affecting – Factors affecting energy requirements – diet induced thermogenesis (SDA) – Water – Functions – requirements – sources.

UNIT 2 **MACRONUTRIENT** **9**

Protein – Classification – functions – Digestion – absorption – RDA – sources and deficiencies – Carbohydrate – Classification – functions – Digestion – absorption – RDA – sources – deficiencies – Fat – Classification – functions – Digestion – absorption – RDA – sources and deficiencies – Dietary fiber – types and functions.

UNIT 3 **MICRONUTRIENT** **9**

Fat-soluble Vitamins (A, D, E & K) – Function – RDA – sources and deficiency and excess Water-soluble vitamins – Thiamin – Riboflavin – Niacin – B12 – Folic acid – Biotin – Vitamin C – functions – RDA – food sources – deficiencies and excess – Macro minerals – Calcium – Phosphorus and magnesium – Sodium – Potassium – Chlorine – Functions – absorption – RDA – sources and deficiencies – Micro Minerals – Iron – Zinc – Fluorine and Iodine – function – absorption – RDA – sources and deficiency.

UNIT 4 **NUTRITIONAL MANAGEMENT** **9**

Definition – importance of balanced diet – RDA for various nutrients – age – gender – physiological state – food group system – factors affecting meal planning – Nutritional deficiency diseases – Causes – symptoms – treatment – Protein Energy Malnutrition (PEM) – Vitamin A Deficiency (VAD) – Iron Deficiency Anemia (IDA) – Iodine Deficiency Disorders (IDD) – Zinc Deficiency – Fluorosis.

UNIT 5 **NUTRITIONAL POLICIES** **9**

National Nutrition Policy and Program – Integrated Child Development Services (ICDS) Scheme – Mid-day Meal Program (MDMP) – National programs for prevention of Anemia – Vitamin A deficiency – Iodine Deficiency Disorders –National and International agencies in uplifting the nutritional status – WHO –UNICEF – CARE – ICMR – ICAR – CSIR – CFTRI – Various nutrition related welfare program – ICDS – SLP – MOM and others

COURSE OUTCOMES:

At the end of the course, students would

CO1: Know the health benefits of food.

CO2: recognize the macronutrients in food.

CO3: Identify the macronutrients in food.

CO4: Utilize the nutritional management criteria for planning balanced diet

CO5: Get aware on the nutritional policies and program available in India.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S. R. Mudambi and M.V. Rajagopal, "Fundamentals of Foods, Nutrition and Diet Therapy" New Age International (P) Limited, Publishers, 5th edition, 2005.
2. B. Srilakshmi, "Nutrition Science" New age International (P) Limited, Publishers, 4th edition, 2012.
3. C. Gopalan, B.V. Ramasastri and S.G. Balasubramaniam, "Nutritive value of Indian foods", NIN, ICMR, Hyderabad, INDIA, 2007.

REFERENCES:

1. S.B. Mahtab. R.N. Prahlad and R. Vinodini, "Text book of Human Nutrition", Oxford & IBH Publishing Co. PVT. LTD, New Delhi, 2003.
2. A. B. Bowmaw and M. R. Russell, "Nutrition", ILSI press, Washington, DC, Eighth Edition. 2001.
3. Sunetra Roday. "Food Science and Nutrition", Oxford University Press, Third edition, 2018
4. Nutrient Requirements and Recommended Dietary Allowances for Indians – Indian Council of Medical Research, National Institute of Nutrition, Hyderabad.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO3
CO1	2	-	-	-	-	-	1	-	2	1	-	3	-	-	-
CO2	2	-	-	-	-	-	1	-	2	1	-	3	-	-	-
CO3	2	-	-	-	-	-	2	-	2	1	-	3	-	-	-
CO4	2	-	2	-	-	-	2	-	2	1	-	2	1	2	1
CO5	2	-	3	-	-	-	2	-	2	1	-	2	1	2	2

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23FT202 SDG: 4	FOOD MICROBIOLOGY	Category: PCC L T P C 3 0 0 3

COURSE OBJECTIVE:

1. To understand the basics of microbiology, the classification and taxonomy of microorganisms
2. To acquire knowledge on different techniques enumeration, identification and culturing of bacteria
3. To understand the microorganism associated with food fermentation
4. To acquire knowledge on microorganism related to food contamination and spoilage
5. To learn about food borne illness and different preservation techniques to preserve from spoilage microbes

UNIT 1 HISTORY, TAXONOMY AND CLASSIFICATION OF MICROORGANISM 9

History and scope of Microbiology – Landmark discoveries in the development of Microbiology – Classification – nomenclature of Microorganisms and Characterization according to Bergey's manual Systematic Bacteriology – Three and Five Kingdom Concepts – Broad classification of Prokaryotes and Eukaryotes. Cell biology – bacterial size, shape and arrangement – cell structure and components of bacteria – Morphology of fungi and algae.

UNIT 2 ENUMERATION, IDENTIFICATION AND CULTURING OF BACTERIA 9

Techniques for isolation and enumeration of bacteria – biochemical tests of bacteria – maintenance and preservation of microbial culture – Staining methods – fixation – types of dyes – simple staining – differential – staining of specific structures – Microscopy – Light microscopy – Brightfield and Darkfield microscope Fluorescent and phase contrast microscopy Electron microscopy.

UNIT 3 MICROORGANISM IN FOOD FERMENTATIONS 9

Microbes in food fermentations – Homo & Hetero – Fermentative Bacteria – Biochemistry of Fermentations – Starter Cultures, Alcoholic Fermentations – Yeast Fermentations – Fungal Fermentations – Microbes Associated with Typical Food Fermentations – Fermented vegetables – Fruits – Bread – Wines – Vinegar – Fermented Dairy Products.

UNIT 4 MICROORGANISM IN FOOD CONTAMINATION AND SPOILAGE 9

Microorganisms associated with foods – Bacteria – Molds – Yeast and their importance – Nutritional requirements of bacteria – Factors affecting the growth of bacteria – Growth curve of bacteria. Factors affecting spoilage of foods – Microbial flora associated with various food groups their – spoilage potential. Microbiological spoilage problems associated with typical food products.

UNIT 5 FOOD BORNE ILLNESSES AND PRESERVATION 9

Food Poisoning and intoxication – food borne diseases – Principle of Preservation – Conventional method of preservation – Thermal mode of preservation – Pasteurization, sterilization and Canning – Low-temperature storage. Nonthermal Methods of Preservation – High pressure processing – Irradiation – Microwave – UV and Ionizing radiation – Use of chemical preservatives – Natural food preservatives – Application of Probiotics and Prebiotics.

COURSE OUTCOMES:

At the end of the course, students will be able to:

CO1: Identify and classify the microorganisms.
CO2: Use different techniques to enumerate, identify and culture the bacteria.
CO3: Identify microorganisms associated with food fermentation.
CO4: Categorize the microorganism associated with food contamination and food spoilage.

CO5: Identify food borne illness caused by different pathogens and use respective preservative technique to preserve the food from spoilage

TOTAL: 45 PERIODS

TEXT BOOKS:

1. William C Frazier and Dennis C. West off, "Food Microbiology", Special Edition, Springer, The Mc Graw-Hill Companies 2008. ISBN-9780070667181.
2. Adams M.R and Moss M.O, "Food Microbiology", Panima Publishing corporation, New Delhi, 2nd Edition, Third reprint, ISBN-13:9788122410143,978-8122410143, 2007.
3. Banwart, G.J. "Basic Food Microbiology" 2nd Edition. CBS Publishers, 1998.
4. M.J Pelczar, E.C.S Chan, N.R Krein "Microbiology", Tata McGraw Hill 5th Edition, New Delhi, India. ISBN 10: 0074623206. 2006.

REFERENCES:

1. Vijaya Ramesh. "Food Microbiology". MJP Publishers, Chennai, 2007.
2. Jay, J.M. "Modern Food Microbiology". 4th Edition. CBS Publishers, 2003.
3. Khetarpaul, Neelam. "Food Microbiology" Daya Publishing House, 2006.
4. Ray, Bibek and Arun Bhunia. "Fundamental Food Microbiology" 4th Edition, CRC Press, 2008.
5. Pawsey, R. K. "Case Studies in Food Microbiology for Food Safety and Quality". The Royal Society of Chemistry, 2001.
6. Doyle, Michael P. "Food Microbiology: Fundamentals and Frontiers". 2nd Edition, ASM Press, 2001.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	2	2	2	-	-	-	-	-	1	1	1	-
CO2	1	2	2	2	-	3	-	-	-	-	1	2	1	1	-
CO3	3	2	2	2	2	1	-	-	-	-	-	-	2	2	-
CO4	2	2	1	2	-	1	-	-	-	-	-	2	3	1	2
CO5	2	2	-	2	2	2	-	-	-	-	1	1	2	2	1

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23FT203 SDG: 4	BASIC MECHANICAL ENGINEERING	Category: ESC L T P C 3 0 0 3

COURSE OBJECTIVE:

1. To understand the types of pumps and their applications
2. To acquire knowledge about mechanical power transmission systems
3. To understand about steam generation and distribution
4. To learn about refrigeration system and chillers
5. To learn about material handling equipment and its working principles

UNIT 1 CASTING PROCESSES 9

Sand Casting – Sand Mould – Type of patterns – Pattern Materials – Pattern allowances – Moulding sand Properties and testing – Cores – Types and applications – Moulding machines– Types and applications.

UNIT 2 POWER TRANSMISSION SYSTEM 9

Speed ratios – Gear boxes – Standard step ratio – Ray diagram kinematics layout – sliding mesh gear box – Constant mesh gear box – Synchromesh gearbox – clutches – axial clutches – cone clutches – internal expanding rim clutches.

UNIT 3 JOINING PROCESSES 9

Introduction – Types of welding – Flame characteristics – Gas Tungsten arc welding– Electro slag welding Operating principle and applications – Resistance welding – Plasma arc welding – Electron beam welding – Weld defects

UNIT 4 REFRIGERATION SYSTEMS & IC ENGINES 9

Types of refrigeration systems – Principle of vapour compression and Absorption system. I.C engines types – two stroke & four stroke engines and SI & CI engines

UNIT 5 SPECIAL MACHINES 9

Centre lathe – constructional features – specification – operations, Capstan and turret lathes – types of grinding process – cylindrical grinding – surface grinding – centreless grinding

COURSE OUTCOMES:

At the end of the course, students would

CO1: Classify the pumps used in food industries.
CO2: Identify the suitable Power Transmission System.
CO3: Select the specific boilers suitable for specific food products.
CO4: Demonstrate the different operations performed in Refrigeration & cold storage systems.
CO5: Obtain knowledge in Material Handling system in Food Plants.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. P.G. Smith, “Introduction to Food Process Engineering”, Springer international Edition, 2005
2. R. Paul Singh, Dennis R. Heldman; “Introduction to Food Engineering” (3rd edition), Academic press, Elsevier, 2001.
3. Shanmugam Gand Palanichamy MS, “Basic Mechanical Engineering”, Tata McGraw Hill Publishing Co., NewDelhi,1996.

REFERENCES:

1. R.K Rajput, “Thermal Engineering”, Laxmi Publications, 2008.
2. R.K. Bansal; “Fluid Mechanics and Hydraulic Machines”, Laxmi publications (P) Ltd, 2004
3. C.P. Arora, “Refrigeration and Air conditioning”, Tata McGraw Hill, 2009.
4. R.S. Khurmi and J.K. Gupta, "A Text Book of Machine Design", Eurasia Publishing House, 2005.
5. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2010.

6.Venugopal K. and Prahu Raja V., "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, 2000.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	1	-	-	1	-	-	1	-	-	-	1	1	-
CO2	3	3	2	-	-	1	-	-	1	-	-	-	1	1	-
CO3	3	3	2	-	-	1	-	-	2	-	-	-	3	3	-
CO4	3	3	2	-	-	1	-	-	2	-	-	-	3	3	-
CO5	3	3	2	-	-	1	-	-	2	-	-	-	3	3	-

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23HS202 SDG: 4	TAMIL'S & TECHNOLOGY	Category: HSMC L T P C 1 0 0 1

COURSE OBJECTIVE:

1. To learn the extensive Weaving Industry during Sangam Age Tamil
2. To review the fine manufacturing technology culture
3. to realize the scientific Tamil computing

UNIT 1 WEAVING AND CERAMIC TECHNOLOGY 3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potterie

UNIT 2 DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period

UNIT 3 MANUFACTURING TECHNOLOGY 3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram

UNIT 4 AGRICULTURE AND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT 5 SCIENTIFIC TAMIL & TAMIL COMPUTING 3

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Remember the weaving industry during sangam age

CO2: Remember the Designing and Structural construction House & Designs in household materials during Sangam Age, Building, Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period

CO3: Understand on. Art of Ship Building Metallurgical studies Iron industry, - Iron smelting, steel Copper and gold Coins as source of history, Minting of Coins Beads making-industries stone beads,

CO4: Understand on Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry, Wells designed for cattle use, Agriculture and Agro Processing, Knowledge of Sea Fisheries Pearl, Ancient Knowledge of Ocean Knowledge Specific Society.

CO5: Understand the Development of Scientific Tamil, Tamil computing – Digitalization of Tamil Books, Development of Tamil Software, Tamil Virtual Academy, Tamil Digital Library, Online Tamil Dictionaries, Sorkuvai Project.

TOTAL: 15 PERIODS

TEXT BOOKS:

1. TAMILS AND TECHNOLOGY. VK PUBLICATIONS (PUBLISHERS OF SCIENCE AND ENGINEERING BOOKS).

REFERENCES:

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
3. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)
4. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
CO2	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
CO3	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
CO4	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
CO5	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23EN202	PROFICIENCY IN ENGLISH	Category: HSMC			
		L	T	P	C
SDG: 4		2	0	2	3

COURSE OBJECTIVE:

1. To improve the communicative competence of learners.
2. To help learners use language effectively in academic /work contexts.
3. To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos, etc.
4. To build on students' English language skills by engaging them in listening, speaking, and grammar learning activities that are relevant to authentic contexts.
5. To use language efficiently in expressing their opinions via various media.

UNIT 1 INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 6

Listening -conversation: Introduction to classmates - Audio / video (formal & informal), Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies.

UNIT 2 NARRATION AND SUMMATION 6

Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences describing experiences and feelings- engaging in small talk- describing requirements and abilities.

UNIT 3 DESCRIPTION OF A PROCESS / PRODUCT 6

Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product.

UNIT 4 CLASSIFICATION AND RECOMMENDATIONS 6

Listening –Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress talking about travel preparations.

UNIT 5 EXPRESSION 6

Listening – Listening to debates/ discussions; panel discussions. Speaking –making predictions- talking about a given topic-giving opinions.

LIST OF EXPERIMENTS

- Conversation: Introduction to Classmates-Audio/video (formal & informal).
- Self-Introduction.
- Telephone Conversation.
- Listening to voicemail & messages.
- Listening and filling a form.
- Debate.
- Group Discussion.
- Exchanging personal Information.
- Introducing a friend politeness strategy.
- Essay Writing.

COURSE OUTCOMES:

At the end of the course, students would

CO1: To listen and comprehend general as well as complex academic information

CO2: To listen to and understand different points of view in a discussion.

CO3: To speak fluently and accurately in formal and informal communicative contexts.

CO4: To describe products and processes and explain their uses and purposes clearly and accurately.

CO5: To express their opinions effectively in both formal and informal discussions.

CO6: To learn at their own pace and can repeat exercises to improve their skills.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. English for Engineers & Technologists, Orient Blackswan Private Ltd. Department of English, Anna University, 2020

2. English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

3. A Handbook for English Language Laboratories, E. Suresh Kumar, Department of English, College of Engineering, Osmania University, P. Sreehari, Department of English, College of Engineering, Osmania University. 2011.

REFERENCES:

1. Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.

2. A Course Book on Technical English By Lakshmi Narayanan, Scitech Publications (India) Pvt. Ltd.

3. English For Technical Communication (With CD) By Aysha Viswamohan Mcgraw Hill Education, ISBN : 0070264244.

4. Effective Communication Skill, Kulbhusan Kumar, R S Salaria, Khanna Publishing House.

5. Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi, 2003.

6. A Manual For English Language Laboratory, D. Sudha Rani, Pearson Education India, 2009.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	-	-	-	-	-	1	1	-	3	1	-	2	-	-	-
CO2	-	-	-	-	-	1	1	-	3	2	-	2	-	-	-
CO3	-	-	-	-	-	2	2	-	3	2	-	3	-	-	-
CO4	-	-	-	-	-	2	2	-	3	1	-	2	-	-	-
CO5	-	-	-	-	-	1	2	-	3	3	-	3	-	-	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23GE202 SDG: 4	BASICS OF ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING	Category: ESC L T P C 3 0 2 4

COURSE OBJECTIVE:

1. Analyze the Electric Circuits.
2. Analyze the electric network using magnetic property and also acquire knowledge about electrical safety measures.
3. Explain the construction and operation of DC and AC Electrical machines
4. Explain the construction, operation and applications of special semiconductor devices and Design simple electronic circuits
5. Explain the operation of basic measuring instruments and transducers

UNIT 1 ELECTRICAL CIRCUITS 12

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state) Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only), Three phase supply – star and delta connection – power in three-phase systems

UNIT 2 MAGNETIC CIRCUITS AND ELECTRICAL INSTALLATIONS 6

Magnetic circuits-definitions-MMF, flux, reluctance, magnetic field intensity, flux density, fringing, self and mutual inductances-simple problems.

Domestic wiring, types of wires and cables, earthing, protective devices- switch fuse unit- Miniature circuit breaker-moulded case circuit breaker- earth leakage circuit breaker, safety precautions and First Aid

UNIT 3 ELECTRICAL MACHINES 9

Construction, Working Principle and applications of DC generators, DC Motors, single phase Transformers, three phase and single-phase induction motors.

UNIT 4 SEMICONDUCTOR DEVICES AND CIRCUITS 9

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET,IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters.

UNIT 5 SENSORS AND TRANSDUCERS 9

Sensors, solenoids, pneumatic controls with electrical actuator, mechatronics, types of valves and its applications, electro-pneumatic systems, proximity sensors, limit switches, piezoelectric, hall effect, photo sensors, Strain gauge, LVDT, differential pressure transducer, optical and digital transducers, Smart sensors, Thermal Imagers.

LIST OF EXPERIMENTS

1. (a)Verification of Kirchoff's Voltage and Current Laws.
   (b)Verification of series and parallel circuits.
2. Study of three phase power system.
3. Load test on DC shunt motor.
4. Load characteristics of DC generator.
5. Load test on single phase transformer.
6. Load test on single phase induction motor.
7. Study of electrical safety measures.
8. Characteristics of PN junction diode and Zener diode.Characteristics of CE configuration.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Analyze the electric circuits using circuit laws

CO2: Interpret the properties of magnetic circuits and various methods in electrical installations and also about electrical safety measures**.**

CO3: Acquire the knowledge about the Construction and operation of DC and AC Electrical machines

CO4: Design simple electronic circuits using semiconductor devices

CO5: Summarize the operation of basic measuring instruments and transducers for Electrical and Electronic circuits

TOTAL: 75 PERIODS

TEXT BOOKS:

1. Sudhakar A. and Shyammohan S. Palli, "Circuits and Networks Analysis and Synthesis", 5th Edition, McGraw-Hill Education, New Delhi, 2017

2. Kalsi.H. S," Electronics Instrumentation" 3 rd Edition (copyright 2010, Second Reprint 2011) Tata McGraw Hill, New Delhi, 2010.

3. Electronic Devices and Circuits by S Salivahanan (Author), N. Suresh Kumar (Author)-5th Edition-2022

REFERENCES:

1. Hayt W.H., Kemmerly J.E., Durbin S.M., "Engineering Circuit Analysis", 9th Edition, Tata McGraw-Hill, New Delhi, 2020.

2. Sawhney.A.K, "A course in Electrical and Electronic measurement and Instrumentation", Dhanpat Rai & Sons New Delhi, 18 th Edition 2001.

3. Anil K Maini, Varsha Agarwal, "Electronic Devices and Circuits", Wiley India Private Ltd., New Delhi 1stEdition 2015

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	1	1	2	-	-	-	1	1	2	1	3	2	1
CO2	2	2	1	2	2	-	-	-	1	1	1	2	2	2	1
CO3	2	1	-	1	1	-	-	-	2	1	1	2	2	1	-
CO4	3	2	1	2	2	1	1	-	1	2	1	3	3	2	1
CO5	3	2	2	1	2	-	-	-	1	1	2	2	3	2	2

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

Category: PCC

L	T	P	C
0	0	4	2

U23FT211 FOOD MICROBIOLOGY LABORATORY
SDG: 4

COURSE OBJECTIVE:

1. To learn about preparation of culture media and sterilization technique
2. To learn and explore isolation of pure culture and preservation technique
3. To acquire knowledge to operate microscope and detection of microbes
4. To learn about isolation and enumeration of spoilage organism
5. To learn on enumeration of food borne pathogen.

LIST OF EXPERIMENTS

1. Introduction, Laboratory Safety, Use of Equipment; Sterilization Techniques
2. Microscopy – Working and care of Microscope
3. Culture Media-Types and Use; Preparation of Nutrient broth and agar
4. Culture Techniques, Isolation and Preservation of Cultures- Broth flask, test tubes, slants, stabs
5. Culture Techniques, Isolation and Preservation of Cultures Solid Pour plates, streak plates, Spread plate
6. Staining Techniques: Staining techniques of bacteria- Gram, Negative, spore staining
7. Staining Techniques: Staining Techniques of Fungi- Lacto phenol Cotton Blue Staining
8. Quantification of Microbes Sampling and Serial Dilution; Bacterial count in food products TVC
9. Microbiological quality of milk
10. Microbiological quality of water (MPN)
11. Thermal destruction of microbes TDT & TDP
12. Enumeration of Lactic acid bacteria from fermented foods
13. Isolation and enumeration of fungi/yeast from fruit drinks
14. Enumeration of spores from spices

COURSE OUTCOMES:

At the end of the course, students would

CO1: Prepare the media for microbial growth
CO2: Isolate pure culture and preserve them
CO3: Operate microscope and use it for detection of microbes
CO4: Isolate and enumerate spoilage organisms
CO5: Enumerate the presence of food borne pathogen

TOTAL: 60 PERIODS

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	1	2	1	2	2	3	1	-	-	-	2	2	2	2	-
CO2	2	1	2	3	2	2	2	-	-	-	2	2	3	3	-
CO3	1	3	3	-	-	-	2	-	-	-	3	3	1	2	-
CO4	2	2	2	-	-	-	1	-	-	-	1	2	2	1	-

CO5	3	2	2	-	-	-	2	-	-	-	1	1	2	1	-
Correlation levels:				**1 – low**			**2 – medium**			**3 – high**			**“-“- no correlation**		

U23EE202 SDG: 17	CAREER ENHANCEMENT TRAINING II	Category: EEC L T P C 3 0 0 1

COURSE OBJECTIVE:

1. To help students demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
2. To enable students critically evaluate various real-life situations by resorting to an analysis of key issues and factors.
3. To help them improve their communicative English for Interview and corporate readiness.

UNIT 1 NUMERICAL REASONING 6

Problems on Ages – Arithmetic Reasoning - Ratio & Proportion – Alligation & Mixtures

UNIT 2 GEOMETRY & SHAPES 6

Mensuration 2D –Mensuration 3D – Height – Distance - Perimeter – Area – Volume

UNIT 3 COMBINATIONS & CALENDARS 6

Permutation and Combination – Probability-Circular Permutation - Clocks and Calendars

UNIT 4 CLASSIC REASONING 6

Blood Relation – Direction Sense – Seating Arrangement – Syllogism – Statement & Conclusion

UNIT 5 VERBAL APTITUDE 6

Spelling – Reading Comprehension – Select Words – Closet Test.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Demonstrate problem-solving skills and critical thinking abilities in the context of Engineering Aptitude.

CO2: To use appropriate strategies and shortcuts to improve speed and accuracy in solving aptitude problems during recruitment processes.

CO3: Evaluate and interpret aptitude test results to identify areas of improvement and develop a personalized study plan for further enhancement.

CO4: Use the correct Grammar, Vocabulary, Spelling and Comprehension ensuring the enhancement their language skills and the ability to use the skills for effective Communication.

TOTAL: 30 PERIODS

TEXT BOOKS:

1. The Pearson Guide to Quantitative Aptitude For Competitive Examinations, Dinesh Khattar. Pearson
2. Quantitative Aptitude Dr. R.S. Aggarwal S. Chand Publication
3. A modern Approach to Verbal and Non-Verbal Reasoning R.s. Aggarwal

REFERENCES:

1. Quantitative Aptitude for CAT, Arun Sharma.
2. Fast Track Objective Arithmetic, Rajesh Verma, Arihant Publication.
3. Quantitative Aptitude Quantum CAT Common Admission Tests for Admission into IIMs, Sarvesh K. Verma.
4. Wiley's Exam Expert Quantitative Ability for CAT, 2ed, Ashu Jain.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	3	3	-	-	-	-	-	1	-	-	-	-	-
CO2	3	2	1	3	-	-	-	-	-	1	-	-	-	-	-
CO3	3	1	1	2	-	-	-	-	-	1	-	-	-	-	-
CO4	1	1	1	1	-	-	-	-	-	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23MA305 SDG: 4	PROBABILITY AND OPTIMIZATION TECHNIQUE	Category: BSC L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

1. To familiarize the knowledge of probability.
2. To design the methodology of Operations Research problems and formulate linear programming problem
3. To develop formulation skills in transportation models and assignment problem.
4. To understand the project management techniques used for planning and scheduling a project
5. To acquire the basic knowledge in the field of game theory and inventory problems.

UNIT 1 **PROBABILITY** **9+3**

Probability axioms, conditional probability, independent events – Addition and Multiplication Law - Theorem of total probability, Bayes theorem Application: Application of probability in decision making

UNIT 2 **LINEAR PROGRAMMING** **9+3**

Formulation of linear programming models – Graphical solution – Simplex method (Minimization and Maximization) - Big M Method. Application: Optimal production quantities

UNIT 3 **TRANSPORTATION PROBLEMS AND ASSIGNMENT PROBLEMS** **9+3**

Transportation Models (Minimization and Maximization Problems) – Balanced and unbalanced Problems – Initial Basic feasible solution by N-W Corner Rule, least cost and Vogel's approximation methods. Check for optimality. Solution by MODI. Assignment Models (Minimization and Maximization Problems) – Balanced and Unbalanced Problems. Solution by Hungarian Method. Application: Decision making in production planning

UNIT 4 **NETWORKING PROBLEMS** **9+3**

Network Construction – Critical Path Method (CPM) – Computations of total, free and independent floats – PERT Analysis. Application: Project Management Techniques

UNIT 5 **GAME THEORY AND INVENTORY MODEL** **9+3**

Game Theory-Two Person Zero Sum Games-Saddle point, Dominance Rule, Algebraic Method, Graphical method - Inventory Models – EOQ and EBQ Models. Application: Network security

COURSE OUTCOMES:

At the end of the course, students would

CO1: Apply the concept of probability in real life situations.

CO2: Understand the importance and value of Operations Research and linear programming in solving practical problems**.**

CO3: Interpret the transportation and assignment models' solutions and infer solutions to the real-world problems.

CO4: Gain knowledge of drawing project networks for quantitative analysis of projects.

CO5: Recognize and solve game theory and inventory problems.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Operations Research - S.D.Sharma, Kedarnath Ram nath & Co, 2008
2. Operations Research - Theory and Applications, J.K Sharma, Macmillan Publications India Ltd, 2013
3. Veerarajan, T, "Probability, Statistics, Random Processes and Queuing Theory", 1st Edition, Tata McGraw-Hill, New Delhi, 2019

REFERENCES:

1. Operations Research - H.A.Taha, Pearson, 7th Edition, June 2002.
2. Introduction to Operations Research - Hiller and Liberman, MGH, 7th Edition, 2002.
3. Douglas C. Montgomery & George C. Runger, "Applied Statistics and Probability for Engineers ", 7th Edition, John Wiley and Sons, USA, 2018
4. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015
5. Devore. J.L., "Probability and Statistics for Engineering and the Sciences‖, Cengage Learning, New Delhi, 8th Edition, 2014

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FT301 SDG: 4	FOOD PROCESS CALCULATIONS	Category: PCC L T P C 3 1 0 4

COURSE OBJECTIVE:

1. To describe the basic units, dimensions and basic related functions involved in food process engineering. 2. To recognize the various law governing the gases and vapors
3. To explain the material balance and law of conservation of energy.
4. To solve problems in Energy balance in heat exchangers.
5. To define the types, properties and agitation processes in fluids

UNIT 1 FOUNDATIONS OF PHYSICAL QUANTITIES AND CONVERSIONS 9+3

Unit Systems, units and dimensions - Fundamental and derived quantities and units - Definitions of some basic physical quantities - Velocity, acceleration, momentum, force, pressure, work, energy, viscosity, power, heat – sensible and latent, specific heat capacity and enthalpy, Unit Conversion - Dimensional analysis, Mole – atomical molar mass - Moisture content - water activity - normality, molality, molarity, mole fraction, PPM and PPB

UNIT 2 GAS BEHAVIOR AND LAWS 9+3

Composition of gases – Volume, Mole fraction and Mass fraction - Average Molecular Weight – Gas Mixtures - Behavior of Gases – Kinetic Theory of gases – Perfect Gas – Gas laws – Ideal gas laws – Real gases – equations, Partial pressure - Dalton's law - Pure component volume - Amagat's law, Pure component - vapour pressure - Raoult's law, Psychrometry – properties – psychrometric chart reading

UNIT 3 MATERIAL BALANCES WITHOUT CHEMICAL REACTIONS 9+3

Law of Conservation of mass - Process flow diagram - system boundaries, Material balance without chemical reactions - overall mass balance – component mass balance – basis and tie material - Continuous and Batch – Recycle, bypass, purge, makeup - steady and unsteady state - mass balance problems on concentration, dehydration, evaporation, crystallization, mixing, distillation

UNIT 4 MATERIAL BALANCES WITH CHEMICAL REACTIONS & HEAT 9+3

Material balance with chemical reactions – Stoichiometry and chemical reaction equations, terminology – Solving material balance involving chemical reaction – basic chemical reaction and combustion problems – Heat of Reaction, Heat of Formation, Heat of fusion, Heat of vaporization, Standard heat of formation, Standard heat of reaction

UNIT 5 HEAT AND ENERGY BALANCE 9+3

Law of conservation of energy - Heat capacity – gases – solids – liquids, Energy balance for a closed system and open system, Process time calculations, Thermobacteriology, Total energy balances - Energy balance problems in heat exchangers and dryers – Energy Audit

COURSE OUTCOMES:

At the end of the course, students will be able to:

CO1: Enumerate the units and dimensions of various physical quantities.
CO2: Explain the laws and theory of gases and vapors.
CO3: Calculate the material balance in food processing units.
CO4: Verify the energy balance involved in food processing operations.
CO5: Describe the types and properties of fluid flow

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Bhatt, B.L and Vora, S.M., "Stoichiometry", Third Edition, McGraw-Hill, New York, 2004.
2. Gavhane, K.A "Introduction to Process Calculations" (Stoichiometery) NiraliPrakashan Publications, Pune, 2009

REFERENCES:

1. Venkataramani, V. and Anantharaman, N., "Process Calculations", Prentice Hall of India, New Delhi, 2011.
2. Himmelblau, D.M., "Basic Principles and Calculations in Chemical Engineering", Eighth Edition, Prentice Hall India, New Delhi, 2015.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1	2	1	1	2	2	2	-	-	-	-	-	1	1	1	-
CO 2	1	2	2	2	-	3	-	-	-	-	1	2	1	1	-
CO 3	3	2	2	2	2	1	-	-	-	-	-	-	2	2	-
CO 4	2	2	1	2	-	1	-	-	-	-	-	2	3	1	2
CO 5	2	2	-	2	2	2	-	-	-	-	1	1	2	2	1

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23FT302 SDG: 12	POST HARVEST ENGINEERING	Category: PCC L T P C 3 0 0 3

COURSE OBJECTIVE:

1. To know minimization of post-harvest losses through effective application of engineering principles 2. To understand cleaning and grading techniques for agricultural produce processing
3. To study milling equipment operation and optimization with a focus on efficiency and power requirements
4. To understand scientific storage procedures and structures
5. To acquire comprehensive knowledge in the design and operation of various conveying equipment for efficient handling of agricultural produces

UNIT 1 FUNDAMENTALS OF POST HARVEST EGINEERING 9

Post-harvest engineering of crops – objectives – post harvest systems and losses in agricultural commodities - structure – engineering properties of agricultural materials – optimum stage of harvest – importance of loss reduction – Post Harvest Handling operations – pre-drying operation – Moisture content – RH measurement – air-grain measurement.

UNIT 2 CLEANING AND GRADING 9

Cleaning of grains – washing of fruits and vegetables – types of cleaners – Screens – types of screens – rotary screens – vibrating screens – machinery for cleaning of fruits and vegetables (air cleaners, washers), cleaning efficiency – care and maintenance – Peeling – Sorting – grading – methods of grading: Size grading – colour grading – specific gravity grading – screening – equipment for grading of fruits and vegetables – grading efficiency – care and maintenance – Magnetic separator – destoners – electrostatic separators – pneumatic separator.

UNIT 3 MILLING 9

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

UNIT 4 STORAGE 9

Importance of scientific storage systems – post-harvest physiology of semiperishables and perishables – Direct damages – indirect damages – causes of spoilage in storage - heat of respiration, sprouting – destructive agents - sources of infestation and control. Storage structures: Traditional storage structures – improved storage structures – modern storage structures – size and capacity of silos – storage of perishables – cold storage – controlled and modified atmospheric storage – hypobaric storage – evaporative cooling storage.

UNIT 5 MATERIAL HANDLING 9

Introduction to different conveying equipment used for handling of grains, fruits and vegetables – Scope and importance of material handling devices Classification – principles of operation – conveyor system selection/design: Belt conveyors – design – capacity – inclined belt conveyors – Chain conveyors – Screw conveyors – capacity – power – Bucket elevators – power requirement – pneumatic conveying system types – air/product separators – Gravity conveyors – capacity and power requirement.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Apply effective engineering principles to minimize post-harvest losses in agricultural produce.

CO2: Demonstrate proficiency in cleaning and grading techniques for efficient processing of agricultural produce.

CO3: Operate and optimize milling equipment, considering efficiency and power requirements to enhance productivity.

CO4: Implement scientific storage procedures and structures for the preservation of agricultural produce.

CO5: Design and operate various conveying equipment, showcasing expertise in the efficient handling of agricultural produces for effective post-harvest management

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Sahay, K. M. and K.K.Singh. "Unit operation of Agricultural Processing", Vikas Publishing House., Pvt Ltd. 2004.

2. Chakravarty et al Handbook of Post-Harvest Technology Marcel Dekker. 2003.

3. Araullo, E.V., dePadna, D.B. and Graham, Michael. Rice Post Harvest Technology. International Development Res. Centre, Ottawa, Canada. 1976..

REFERENCES:

1. Birewar, B.R., Krishnamurthy, K., Girish, G.K., Varma, B.K. and Kanjilal, S.C.. Modern Storage Structures. Indian Grain Storage Institute, Hapur.1983.

2. Earle, R.L, "Unit Operations in Food Processing". Pergamon Press. Oxford. U.K, 2003

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	2	-	-	3	2	-	-	-	-	1	1	2	2
CO2	3	3	2	-	-	3	1	-	-	-	-	1	1	1	2
CO3	3	3	3	-	-	3	1	-	-	-	-	1	1	1	2
CO4	3	3	3	-	-	3	1	-	-	-	-	1	1	1	2
CO5	3	3	3	-	-	3	1	-	-	-	-	1	1	1	2

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FT303 SDG: 4	FLUID MECHANICS FOR FOOD TECHNOLOGISTS	Category: ESC L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To familiarize the basic properties of fluids and pressure measurement devices.
2. To impart knowledge on the basics of fluid mechanics.
3. To provide knowledge about the applications of fluid mechanics in food technology.
4. To illustrate the various types of fluid flow.
5. To develop technical knowledge on the calculations involving fluid flow.

UNIT 1 PROPERTIES OF FLUIDS 9

Properties of fluids - Density - Specific weight - Specific Volume - Specific gravity- Viscosity - Thermodynamic properties - Compressibility and Bulk modulus- Surface tension and Capillarity - Dimensional Analysis - Secondary or derived quantities-Dimensional homogeneity - Methods of Dimensional AnalysisDimensionless Numbers - Pressure: Fluid pressure at a point - Pascal's lawPressure variation in a fluid at rest - Absolute, Gauge, Atmospheric and vacuum pressures - Measurement of pressure - Simple manometers - Differential manometers.

UNIT 2 APPLICATION OF FORCES AND KINEMATICS 9

Hydrostatic forces on surfaces - Total pressure and centre of pressure- Vertical plane surface submerged in liquid- Horizontal plane surface submerged in liquid - Inclined plane surface submerged in liquid - curved surface submerged in liquid - Archimedes Principle - Buoyancy- Application in fluid foods. Kinematics of flow -Types of fluid flow - Rate of flow - continuity equation - continuity equation in three dimensions - velocity and acceleration - velocity potential function and stream function - vortex flow.

UNIT 3 DYNAMICS OF FLUID FLOW 9

Dynamics of Fluid flow - Equations of motion - Euler's equation of motion. Bernoulli's equation - Practical applications of Bernoulli's equation – Venturimeter - Orifice meter - Pitot tube - Momentum equation – moment - Free Liquid Jets.

UNIT 4 VISCOUS FLOW AND TURBULENT FLOW OF FLUIDS 9

Flow of viscous fluid through a circular pipe - Flow of viscous fluid between two parallel plates - Power absorbed in viscous flow - Loss of head due to friction in viscous flow - Methods of determination of coefficient of viscosity. Turbulent flow - Frictional loss in turbulent flow - expression for loss of head due to friction in pipes - velocity distribution in turbulent flow in pipes - Resistance of smooth and rough pipes.

UNIT 5 FLOW THROUGH PIPES 9

Reynolds Experiment - Laminar and turbulent flow - Loss of energy in pipes- Loss of energy due to friction - Minor energy losses - Hydraulic gradient and Total Energy line - Flow through pipes in series - Equivalent pipe -Flow through parallel pipes - Flow through branched pipes - Power transmission through pipes - Water hammer in pipes - Flow through nozzles - Pipe network

COURSE OUTCOMES:

At the end of the course, students would

CO1: Understand the various properties of fluids.

CO2: Identify the suitable methods of pressure measurement.

CO3: Analyze the forces acting on bodies submerged in different positions in liquids.

CO4: Determine the type of flow of fluid and quantify the fluid flow through pipes.

CO5: Develop solutions for problems in dimensional analysis.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Bansal, R.K., "A Textbook of Fluid Mechanics and Hydraulic Machines". 10th edition, Laxmi Publications, New Delhi, 2018.
2. Modi, P.N. and Seth, S.M., "A Textbook of Fluid Mechanics and Hydraulic Machines", 22nd Edition, Standard Book House, New Delhi, 2017.
3. K. Subramanya, "Theory and Applications of Fluid Mechanics", 1st Edition, Tata McGraw-Hill New Del

REFERENCES:

1. S K Som, Gautam Biswas, S Chakraborty, "Introduction to Fluid Mechanics and Fluid Machines". 3rd edition, Tata McGraw Hill, 2017
2. Rajput, R.K., "A Text book of Fluid Mechanics and Hydraulic Machines", S Chand & Company, New Delhi, 2016.
3. Agarwal, S.K., "Fluid Mechanics and Machinery", Tata Mc Graw Hill Co. New Delhi, 2006
4. McCabe W.L., Smith J.C., and Harriot P., "Unit Operations of Chemical Engineering", 7th Edition, McGraw Hill, New York, 2017.
5. B.R.Munson and D.F Young, "Fundamentals of Fluid Mechanics", John Wiley & sons U.K., 2011
6. Frank.M.White, "Fluid Mechanics", 3rd Edition, New Delhi, Mc Graw Hill, 1994

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	-	-	-	-	-	-	-	1	2	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	1	2	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	1	2	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	1	2	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	1	2	3	2

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FT304 SDG: 4	FOOD CHEMISTRY	Category: PCC L T P C 3 0 0 3

COURSE OBJECTIVE:

1. To introduce the basic concepts of Food Chemistry.
2. To understand the properties and composition of food
3. To explain the changes in chemistry of food during processing.
4. To strengthen the knowledge about food chemistry for better management of food processing.
5. To study the importance of micronutrients in food.

UNIT 1 INTRODUCTION TO FOOD COMPONENTS 8

Importance of food - Scope of food chemistry: Different food groups - classification and importance: Water - Structure of water molecule - properties of water - Functions of water in food processing - Water activity - definition - significance - measurement.

UNIT 2 CARBOHYDRATES IN FOOD 9

Carbohydrates - Definition - sources - Chemistry of carbohydrates - Composition - structure - classification - caramelization - Maillard reaction - significance and food applications; Starch - sources - structure and composition - gelatinization and retrogradation; Modified and resistant starch - pectin - gums..

UNIT 3 PROTEINS IN FOOD 10

Proteins- functions- food sources- classification - Structure of protein - amino acids - types of amino acids - examples - Physical - Chemical - Functional properties of proteins in food and industrial importance- Texturized proteins - enzymes and its applications.

UNIT 4 FATS AND OILS IN FOOD 9

Lipids- Structure - classification and nomenclature of fats - Properties of fats and oils - physical properties - Chemical reactions of fat - Significance in food processing - Rancidity of fat - Modification of fat - shortening - fat replacers.

UNIT 5 VITAMINS, MINERALS, FLAVOURS AND COLOURS 9

Vitamins - Classification, Sources – biological Functions. Minerals - Classification, Sources - biological Functions. Flavours – classification – sources – functions. Colours – classification – sources – functions

COURSE OUTCOMES:

At the end of the course, students would

CO1: Understand the fundamentals of bio-molecules and describe the food sources

CO2: Explain the principal components of food, their chemical and nutritional properties

CO3: Analyze the relationship between the composition of the individual food components and their chemical and physical properties

CO4: Recognize Illustrate real examples underlying physicochemical mechanisms responsible for food functionality and be able to use their knowledge of food chemistry

CO5: Analyze the quality changes in food components during processing and preservation

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Chopra, H.K. and P.S. Panesar. “Food Chemistry”. Narosa, 2010. ISBN: 9788184870398
2. Srinivasan Damodaran, Kirk L. Parkin, and O.R. Fennema, E, “Food Chemistry” 4th Edition, CRC Press, New York 2007. ISBN- 9780849392726
3. Food Chemistry, H. – D. Belitz, W. Grosch, P. Schieberle 3rd ed. 2004, Publisher: Springer. ISBN: 3-540-40817-7

REFERENCES:

1. Principles of Food Chemistry (Food Science Text Series), John M. deMan, John W. Finley, W. Jeffrey Hurst, Chang Yong Lee, 4th ed. 2018 Edition, Springer. ISBN: 978-3-319-63607-8
2. Handbook of Food Chemistry, Peter Chi Keung Cheung, Bhavbhuti M. Mehta, 1st ed. 2015, Springer Berlin Heidelberg.
3. Robinson, D. S, "Food – Biochemistry and Nutritional Value" Longman Scientific and Technical, London, 1987. ISBN 978-3-642-36606-2
4. Charley, H, "Food Science" John Wiley and Sons Inc., New York, 1982. ISBN: 9780471062066
5. Birch, G.G., Brennan, J. G. and Parker, K. J, "The Sensory Properties of Foods" Applied Science Publication, London, 1977. 6. H.D.Belitz, W.Grosch,P. Schieberle, Food Chemistry, Springer, 2009

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	1	2	2	3	2	-	-	-	-	-	2	1	2	1
CO2	3	1	2	2	2	1	-	-	-	-	-	2	2	1	1
CO3	2	1	2	2	2	1	-	-	-	-	-	2	2	1	1
CO4	2	1	2	2	2	1	-	-	-	-	-	2	1	3	1
CO5	2	1	2	2	2	-	-	-	-	-	-	2	2	1	3

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23GE301 SDG: 4	PROBLEM SOLVING AND PYTHON PROGRAMMING	Category: ESC L	T	P	C
		2	0	2	3

COURSE OBJECTIVE:

1. To understand and develop programs using Python.
2. To use the concepts of strings, control flow, data types in python programs.
3. To create programs using list, tuples, dictionaries, and files concept in Python.
4. To analyze image processing, networking and object-oriented programming in Python.
5. To create new ideas for problems in real world application using python

UNIT 1 INTRODUCTION TO PYTHON PROGRAMMING 6

Introduction to Computer and its generations-Basics of Programming languages- Overview of Python-Python Interpreter and Interactive Mode -Variables- Numerical types- Arithmetic operators and Expressions-Psuedo Code - Values and types: int, float, Boolean - Variables, Expressions, Statements.

UNIT 2 DATA TYPES, CONTROL FLOW, STRINGS 6

Control Flow -conditional (if), Alternative (if-else), Chained conditional (if-elif-else)- Iteration: state, while, for, break, continue, pass - Strings: string slices, immutability, string functions and methods, string module, Regular expression, Pattern matching. - Illustrative Problems

UNIT 3 LISTS, TUPLES DICTIONARIES AND FUNCTIONS 6

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters-Tuples: tuple assignment, tuple as return value- Dictionaries: operations and methods- Functions and User Defined Functions, Recursion -Illustrative Problems

UNIT 4 FILES AND GIS AND SPATIAL ANALYSIS CONCEPT IN PYTHON 6

Files, Text files, reading and writing files-format operator; Files and exception handling - Introduction to Geographic Information Systems (GIS) and spatial data - Working with GeoPandas: Manipulating and analyzing geospatial data.

UNIT 5 IOT AND SENSOR DATA PROCESSING USING PYTHON 6

Internet of Things (IoT) in agriculture: Sensors, data collection, and communication protocols. Processing sensor data: Filtering, smoothing, and analyzing time-series data-Applying Python programming skills to solve real-world agricultural engineering problems.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Explain the concepts of Python.

CO2: Use appropriate constructs to represent data.

CO3: Analyze programs using different constructs in Python.

CO4: Develop real world applications using GIS and Spatial Analysis

CO5: Apply simple programs for real world application using IOT and Sensor in python

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Python Programming for Beginners: Skyrocket Your Code and Master Python in Less than a Week. Discover the Foolproof, Practical Route to Uncover Insider Hacks, Unlock New Opportunities, and Revolution Kindle Edition by Kit Jackson (Author), 31 May 2023
2. 2. Introducing Python, 2nd Edition, by Bill Lubanovic, O'Reilly Media, Inc., 2019.

REFERENCES:

1. Python Programming for Beginners,ISBN-13-979-8870875248, Narry Prince, 2023.
2. Python Programming, West McKinney,ISBN-13-979-8870534817,2023.
3. Python Quick Start Guide: The Simplified Beginner's Guide to Python Programming Using Hands-On Projects and Real-World Applications, by Robert Oliver,ISBN-13- 978-163610037, 2023.
4. Mastering Python Networking:Utilize Python packages and framewor

LIST OF EXPERIMENTS

1. Simple programs to execute the concept of python for editing, saving and handling error message.
2. Python program using Statements and Expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops (Number series, Number patterns, pyramid pattern).
4. Programs for functions using python (Factorial, larger number in a list).
5. Implementing programs using regular expressions.
6. Program for implementing strings (reverse, palindrome).
7. Implementing real time application using List, Tuples (Items present in library, operations of list and tuples).
8. Python programs for real time using file handling (Coping from one file to another, word count, longest word)
9. Python program using gis and spatial analysis
10. Python program using IOT and sensor data processing
11. Mini Project

TOTAL: 45 PERIODS

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	2	-	1	-	-	-	-	-	1	1	-	3	1	1	-
CO2	2	-	1	-	-	-	-	-	1	1	-	3	1	1	-
CO3	2	-	1	-	-	-	-	-	1	1	-	3	1	1	-
CO4	2	3	1	-	3	-	-	1	1	1	3	3	1	1	-
CO5	2	3	1	1	3	-	-	1	1	1	3	3	1	1	-

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23FT311
SDG: 4

FOOD CHEMISTRY LABORATORY

Category : PCC

L	T	P	C
0	0	4	2

COURSE OBJECTIVE:

1. To explain a detailed insight into understanding the composition and molecular interaction of the food component
2. To carry out estimation of chemical constituents and chemical properties of food sample
3. To see how food components, processing, storage, etc. influences the quality, sensory, and chemical parameters of finished food products.
4. To design and carry out scientific experiments as well as accurately record and analyze the results of such experiments
5. To perform as a member of a team, communicate effectively and engage in further learning

LIST OF EXPERIMENTS

1. Water analysis – TDS by gravimetry and TDS meter, alkalinity, hardness – temporary and permanent
2. Determination of Water activity
3. Moisture content in foods in relation to their stability
4. Determination of crude and dietary fibre
5. Determination of free fatty acid content in fats and oils
6. Detection and estimation of oxidative rancidity in fats/oils
7. Determination of ash content of food materials
8. Detection/Estimation of adulterants in some foods
9. Estimation of antioxidant(s) / polyphenol(s) in food sample
10. Determination of reducing and non-reducing sugars – Lane and Eynon Methods
11. Determination of iodine value and saponification value of fats and oils
12. Determination of protein content – Kjeldahl's method
13. Estimation of Vitamin C in food materials
14. Estimation of Calcium in food materials
15. Estimation of Iron in food materials

COURSE OUTCOMES:

At the end of the course, students would

CO1: Explain different methods for the analysis of water for potable and food purposes
CO2: Compare the moisture content in different foods in relation to their stability
CO3: Explain analytical procedures for characterizing the properties of foods and their constituents
CO4: Explain different quality characteristics of food that is acceptable to consumers.
CO5: Apply the principles and methods for the analyses of micronutrients

TOTAL: 60 PERIODS

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	2	2	1	-	-	-	-	-	-	-	-	-	2	-	-

CO2	2	2	1	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	1	-	3
CO4	3	2	1	-	-	-	-	-	-	-	-	-	2	-	3
CO5	2	2	1	-	-	-	-	-	-	-	-	-	2	2	-
Correlation levels:			**1 – low**			**2 – medium**			**3 – high**			**"-"- no correlation**			

U23EE313 SDG: 4	Aptitude and Communication for Engineers I (Common to all Branches)	Category : EEC L T P C 1 0 1 1

COURSE OBJECTIVE:

1. To create an awareness regarding the internal inhibitions that prevents the students from opening out in classrooms and other forums and there by overcoming the shyness to perform..
2. To make students understand the importance of English as a global language and train them for simple English communication through various speech craft activities and improve their communicative English for industry readiness.
3. To develop an awareness about making a conscious effort towards avoiding errors in daily communication
4. To train students on clearing various placement papers with greater accuracy

UNIT 1 **Introduction** **3**

Introduction about the Course -Learning expectations - Communication pre-assessment

UNIT 2 **Speaking Skills -Novice** **6**

Communication skills – Shy barrier - Importance of English - Challenges faced in English communication - Developing a globally comprehensible accent -Speech Craft- Public Speaking - Squabble

UNIT 3 **Speaking Skills -Intermediate** **6**

Speech Craft –for and against –Debate (Ship Wreck Activity)

UNIT 4 **Language Gym - I** **6**

Tenses for various communication scenarios – Common errors in daily communication – Thought Group reading – Passage writing

UNIT 5 **Aptitude for Placements - I** **6**

Placement Paper 1 – HCF & LCM, Problems on Numbers-Placement Paper 2 – Average, Simplification – Placement Paper 3-Percentage, Simple & compound Interest - Placement Paper 4 – Time & Distance – Placement Paper 5-Trains & Boats, Placement Paper 6 – Time & Work, Pipes & Cistern.

COURSE OUTCOMES:

Upon completion of this course,

CO1: Students will be able to participate in any learning activity without any reservations. They shall be ready to move beyond their comfort zone to acquire new skills throughout their life.

CO2: Students shall understand and appreciate the importance of English in the current global scenario and make efforts towards up skilling the same.

CO3: Students shall be able to present their view and standpoints in any scenarios confidently.

CO4: Use the correct Grammar and Vocabulary, ensuring the enhancement their language skills and effective communication.

CO5: To use appropriate strategies and shortcuts to improve speed and accuracy in solving aptitude problems during recruitment processes

TOTAL: 30 PERIODS

TEXT BOOKS:

1. The Pearson Guide to Quantitative Aptitude for Competitive Examinations, Dinesh Khattar. Pearson
2. Quantitative Aptitude Dr. R.S. Aggarwal S. Chand Publication
3. A modern Approach to Verbal and Non-Verbal Reasoning R.S. Aggarwal
4. A Modern Approach to Verbal & Non-Verbal Reasoning - Aggarwal R. S

REFERENCES:

1. Quantitative Aptitude for CAT, Arun Sharma
2. Fast Track Objective Arithmetic, Rajesh Verma, Arihant Publication
3. Quantitative Aptitude Quantum CAT Common Admission Tests for Admission into IIMs,Sarvesh K. Verma
4. Wiley's Exam Xpert Quantitative Ability for CAT, 2ed, Ashu Jain

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
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CO 2	1	-	-	-	-	-	-	1	-	3	-	-	-	-	-
CO 3	1	-	-	-	-	-	-	1	-	3	-	-	-	-	-
CO 4	1	-	-	-	-	-	-	1	-	3	-	-	-	-	-
CO 5	3	-	-	-	-	-	-	1	1	-	-	-	-	-	-

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

SEMESTER IV

		Category: PCC			
U23FT401 **SDG - 9**	**UNIT OPERATIONS IN FOOD PROCESSING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

1. To understand the various units, dimensions, material and energy balances
2. To explain the principle of evaporation, types and classification of evaporators
3. To discuss the mechanical separation processes and various filtration techniques
4. To outline the principles and operations of distillation equipment
5. To simplify the principles of comminution, laws of grinding and size reduction equipment

UNIT 1 **DRYING AND DEHYDRATION** **9**

Principles of drying- Water content in foods and its determination. Driers – Cabinet drier, Vacuum drier, Drum driers, Rotary Dryer, Freeze drier, Fluidized bed drier - types, principles of operation, applications in food industries. Foam Mat Drying- Principles- Equipment- Factors affecting Foam mat drying. Osmotic dehydration – Principles – Factors affecting osmosis-
Equipment used.

UNIT 2 **EVAPORATION AND CRYSTALLIZATION** **9**

Evaporation theory, boiling point elevation and Duhring's rule, Single effect evaporator, Multiple effect evaporator: feeding mechanism, steam economy. Types and classification of evaporators– vertical tube, horizontal tube, falling film, climbing film, scraped surface, plate evaporators, advantages and disadvantages.
Crystallization equilibrium -rate of crystal growth – stage of crystallization – magma- nucleation crystallization equipment. Variations in crystallizers – vacuum crystallizers. Draft tube, baffle crystallizers.

UNIT 3 **MECHANICAL SEPARATION PROCESS** **9**

Mechanical separation process: sedimentation, principle, Stoke's law, equipment-sedimentation in cyclones and applications. Centrifugation: principle, rate of separation, centrifugation equipment and applications in food industries.
Filtration: Theory, filter media types and requirement–constant rate filtration–constant pressure filtration – filter cake resistance. Equipment – plate and frame filter press, continuous rotary vacuum filter, pressure leaf filters, application.

UNIT 4 **DISTILLATION** **9**

Principles of diffusion and mass transfer- Fick's law- definition of distillation–Flash distillation—continuous distillation with reflux–combined rectification and stripping-McCabe and Thiele method of determination of no of plates–Advantages and limitations–distillation equipment–construction and operation– factors influencing the operation.

UNIT 5 **SIZE REDUCTION** **9**

Principles of comminuting– characteristics of comminuted products–particle size distribution in comminuted products–energy and power requirements. Laws of grinding- Rittinger's, Bond's and Kick's law. Size reduction equipment: jaw crushers, hammer mill, plate mill, ball mill, roller mill and knife cutter.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Recall the fundamental concepts underlying the unit operations in food industries

CO2: Classify the types and operating principles of food processing equipment.

CO3: Illustrate the construction and mechanization of equipment in food industries.

CO4: Measure the efficiency of driers, evaporators, crystallizers, mechanical separation and milling equipment.

CO5: Apply the concepts of unit operations in food processing industries.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Geankoplis, C.J (2003). *Transport Processes and Separation Process Principles*, 4th Edition, Prentice Hall.
2. McCabe W.L., Smith J.C (2001). *Unit Operations in Chemical Engineering*, 7th Edition, McGraw – Hill Int.

REFERENCES:

1. Sahay, K. M. and K.K.Singh (2004). *Unit operation of Agricultural Processing*. Vikas Publishing House Pvt. Ltd. New Delhi.
2. Earle, R. L. (2013). *Unit Operations in Food Processing*. Pergamon Press. Oxford. U.K.
3. Fellows, P. J. (2009). *Food Processing Technology Principles and Practice*. 3rd Edition, Woodhead Publishing.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	2	1	2	1	-	-	-	1	2	2	1	-
CO2	3	3	2	3	2	3	2	-	-	-	1	3	2	1	-
CO3	3	3	3	3	1	2	1	-	-	-	1	3	2	1	-
CO4	3	3	2	3	2	2	2	-	-	-	2	2	2	1	-
CO5	1	3	2	2	1	2	1	-	-	-	2	3	2	1	-

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23FT402 SDG - 3	FOOD ADDITIVES	Category: PCC L T P C 3 0 0 3

COURSE OBJECTIVE:

1. To expose students to the use of different food additives in food product manufacturing.
2. To extend knowledge about different instrumental analysis techniques for food flavors.
3. To develop an understanding of the functional roles of food additives such as preservatives, stabilizers, emulsifiers, and colorants in food systems.
4. To evaluate the safety, regulatory aspects, and permissible limits of food additives as per global and national standards.
5. To apply the principles of selecting and incorporating food additives in developing innovative and sustainable food products.

UNIT 1 **Food Preservatives and Acidulants** **9**

Role of food additives, classification of food additives based on their role, dual role of certain additives, INS numbering system of food additives, safety requirements of food additives. Preservatives of chemical and microbial origin, mode of action, factors affecting performance, levels of usage, permitted preservatives and applications. Acidity Regulators – definition, chemical structure, role and importance, pH modulation and taste, acidity profile, permitted acidity regulators, levels of usage and food applications.

UNIT 2 **Emulsifiers, Stabilizers and Thickeners** **9**

Emulsion, surface tension, oil in water and water in oil emulsion, Hydrophilic and Lipophilic balance (HLB), role of emulsifiers, classes of emulsifiers, HLB values. Stabilizers – role in emulsion stability, emulsion formation process, equipment and measurement, permitted stabilizers and applications. Thickeners – chemical structure, role in food processing and product formulation, permitted thickeners and its applications.

UNIT 3 **Antioxidants and Sweeteners** **9**

Antioxidants – classification, water soluble and oil soluble antioxidants, mechanism of action, permitted levels and applications. Sweeteners –Nutritive sweeteners – fructose, xylitol, sorbitol, mannitol, lactulose, isomalt, glucose and fructose syrups. Non-nutritive sweeteners – saccharin, cyclamates, aspartame, sucralose, plant based sugar substitutes, taste modifiers.

UNIT 4 **Colours, Flavours and Flavour Perception** **9**

Color – natural and synthetic food colors, permitted colors, usage levels and food applications. Food flavors – classification, synthetic and natural flavourings, stability of flavours during food processing, flavour enhancers, flavour emulsions, flavour and taste perception. Flavour responses – chemesthetic and tactile, Bioflavour and reconstituted flavours.

UNIT 5 **Other Food Additives and Food Ingredients** **9**

Anticaking agents, Antibrowning agents – Treatment of Foods with Sulfites, alternatives, safety and regulatory issues. Food Phosphates – Production methods, Solubility, Sequestration, uses and applications in food. Humectants and surfactants, Glazing and Bulking agents, Flour conditioners, Firming and softening agents.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Relate the role of different food additives used in processing of foods.
CO2: Summarize the functions of food additives in improving the shelf life and quality of foods.
CO3: Apply the usage levels of food additives in food formulations.
CO4: Prioritize the classification of food flavours and its chemical composition
CO5: Demonstrate the flavour analysis method in food industries

TOTAL: 45 PERIODS

REFERENCES :

1. Mahindru., S. N (2000). *Food Additives- Characteristics Detection and Estimation*.TATA McGraw Hill.
2. Wilson. R. (2007). *Ingredient Handbook Sweeteners*. Blackwell
3. Peter A Williams and Glyn O Philips, " Gums and stabilizers for the Food Industry", RSC, 2006.

PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	1	3	1	1	-	2	2	-	-	-	1	3	2	-
1	1	1	1	3	-	3	1	-	-	-	2	2	3	-
2	1	3	2	1	-	3	1	-	-	-	1	-	3	-
1	3	1	1	2	-	1	1	-	-	-	2	2	1	-
1	1	2	3	2	-	3	1	-	-	-	3	3	3	-

U23FT403 SDG – 7, 12	THERMODYNAMICS IN FOOD PROCESSING	Category: PCC L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To understand the fundamental principles and laws of thermodynamics and their application in food systems.
2. To analyse and solve problems related to energy transfer and transformations in food processing operations.
3. To understand and calculate operational aspects of food processes based on thermodynamic properties.
4. To apply thermodynamic concepts in designing and optimizing equipment used in food preservation and production.
5. To promote energy-efficient and sustainable practices in food processing systems while maintaining product quality and safety.

UNIT 1 **Introduction to Thermodynamic Systems** **9**

Thermodynamic terms - variables - processes - states - Zeroth and First Laws of Thermodynamics - State and path functions - Specific heats (Cp and Cv) - Joule-Thomson porous plug experiment - Calculation of thermodynamic properties - Isothermal expansion - free expansion - adiabatic reversible processes – problems

UNIT 2 **Thermodynamics of Energy Systems** **9**

Steady flow energy equation and its application to steam generator, condenser, nozzles and air compressors. Second law of thermodynamics and its application to refrigerator, heat engine and heat pump.

UNIT 3 **Thermodynamic Properties of Fluids and Solutions** **9**

PVT Behavior of Pure Fluids - PVT Surfaces - P-V, P-T, T-S, and H-S Diagrams - Helmholtz and Gibbs free energy - Maxwell's Relations and Equations of State - Partial molar properties and property laws - Chemical potential - Fugacity and Activity

UNIT 4 **Thermodynamics of Steam** **9**

Steam Formation at constant pressure - Wet, Dry, Saturated, and Superheated Steam - Dryness Fraction - Enthalpy and Specific Volume of Steam - Use of Steam Tables - Classification of Steam Boilers - Analysis of Steam Boilers

UNIT 5 **Psychrometrics** **9**

Psychrometric properties of air - Psychometric chart - Psychrometric process - sensible heat exchange process, latent heat exchange process, adiabatic mixing, evaporative cooling - problems

COURSE OUTCOMES:

At the end of the course, students would

CO1: Understand and apply fundamental thermodynamic concepts to various systems

CO2: Evaluate energy systems through the application of thermodynamic principles

CO3: Examine the thermodynamic behavior of fluids and solutions

CO4: Gain insight into the thermodynamic properties and behavior of steam

CO5: Analyze and assess psychrometric processes and their applications in thermodynamics

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Narayanan K.V., A Textbook of Chemical Engineering Thermodynamics, 2nd Edition, PHI Learning Private Limited, Delhi, 2013
2. Rastogi R.P. and Misra R.R., An Introduction to Chemical Thermodynamics, Vikas Publishing House Pvt Ltd., 2008
3. Kothandaraman C.P., Khajuria P.R., Arora S.C., and Domkundwar S.A., Course in Thermodynamics and Heat Engines, 3rd Edition, Dhanpat Rai & Sons, New Delhi, 1993

REFERENCES:

1. Nag P.K., Engineering Thermodynamics, 6th Edition, McGraw Hill Education (India) Private Limited, New Delhi, 2017
2. Roy Choudhury T., Basic Engineering Thermodynamics, Tata McGraw Hill, 1973
3. Van Wylen and Sontag, Fundamentals of Classical Thermodynamics, 4th Edition, Wiley Eastern, 1994

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	1	-	-	-	-	1	3	3	1
CO2	3	3	3	3	1	-	3	-	-	-	-	1	3	3	1
CO3	2	3	2	2	-	-	1	-	-	-	-	1	2	2	1
CO4	3	3	2	3	-	-	2	-	-	-	-	1	3	3	1
CO5	2	3	2	3	1	-	2	-	-	-	-	1	2	3	1

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FT404
SDG - 3

FOOD BIOCHEMISTRY

Category: PCC

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To explain the metabolic pathways of carbohydrates
2. To outline the metabolism of fatty acids
3. To discuss the synthesis and metabolism of amino acids and nucleic acids
4. To classify and apply the enzymes for food processing and preparation
5. To categorize the biogenic amines and various food allergens

UNIT 1 **METABOLISM OF CARBOHYDRATES** **8**

Carbohydrate – Glycolysis (EMP) pathway, CORI's cycle, Energy yield from glycolysis, TCA cycle – Energetics, HMP or PP pathway, Gluconeogenesis, Glycogenolysis, Glycogenesis.

UNIT 2 **METABOLISM OF FATTY ACIDS** **10**

Synthesis of TAG's, Metabolism of adipose tissue – in well-fed condition – in fasting condition – obesity. Fatty liver and lipotropic factors, Metabolism of ketone bodies – ketogenesis – ketolysis – ketosis – regulation and management. Cholesterol – biosynthesis and metabolism. Plasma lipids – Classification – chylomicrons – VLDL – LDL – HDL – Atherosclerosis and CAD – risk factors and prevention. Formation of bile acids – functions of bile salts

UNIT 3 **METABOLISM OF AMINO ACIDS AND NUCLEIC ACIDS** **9**

Miester cycle – Intracellular protein degradation – Inter-organ transport of amino acids - General metabolism of amino acids – transdeamination, transamination and oxidative deamination - pathways, Urea cycle. Nucleic acid – Nucleotides – Nucleosides – digestion – Biosynthesis of purine nucleotides – Uric acid – Disorders of purine metabolism

UNIT 4 **ENZYMES** **9**

Enzyme – Sources of Food Enzymes – Major Enzyme Classification – Oxidoreductases – Transferases – Proteases – Carbohydrases – Lipases – Enzymes in Food and Feed Manufacture, Bakery, Dairy, Meat and Fish, Beverages, Candies and Confectioneries – Controlling Enzymatic Activity in Foods – Temperature, pH, Enzyme inhibitors, Water activity, Pressure and Irradiation

UNIT 5 **BIOGENIC AMINES AND FOOD ALLERGENS** **9**

Biogenic amines – occurrence, significance and effects of food processing and storage - Food allergy – Food hypersensitivity – Immediate and delayed hypersensitivity reactions. Food intolerance – Lactose intolerance, Phenylketonuria and Favisim. Milk allergens – Prevalence, symptoms and threshold of Egg allergens, Soya bean allergens, peanut and treenut allergens – Fish and shellfish allergens – Allergens in cereals – Minor food allergens – Management of food allergy.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Understand the various metabolic pathways of carbohydrates
CO2: Recall the metabolism of adipose tissue, cholesterol, plasma lipids and bile acids
CO3: Interpret the metabolism of amino acids and nucleic acids
CO4: Apply the suitable enzyme for the specific food processing and preparations
CO5: Identify the biogenic amines and the prevalence, symptoms and threshold of food allergens

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Nelson DL and Cox MM. (2017). Lehninger Principles of Biochemistry. 7th Edition. W.H. Freeman Company.
2. Benjamin K. Simpson. (2012). Food Biochemistry and Food Processing. 2nd Edition, Wiley-Blackwell Publication.
3. Vasudevan DM, Sreekumari S and Vaidyanathan K (2019). Textbook of Biochemistry. 9th Edition, Jaypee Brothers Medical Publishers.

REFERENCES:

1. Voet D, Voet JG and Pratt CW. (2016). Fundamentals of Biochemistry Life at the Molecular Level. 5th Edition. John Wiley and Sons.
2. Fatih Yildiz (2010). Advances in Food Biochemistry. CRC Press.
3. Jain J.L., Sunjay Jain and Nitin Jain (2008). Fundamentals of Biochemistry, S. Chand & Co.
4. Sunetra Roday. (2012). Food Science and Nutrition. 2nd Edition. Oxford Higher Education/ Oxford University Press.
5. Fennema, Owen R., Srinivasan Damodaran, and Kirk L. Parkin (2017). Introduction to food chemistry. In Fennema's Food Chemistry, Fifth Edition, pp. 1-16. CRC Press.
6. Vaclavik, V. A. and Christian E. W. (2003), Essentials of Food Science - 2nd Edition, Kluwer Academic, Springer.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	2	1	-	-
CO2	2	1	1	-	-	-	-	-	-	-	-	2	1	-	-
CO3	2	1	2	1	2	-	-	-	-	-	-	2	2	1	3
CO4	2	2	2	2	-	2	-	-	-	-	-	2	2	1	3
CO5	2	2	2	2	-	2	-	-	-	-	-	2	2	1	3

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FT405	DAIRY PROCESS TECHNOLOGY	Category: PCC			
		L	T	P	C
SDG- 2		2	0	2	3

COURSE OBJECTIVE:

1. To understand the fundamental properties of milk and their influence on processing, storage, and product quality.
2. To learn and apply various milk processing techniques, including pasteurization, homogenization, and drying, for quality dairy production.
3. To analyze the composition and functional properties of milk in relation to the development of traditional and fermented dairy products.
4. To evaluate the impact of processing parameters on the quality, safety, and nutritional value of milk powder and dairy substitutes.
5. To design and implement sanitation and effluent treatment strategies for efficient and sustainable dairy processing.

UNIT 1 PROPERTIES OF MILK **6**

Milk-Types-Composition-Physical-Chemical and Thermal Properties-Heat Capacity, Density Freezing-Boiling point-Expansion-Agitation-Viscosity-Classification of milk Market and Special Milk, Handling-effects -toxicity of metals.

UNIT 2 PROCESSING AND QUALITY PARAMETERS OF MILK **6**

Processing of Milk- Pasteurization-HTST, UHT, sterilization, Homogenization, Filtering and Clarification of Milk-cream separation-Methods and Equipment's-Emulsification – Fortification, packaging of milk and milk products, judging and grading of milk, national and international standards of milk and milk products.

UNIT 3 MILK PRODUCTS **6**

Traditional dairy products, Manufacturing of Yogurt, Cheese, Butter, Ghee, Ice-cream, malted products, evaporated milk products - properties, Classification-processing Methods, Equipment used, standards and quality parameters.

UNIT 4 MILK POWDER PROCESSING AND MILK SUBSTITUTES **6**

Processing of Milk Powder- Composition - Properties- methods of drying, substitutes for milk and milk products – casein, lactose and other by-products, weaning foods, therapeutic foods, fortification and enrichment.

UNIT 5 STORAGE SANITATION AND EFFLUENT TREATMENT **6**

Storage of Milk in Tanks-Storage of ice cream and other milk products - in cold storage - Cleaning and Sanitation-Importance-Detergents-Properties-Cleaning procedures-Cleaning in place-Dairy effluent treatment and disposal. Mechanization and equipment used in manufacture of dairy products

LIST OF EXPERIMENTS

1. Analysis of milk
2. Determination of Specific Gravity of Milk by Lactometer
3. Determination of Fat in Milk by Gerber's Method
4. Estimation of Total Solids/ SNF Content in Milk
5. Platform test - Methylene Blue Reduction Test, clot on boiling test
6. Estimation of Titratable Acidity of Milk
7. Preparation of Fat Rich Products
8. Preparation of Heat and Acid coagulated Products
9. Preparation of Heat Desiccated Products
10. Preparation of Fermented Dairy Products
11. Preparation of Frozen Dairy Products
12. Waste water analysis in dairy industry

COURSE OUTCOMES:

At the end of the course, students would

CO1: To understand the fundamental properties of milk and their influence on processing, storage, and product quality.

CO2: To learn and apply various milk processing techniques, including pasteurization, homogenization, and drying, for quality dairy production.

CO3: To analyze the composition and functional properties of milk in relation to the development of traditional and fermented dairy products.

CO4: To evaluate the impact of processing parameters on the quality, safety, and nutritional value of milk powder and dairy substitutes.

CO5: To design and implement sanitation and effluent treatment strategies for efficient and sustainable dairy processing.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ananthakrishnan, C.P., and Sinha, N.N., "Technology and Engineering of Dairy Plant Operations, Laxmi Publications, New Delhi, 1984.

2. Warner, J.N., "Principles of Dairy Processing", Wiley Eastern Pub. Co., New York, 1975.

3. Walstra, P., "Diary Technology: Principles of Milk Properties and Processes". Marcel Spreer, Edgar "Milk and Diary Product Technology". Marcel Dekker, 2005.

REFERENCES:

1. De, Sukumar – *Outlines of Dairy Technology*, Oxford University Press, 2001.
2. Ahmad, Tufail – *Dairy Plant Engineering and Management*, Kitab Mahal, 1997.
3. Tetra Pak – *Dairy Processing Handbook*, Tetra Pak International, 2015.
4. Spreer, Edgar "Milk and Diary Product Technology". Marcel Dekker, 2005.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	-	2	2	1	-	-	3	3	-	1	2	2	-	1
CO2	3	2	3	-	-	-	-	3	3	-	2	2	3	2	3
CO3	2	2	3	3	1	-	-	2	3	-	2	3	3	2	3
CO4	3	2	3	1	-	-	-	3	3	-	2	3	3	2	3
CO5	3	2	2	3	1	-	-	3	3	-	1	1	3	2	2

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FT411 SDG - 3	FOOD BIOCHEMISTRY LABORATORY	Category: PCC L T P C 0 0 4 2

COURSE OBJECTIVES:

1. To explain the analysis of total carbohydrate and reducing sugars in the food sample
2. To experiment with the proteins and amino acids for the given sample
3. To measure the concentration of cholesterol and activity of enzymes
4. To separate the amino acids using thin layer chromatography
5. To estimate the number of tannins and trypsin inhibitors in the food materials

LIST OF EXPERIMENTS

1. Estimation of carbohydrates by anthrone method
2. Estimation of reducing sugars by DNS method
3. Estimation of proteins by Lowry's method
4. Estimation of cholesterol by ZAKs method
5. Estimation of amino acid by ninhydrin method
6. Estimation of α-amino nitrogen by Sorensons formol titration
7. Enzyme α-amylase activity – pH and temperature
8. Estimation of enzyme lipase activity
9. Indirect estimation of lactate dehydrogenase
10. Estimation of phytic acid
11. Estimation of lysine from the grain sample
12. Qualitative phytochemical screening of nutraceuticals in food
13. Separation of amino acids by thin layer chromatography
14. Estimation of tannins in the food sample
15. Estimation of trypsin inhibitor activity in food

COURSE OUTCOMES:

At the end of the course, students would

CO1: Measure and quantify the concentration of total carbohydrates and reducing sugars in the given sample

CO2: Analyze the proteins, free amino acids and total amino acids with standard protocol

CO3: Examine and report the level of cholesterol present in the food samples

CO4: Estimate the lactate dehydrogenase and phytic acid in the food materials

CO5: Test for various amino acids, tannins and trypsin inhibitors.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Nelson DL and Cox MM. (2017). Lehninger Principles of Biochemistry. 7th Edition. W.H. Freeman Company.
2. Benjamin K. Simpson. (2012). Food Biochemistry and Food Processing. 2nd Edition, Wiley-Blackwell Publication.
3. Vasudevan DM, Sreekumari S and Vaidyanathan K (2019). Textbook of Biochemistry. 9th Edition, Jaypee Brothers Medical Publishers.

REFERENCES:

1. Voet D, Voet JG and Pratt CW. (2016). Fundamentals of Biochemistry Life at the Molecular Level. 5th Edition. John Wiley and Sons.
2. Fatih Yildiz (2010). Advances in Food Biochemistry. CRC Press.
3. Jain J.L., Sunjay Jain and Nitin Jain (2008). Fundamentals of Biochemistry, S. Chand & Co.
4. Sunetra Roday. (2012). Food Science and Nutrition. 2nd Edition. Oxford Higher Education/ Oxford University Press.
5. Fennema, Owen R., Srinivasan Damodaran, and Kirk L. Parkin (2017). Introduction to food chemistry. In Fennema's Food Chemistry, Fifth Edition, pp. 1-16. CRC Press.
6. Vaclavik, V. A. and Christian E. W. (2003), Essentials of Food Science - 2nd Edition, Kluwer Academic, Springer.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	3	2	1	-	-	-	1	2	3	2	-
CO2	2	3	2	3	3	3	2	-	-	-	1	3	3	2	-
CO3	2	2	2	2	3	2	3	-	-	-	1	3	3	2	-
CO4	3	3	2	3	3	2	2	-	-	-	2	2	3	2	-
CO5	1	1	1	3	3	2	2	-	-	-	1	3	3	2	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FT412 SDG - 9	UNIT OPERATIONS IN FOOD PROCESSING LABORATORY	Category: PCC L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

1. To study the flow of liquids by orifice meter, venturimeter and rotameter
2. To understand the principle and operation of evaporators
3. To explain the separation and collection efficiency of centrifugal and cyclone separator
4. To evaluate the performance of various milling equipment and particle size of food materials
5. To measure the efficiency of filtration and distillation processes

LIST OF EXPERIMENTS

1. Flow measurement a) Orifice meter, b) Venturimeter, c) Rotameter
2. Determination of economy and thermal efficiency by rotary flash evaporator
3. Solving problems on single and multiple effect evaporator
4. Determination of separation efficiency of centrifugal separator
5. Determination of collection efficiency in cyclone separator
6. Determination of efficiency of liquid solid separation by filtration
7. Determination of absorption efficiency in a packing tower
8. Determination of porosity, coefficient of friction and angle of repose of grains
9. Determination of performance characteristics in size reduction using the burr mill
10. Determination of energy requirement in size reduction using the ball mill and hammer mill
11. Performance evaluation of pin mill and hammer mill
12. Performance evaluation of a steam distillation process
13. Determination of particle size of granular foods by sieve analysis
14. Visit to a solvent extraction plant and sugar industry.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Measure the flow of liquids using orificemeter, venturimeter and rotameter

CO2: Operate and solve the problems, economy and thermal efficiency of evaporators

CO3: Analyze the separation and collection efficiency of cyclone and centrifugal separators

CO4: Assess the performance of various milling equipment and particle size of food materials

CO5: Perform the various filtration and distillation processes

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Geankoplis, C.J (2003). *Transport Processes and Separation Process Principles*, 4th Edition, Prentice Hall.
2. McCabe W.L., Smith J.C (2001). *Unit Operations in Chemical Engineering*, 7th Edition,

McGraw – Hill Int.

REFERENCES:

1. Sahay, K. M. and K.K.Singh (2004). Unit operation of Agricultural Processing. Vikas Publishing House Pvt. Ltd. New Delhi.
2. Earle, R. L. (2013). Unit Operations in Food Processing. Pergamon Press. Oxford. U.K.
3. Fellows, P. J. (2009). Food Processing Technology Principles and Practice. 3rd Edition, Woodhead Publishing.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	2	2	3	1	-	-	-	1	2	2	1	1
CO2	2	2	3	3	2	2	2	-	-	-	3	3	2	1	1
CO3	1	2	3	2	2	3	1	-	-	-	3	3	2	1	1
CO4	2	2	2	2	2	3	2	-	-	-	2	2	2	1	1
CO5	3	2	2	2	2	3	1	-	-	-	1	3	2	1	1

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23BS401 **ENVIRONMENTAL SCIENCES AND SUSTAINABILITY** **Category: BSC**

SDG:

L	T	P	C
2	0	0	0

COURSE OBJECTIVE:

1. Study the interrelationship between living organism and environment
2. Assess the environmental pollution and its impact.
3. Understand the significance of natural resources and their conservation.
4. Identify and implement scientific, economic and political solutions to environmental problems.
5. Understand the influence of human population on environmental issues and role of information technology as a tool to minimize the environmental problems.

UNIT 1 ECOSYSTEMS AND BIODIVERSITY 3

Definition, Scope and importance of environment - Concept of an ecosystem - Structure and function of an ecosystem (Grassland and River ecosystem only) - Food chains, Food webs and ecological pyramids - Introduction to biodiversity- Definition- Genetic, Species and ecosystem diversity - Value of biodiversity - Threats to biodiversity- Conservation of biodiversity. Case study of simple ecosystems -pond, river, hill slopes, etc.

UNIT 2 ENVIRONMENTAL POLLUTION 3

Definition - Causes, Effects and control measures of (a) Air pollution (b) Water pollution (c) Thermal pollution - Solid waste management: Causes, Effects and control measures of municipal solid wastes - Role of an individual in prevention of pollution - Pollution case studies -Disaster management - Floods, Earthquake, Cyclone and landslides. Case study of local polluted site - Urban / Rural / Industrial / Agricultural.

UNIT 3 NATURAL RESOURCES 3

Forest resources - Use and over-exploitation, Deforestation - Water resources - Use and over-utilization of surface and ground water, Drought, Conflicts over water, dams-Benefits and problems - Food resources- Changes caused by agriculture and overgrazing, Effects of modern agriculture, Fertilizer-pesticide problems, water logging, Salinity-Role of an individual in conservation of natural resources (National and International level).

UNIT 4 SOCIAL ISSUES AND SUSTAINABILITY MANAGEMENT 3

Unsustainable to sustainable development- millennium development goals, and protocols- Sustainable Development Goals-targets- Zero waste and R concept - ISO 14000 Series- Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials-Sustainable transports –Carbon credit, Carbon footprint, Climate change, Global warming, Acid rain, Ozone layer depletion.

UNIT 5 HUMAN POPULATION AND THE ENVIRONMENT 3

Population growth, Variation among nations -Population explosion - Family welfare programme - Environment and human health -Value education - Pandemic issues and management-Women and child welfare - Role of information technology in environment and human health - Case studies

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1: The students will able to understand the basis of ecological principles and environmental regulations which in turn helps in sustainable development and human population and environment. Use and over exploitation of forest and water and food resources.

CO2: The students will able to understand various schemes for the protection of species, role of an individual in prevention of pollution and conservation of natural resources

CO3: The students will able to understand design of pollution control structures, resettlement and rehabilitation of people, welfare about the women and child.

CO4: The students will able to apply enough knowledge of implement various Environmental ethics, regulations and schemes, Pandemic issues and management, dams-benefits and problems, conservation of biodiversity.

CO5: The students will able to analyze the disaster management – floods, earthquake, cyclone and landslides. Water logging, salinity, climate change, global warming, acid rain and ozone layer depletion.

TOTAL: 15 PERIODS

TEXT BOOKS:

1. Benny Joseph, "Environmental Science and Engineering", Tata McGrawHill, New Delhi, 2017.
2. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd Edition, Pearson Education, 2016.
3.George Tchobanoglous, Frank Kreith, "Handbook of Solid Waste Management" (McGrawHill Handbooks), McGraw-Hill Education, 2ndEdition July 2017.

REFERENCES:

1. R.K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media. 2015.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press (I) Private Limited, Hydrabad, 2015.
3. Rajagopalan R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	3	-	-	-	-	2	-	-	-
CO2	3	2	-	-	-	3	3	-	-	-	-	2	-	-	-
CO3	3	-	1	1	-	2	2	-	-	-	-	2	-	-	-
CO4	3	2	1	-	-	2	2	-	-	-	-	2	-	-	-
CO5	3	2	1	1	-	2	2	-	-	-	-	1	-	-	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23EE414 SDG: 4	Aptitude and Communication for Engineers II	Category : EEC L T P C 1 0 1 1

COURSE OBJECTIVE:

1. To enhance the students' ability to contribute effectively and confidently in classroom and other forums and thereby they can exhibit their skills and gain attention.
2. To further enhance and improve their communicative English for industry readiness through various speech craft activities.
3. To take a stock of internal strength and weakness and prepare a plan to manage external threats and opportunities
4. To get ready to kick start their career journey by assessing their current skills and talents.
5. To train students on clearing various placement papers with greater accuracy

UNIT 1	**Course Introduction**	**2**

Introduction about the Course - Learning expectations

UNIT 2	**Speaking Skills -Vantage**	**12**

Speech Craft –My buddy - Impromptu

UNIT 3	**Personality Development**	**3**

Psychometric Assessments - SWOT analysis

UNIT 4	**Placement Readiness**	**4**

Placement inventory-– Resume - Grooming

UNIT 5	**Aptitude for Placements - II**	**9**

Placement Paper 7–Permutation & Combination – Probability, Placement Paper 8 – Arithmetic Reasoning – Problems on Ages, Placement Paper 9 – Ratio Proportion & Alligation Mixture, Placement Paper 10 – Clocks & Calendars.

COURSE OUTCOMES:

Upon completion of this course,

CO1: Students will be able to participate in any learning activity without any reservations. They shall be ready to move beyond their comfort zone to acquire new skills throughout their life.

CO2: Students shall understand and appreciate the importance of English in the current global scenario and make efforts towards up skilling the same.

CO3: They must be able to identify their strength and enhance the same.

CO4: They shall prepare themselves to kick start their career by taking a stock of their existing skills and plan to acquire new skills required to achieve their goals.

CO5: They shall demonstrate a good understanding of basic mathematical concepts required to learn engineering. To use appropriate strategies and shortcuts to improve speed and accuracy in solving aptitude problems during recruitment processes

TOTAL: 30 PERIODS

TEXT BOOKS:

1. The Pearson Guide to Quantitative Aptitude for Competitive Examinations, Dinesh Khattar. Pearson
2. Quantitative Aptitude Dr. R.S. Aggarwal S. Chand Publication
3. A modern Approach to Verbal and Non-Verbal Reasoning R.S. Aggarwal
4. A Modern Approach to Verbal & Non-Verbal Reasoning - Aggarwal R. S

REFERENCES:

1. Quantitative Aptitude for CAT, Arun Sharma
2. Fast Track Objective Arithmetic, Rajesh Verma, Arihant Publication
3. Quantitative Aptitude Quantum CAT Common Admission Tests for Admission into IIMs,Sarvesh K. Verma
4. Wiley's Exam Xpert Quantitative Ability for CAT, 2ed, Ashu Jain

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
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CO 2	-	-	-	-	-	2	2	1	-	3	-	-	-	-	-
CO 3	3	3	3	3	-	-	-	-	-	1	-	-	-	-	-
CO 4	3	2	1	3	-	-	-	-	-	1	-	-	-	-	-
CO 5	1	1	1	1	-	-	-	-	-	3	-	-	-	-	-

Correlation levels:	**1 – low**	**2 – medium**	**3 – high**	**“-“- no correlation**

SEMESTER V

U23FT501 SDG: 4	FOOD PACKAGING TECHNOLOGY	Category: PCC L T P C 3 0 0 3

COURSE OBJECTIVE:

1. To understand the basic concepts of functions and properties of packaging materials
2. To familiarize with different types of packaging materials
3. To gain knowledge on manufacturing process of packaging materials
4. To understand the various types of tests performed on packaging materials
5. To remember the recent trends in food packaging systems

UNIT 1 INTRODUCTION TO FOOD PACKAGING 9

Introduction, Packaging of foods, requirement, importance and scope, packaging terminologies. Functions of packaging, properties of packaging materials. Factors affecting the choice of packaging materials Classification of packaging materials, Factors affecting shelf life of food material during storage. Factors affecting the choice of packaging materials - Factors affecting shelf life of food material during storage

UNIT 2 TYPES OF PACKAGING MATERIALS 9

Packaging systems, types: flexible and rigid; retail and bulk; levels of packaging; special solutions and packaging machines, technical packaging systems and data management packaging systems, Different types of packaging materials, their key properties and applications, Metal cans, manufacture of two piece and three piece cans, Plastic packaging, different types of polymers used in food packaging and their barrier properties. manufacture of plastic packaging materials, profile extrusion, blown film/ sheet extrusion, blow molding, extrusion blow molding, injection blow molding, stretch blow molding, injection molding.

UNIT 3 MANUFACTURE OF PACKAGING MATERIALS 9

Glass containers, types of glass used in food packaging, manufacture of glass and glass containers, closures for glass containers. Paper and paper board packaging, paper and paper board manufacture process, modification of barrier properties and characteristics of paper/ boards. Advantages and disadvantages of different packaging materials.

UNIT 4 TESTING OF PACKAGING MATERIALS 9

Testing methods for flexible materials, rigid materials and semi rigid materials; Tests for paper- thickness, bursting strength, breaking length, stiffness, tear resistance, folding endurance, ply bond test, surface oil absorption test. Plastic film and laminates- thickness, tensile strength, gloss, haze, burning test to identify polymer. Aluminium foil- thickness, pin holes. Glass containers- visual defects, colour, dimensions, impact strength. Metal containers- pressure test, product compatibility.

UNIT 5 PACKAGING SYSTEMS 9

CAS and MAP, shrink and cling packaging, vacuum and gas packaging - Aseptic packaging, requirements, shallow and deep path sterilization of Aseptic packaging, Active packaging, Smart packaging, intelligent packaging - Retort packaging, Biodegradable and edible packaging principles, application. Printing and Labelling.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Understand the basic concepts of packaging for different food materials and their importance

CO2: Remember the different types of packaging materials

CO3: Apply the knowledge of packaging materials to select appropriate packaging manufacture solutions for different food products.

CO4: Evaluate packaging materials using standard testing methods

CO5: Apply innovative food packaging solutions for various food products.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Coles, R., McDowell, D., Kirwan, M .J. 2003. Food Packaging Technology. Blackwell Publishing Co.
2. Robertson, G. L. 2001. Food Packaging and Shelf life: A Practical Guide. Narendra Publishing House.
3. Gosby, N.T. 2001. Food Packaging Materials. Applied Science Publication
4. John, P.J. 2008. A Handbook on Food Packaging Narendra Publishing House,
5. Mahadevia, M., Gowramma, R.V. 2007. Food Packaging Materials. Tata McGraw Hill

REFERENCES:

1. Dong Sun Lee, Kit L Yam and Luciano Piergiovanni. Food Packaging science and Technology. CRC Press. New York.
2. Crosby N.T. 1981. Food Packaging Materials. Applied Science Publishers Ltd., New York.
3. Heiss, R. 1970. Principles of food packaging. An International guide. P. Kepplerverlag KG, Heusenstamn, Germany.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	3	-	-	-	-	-	3	2	2	2
CO2	3	2	-	-	-	-	-	-	-	-	-	3	3	3	3
CO3	3	3	-	2	-	-	-	-	-	-	-	2	3	3	3
CO4	3	3	-	-	2	-	-	-	-	-	-	2	3	3	3
CO5	3	2	-	2	3	-	3	-	-	-	-	2	3	2	2

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FT502 SDG: 4	LIVESTOCK AND FISH PROCESSING TECHNOLOGY	Category: PCC L T P C 3 0 0 3

COURSE OBJECTIVES:

1. To infer the knowledge on types, composition, post-mortem and preservation of meat
2. To inculcate the industrial processing of poultry and quality and standards of poultry meat
3. To outline the formation, grading, structure, composition and quality of eggs
4. To explain the sources, classification, handling, spoilage and preservation of fish
5. To summarize the features, sanitation, handling of equipment, and meat regulations

UNIT I **MEAT PROCESSING** **8**

Types of Meat and its sources, composition, structure of meat. Pre-slaughter care, handling and transportation. Ante mortem handling, slaughtering and dressing of animals, Post-mortem inspection and grading of meat, biochemical changes in meat muscle, microbiology and spoilage factors, Meat - Tenderization, Meat quality evaluation. Mechanically deboned meat. Preservation of meat- curing, smoking, drying, freezing, canning and irradiation. Meat adulteration.

UNIT II **POULTRY PROCESSING** **9**

Poultry classification – chicken, Turkey, goose, duck, Guinea fowl and pigeon. Unit operation in poultry processing. Pre-slaughter factors affecting poultry meat quality. Slaughter through chilling, Types of poultry cuts. Sensory quality of poultry meat- color, texture and flavor. Eating quality – tests- Warner_Bratzler Shearing blade and the Volodkevich method, Electronic nose Indian standards for dressed chicken. The Kosher and halal market – dietary laws, Kosher poultry and halal poultry.

UNIT III **EGG PROCESSING** **9**

Formation of egg, Structure, composition, nutritive value of egg. Functional properties of eggs, Factors affecting egg quality and evaluation of egg quality. Preservation and maintenance of egg – cleaning, oil treatment, cold storage, thermostabilization, immersion in liquids. Microbial spoilage of eggs, Egg powder processing-spray drying, Foam mat drying.

UNIT IV **FISH PROCESSING** **9**

Classification of fisheries, composition and nutritive value of fish. Fishing techniques, Handling of fishes, Transportation, Spoilage factors of fish. Bacteriology of fish, Preservation- Freezing and Individual quick freezing, Canning and smoking operations, Salting and drying of fish, pickling. Value added products

UNIT V **MEAT PLANT HYGIENE AND REGULATION** **10**

Modern abattoirs and its features Handling and maintenance of tools and core equipment. Agents used in sanitation, properties and classification of sanitizing agents – sanitizers and disinfectants, SSOP's, Organization of cleaning schedule, Manual cleaning, Specialized cleaning techniques, Automated cleaning systems. Meat regulations – International level – FAO, WHO, OIE, CEC, ICMSF, ISO and National level – APEDA, AGMARK, PFA, MFPO, BIS, state and local self-government and MOU's.

COURSE OUTCOMES:

At the end of the course, students can

CO1: Explain the types, structure, slaughtering, post-mortem, and preservation methods of meat
CO2: Understand the processing of poultry and quality standards of poultry meat
CO3: Outline the structure, composition, preservation and evaluate the quality of egg
CO4: Infer the sources, classification, handling, spoilage and preservation of fish
CO5: Prioritize the sanitation, cleaning, handling and regulations of abattoir and meat

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Panada P.C., ―Text book on Egg and Poultry Technology‖, 1st Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 1996
2. Gunter Heinz and Peter Hautzinger, ―Meat Processing Technology‖, 1st Edition, Rap Publication, Monteplier, 2007

REFERENCES:

1. Ionnis S. Boziaris, ―Seafood Handbook: Technology, Quality and Safety‖, Wiley Blackwell, UK, 2014
2. Mead G.C., ―Poultry Meat Processing and Quality‖, 1st Edition, CRC Press, London, 2004
3. Alan R. Sams, ―Poultry Meat Processing‖, 1st Edition, CRC Press, London, 2001
4. Joseph Kerry, John Kerry and David Ledwood. ― Meat Processing, Woodhead Publishing Limited, England (CRC Press), 2002.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	2	2	2	2	-	-	-	-	-	2	1	2	1
CO2	2	3	3	2	2	2	-	-	-	-	-	2	2	1	1
CO3	3	3	3	2	3	2	-	-	-	-	-	2	2	1	1
CO4	2	3	3	2	3	2	-	-	-	-	-	2	1	3	1
CO5	3	3	2	1	1	2	-	-	-	-	-	2	2	1	3

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FT503 SDG: 4	FRUITS AND VEGETABLES PROCESSING TECHNOLOGY	Category: PCC			
		L	T	P	C
		3	0	2	4

COURSE OBJECTIVE:

1. To identify spoilage issues in fruits and vegetables and describe the role of post-harvest operations and preservation in India.
2. To assess the maturity indicators and textural features of fresh produce, and apply methods to determine maturity and measure respiration rates.
3. To understand different preservation methods of fruit and vegetable
4. To apply the key steps in canning (like blanching and aseptic packing), and evaluate juice and puree processes based on quality standards and regulations.
5. To develop processed fruit/vegetable product (like jam or chutney) and evaluate its nutritional quality and waste impact.

UNIT 1 PRODUCTION AND POST HARVEST OPERATIONS 8

Production and processing scenario of fruits and vegetable India and World. Scope of Fruit and Vegetable Preservation Industry in India. Composition of each of the major fruits and vegetables produced in the country-Spoilage factors, Post harvest field operations, Preservation treatments for freshly harvested fruits and vegetables, Packaging of whole fruits and vegetables for internal and export markets. Processing and packaging of cut fruits and vegetables

UNIT 2 FRESH FRUITS AND VEGETABLES 8

Physical, Textural characteristics, structure and composition. Maturity standards; Importance, methods of Maturity determinations maturity indices for selected fruits and vegetables. Harvesting of important fruits and vegetables. Fruit ripening- chemical changes, regulations, methods. Calculation of respiration rates, Spoilage of fruits, vegetable and their processed products.

UNIT 3 PRESERVATION OF FRUITS AND VEGETABLES 9

Preservation by fermentation- Definition, Advantages, disadvantages, Types of fermentation, equipments; Fruit wine. Irradiation applications for fruits and Vegetable. Minimally processed fruits and vegetables, solving problems with respect to natural resistance of fruit, General preprocessing, drying and freezing of fruits and vegetables - problems associated with specific fruits and vegetables, problem solving in post-cutting treatments to extend the shelf-life of fresh-cut products.

UNIT 4 CANNING, PUREES AND JUICES 10

Canning- General pre-processing, specific or salient points in fruits and vegetables like – Blanching, exhausting, processing conditions; Indian Food Regulation and Quality assurance Fruit Juice / pulp/ Nectar/Drinks, concentrates – General and specific processing, different packing including aseptic. Indian Food Regulation and Quality assurance Vegetable Purees/pastes - General and specific processing, different packing including aseptic. Technology for juice pressing, juice extraction and clarification, methods of bottling, enzymatic clarification and debittering of juices, fruit juice powders- preparation and packaging

UNIT 5 FRUIT AND VEGETABLE PRODUCTS 10

Ready to eat fruit and vegetable products, Jams/Marmalades, Squashes/cordials, Ketchup/sauces, Chutneys, Fruit Bar, Soup powders, Candied Fruits, Fruit and Vegetable Fibres- General and specific processing, different packing including aseptic, Dried Onion, Powder. Garlic Dried Garlic, Powder, Oil. Potato Wafer; starch, Papad, Carrot Preserve, candy, Pickle, Jam. Cauliflower and cabbage Dried cauliflower and cabbage, Sauerkraut, Pickle Leafy vegetables; Dried Leafy Vegetables. (Spinach, Fenugreek, Coriander leaves, Curry leaves). Bitter gourd Pickle, Dried bitter gourd. Indian Food Regulation and Quality assurance, Case studies- Improving the nutritional quality of processed fruits and vegetables, Waste management in fruit and vegetable processing industries

LIST OF EXPERIMENTS

1. Preparation of Fruit juice - RTS Beverages, Squash/Cordial
2. Preparation of Fruit Jam and Jelly
3. Preparation of Tomato Products (ketchup, puree, sauce)
4. Dehydration of Vegetables
5. Preparation of fermented fruit and vegetable products (wine, pickle, kimchi)
6. Preparation of Fruit Bar or Leather
7. Study of Minimally Processed Fruits (Packaging & Shelf-Life)
8. Canning of Fruits and vegetables
9. Preparation of preserves and candy preparation from fruit
10. Quality Evaluation of Processed Products

COURSE OUTCOMES:

At the end of the course, students would

CO1: Understand causes and types of spoilage in fruits and vegetables, and explain the role of post-harvest operations and preservation techniques in reducing losses.

CO2: Evaluate maturity and texture characteristics of fresh produce using standard indices, and apply methods to measure maturity and respiration rates.

CO3: Compare various preservation methods (e.g., fermentation, drying, freezing), including their pros and cons, and design a basic preservation protocol for fresh-cut produce.

CO4: Apply essential steps in canning (such as blanching and aseptic packaging) and assess juice and puree processing methods in accordance with regulatory and quality standards.

CO5: Develop a value-added product (e.g., jam, chutney, vegetable powder), evaluate its nutritional quality and environmental impact, and propose waste management strategies.

TOTAL: 60 PERIODS

TEXT BOOKS:

1.Fellows, P J. "Food Processing Technology Principles and Practice". 3rd Edition, Woodhead, 2009.

2. Salunke,D . K and S. S Kadam "Hand Book of Fruit Science and Technology Production, Composition, Storage and Processing". Marcel Dekker, 2005.

3. Sivasankar, B. "Food Processing & Preservation", Prentice Hall of India, 2002.

REFERENCES:

1. R. P. Srivastava & Sanjeev Kumar. Fruit and Vegetable Preservation: Principles & Practices International book distributing Co. Lucknow (2019 4th print). ISBN 10: 8123924372ISBN 13: 9788123924373
2. Rosenthal, A., Deliza, R., Welti-Chanes, J., & Barbosa-Cánovas, G. V. (Eds.). Fruit Preservation: Novel and Conventional Technologies. Springer. 2018. ISBN 978-1-4939-3311 2
3. Giridhari Lal, G.S. Siddappa & G.L. Tondon. Preservation of Fruits and Vegetables CFTRI, ICAR, New Delhi -12. 1990
4. Y. H. Hui, S. Ghazala, D.M. Graham, K.D. Murrell & W.K. Nip Handbook of Vegetable Preservation and Processing Marcel Dekker. 2003

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	2	2	2	3	3				1	2	2		2

CO2	3	3	3	3	3	3	3		1	3	2	2
CO3	3	3	3	2	3	2	2		1	3	3	2
CO4	3	3	3	2	3	2	2		1	2	2	1
CO5	3	3	3	3	3	3	3		2	3	2	2

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FT511 SDG: 4	FOOD PACKAGING AND TESTING LABORATORY	Category : PCC L T P C 0 0 4 2

COURSE OBJECTIVE:

1. To identify and classify food packaging materials
2. To measure key mechanical and barrier properties of different packaging materials
3. To ensures every student understands and applies regulatory testing and compliance.
4. To bridges theory to practice, requiring evaluation of real-world packaging needs.
5. To Use modern testing tools for quality evaluation

LIST OF EXPERIMENTS

1. Identification of different types of packaging materials and determine the tensile/ compressive strength of given packaging material
2. To determine the tear resistance of given packaging material
3. Determination of thickness and GSM for different packaging material
4. Determination of Cobb index for packaging material
5. Determination of bursting strength of paper
6. Determination of drop test of food package
7. Determination of water-vapour transmission rate of the given packaging material
8. Shrink wrapping of various horticultural produce
9. A study on packaging machine for semi solid foods
10. A study on canning of food and testing of cans
11. A study on vacuum packaging of agricultural produces
12. A study on shrink wrapping of various horticultural produce
13. Visit to food packaging material manufacturing unit

COURSE OUTCOMES:

At the end of the course, students would

CO1: Understand and classify various types of food packaging materials

CO2: Evaluate mechanical properties of packaging materials such as tensile strength, compressive strength, tear resistance, and bursting strength.

CO3: Demonstrate a testing and properties of packaging materials for its regulatory requirements for raw and processed foods

CO4: Analyze the food packaging techniques and assess their suitability for specific food applications.

CO5: Evaluate the quality of packing materials using latest machineries

TOTAL: 60 PERIODS

CO's-PO's & PSO's MAPPING

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	2	2	2	-	-	-	-	3	-	-	2	2	2	2
CO2	3	2	2	3	-	-	-	-	3	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	3	-	-	3	3	3	3
CO4	3	3	2	3	2	-	-	-	3	-	-	2	2	3	3

CO5	3	3	3	3	3	-	-	-	3	-	-	2	2	3	3

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23FT512 SDG:4	FOOD PRODUCT DEVELOPMENT LABORATORY	Category: PPC L T P C 0 0 2 4

COURSE OBJECTIVE:

1. Recall the fundamental ingredients and techniques used in preparing various baked goods and snacks.
2. Explain the role of each ingredient in the preparation of baked goods and snacks.
3. Demonstrate the preparation of at least three different types of baked goods or snacks.
4. Compare and contrast different methods of baking and their effects on the final product.
5. Design an original recipe for a baked good or snack incorporating learned techniques and ingredients.

LIST OF EXPERIMENTS

1. Preparation of cookies
2. Preparation of bread and bun
3. Preparation of cakes and muffin
4. Preparation of baked chips
5. Preparation of puffs
6. Preparation of doughnuts
7. Preparation of toffees.
8. Preparation of sugar boiled confectionary.
9. Preparation of chocolate products
10. Preparation of energy bar
11. Preparation of Instant Soup Mix
12. Preparation of RTS
13. Preparation of carbonated beverages
14. Preparation of waffles

TOTAL: 60 PERIODS

Course Outcomes:

At the end of the course, students will be able to:

CO1: List the essential ingredients for making millet cookies, bread, buns, and other baked items.

CO2: Describe how ingredients like flour, yeast, and sugar contribute to the texture and flavor of products such as bread and doughnuts.

CO3: Prepare millet cookies, baked chips, and puffs, applying appropriate techniques and measurements.

CO4: Analyze how variations in baking time and temperature affect the texture and taste of bread and buns.

CO5: Create a unique recipe for a healthy energy bar, combining various grains and nuts, and present it to the class.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	2	2	-	-	-	-	3	-	-	2	2	2	2
CO2	3	2	2	3	-	-	-	-	3	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	3	-	-	3	3	3	3
CO4	3	3	2	3	2	-	-	-	3	-	-	2	2	3	3
CO5	3	3	3	3	3	-	-	-	3	-	-	2	2	3	3

Correlation levels:	**1 – low**	**2 – medium**	**3 – high**	**“-“- no correlation**

U23EE517 **SDG: 4**	**Campus to Corporate- I** **(Common to all Branches)**	**Category : ESC** **L T P C** **1 0 1 1**

COURSE OBJECTIVE:

1. To orient students to the course structure, clarify learning expectations, and reinforce the importance of aptitude skills in the placement process through a quick recap of concepts and practice from previous placement papers.
2. To develop students' verbal communication proficiency through speech crafting, role-play exercises, and structured presentation practice, enabling them to communicate ideas confidently and effectively in academic and professional contexts.
3. To enhance students' understanding of current industry trends, expectations, and hiring practices, and to equip them with a structured resume inventory that reflects their skills, qualifications, and achievements accurately.
4. To strengthen students' analytical and visual reasoning skills by practicing figure series, figure matrices, analogies, mirror and water images, counting figures, and embedded figures, preparing them for aptitude and competitive assessments.
5. To improve grammatical accuracy and fluency in English through targeted practice in tenses for daily conversation, sentence correction (focusing on tenses and subject–verb agreement), and correct usage of articles, thereby enhancing overall language competence for interviews and workplace communication.

UNIT 1 **Introduction** **4**

Course Introduction: Introduction about the Course - Learning expectations - Recap of Aptitude (Placement Papers)

UNIT 2 **Speaking Skills -Novice** **12**

Speaking Skills –Vantage: Speech Craft – Role Play - Presentation Skills

UNIT 3 **Placement Readiness II** **2**

Industry Awareness - Resume Inventory

UNIT 4 **Non-Verbal Reasoning** **6**

Figure series, Figure Matrix, Figure Analogy, Mirror and Water Image, Counting Figures – Embedded Figures

UNIT 5 **Language Gym – English Proficiency** **6**

Tenses for daily conversation, Sentence Correction (Tenses & SV Agreement) – Articles

COURSE OUTCOMES:

Upon completion of this course,

CO1: Students will be able to participate in any learning activity without any reservations. They shall be ready to move beyond their comfort zone to acquire new skills throughout their life.

CO2: Explain the expectations, and the role of aptitude in the placement process .

CO3: Analyse current industry trends and prepare a comprehensive resume that aligns with employer expectations.

CO4: They shall prepare themselves to kick start their career by taking a stock of their existing skills and plan to acquire new skills required to achieve their goals **.**

CO5: Solve non-verbal reasoning problems including figure series, matrices, analogies, mirror/water images, counting, and embedded figures with accuracy and speed.

TOTAL: 30 PERIODS

TEXT BOOKS:

1. The Pearson Guide to Quantitative Aptitude for Competitive Examinations, Dinesh Khattar.

Pearson

2. Quantitative Aptitude Dr. R.S. Aggarwal S. Chand Publication
3. A modern Approach to Verbal and Non-Verbal Reasoning R.S. Aggarwal
4. A Modern Approach to Verbal & Non-Verbal Reasoning - Aggarwal R. S

REFERENCES:

1. Quantitative Aptitude for CAT, Arun Sharma
2. Fast Track Objective Arithmetic, Rajesh Verma, Arihant Publication
3. Quantitative Aptitude Quantum CAT Common Admission Tests for Admission into IIMs,Sarvesh K. Verma
4. Wiley's Exam Xpert Quantitative Ability for CAT, 2ed, Ashu Jain

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
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CO 2	1	-	-	-	-	-	-	1	-	3	-	-	-	-	-
CO 3	1	-	-	-	-	-	-	1	-	3	-	-	-	-	-

CO 4	1	-	-	-	-	-	-	1	-	3	-	-	-	-	-
CO 5	3	-	-	-	-	-	-	1	1	-	-	-	-	-	-
Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation															

U23FTP11 SDG: 4	BEVERAGE TECHNOLOGY	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To introduce the formulation principles and ingredient selection for different types of beverages.
2. To understand the unit operations involved in beverage manufacturing processes.
3. To study the various production techniques used in the beverage industry.
4. To learn methods for evaluating and maintaining the quality of beverages.
5. To provide knowledge on food laws, safety standards, and regulations related to beverages.

UNIT 1	**Ingredients in Beverages**	**9**

Beverage-definition--ingredients- water, quality evaluation and raw and processed water, bulk and intense sweeteners, water miscible and water dispersible flavouring agents, colours – natural and artificial, Micro and nano-emulsions of flavors and colors in beverages, preservatives, emulsifiers and stabilizers

UNIT 2	**Carbonated Beverages**	**9**

Procedures- ingredients- preparation of Syrup making, carbonation of soft drinks. Carbonation equipments and machineries- -containers and closures. low-calorie and dry beverages; isotonic and sports drinks; Fruit based carbonated beverages, carbonated water

UNIT 3	**Non-Carbonated Beverages**	**9**

Beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, dairy based beverages, RTS beverages, isotonic Beverages. Flash pasteurization, Canning and Aseptic Packaging of beverages. bottled. Water; mineral water, natural spring water, flavored water

UNIT 4	**Alcoholic Beverages**	**9**

Alcoholic beverages- types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, equipment's used for brewing and distillation, wine and related beverages, distilled spirits.

UNIT 5	**Sanitation and Quality Control**	**9**

Quality control, Filling-inspection and quality controls-sanitation and hygiene in beverage industry-Quality of water used in beverages threshold limits of ingredients. FSSAI, EFSA and FDA regulations

COURSE OUTCOMES:

At the end of the course, students would

CO1: Capable of formulating beverages using various ingredients.

CO2: Demonstrate various UNIT operations involved in the food beverage manufacturing

CO3: Understand the various production techniques in beverages.

CO4: Evaluate the quality parameters of all beverages

CO5: Familiarize with food laws and regulations of beverages

TOTAL: 45 PERIODS

REFERENCES:

Handbook of Beverage Production (2023) by F. A. K. Azam, S. R. Kumar
Beverage Quality Assurance and Control (2021) by A. Shah, S. B. McDonald
Modern Carbonated Soft Drinks (2020) by Joseph J. Jenkins
Brewery Technology: Theory and Practice (2021) by Peter M. H. Wilson, G. H. A. P. Clarke

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	1	-	-	-	1	3	-	-	-	1	2	2	2	-
CO2	2	1	1	2	1	1	3	1	1	-	1	2	2	2	-
CO3	2	1	2	2	-	1	2	-	-	-	1	2	2	2	-
CO4	2	1	1	2	1	1	2	2	-	-	2	1	1	1	-
CO5	2	1	2	2	2	1	3	2	1	-	2	2	2	2	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FTP12 SDG: 4	SNACK FOODS TECHNOLOGY	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. Outline the current status of snack food Industry
2. Describe the production, processing and marketing trends of potato and tortilla chips
3. Outline the overall processing of popcorn
4. Explain the production and processing of fruits involved in snack food preparation
5. Summarize the sensory analysis methods and packaging techniques of snack foods

UNIT 1	SNACK FOOD INDUSTRY	9

Introduction-History-Past innovations- Outline of snack food industry- Nutrition-Total Quality Management of Technology-Domestic Snack Food Market-Global Market-Snack Food Association Future Considerations

UNIT 2	POTATO AND TORTILLA CHIPS PROCESSING	9

Potato Production- Potato snack Ingredients- Potato Analysis and Composition-Potato chip manufacturing process-Unit Operations-Other value added products from Potato. Tortilla chips - Raw Materials-Processing steps-Equipment involved-Reconstitution of Dry Maize Flour-Unit operations

UNIT 3	POPCORN PROCESSING	9

Introduction- Raw popcorn selection and preparation-Popping Methods-Home preparation of Popcorn-Equipments-Industrial manufacturing process- Flavorings and Applicators-Popcorn Packaging- Relative Nutrition- Marketing.

UNIT 4	FRUIT BASED SNACKS	9

Introduction-production and processing of fruit crops – fruit purees – fruit powders – canned fruit snacks – alcoholic preservation of fruit snacks – fruit candies – fruit bars – exotic fruits.

UNIT 5	SENSORY EVALUATION AND PACKAGING	9

Introduction- Analytical methods-Sensory methods- Sensory Aspect of Processing- Quality properties of Snack Foods and Packaging Materials-Automated Bag- Pouch Packaging- Cartoning Case Packing-Current Issues in Snack Foods Packaging

COURSE OUTCOMES:

At the end of the course, students would

CO1: Identify current trends and consumer demands in the snack food industry.

CO2: Explain how potato and tortilla chips are produced, processed, and marketed.

CO3: Describe the steps involved in popcorn processing and its recent innovations.

CO4: Analyze how fruits are processed and preserved for use in snack foods.

CO5: Evaluate sensory quality and suggest suitable packaging for snack foods.

TOTAL: 45 PERIODS

REFERENCES:

1. Panda, H. The Complete Technology Book on Snack Foods, National Institute of Industrial Research, Delhi. 2nd Edition 2013
2. Suvendu Bhattacharya, Snack Foods: Processing and Technology,2022
3. Brijesh K. Tiwari ,*Chemistry of Thermal and Non-Thermal Food Processing Technologies,2024*
4. C. Anandharamakrishnan& J. A. Moses , Emerging Technologies for the Food Industry ,2024

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-
CO2	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-
CO3	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-
CO4	3	2	2	1	1	1	1	1	-	-	-	1	1	1	-
CO5	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23FTP13 SDG: 4	EXTRUSION TECHNOLOGY	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To introduce the fundamentals of extrusion processing, including its definition, working principles, historical development, and types of extruders used in the food industry.
2. To provide knowledge on the pre-conditioning of raw materials before extrusion, highlighting the processes, equipment, and benefits involved in improving extrusion efficiency.
3. To develop a comprehensive understanding of single and twin-screw extruders, including their constructional and operational features, process variables, and design considerations.
4. To explore the physical, chemical, and nutritional changes in food materials during extrusion, along with evaluation of textural, sensory, and rheological characteristics of extruded products.
5. To expose students to practical applications of extrusion technology, such as in the production of breakfast cereals, snack foods, confectionery, and texturized vegetable proteins, including emerging trends and industrial practices.

UNIT 1	INTRODUCTION	9

Extrusion: definition, introduction to extruders and their principles, types of extruders. Extruders in the food industry: History and uses of extruders in the food industry.

UNIT 2	PRECONDITIONING	9

Pre-conditioning of raw materials used in extrusion process, Pre-conditioning operations and benefits of pre-conditioning and devolatilization. Interpreted-flight expanders - extruders, dry extruders.

UNIT 3	SINGLE AND TWIN SCREW EXTRUDER	9

Single screw extruder: Constructional and operational characteristics, principle of working, net flow, factors affecting extrusion process, co-kneaders. Twin screw extruder: counter rotating and co-rotating twin screw extruder. Process characteristics of the twin screw extruder: feeding, screw design, screw speed, screw configurations, die design. Barrel temperature and heat transfer, adiabatic operation, heat transfer operations and energy balances. Problems associated with twin screw extruder.

UNIT 4	CHARACTERISTICS OF VARIOUS EXTRUDED FOOD PRODUCTS	9

Rheological properties, textural properties. Sensory characteristics and nutritional value. Chemical and nutritional changes in food during extrusion. Practical considerations in extrusion processing: pre-extrusion processes, cooker extruder profiling. Addition and subtraction of materials, shaping and forming at the die, post extrusion processes

UNIT 5	APPLICATION	9

Cold extrusion; extrusion cooking, new extrusion technology for confectionery product; Breakfast cereal products. Breakfast cereals: introduction, type of cooking - High shear cooking process, steam cookers, low shear, low pressure cookers and continuous steam pre-cooking, available brands. Traditional and extrusion methods, classification of breakfast cereals - flaked cereals, oven puffed cereals, gun puffed cereals, shredded products. Texturized vegetable protein: Definition, processing techniques, and foods. Snack food extrusion: Direct expanded (DX) and third generation (3G) Snacks: types, available brands, co- extruded snacks and indirect-expanded products

COURSE OUTCOMES:

At the end of the course, students would

CO1: Define extrusion processing and describe the working principles and types of extruders.

CO2: Explain the pre-conditioning methods and equipment used to prepare raw materials for extrusion.

CO3: Compare single and twin-screw extruders in terms of design, operation, and process variables.

CO4: Analyze the changes in food properties during extrusion and evaluate product quality characteristics.

CO5: Apply extrusion technology in producing various food products and identify current industrial trends.

TOTAL: 45 PERIODS

REFERENCES:

1. Richardson P., Thermal Technologies in Food Processing, Wood head Publishers, Cambridge, CRC Press, 2001.
2. Guy R. Extrusion Cooking, Technologies and Applications. Wood head Publishing Limited, Abington, Cambridge, 2001.
3. Fast R.B. and Caldwell E.F. Breakfast Cereals and How they are made. American Association of Cereal Chemists, St. Paul, Minnesota, 2000.
4. Frame N.D. The Technology of Extrusion Cooking, Blackie Academic & Professional, New York. 1994.
5. Harper J.M. Extrusion of Foods. Vol. 1&2, CRC Press, Inc; Boca Raton, Florida. 1991.
6. O'Connor C. Extrusion Technology for the Food Industry. Elsevier Applied Science, New York, 1987.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-
CO2	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-
CO3	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-
CO4	3	2	2	1	1	1	1	1	-	-	-	1	1	1	-
CO5	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FTP14 SDG: 4	BAKERY AND CONFECTIONERY TECHNOLOGY	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To understand the importance and role of various ingredients used in baking.
2. To learn about the equipment used in bakery processing and quality testing.
3. To study commercial bread-making methods and how bread spoilage occurs.
4. To explore the production processes of cakes, biscuits, and other bakery items.
5. To gain knowledge about the preparation and quality control of confectionery products.

UNIT 1	Introduction to Baking	9

Historical development and status of bakery industry in India; Introduction and definition of bakery products as per FSSAI – bread, biscuit, cake, pastries, rusk, crackers, bun and their specifications. Bakery ingredients and their functions-Essential ingredients: Flour, yeast and sour dough, water, salt- Other ingredients: Sugar, color, flavor, fat, milk, milk powder, egg and bread improvers. Leaveners and yeast foods. Shortenings, emulsifiers and antioxidants.

UNIT 2	Bakery Equipment	9

Bulk handling of ingredients- Dough mixing and mixers, Dividing, rounding, sheeting, laminating, fermentation enclosures and brew equipment. Ovens and Slicers. Rheology of dough-Farinograph, Amylograph, Alveograph and Extensiograph.

UNIT 3	Bread Making Process	9

Bread making methods. Dough retarding and freezing-emergency, No time process, Chorleywood bread process-Advantages and disadvantages. Characteristics of good bread: Internal characters; external characters. Bread defects/faults and remedies. Spoilage of bread- Causes, detection and prevention.

UNIT 4	Other Bakery Products	9

Cake making: Ingredients and their function, processing - types of cakes, manufacturing methods of different types of cakes, cake defects. Production of cookies and biscuits. Other miscellaneous products-puff, pastry, wafers, pretzels, short breads- role of ingredients -production methods – equipment. Quality control of bakery products.

UNIT 5	Confectionery Products	9

Classification of confectionery Products – Ingredients - Basic Technical considerations-crystallization, stickiness, TSS, TS, pH. Types of confectionery products- lollipop, lozenges, caramel, toffee, Fudge, hard boiled candies, aerated confectionery. Chocolate Processing – chocolate shells, bar chocolates, fruit confections. Confectionery product quality parameters, faults and corrective measures. Spoilage of confectionery products. Bubble gums and chewing gums - ingredients - Formulation – Processing method-Quality control of confectionery products

COURSE OUTCOMES:

At the end of the course, students would

CO1: Recognize the status and significance of ingredients for baking.

CO2: Evaluate suitable processing and quality testing equipment for bakery different products.

CO3: Familiarize with the commercial methods of bread manufacturing and spoilage mechanisms in bread.

CO4: Infer the process and production technologies for cakes, biscuits and other bakery products.

CO5: Comprehend the processing methods and quality control for various confectionery products.

TOTAL: 45 PERIODS

REFERENCES:

Matz, Samuel., A. (2012).*Bakery Technology and Engineering*. III Edition. Chapman & Hall, London.
Yogambal Ashokkumar., (2012). *Text book of Bakery and Confectionery*, 2nd Edition, PHI Learning Pvt. Ltd, New Delhi.
Weibiao Zhou., and Hui., Y. H. (2014). *Bakery Products Science and Technology*, 2nd Edition, Wiley Blackwell, US, 2014.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-
CO2	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-
CO3	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-
CO4	3	2	2	1	1	1	1	1	-	-	-	1	1	1	-
CO5	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FTP21 SDG: 4	FOOD PRODUCT DESIGN AND DEVELOPMENT	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To introduce the basics of food product design and development.
2. To understand stages from idea to product launch and evaluation.
3. To highlight the role of consumer behavior in product development.
4. To provide knowledge on managing the development process effectively.
5. To evaluate and improve product stability, shelf life, and quality

UNIT 1	Concept behind food product design and development process	9

Concept of product development, product success and failure, factors for success- Market survey process for product development, managing for product's success- Innovation strategy -possibilities for innovation, building up strategy, product development programme .

UNIT 2	Knowledge base for product development	9

Stages of product development process - product life cycle- Product development, product commercialization, product launch and evaluation- Technology, knowledge and the food system, knowledge management, knowledge for the conversion of raw material properties, equipment needed and design.

UNIT 3	Role of consumers	9

Role of consumers in product development - consumer behaviour, Food preferences, Avoiding and acceptance of consumers, Integration of consumer needs in product development

UNIT 4	Managing the product development process	9

Principles of product development management, People in product development management, Establishing outcomes, budgets and constraints.

UNIT 5	Improving the product development process	9

Improving the product development process - key message, evaluating product development - Product Stability evaluation of shelf life, changes in sensory attributes and effects of environmental conditions. Case studies.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Gain knowledge on the basic concepts of product development and innovation strategy

CO2: Learn to apply the concept of product development process

CO3: Understand the knowledge base required for product development

CO4: Analyse the role of consumers in product development process

CO5: Develop skills to manage product development process

TOTAL: 45 PERIODS

TEXT BOOKS

1. Clarke and Wright W, Managing New Product and Process Development, Free Press, 1999, ISBN-13: 978-0029055175
2. Earle R, Earle R and Anderson A, Food Product Development. Woodhead Publishing, 2001, ISBN 978-1-84569-722-8
3. Karl Ulrich and Steven Eppinger, Product Design and Development (Irwin Marketing), 6th Edition. McGraw-Hill Education, 2015, ISBN-13: 978-0078029066

REFERENCE BOOKS

1. Earle, Mary D., Earle, Richard L, Creating New Foods, Chadwick House Group, 2001, ISBN 1-902375-12-2 / 1-902423-41-0
2. Gordan W. Fuller, New Food Product Development - from Concept to Market Place, CRC Press, 2004, ISBN 9781439818640
3. Brody, Aarn L and John B Lord, Developing new Food Products for a Changing Marketplace, 2nd Edition, Taylor & Francis, 2008, ISBN 9781420004328
4. Howard R Moskowitz, Jacqueline H Beckley and Anna V. A. Resurreccion, Sensory and Consumer Research in Food Product Design and Development (Institute of Food Technologists Series), 2nd edition, Wiley-Blackwell, 2012, ISBN 978-0-8138-1366-0
5. Jacqueline H Beckley, Leslie J Herzog and M Michele Foley, Accelerating New Food Product Design and Development, 2nd Edition, Wiley-Blackwell, 2017, ISBN:9781119149330

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1	2	2	-	-	-	-	-	-	-	-	-	1	2	2
CO2	1	3	1	-	-	-	-	-	-	-	-	1	1	3	1
CO3	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	-	-	-	-	2	-	-	-	-	-	-	3	-	-
CO5	3	1	-	-	-	-	-	-	-	-	3	-	3	1	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FTP22 SDG: 4	SPICES AND PLANTATION CROPS PROCESSING TECHNOLOGY	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To introduce the classification, composition, and health benefits of various spices, condiments, and leafy spice vegetables.
2. To provide knowledge on harvesting, processing, packaging, and quality control methods of major spices.
3. To understand the preparation, grinding, and packaging of spice-based products such as spice powders, curry powders, and spice oils.
4. To explore the processing and value addition of plantation crops like coffee, tea, cocoa, and coconut.
5. To explain the extraction and analysis of oleoresins and natural food colours used in food processing.

UNIT 1	Spices and Condiments	9

Spices & Condiments - Definition and classification of spices and condiments; global trade scenario; Description of various types of spices and condiments, their composition, functional properties, flavoring agents. Nutritive value of spices and their health benefits. Leafy spice vegetables - Description of various types of leafy spice vegetables, viz., hibiscus, curry leaves, coriander leaves, etc. Their composition, nutritive value, health benefits. Preservation methods and packaging techniques.

UNIT 2	Processing of Spices	9

Pepper, cardamom, ginger and turmeric, garlic, cumin, coriander, cinnamon, clove and vanilla-classification, harvesting, production methods, equipment. Quality control of spices and spice products. Packaging of spices, Fumigation of spices. Irradiation of spices. Adulteration-whole spices, grounded spices, adulteration detection methods. Intermediate Moisture Products from spices –ginger paste, ginger –garlic paste, tamarind paste, tamarind concentrate. Their importance in culinary preparations. Challenges in spices and condiments production, processing and trade.

UNIT 3	Processing of Spice Products	9

Spice Powders and Curry Powders: Their importance in culinary preparations, their preparation methods, grinding and packaging methods for spice powders like chili powder, turmeric powder, ginger powder, garlic powder; and Masala Powders Importance of Cryogenic grinding of spices. Spice Oils – Concept and importance of spice oils from spices their application in food processing, and extraction methods of spice oils by various techniques, viz., solvent extraction, steam distillation etc. Advantages and disadvantages.

UNIT 4	Processing of Plantation Crops	9

Plantation Crops - Description of various types of Plantation crops, viz., coconut, arecanut, coffee, tea, cocoa etc, Importance of plantation crops. Coffee- Occurrence, chemical constituents; Manufacturing of coffee powder; instant coffee, chicory and its importance in coffee processing; quality grading of coffee. Tea - manufacture of tea, black tea, white tea, oolong tea, green tea, macha tea, pu-erh tea. Cocoa-occurrence, chemistry and fermentation of cocoa bean; processing of cocoa, cocoa powder; cocoa liquor manufacture; chocolates–types, chemistry and technology of chocolate manufacture; quality control of chocolates.

UNIT 5	Oleoresins	9

Extraction of Oleoresins – Concept and importance of oleoresins in food processing, processing of spices like chili, turmeric, pepper, ginger etc. for solvent extraction of Oleoresins technology, desolventization methods, regulatory and statutory requirements for oleoresin processing. Extraction and analysis of active components using TLC, HPLC, GC. Extraction of Natural Food Colours - Extraction of Natural Food colours from paprika, turmeric, blue grapes, beet root etc. Their importance in food processing.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Identify and classify various spices, condiments, and leafy spice vegetables along with their nutritional and health benefits.

CO2: Describe the processing methods, quality control, and packaging techniques used for spices and condiments.

CO3: Apply appropriate techniques for preparation and packaging of spice products and analyze the benefits of cryogenic grinding and spice oils.

CO4: Explain the processing of plantation crops and evaluate the quality and chemical composition of products like tea, coffee, and chocolate.

CO5: Analyze and compare different methods of oleoresin and natural food color extraction and assess their regulatory and food processing relevance. **TOTAL: 45 PERIODS**

REFERENCE BOOKS

1. Pandey., P.H.(1998). Post-Harvest Engineering of Horticultural Crops through Objectives. Indian Council of Agricultural Research, Kristi Anusandhan Bhavan, Pusa., New Delhi.

2. Saroj Prakasam and Pruthi., J.S. (2002). Major Spices of India–Crop Management and Post-Harvest Technology, Allahabad

3. Shanmugavelu., K.G. Kumar., N and Peter., K V. (2020). Production Technology of Spices and Plantation Crops. Agro-bios (India).

4. Swati Barche., (2015). Production Technology of Spices, Aromatic, Medicinal and Plantation Crops, New India Publishing Agency.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	1	2	-	-	-	-	-	-	2	2	2	-
CO4	3	2	2	1	2	-	-	-	-	-	-	2	2	2	-
CO5	3	2	2	1	2	-	-	-	-	-	-	2	2	2	-

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23FTP23 SDG: 4	FAT AND OIL PROCESSING TECHNOLOGY	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To comprehend the sources and the properties of fat and oil
2. To learn about the extraction method, process and techniques and the equipments
3. To study refining techniques in fat and oil processing
4. To acquaint with the packaging for fats and oils
5. To gain knowledge about the quality standards followed in food industry

UNIT 1	Introduction to Fat and Oil	9

Introduction of fat and oils – nutritional importance, functions in human body. Oil seeds -National and International production status, oil content in different plant oil sources, structural classification of fats and oils. Physical properties - colour, odour, consistency, melting point, flash point, smoke point and refractive index, SFI, optical properties. Chemical properties of fats and oils – esterification, saponification value, iodine value, hydrolysis, polymerization, peroxide value and free fatty acids

UNIT 2	Oil Extraction Methods	9

Oil seed preparation and pre treatments, oil extraction methods-mechanical expression-ghani, power ghani, hydraulic press, screw press, cold and hot press, expellers, filter press - principle, construction and operation - solvent extraction of oil seeds -steps involved, batch - continuous. Production of palm oil, peanut oil, sesame oil, cotton seed oil, sunflower oil, soy bean oil, rice bran oil, virgin and refined coconut oil. By products of oil extraction

UNIT 3	Refining of Oils	9

Refining of oils - scope and importance, methods- degumming, neutralization, bleaching, decolourising, deodorisation process, winterization process, hydrogenation of oil. Modified fats and fat substitutes - vanaspati, margarine, shortening, lard, mayonnaise, plasticizers – production methods and uses. Processing of other edible oils and fats - rice bran, maize germ, wheat germ.

UNIT 4	Packaging of Edible Oils	9

Packaging of edible oils: types: tinplate, semi rigid, glass, flexible pouches, packaging equipment, and storage of oil. Rancidity- causes, hydrolytic, oxidative and photolytic rancidity, free fatty acid and colour changes. Methods to measure oil flavour quality - chemical, sensory analysis, oil quality improvement through processing.

UNIT 5	Industrial applications and HACCP	9

Edible use of fat and oils in food industries. Industrial applications of fats and oils - manufacture of soap, candle, paints and varnishes. Quality regulations - ISI and AGMARK standards, safety aspects, shelf life and oxidative stability of oil. HACCP implementation in oil industries – case studies in oil industries.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Recognize the sources and the properties of fat and oil

CO2: Understand the extraction method, process and techniques and the equipments

CO3: Understand the refining techniques in fat and oil processing

CO4: Understand the packaging used for fats and oils

CO5: Gain knowledge about the quality standards followed in food industry

TOTAL: 45 PERIODS

REFERENCE BOOKS

1. Harry W. Lawson., (2011), Food oils and Fats - Technology, Utilization and Nutrition. Springer.
2. Gunstone F.D., (2008), Oils and Fats in Food Industry, Blackwell Publishing, United Kingdom, SBN – 13: 9781405181212.
3. Gunstone., FrankD., (2004), The Chemistry of Oils and Fats: Sources, Composition, Properties and Use, Blackwell Publishing.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	2	-	2	-	-	-	-	-	-	-	1	1		-
CO2	3	2	-	2	2	-	-	-	-	-	-	1	2	1	-
CO3	3	2	3	2	2	-	-	-	-	-	-	1	2	1	-
CO4	2	2	3	2	2	-	-	-	-	-	-	2	2	2	-
CO5	2	2	3	3	3	-	-	-	-	-	-	3	2	3	2

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FTP24 SDG: 4	NUTRACEUTICALS AND FUNCTIONAL FOODS	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To introduce the history, definition, and importance of functional foods and nutraceuticals in promoting health and preventing disease.
2. To provide knowledge about the different functional ingredients used in food systems and their physiological roles.
3. To explore the antioxidant properties of bioactive compounds and their role in health promotion.
4. To understand the nature, impact, and control of anti-nutritional factors present in foods.
5. To familiarize students with various nutraceutical supplements and functional foods used in therapeutic applications.

UNIT 1	Introduction Nutraceuticals and Functional Foods	9

Introduction to Nutraceuticals and functional food; importance, history, definition, classification, list of functional foods and their benefits. Functional food overview; definition, classification; functional food, functional food science, food technology and its impact on functional food development; key issues in Indian functional food industry and Nutraceuticals. Relation of functional foods and Nutraceuticals (FFN) to foods
and drugs.

UNIT 2	Functions of Various Nutraceuticals/Functional Food Ingredients	9

Protein, complex carbohydrates like dietary fibers as functional food ingredients; probiotic, prebiotics and symbiotic foods, and their functional role. Sources and role of isoprenoids, isoflavones, flavonoids, carotenoids, tocotrienols, chlorophyll, polyunsaturated fatty acids, lecithin, choline, terpenoids. Glucosamine, lycopene, proanthocyanidins.

UNIT 3	Assessment of Antioxidant Activity	9

In vitro and In vivo methods for the assessment of antioxidant activity, Comparison of different In vitro methods to evaluate the antioxidant. Concept of free radicals and antioxidants; antioxidants role as nutraceuticals and functional foods

UNIT 4	Anti-Nutritional Factors Present in Foods	9

Types of inhibitors present in various foods and their inactivation. Assessment of nutritional status and recommended daily allowances. Effects of processing, storage and interactions of various environmental factors on the potentials of such foods. Marketing and regulatory issues for functional foods and nutraceuticals. Recent development and advances in the areas of nutraceutical and functional foods

UNIT 5	Nutraceuticals Supplements and Remedies	9

Nutraceutical Rich Supplements - Bee Pollen, Caffeine, Green Tea, Grape Tea, Wheat Grass, Lecithin, Mushroom Extract, Chlorophyll. Food as remedies: Nutraceuticals bridging the gap between Food and Drug, nutraceuticals in treatment for cognitive disorders. Medicinal Plant derived nutraceuticals: Anti Aging, Anti-inflammatory compounds.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Comprehend the history and importance of functional foods and nutraceuticals.

CO2: Acquire knowledge about functions of various functional food ingredients.

CO3: Prioritize about the role of antioxidant activity of functional food and nutraceuticals.

CO4: Predict the importance of anti-nutritional factors present in foods.

CO5: Summarize the nutraceutical supplements and foods that act as remedies.

TOTAL: 45 PERIODS

REFERENCE BOOKS

1. Aluko, R. E. (2012). Functional foods and nutraceuticals (pp. 37-61). New York, NY, USA:: Springer.
2. Bagchi, D. (Ed.). (2014). Nutraceutical and functional food regulations in the United States and around the world. Elsevier.
3. Gunstone, F. D. (2003). Lipids for functional foods and nutraceuticals. The Oily Press.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	2	2	-	-	-	2	-	-	-	-	-	1	-	-
CO2	2	2	2	-	-	-	2	2	-	-	-	-	1	-	-
CO3	3	2	1	-	2	2	-	2	-	-	-	2	3	2	-
CO4	2	2	2	-	2	2	2	2	-	-	-	-	-	-	-
CO5	2	2	3	-	-	2	3	3	-	-	3	1	3	2	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FTP31 SDG: 4	NON-THERMAL TECHNIQUES IN FOOD	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To introduce the principles and applications of high-pressure processing (HPP) for enhancing food safety and quality.
2. To impart knowledge about pulsed electric field (PEF) processing and other non-thermal methods in food preservation.
3. To explore various novel processing technologies such as ultrasound, irradiation, extrusion, and freeze-drying.
4. To understand the concept and application of hurdle technology, including chemical and biochemical hurdles.
5. To provide insights into modern refrigeration innovations like vacuum cooling, high-pressure freezing, and freeze concentration.

UNIT 1	HIGH PRESSURE PROCESSING OF FOODS	9

Introduction, principles, use of high pressure to improve food safety and stability. Effectsof high pressure on food quality, Applications of high pressure. HPP of Salads/Ready Meals – effects on microorganisms, enzyme activity, texture and nutrients.

UNIT 2	PULSED ELECTRIC FIELD PROCESSING	9

Mechanism of action, PEF treatment systems; PEF processing of liquid foods and beverages. High intensity electric field pulses on solid foods. Non thermal methods- its applications - Application of light pulses in sterilization of foodsand packaging materials.

UNIT 3	NOVEL METHOD	9

Non thermal processing by radio frequency electric fields; Ultrasound as a food preservation tool; Freeze drying - Food irradiation - advantages and applications. – Super critical fluidextraction – Aseptic processing in foods - extrusion cooking – equipment

UNIT 4	HURDLE TECHNOLOGY	9

Basics of hurdle technology – Mechanism, Application to foods - Newer Chemical and Biochemical hurdles- organic acids – Plant derived antimicrobials – Antimicrobial enzymes– bacteriocins – chitin / chitosan (only one representative example for each group of chemical and biochemical hurdle).

UNIT 5	INNOVATION IN FOOD REFRIGERATION	9

Vacuum cooling of foods; High pressure freezing; Freeze drying (lyophilisation) – Theory – Equipment - Effect on foods – Freeze concentration – Theory - Equipment

COURSE OUTCOMES:

At the end of the course, students would

CO1: Explain the working principles and applications of high-pressure processing and its impact on food quality.

CO2: Describe and evaluate the effectiveness of pulsed electric field (PEF) and other non-thermal technologies in food processing.

CO3: Analyze various novel food processing methods including ultrasound, freeze-drying, supercritical fluid extraction, and aseptic processing.

CO4: Apply the concept of hurdle technology using chemical and biochemical preservation techniques in food systems.
CO5: Assess the role and effects of innovative refrigeration methods like vacuum cooling and high-pressure freezing on food preservation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Da-Wen Sun,"Emerging Technologies for Food Processing", Academic press/ Elsiever, London, UK,2005.

REFERENCE BOOKS

1. Leistner L. and Gould G. Hurdle Technologies – Combination treatments for food stability safety and quality, Kluwer Academics / Plenum Publishers, New York (2002).
2. Da –Wen Sun, "Thermal Food Processing: New Technologies and Quality Issues, 2nd Edition, CRC Press/Taylor & Francis, Boca Raton, Florida,USA, 2012.
3. Gustavo V.Barbosa-Canovas, Maria S.Tapia and M.Pilar Cano, " Novel Food Processing Technologies". CRC Press, 2004.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	3	3	-
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3	-
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3	-
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3	-

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23FTP32 SDG: 4	REFRIGERATION AND COLD CHAIN MANAGEMENT	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To introduce the basic principles, importance, and applications of refrigeration and cold chain systems in food preservation.
2. To provide in-depth knowledge about the vapor compression refrigeration system, including its components and working mechanism.
3. To classify various refrigerants, analyze their thermodynamic properties, and evaluate their environmental impacts, including an understanding of vapor absorption systems.
4. To familiarize students with predictive modeling techniques for estimating the shelf life of refrigerated and frozen foods.
5. To understand the structure and function of transportation and supply chain logistics involved in the food cold chain industry.

UNIT 1	**Refrigeration Principles**	**9**

Introduction to refrigeration, unit of refrigeration capacity. Review of Second law of thermodynamics and interpretation. Difference between a heat engine, refrigerator and heat pump-Production of low temperatures –principles and process-Reversed Carnot cycle. Limitations of reversed Carnot systems. – Simple problems

UNIT 2	**Vapour Compression Refrigeration system and its Components**	**9**

Vapour compression system - refrigeration components – compressor and condenser – types, construction and working - expansion device and evaporators – types, construction and working

UNIT 3	**Refrigerants and Vapour Absorption Cycle**	**9**

Refrigerants, properties, classification, comparison and advantages, chloroflouro carbon (CFC) refrigerants, effect on environmental pollution, alternate refrigerants, vapour absorption cycle, theoretical, deviation in practice, Electrolux refrigerator, construction and principles

UNIT 4	**Cold Chain and Predictive Modelling for Shelf-Life Assessment of Foods**	**9**

Pre-cooling systems, Cold storage- introduction, construction, components of cold chain, insulation and operation. Design of cold storage unit. Calculation of refrigeration load in cold store. Defining overall Shelf-life, remaining shelf life in the context of Chilled & Frozen food, Deterioration modes of food items; Models of quality deterioration- Kinetic model; shelf-life model; Q10/q10 model; TTT model for the remaining shelf – life; Storage of frozen foods to improve the shelf life of the product. Basic design requirements of storage to uphold the shelf life Pre-fabricated systems, walk-in-coolers. Frozen storages.

UNIT 5	**Transport Refrigeration**	**9**

Refrigerated distribution and transport systems-Automobile, Railway, Marine, Air craft air conditioning, Cold chain in retail, Traceability- Application of RFID in cold chain. Role of refrigeration in food production-candy manufacture, beverage processing, bakery products, meat products, poultry products, fishery products, fruit /vegetables and dairy products.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Acquire knowledge on the principles and applications of refrigeration and cold chain.

CO2: Gain understanding on the principle of Vapor compression system and components used in the refrigeration system.

CO3: Classify the refrigerants, properties and its environmental impacts and understand the underlying principles of Vapour Absorption system.

CO4: Demonstrate the predictive modelling for shelf-life assessment of foods.

CO5: Relate the overall transportation and supply chain used in food preservation in food industry

TOTAL: 45 PERIODS

REFERENCE BOOKS

1. Arora C.P., (2008). Refrigeration and Air Conditioning, 2nd Edition, Tata McGraw-Hill Publishing Company Ltd., Delhi.
2. Khurmi, R.S., and Gupta., J.K.(2006), Text book of Refrigeration and Air Conditioning, 5th Edition, S.Chand Publishers, New Delhi.
3. Rajput., R.K. (2012). Refrigeration And Air-Conditioning, 3rd Edition, S.K.Kataria and Sons (Publishers), Delhi.
4. Dellino., C.V.J. (2011). Cold and Chilled Storage Technology, 2nd Edition, Springer, US

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3	-
CO4	3	3	3	3	3	2	-	-	-	-	-	-	3	3	-
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3	-

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23FTP33 SDG: 4	THERMAL PROCESSING TECHNOLOGIES	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To introduce the fundamental concepts and principles of thermal processing in food preservation.
2. To provide knowledge on critical factors influencing the production and safety of thermally processed foods.
3. To explore various retort systems and their applications in the thermal processing of foods.
4. To understand the methods for measurement, control, and validation of thermal processes in the food industry.
5. To expose students to recent innovations and emerging technologies in thermal food processing.

UNIT 1	Thermal Processing Design and Optimization	9

Basic principles in thermal destruction of microorganisms - D, Z, F_o values; Thermal processing, sterilization classification U.H.T. systems, recent advances design of thermal processes. Survival curves, thermal death curves, analysis of thermal resistance data, process time evaluation.

UNIT 2	Production of Thermal Processed Foods	9

Sterilization processes, commercial sterilization, concepts of microbial death kinetics –log reductions. Determining process recommendations for acid foods and acidified foods, calculation of pasteurisation values, inhibitory factors to microorganism growth, guidelines to critical factors in thermal processing of acid foods.

UNIT 3	Thermal Processing Systems	9

In-pack processing: Retort systems, condensing steam retorts, crateless retorts, water immersion retorts, water spray and cascade, steam/air retorts, Shaka retorts, reel and spiral retorts, hydrostatic retorts - heat exchangers and its applications.

UNIT 4	Measurement and Validation of Thermal Processes	9

Setting the target process value and principles, temperature measurement approaches. Heat penetration tests, Locating the product cold point, Establishing the scheduled process time and temperature. Thermal process calculations– Ball's formula method–problems on thermal process calculation.

UNIT 5	Innovations in Thermal Food Processes	9

Ohmic heating in Food processes, radio frequency dielectric heating, infrared heating, and pressure assisted thermal processing, pH assisted thermal processing, time-temperature integrators for thermal process evaluation, and laser-based packaging sterilization in aseptic processing.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Extend knowledge about the basic concepts of thermal processing.
CO2: Acquire information about the factors in the production of thermal processed foods.
CO3: Interpret about different retort systems used in food industry.
CO4: Prioritize the measurement and validation of thermal processes in foods.
CO5: Illustrate innovative techniques in thermal processing.

TOTAL: 45 PERIODS

REFERENCE BOOKS

1. Sandeep. K. P. (2011). Thermal Processing of Foods. Blackwell publishing.
2. Tucker. G. and Susan. F. (2011). Essentials of Thermal Processing, 1st Edition, Wiley-Blackwell.
3. Philip Richardson. (2004). Improving the Thermal Processing of Foods. 1st Edition. CRC Wood head publishing limited.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	3	3	-
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	-
CO3	3	3	3	3	3	3	-	-	-	-	-	-	3	3	-
CO4	3	3	3	3	3	3	-	-	-	-	-	-	3	3	-
CO5	3	3	3	3	3	3	-	-	-	-	-	-	3	3	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FTP34 SDG: 4	SMART TECHNOLOGIES IN FOOD PROCESSING	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To learn how robotics and AI are used in the food industry.
2. To understand the problems with current food processing methods and how smart technologies can help.
3. To know the basics of automation and how it improves food production.
4. To learn about different types of robots and the challenges of using them in food processing.
5. To understand how tools and automation are used in smart farming.

UNIT 1	Internet of Non thermal Food Processing Technologies	9

IoT Communication Models and APIs, Internet of things and cyber-physical systems, Food Industry 4.0 and Sustainability, Machine learning, Cloud-based dashboard, Virtualisation and smart factory.

UNIT 2	Artificial Intelligence	9

Introduction, Different fields of artificial intelligence, Machine Learning (ML),Natural Language Processing (NLP),Vision, Robotics, Autonomous Vehicles, Applications of artificial intelligence in food industry, Challenges to the adoption of artificial intelligence technology in the food industry.

UNIT 3	Smart Food Key Info graphics	9

Food & Beverage Market: Consumer Expenditure by Primary Demand Channels and Region, Global, Processed Food & Beverage Market, Food & Beverage Industry Challenge, Smart Factory: Equipment Innovations, Digital Transformation of Safety, Safety Solutions, IIoT in Food & Beverages Industry: Technological Hotspots

UNIT 4	Robotics in Food Industries	9

Introduction of robotics, Requirements in food industry: Kinematics, dynamics and control, Hygiene, Productivity, Workers' safety; Classification of robots in food industry, Challenges and opportunities, Environmental basis for agriculture and food

UNIT 5	Automation in Food Industry	9

Automate , Tools of Automation :Systemic Textual Analysis ,Function Means Analysis chart,Pugh Matrix, Final Design Concept; Sensor Selection and their industrially application, Complete Design of Embedded Systems, Smart Agriculture

COURSE OUTCOMES:

CO1: Understand the applications of robotics and AI in food industries.
CO2: Analyse the challenges faced using the current process over the smart technologies.
CO3: Evaluate the concepts of automation in Food Industries
CO4: Acquire knowledge about the robotics classification and challenges in food industries
CO5: Interpret the functions of systematic tools and automation in smart agriculture

TOTAL: 45 PERIODS

REFERENCE BOOKS

1. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro (2017).IoT Fundamental: Networking Technologies, Protocols, and Use Cases for the Internet of Things. CISCO Press
2. Darwin Caldwell.(2012). Robotics and Automation in the Food Industry. 1st EditionWood Head Publishing.
3. E R Davies., (2000). Images Processing for the food industry (Machine Perception and Artificial Intelligence. World Scientific Publishing Company.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	3	3	3	3	-	-	-	-	-	-	3	3	-
CO2	3	3	3	3	3	3	-	-	-	-	-	-	3	3	-
CO3	3	3	3	3	3	3	-	-	-	-	-	-	3	3	-
CO4	3	3	3	3	3	3	-	-	-	-	-	-	3	3	-
CO5	3	3	3	3	3	3	-	-	-	-	-	-	3	3	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FTP41 SDG: 4	GREEN TECHNOLOGY IN WASTE MANAGEMENT	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To introduce the fundamentals of waste generation, classification, and its environmental impact, especially in the food industry.
2. To explore the principles, evolution, and applications of green technologies in energy and materials.
3. To examine various physical, chemical, and biological methods of waste treatment, recycling, and energy recovery.
4. To understand the design, operation, and application of bioreactors and landfill technologies for effective waste management.
5. To familiarize students with national and international waste management policies, industry practices, and emerging trends in sustainable waste management.

UNIT 1	Introduction to Waste Management and Green Technologies	9

Waste management in food industries - Types of waste: Solid, liquid, gaseous; biodegradable vs. non-biodegradable, Sources of waste in the food industry - Environmental impacts of food processing waste. Green Technology: definition, Importance, historical evolution, advantages and disadvantages of green technologies, factors affecting green technologies, role of Industry, government and institutions, industrial ecology, role of industrial ecology in green technology. Principles of Green Technologies, reasons for Green Technology, resource minimization, waste minimization, concepts, green reactions solvent free reactions, catalyzed (heterogeneous/homogeneous) reactions, ultrasound mediated reactions, bio catalysts etc.

UNIT 2	Materials for "Green" Systems	9

Green materials, including biomaterials, biopolymers, bioplastics, and composites.Materials for "Green" Systems: Green materials, including biomaterials, biopolymers, bioplastics, and composites. Green technologies for energy, green fuels, definition, benefits and challenges, comparison of green fuels with conventional fossil fuels with reference to environmental, economic and social impacts.

UNIT 3	Green Technologies in Waste Treatment	9

Biological Treatment - Composting, anaerobic digestion, vermicomposting, and their applications- Chemical Treatment - Advanced oxidation processes, chemical precipitation, and other methods for treating specific waste streams, Physical Treatment - Sorting, shredding, size reduction, and separation technologies - Waste-to-Energy Technologies - Incineration, gasification, pyrolysis, and their role in energy recovery from waste - Recycling Technologies - Specific technologies for recycling different materials (plastics, paper, metals, etc.).

UNIT 4	Biological Waste Treatment and Landfilling and Leachate Management Technologies	9

Home-scale and industrial composting methods- Vermicomposting, bokashi composting- In-vessel composting systems- Biochar and soil amendment products. Modern landfill design and operation- Methane capture and flaring - Leachate treatment technologies- Bioreactor landfills. Introduction to waste management. Introduction to bioreactor, Microbial growth kinetics, Design of a bioreactors, Instrumentation and control, Aeration and agitation, Effluent treatment.

UNIT 5	Bio-Industrial Waste Management in Industries and Policies	9

Bio-industrial waste management. Bioreactors for wastewater treatment – Aerobic System Biological processes for domestic and industrial wastewater treatments. Aerobic systems - activated sludge process, trickling filters, biological filters, rotating biological contractors (RBC), Fluidized bed reactor (FBR), expanded bed reactor, inverse fluidized bed biofilm reactor (IFBBR) packed bed reactors air sparged reactors. National and international waste management laws (e.g., SWM Rules 2016, EU directives)-

Extended Producer Responsibility (EPR) - Public-private partnerships (PPP)- Community-based and decentralized waste management systems. Successful case studies (e.g., Sweden, Japan, India)- Smart cities and zero-waste cities - Role of startups and innovation in waste management - Future trends in green waste technologies.

COURSE OUTCOMES:

CO1: Identify different types of waste and analyze their environmental impacts, particularly from food industry sources.

CO2: Explain the importance, advantages, and limitations of green technologies and evaluate their role in sustainable development.

CO3: Demonstrate knowledge of biological, chemical, and physical waste treatment technologies and their industrial applications.

CO4: Design and assess biological treatment systems like bioreactors and composting setups, including modern landfill and leachate management methods.

CO5: Interpret and apply waste management laws, policies, and frameworks at both national and global levels, and evaluate real-world case studies and innovations in green waste technologies.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R. E. Hester & R. M. Harrison (2002). *Waste Management.* Royal Society of Chemistry.
2. IGI Global (2011). *Green Technologies: Concepts, Methodologies, Tools and Applications.* IGI Global Publishers.
3. Bruce E. Rittmann & Perry L. McCarty (2001). *Environmental Biotechnology: Principles and Applications.* McGraw-Hill Education.
4. P. Aarne Vesilind, William Worrell & Debra Reinhart (2011). *Solid Waste Engineering.* Cengage Learning.

REFERENCES:

1. Woodard & Curran Inc. (2006). *Industrial Waste Treatment Handbook.* Butterworth-Heinemann.
2. Anne E. Marteel-Parrish & Martin A. Abraham (2013). *Green Chemistry and Engineering: A Pathway to Sustainability.* Wiley.
3. James E. Bailey & David F. Ollis (1986). *Biochemical Engineering Fundamentals.* McGraw-Hill Education.
4. Louis E. Malina (1993). *Composting and Recycling Municipal Solid Waste.* CRC Press.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	E	3	3	-	2	2	3	3	-	-	-	-	3	3	-
CO2	3	3	3	-	2	2	3	3	-	-	-	-	3	3	-
CO3	3	3	3	-	2	2	3	3	-	-	-	-	3	3	-
CO4	3	3	3	-	2	2	3	3	-	-	-	-	3	3	-
CO5	3	3	3	-	2	2	3	3	-	-	-	-	3	3	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FTP42 SDG: 4	INDUSTRIAL FOOD WASTE MANAGEMENT	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To understand different types of food waste and ways to reduce them.
2. To learn how cereal industry waste can be used to create useful by-products.
3. To identify waste from oilseeds and tuber processing industries for value-added products.
4. To explore how animal processing waste can be used effectively.
5. To apply waste utilization methods in fruit, vegetable, sugar, and packaging industries.

UNIT 1	Introduction on Waste and disposal strategies	9

Introduction : Different Sources of waste from Food Industries and their availability in India, nature of different waste, potentials and prospects of developing by products in India. Characteristics of Industrial Waste and disposal strategies : Classification of waste, characterization of waste, magnitude of waste generation in different food processing industries, importance of waste management, Economical aspects of waste treatment and disposal, Strategies for minimizing waste, Application of 3R‘s and Life Cycle Assessment (LCA).

UNIT 2	Waste utilization in Cereal Food Industries	9

Waste utilization in Cereal Food Industries: Waste utilization from rice mill – thermal and biotechnological uses of rice husk- pyrolysis and gasification of rice husk- cement preparation and different thermal applications- utilization of rice bran- stabilization – defatted bran utilization.

UNIT 3	By-Products from Oil Seed and Tuber Processing Industries	9

By-Products from Oil Seed and Tuber Processing Industries: Oil processing industries – Introduction, De-oiled cake, animal feed, fertilizer, bio sorbents, waxes, soap stock, cocoa butter replacer. Tuber processing industries- Introduction, enzyme production, biogas, bakers yeast, bio-ethanol, animal feed, corn syrup, organic acids, nutraceuticals

UNIT 4	By Products from Animal Product based Industries	9

By Products from Animal Product based Industries: Dairy industry - Introduction- opportunities – whey, bio surfactants, bacteriocin. Meat, fish, poultry processing industries- bio active peptide, protein extract, gelatin, heparin, pepsin, bio molecule from bone and blood, keratin form animal hair, bone meal, meat meal, fish oil, micro nutrients- vitamins and minerals, pigments.

UNIT 5	Utilization of Fruits, Vegetables and Food Packaging Waste	9

Utilization of Fruits and Vegetables waste: processes for waste utilization from fruits and vegetable industries –Pectin, essential oils, antioxidants, and organic acids. Distillation for production of alcohol, SCP production, by products of sugar industry. Handling of Food Packaging Waste: Handling and treatment, far waste, incineration of solid food waste and its disposal.

COURSE OUTCOMES:

CO1: Classify food waste and strategies for waste minimization
CO2: Acquire knowledge on wastes from cereal industries for developing by-products
CO3: Identify thewastes from oilseeds and tuber processing industries for developing by-products
CO4: Utilize the waste produced from animal processing industries and its by-products
CO5: Apply the concept of waste utilization of fruit and vegetable, sugar and packaging industries

TOTAL: 45 PERIODS

REFERENCE BOOKS

1.Chandrasekaran M.(2016). Valorization of Food Processing By-Products. 1st Edition. CRC Press. USA.
2.Keith Waldron. (2007).Handbook of Waste Management and Co-Product Recovery in Food Processing. 1st Edition. Wood head Publishing Ltd. England.
3.VassoOreopoulou.,& Winfried Russ. (2006).Utilization of By-Products and Treatment of Waste in the Food Industry. 1st Edition. Springer Science and Business Media. USA.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	3	-	2	2	3	3	-	-	-	-	3	3	-
CO2	3	3	3	-	2	2	3	3	-	-	-	-	3	3	-
CO3	3	3	3	-	2	2	3	3	-	-	-	-	3	3	-
CO4	3	3	3	-	2	2	3	3	-	-	-	-	3	3	-
CO5	3	3	3	-	2	2	3	3	-	-	-	-	3	3	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FTP43 SDG: 4	WASTE WATER TREATMENT TECHNOLOGIES	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To learn about different types of waste from food industries and their effects.
2. To understand how wastewater is managed in food processing industries.
3. To explore ways to use by-products from cereals and pulses processing.
4. To gain practical experience in treating industrial wastewater.
5. To learn advanced techniques used in modern wastewater treatment.

UNIT 1	INTRODUCTION TO WASTE WATER TREATMENT	9

Types and formation of by-products and waste; magnitude of Waste generation in different food processing industries; concept scope and maintenance of waste management and effluent treatment.

UNIT 2	CHEMICAL PROPERTIES	9

Temperature, pH, Oxygen demands (BOD, COD), fat, oil and grease content, metal content, forms of phosphorous and sulphur in waste waters, microbigy of waste, other ingredients like insecticide, pesticides and fungicides residues.

UNIT 3	BY-PRODUCTS UTILIZATION	9

Waste utilization in various industries, furnaces and boilers run on agricultural wastes and by products, briquetting of biomass as fuel, production of charcoal briquette, generation of electricity using surplus biomass, producer gas generation and utilization, waste treatment and disposal, design, construction, operation and management of institutional community and family size biogas plants, concept of vermi-composting.

UNIT 4	PROCESSING TECHNIQUES	9

Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation, Secondary· treatments: Biological and chemical oxygen demand for different food plant waste- trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, Tertiary treatments.

UNIT 5	ADVANCED WASTE WATER TREATMENT PROCESSES	9

Sand, coal and activated carbon filters, phosphorous, sulphur, nitrogen and heavy metals removal, Assessment, treatment and disposal of solid waste; and biogas generation.

COURSE OUTCOMES:

CO1: Types of waste and influences.
CO2: Waste water management from any food industry.
CO3: By product utilization from processing plants of cereals, pulses
CO4: Hands on training in wastewater treatment process
CO5: Advance procession techniques for waste water treatment

TOTAL: 45 PERIODS

TEXT BOOK:

1. Huang, R.T. 1982. Compost Engineering: Principles and Practices.John Willey & Sons, New York

REFERENCE BOOKS

1. Standards, ASAE: Manure Production and Characteristics. ASAE, NewYork.
2. USDA: Agricultural Waste Management Field Hand Book, New York, USA.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	1	2	2	1	3	3	2	2	1	3	2	2	2	2
CO2	3	1	2	2	3	3	2	2	2	1	3	2	2	2	2
CO3	3	1	3	2	3	3	3	2	2	1	3	2	2	2	2
CO4	3	2	2	3	3	3	3	2	2	1	3	2	2	2	2
CO5	3	3	3	3	3	3	3	2	2	1	3	2	2	2	2

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23FTP44 SDG: 4	RENEWABLE ENERGY RESOURCES IN FOOD WASTE	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To understand how food waste and renewable energy help support sustainable development.
2. To learn about the types, sources, and features of food waste that can be used for energy
3. To explore technologies used to turn food waste into usable energy.
4. To understand the rules, design needs, and policies related to food-waste-to-energy systems.
5. To learn about real-world examples, innovations, and sustainable practices in food waste valorization.

UNIT 1	INTRODUCTION TO FOOD WASTE	9

Definition and classification of food waste – global and Indian food waste statistics – causes and impacts – food loss vs food waste. Introduction to renewable energy – forms and relevance in food systems. Environmental concerns and energy recovery – role of food waste in circular economy. Concept of food-energy nexus – SDGs related to food waste and renewable energy.

UNIT 2	CHARACTERIZATION AND COLLECTION OF FOOD WASTE	9

Types of food waste: domestic, institutional, agricultural, and industrial. Segregation, preprocessing, and collection systems. Physical, chemical, and biological characterization – calorific value, C:N ratio, moisture content. Sources of food processing waste – fruit peels, dairy sludge, spent grains, etc. Quality and variability of waste for energy conversion.

UNIT 3	TECHNOLOGIES FOR ENERGY RECOVERY FROM FOOD WASTE	9

Anaerobic digestion – process flow, parameters, biogas upgrading. Bioethanol production from sugar- and starch-rich waste. Biodiesel from used cooking oil and lipid waste. Thermochemical processes: pyrolysis, gasification, incineration – energy yield, pros & cons. Composting vs energy recovery – decision criteria. Case studies of food-waste-to-energy projects in India and abroad .

UNIT 4	DESIGN, POLICY AND REGULATORY FRAMEWORK	9

Design principles for small- and large-scale bioenergy plants – system components and efficiency. National and international regulations – SWM Rules 2016, MNRE policies, FSSAI norms. Government schemes: PM-FME, MSME support, Startup India. Safety and compliance – emissions, waste handling, and community guidelines. Role of ULBs and NGOs in food waste energy models.

UNIT 5	SUSTAINABILITY AND INNOVATIONS	9

Environmental sustainability of food-waste-to-energy systems – Life Cycle Assessment (LCA) and carbon footprint analysis – indicators for energy efficiency and environmental impact. Technological innovations in food waste valorization – hybrid systems, microbial fuel cells, enzymatic treatments, and smart digesters. Techno-economic feasibility of decentralized and community-scale models. Role of academic institutions, food incubators (TBI, IIFPT, CFTRI), and startups in promoting circular bioeconomy.

COURSE OUTCOMES:

CO1: Understand the significance of food waste and renewable energy integration in sustainable development.

CO2: Analyze the types, sources, and characteristics of food waste for energy use.

CO3: Apply knowledge of appropriate technologies for converting food waste into usable energy.

CO4: Evaluate regulatory, design, and policy aspects of food-waste-to-energy systems

CO5: Demonstrate an understanding of real-world practices, innovations, and sustainability in food Waste valorization.

TOTAL: 45 PERIODS

TEXT BOOKS:

5. Khandelwal, K.C. & Gupta, M.M. "Biogas Technology: A Practical Handbook." Tata McGraw Hill.
6. Singh, R.P. et al. "Food Waste to Sustainable Energy: The Chemical Potential of Food Waste." Academic Press.
7. Ghosh, P. "Waste to Energy Conversion Technology." Woodhead Publishing

REFERENCES:

1. Pandey, A., Khanal, S.K., & Mohan, S.V. Biomass, Biofuels, Biochemicals: Food Waste to Valuable Resources. Elsevier, 2020.

2. Kalogo, Y. & Monteith, H. Energy from Waste: Current Trends and Future Perspectives. IWA Publishing, 2008.

3. 3. FAO & UNEP Reports Preventing Food Loss and Waste: A Global Priority. FAO/UNEP Publications (Latest Editions).

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	3	-	-	3	3	3	-	-	-	-	3	3	-
CO2	3	3	3	-	-	3	3	3	-	-	-	-	3	3	-
CO3	3	3	3	-	3	3	3	3	-	-	-	-	3	3	-
CO4	3	3	3	-	3	3	3	3	-	-	-	-	3	3	-
CO5	3	3	3	-	3	3	3	3	-	-	-	-	3	3	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FTP51 SDG: 4	HACCP IN FOOD PROCESSING AND PRESERVATION	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To introduce the concept and principles of HACCP in food safety management.
2. To understand how HACCP is implemented in food industries
3. To learn about proper food handling and protection practices.
4. To understand the basics of food plant layout and logistics in the food industry.
5. To gain knowledge of different food packaging methods and labeling requirements.

UNIT 1	Introduction to HACCP	9

HACCP Principles, HACCP Plan, role of Pre-Requisite Programmes (PRP), Operational Pre-requisite Programmes (OPRP), GMP in Food Industry, Implementation of HACCP in a food industry/retail food establishment/catering industry. Documentation required for implementation of HACCP.

UNIT 2	HACCP Plan Preparation	9

HACCP levels, CP's, CCP Controls, Audit: First, second-& third-party audits, CAPA report Comprehensive global perspective of HACCP (USA, Canada, UK, EU, Africa, Japan) HACCP as a part of ISO 22000/FSSC 22000 8, HACP plan Preparation for different food products, Case Studies

UNIT 3	HACCP in Food Processing	9

Food processing and its types, Microbial, Chemical, Physical Hazards, HACCP generic Model,\ Importance of Equipment/ Process Selection, Advantages in Implementing HACCP, Risks at different stages of Food Chain. Food Preservation and techniques, Food Good Manufacturing Practices, Good Laboratory Practices HACCP Implementation in Storage and Transport, Retail and Distribution

UNIT 4	HACCP in Food Plant Design	9

Food Plant Design, layout and Food Logistics, Food Packaging Technology and Labelling Food Microbiology, food borne illness and hazards, Food Sensory Evaluation, Entrepreneurship Development in Food Processing, Case studies, Quality Risk Assessment, Quality Risk Management: Ins and Outs, Deviation Management, CAPA, and Change control, Case Study

UNIT 5	HACCP based approach towards Food Safety	9

Principles of HACCP, Steps in HACCP, VACCP, Principles of Food Preservation, Processing and Packaging, Food Processing Operations, Principles, Good Manufacturing Practices, principles including novel and emerging methods, Hazards Associated with Sea foods, production of safe sea foods –Pre requisite programmes and HACCP, Risk assessment at different stages of sea food process, Application of HACCP, VACCP and TACCP system in Sea food Process

COURSE OUTCOMES:

CO1: Understand about the HACCP and its principles
CO2: Appraise the implementation of HACCP in food industries
CO3: Facilitate in understanding the overall protection and handling of food materials
CO4: Apply the Food Plant Design layout and Food Logistics in food Industry.
CO5: Gain knowledge about different types of food packaging and its labelling.

TOTAL: 45 PERIODS

REFERENCES:

1. Yasmine Motarjemi, Huub Lelieveld. (2023). Food Safety Management: A Practical Guide for the Food Industry. Elsevier Science.
2. Schmidt, Ronald H, Rodrick, Gary E. (2015). Food Safety Handbook. Germany, Wiley.
3. Puja Dudeja, Amarjeeth Singh and SukhpalKhaur. (2016). Food Safety Implementation. CBS Publishers and Distributors Pvt Ltd.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	3	-	-	3	3	3	-	-	-	-	2	2	-
CO2	3	3	3	2	-	3	3	3	-	-	-	-	2	2	-
CO3	3	3	3	2	-	3	3	3	-	-	-	-	2	2	-
CO4	3	3	3	2	-	3	3	3	-	-	-	-	2	2	-
CO5	3	3	3	2	-	3	3	3	-	-	-	-	2	2	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FTP52 SDG: 4	FSMS & FOOD PRODUCT AND SUPPLY CHAIN MANAGEMENT	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To introduce the basic principles and common techniques used in food analysis.
2. To understand the structure and function of key nutrients in food.
3. To explore the roles of enzymes, nutraceuticals, and common food contaminants.
4. To learn about statistical and analytical tools used for food quality assessment.
5. To understand food safety standards and practices followed in the food industry

UNIT 1	Introduction	9

Introduction to GMP & PRP in the food industry, Global Food regulatory Authorities, Concept of HACCP implementation, Hazards and Risks, ISO 22000: Food Safety Management System.

UNIT 2	FSMS in a Food Industry	9

Role of Management in FSMS in a Food Industry, FSMS Auditing, types of Audits and CAPA reports: Food Safety System Certification 22000 (FSSC 22000): Introduction & Audit Requirements, Pest Management, pests of Food Processing and Production, Facilities and Risks Involved, Pest Detection Strategies, Pest Control Strategies, Export and Import Clearance, Commodity Clearance at IEC and regulations, Case Studies.

UNIT 3	HACCP Implementation in Food Industries	9

Historical Background, The Need for HACCP, Principles of HACCP System, Application of HACCP, HACCP in Small-large Food Business, Assessment of HACCP, Operational Maintenance, Introductory of HACCP Concept in Product Development, HACCP team and Resource Management, Novelties in HACCP for Food Operations , Principals Systems and schemes, Principles and associated Systems, Integrated Schemes and their limitations, CIP Background, Cleaning, Sanitization Chemistry, Common Cleaning Problems in Food Process environment.

UNIT 4	Assessment of New Product Development Prototype	9

Formulation and Optimization of New Product, Sensory & Physical Estimation of Permuted Product, Analytical assessment of New Product Development Prototype, assessment with benchmark, Financial Estimation of Novel Products, Food safety Vigilance, Food Safety Problems with Acidic Foods, Contaminants, Adulterants, Legal compliance, regulatory affairs & Documentation, Hazards associated with drinking water, Risk Assessment and Risk Management, HACCP Case Studies –Industry Based Case Study

UNIT 5	Food Supply Chain Management	9

Food Industry-An Overview, Role of GMP & GAP in Food Supply Chain, Principles of FoodSupply Chain Management, Principles of Management, Food Quality & Safety Aspects of Food Supply Chain (An international perspective) Food Supply Chain Risk Management and Mitigation Strategies, Industry based Case Studies

COURSE OUTCOMES:

CO1: Understand about the general principles and techniques in food analysis
CO2: Interpret on structure and functions of nutrients
CO3: Summarize functions of enzymes, nutraceuticals and food contaminants
CO4: Recall about the statistical and analytical tools used in food analysis
CO5: Comprehend the food safety practices followed in food industry

TOTAL: 45 PERIODS

REFERENCES:

1. YasmineMotarjemi& Huub Lelieveld. (2023). Food Safety Management: A Practical Guide for the Food Industry, Elsevier Science.
2. Schmidt, Ronald H, Rodrick, Gary E. (2015). Food Safety Handbook. Germany, Wiley.
3. Samuel Ford (2023). Principles and Techniques of Food Analysis. Syrawood Publishing House.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	3	-	-	3	3	3	-	-	-	-	3	3	-
CO2	3	3	3	-	-	3	3	3	-	-	-	-	3	3	-
CO3	3	3	3	3	-	3	3	3	-	-	-	-	3	3	-
CO4	3	3	3	3	-	3	3	3	-	-	-	-	3	3	-
CO5	3	3	3	-	3	3	3	3	-	-	-	-	3	3	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FTP53 SDG: 4	FOOD LAWS – INDIAN AND INTERNATIONAL	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. Introduce the legal framework and provisions of the Food Safety and Standards Act (FSSA), 2006.
2. Familiarize students with global food safety laws, regulatory bodies, and quality assurance practices.
3. Explain the regulatory processes involved in launching food products, including documentation and intellectual property rights.
4. Educate on the structure and functions of FSSAI and its initiatives for ensuring food safety and consumer awareness.
5. Develop understanding of state-level food authority functions, compliance systems, and food safety training programs.

UNIT 1	Food Safety and Standards Act & Global Framework	9

Food Safety and Standards Act of India, 2006: Provision, definitions and different sections of the Act and implementation, FSS Rules and Regulations, Overview of other relevant national bodies (e.g. APEDA, BIS, EIC, MPEDA, Spice Board etc.), International Food Control Systems/Laws, Regulations and Standards/Guidelines with regard to Food Safety – (i) Overview of CODEX Alimentarius Commission (History, Members, Standard setting and Advisory mechanisms: JECFA, JEMRA JMPR): WTO agreements (SPS/TBT), Important national and international accreditation bodies

UNIT 2	Food Regulatory Affairs	9

Food Regulatory Affairs: Introduction to global regulatory authorities for food Industry, Food GMP and its regulations, From Farm to Fork: Understanding the Food Regulatory Cycle [International perspective of USA, Europe, UK, Canada, GCC (UAE), South Africa, Australia & New Zealand], Food safety in the process chain.

UNIT 3	Product Documentation and Compliance	9

Documentation for launch of a new food product and regulatory filing in US, Europe, UK, India, Canada and Japan, Food Industry IPR, Patents, Copyrights and Trademarks, Food Product Marketing, Import and Export regulations, Compliance guidelines, Govt. Audits (FSSAI, BIS, etc), Food Regulations & Guidelines in India, Food Licensing & Registration in India, Industry based case studies.

UNIT 4	FSSAI – Role and Initiatives	9

FSSAI – Role, Functions, Initiatives (A General Understanding) Genesis and Evolution of FSSAI, Structure and Functions of Food Authority, Overview of systems and processes in Standards, Enforcement, Laboratory ecosystem, Imports, Third Party Audit etc., Promoting safe and wholesome Food (Eat Right India, Food Fortification, snf, Clean Street Food Hub, RUCO and various other social and behavioural change initiatives).

UNIT 5	Training, Systems & Tools	9

Training and capacity building, Role of State Food Authorities. Food Safety Compliance System (FoSCoS), Foos Safety Training and Certification (FoSTaC), Food Licensing and Registration System' or (FLRS), food business operators, Food Import Clearance System, Indian Food Laboratory Network, (INFoLNET) RUCO, Detect Adulteration with Rapid Test (DART) FSSAI e Books on Food Safety (pink, purple, Yellow, Orange etc)

COURSE OUTCOMES:

CO1: Understand the main rules and purpose of the Food Safety and Standards Act (FSSA), 2006.
CO2: Learn about international food safety laws and the role of global food safety organizations.
CO3: Know the steps and paperwork needed to launch new food products, including patents and rights.
CO4: Understand what FSSAI does and how it helps keep food safe and informs consumers.
CO5: Learn about the role of state food authorities and food safety training programs.

TOTAL: 45 PERIODS

REFERENCES:

1. David Acheson, Introduction to Food Safety, 2021
2. M. R. Adams and M. O. Moss, Food Microbiology, 2008
3. P. R. Jayasree, Food Safety and Quality Control, 2016

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	3	3	-	3	3	3	-	-	-	-	3	3	-
CO2	3	3	3	3	-	3	3	3	-	-	-	-	3	3	-
CO3	3	3	3	3	-	3	3	3	-	-	-	-	3	3	-
CO4	3	3	3	3	-	3	3	3	-	-	-	-	3	3	-
CO5	3	3	3	3	3	3	3	3	-	-	-	-	3	3	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FTP54 SDG: 4	FOOD ANALYSIS, TESTING & MICROBIAL SAFETY ANALYSIS	Category: PEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1.To provide students with fundamental knowledge of food analysis concepts, rules, and regulations governing food testing
2.To familiarize students with the principles, classification, and applications of spectroscopic and chromatographic techniques
3.To equip students with a foundation for research and innovation in modern food testing technologies
4.To explain students with knowledge and practical understanding of modern microbiological assays and techniques
5.To introduce students to the principles and applications of solid-state sensors, acoustic sensors, and rapid microbiological detection methods

UNIT 1	CONCEPTS AND METHODS OF FOOD ANALYSIS	9

Concepts of food analysis; Rules and regulations of food analysis Principles and methodology involved in analysis of foods: Sampling – types and sample preparation, Rheological analysis, textural profile analysis of foods Methods of analysis: Proximate constituents: Total fat, crude fiber, protein, moisture, minerals analysis; adulterations testing.

UNIT 2	SPECTROSCOPY AND CHROMATOGRPHY TECHNIQUES	9

Spectroscopy – properties of light – principles – instrumentation – working of UV-Vis spectroscopy, atomic absorption spectroscopy, inductively coupled plasma – optical emission spectroscopy, infra-red spectroscopy. Chromatography – classification – principles – gas chromatography – injector types – detectors, high-performance liquid chromatography – solvent systems - detectors

UNIT 3	EMERGING TECHNIQUES IN FOOD TESTING	9

Hyper spectral imaging (HSI) – working principle, components and challenges. Fluorescence imaging types, principles, instrumentation and applications. Micro-fluidics – key components of device, application, advantages and challenges, MALDI-TOF-MS – principle, instrumentation, sample preparation and application, Nuclear magnetic resonance – types, principle, working and application, Ultrasound and acoustic resonance – basics of sound waves, methodology and application.

UNIT 4	MICROBIAL ANALYSIS AND TESTING	9

sample preparation, stomacher digester, Flow cytometry – principle, working and application. Micro array – principles, types, instrumentation and experiment. Polymerase chain reaction (PCR) – types, principle, components, and application in food. Phase contrast and fluorescence microscopy. Scanning electron microscopy (SEM) – principle, components, sample preparation and analysis. ELISA – allergens and toxin analysis. Isothermal micro colorimetry.

UNIT 5	SENSORS AND RAPID MICROBIOLOGICAL METHODS	9

Sensors, solid-state sensors for pH, acidity, amperometric, potentiometric and; Acoustic sensors
Rapid microbiological methods: Overview, Conductance/impedance techniques for microbial assay; chemosensors, biosensors, immunosensors.

COURSE OUTCOMES:

CO1: Explain the basic concepts, principles, and regulatory framework of food analysis.

CO2: Classify and differentiate various chromatographic and spectroscopic methods based on principles and applications.

CO3: Describe and differentiate the types, principles, and instrumentation of emerging food analysis techniques and its food applications.

CO4: Apply advanced analytical tools to accurately detect, identify, and characterize microorganisms, allergens, and toxins in food systems.

CO5: Explain the working of electrochemical and acoustic sensors, and apply rapid microbiological techniques for detecting microbial activity and food contaminants.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Pomeranz, Yeshajahu and Clifton E. Meloan "Food Analysis : Theory and Practice",3rd Edition, Springer, 2004.
2. Nollet, Leo M.L. "Handbook of Food Analysis" 2nd Edition, Vol. 1-3. Marcel Dekker, 2004.
3. Riemann, Hans P. and Dean O. Cliver, Food Borne Infections and Intoxications, 3rd Edition, Academic Press/Elsevier, 2006

REFERENCES:

1. Wood R, Foster L, Damant A and Key Pauline. Analytical Methods for Food Additives. CRC Woodhead Publishing 2004
2. Hurst, Jeffrey W. "Methods of Analysis for Functional Foods and Nutraceuticals" 2nd Edition, CRC Press, 2008.
3. Shibamoto, Taka yuki and Leonard F.Bjeldanzes, Introduction to Food Toxicology, 2nd Edition, Academic Press, 2009.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	3	3	-	3	3	3	-	-	-	-	3	3	-
CO2	3	3	3	3	-	3	3	3	-	-	-	-	3	3	-
CO3	3	3	3	3	-	3	3	3	-	-	-	-	3	3	-
CO4	3	3	3	3	-	3	3	3	-	-	-	-	3	3	-
CO5	3	3	3	3	3	3	3	3	-	-	-	-	3	3	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FTO11 SDG: 4	Traditional Indian Foods	Category: OEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1 To provide an understanding of the historical origins, cultural significance, and social dimensions of food in human societies.
2 To impart knowledge on traditional and modern methods of food processing, preservation, and their comparative impact on nutrition and efficiency.
3 To explore the diversity of Indian regional foods, including traditional fermented products, beverages, snacks, and their global relevance.
4 To introduce commercial aspects of traditional food production, packaging, and the role of SHGs, SMEs, and industries in the food sector.
5 To evaluate traditional foods in comparison with modern fast foods, focusing on nutritional value, food safety, sustainability, and therapeutic applications.

UNIT 1	HISTORICAL AND CULTURAL PERSPECTIVES	9

Food production and accessibility - subsistence foraging, horticulture, agriculture and pastoralization, origin of agriculture, earliest crops grown. Food as source of physical sustenance, food as religious and cultural symbols; importance of food in understanding human culture - variability, diversity, from basic ingredients to food preparation; impact of customs and traditions on food habits, heterogeneity within cultures (social groups) and specific social contexts - festive occasions, specific religious festivals, mourning etc. Kosher, Halal foods; foods for religious and other fasts.

UNIT 2	TRADITIONAL METHODS OF FOOD PROCESSING	9

Traditional methods of milling grains – rice, wheat and corn – equipments and processes as compared to modern methods. Equipments and processes for edible oil extraction, paneer, butter and ghee manufacture – comparison of traditional and modern methods. Energy costs, efficiency, yield, shelf life and nutrient content comparisons. Traditional methods of food preservation – sundrying, osmotic drying, brining, pickling and smoking.

UNIT 3	TRADITIONAL FOOD PATTERNS	9

Typical breakfast, meal and snack foods of different regions of India.Regional foods that have gone Pan Indian / Global. Popular regional foods; Traditional fermented foods,pickles and preserves, beverages, snacks, desserts and sweets, street foods; IPR issues in traditional foods

UNIT 4	COMMERCIAL PRODUCTION OF TRADITIONAL FOODS	9

Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozen foods – types marketed, turnover; role of SHGs, SMES industries, national and multinational companies; commercial production and packaging of traditional beverages such as tender coconut water, neera, lassi, buttermilk, dahi. Commercial production of intermediate foods – ginger and garlic pastes, tamarind pastes, masalas (spice mixes), idli and dosa batters.

UNIT 5	HEALTH ASPECTS OF TRADIONAL FOODS	9

Comparison of traditional foods with typical fast foods / junk foods – cost, food safety, nutrient composition, bioactive components; energy and environmental costs of traditional foods; traditional foods used for specific ailments /illnesses.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Explain the evolution of food production systems and analyze the role of food in cultural, religious, and social practices.

CO2: Compare traditional and modern methods of food milling, oil extraction, dairy product preparation, and preservation in terms of yield, energy, efficiency, and nutrition.

CO3: Identify and discuss the variety of regional Indian foods, their cultural value, global reach, and issues related to intellectual property rights (IPR).

CO4: Analyze the processes and commercial production of traditional snacks, beverages, ready-to-eat foods, and intermediate food products.

CO5: Assess the nutritional, safety, environmental, and therapeutic aspects of traditional foods in comparison with modern fast/junk foods**.**

TOTAL: 45 PERIODS

REFERENCES:

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

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-
CO2	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-
CO3	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-
CO4	3	2	2	1	1	1	1	1	-	-	-	1	1	1	-
CO5	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23FTO12 SDG: 4	Food, Nutrition and Health	Category: OEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To provide foundational knowledge on the nutritional composition and health benefits of various types of foods.
2. To enable students to understand the role of food in human metabolism and its significance in maintaining a balanced diet.
3. To impart knowledge on methods for assessing health indicators such as BMI and their relation to lifestyle and stress-related disorders.
4. To develop critical thinking and decision-making skills in choosing appropriate foods for the prevention of lifestyle-related diseases.
5. To familiarize students with food laws, policies, and the classification of modern food categories such as junk, modified, and superfoods.

UNIT 1	FOOD AND MICROBIOLOGY OF HEALTH	9

Food resources (plant, animal, microbes); Overview of current production systems; constraints and necessity of novel strategies. Functional and "Super" Foods - role in optimal nutrition. Sugar, protein and fat substitutes. Food and behaviour- physiological disturbances in alcoholism, drug abuse and smoking. Food Related Laws: Inspection – Microbial Indicators of product quality – Indicators of food safety – 229 Microbiological safety of foods - control strategies – Hazard Analysis Critical Point System (HACCP concept)- Microbiological criteria.

UNIT 2	NUTRIENTS AND FOOD ADDITIVES	9

Macro nutrients- carbohydrates, proteins and lipids. Micronutrients-Minerals: Calcium, Magnesium, Iron, Zinc, Copper and Selenium; Vitamins. Nutritional Physiology: Digestion, absorption, and utilization of major and minor nutrients. Biotechnology of food additives- Bioflavors and colors, microbial polysaccharides, recombinant enzymes in food sector.

UNIT 3	NANO FOOD TECHNOLOGY	9

Nano materials as food components, food packaging and nano materials, policies on usage of nanomaterials in foods. Food product development: steps involved in food product development, shelf-life assessment.

UNIT 4	FOOD RELATED NUTRITIONAL DISORDERS AND ENERGY CALCULATION	9

Type I Disorders-Causes of life style and stress related diseases. Cardio-vascular diseases, hypertension, obesity. Type-II Disorders: Cancer, diabetics, ulcers, electrolyte and water imbalance. Health indices. Preventive and remedial measures. Energy balance and methods to calculate individual nutrient and energy needs. Planning a healthy diet.

UNIT 5	CONSUMERS ON GM FOODS AND CONTEMPORARY ISSUES	9

Global perspective of consumers on GM foods; Major concerns of transgenic, foods GM ingredients in food products. (labeling, bioavailability, safety aspects); regulatory agencies involved in GM foods, Case studies- GM foods.

COURSE OUTCOMES:

At the end of the course, students would

CO1 To be able to understand the nutritional values of the various types of foods

CO2: To be able to Analyze the role of food in the metabolic activity of the healthy diet

CO3: :To be able to Infer the BMI calculation and stress related diseases.

CO4: To be able to Elaborate the independent decision on the choice of food to prevent life style disorders and diseases

CO5: To be able to Assess about the food laws governance

CO6: To be able to Compare junk, modified and super foods

TOTAL: 45 PERIODS

REFERENCES:

TEXT BOOK(S):

1. P.J. Fellows.2009. Food Processing Technology -Principles and Practice (Third Edition). A volume in Woodhead Publishing Series in Food Science, Technology and Nutrition.

2. Kalidas Shetty, Gopinadhan Paliyath, Anthony Pometto, Robert E. Levin. 2015. Food Biotechnology. CRC Press. Second edition.

REFERENCE BOOKS

1. Understanding Nutrition. 2010. Ellie Whitney, Sharon Rady Rolfes, 11e. Thompson Wadsworth.

2. Nutritional Sciences- From Fundamentals to Food.2013. Michelle McGuire, Kathy A. Beerman, 2 nd Thompson Wadsworth.

3. Yasmine Motarjemi, Huub Lelieveld, Food Safety Management - A Practical Guide for the Food Industry (2014), 1st Edition, Academic Press, London, UK

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	1	3	-	-	-	1	2	2	2	-
CO2	2	1	1	2	1	1	3	1	1	-	1	2	2	2	-
CO3	2	1	2	2	-	1	2	-	-	-	1	2	2	2	-
CO4	2	1	1	2	1	1	2	2	-	-	2	1	1	1	-
CO5	2	1	2	2	2	1	3	2	1	-	2	2	2	2	-

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23FTO13 SDG: 4	INTRODUCTION TO FOOD PROCESSING	Category: OEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. Understand the sources of food from plant, animal, and microbial origin, and their significance in food processing.
2. Gain knowledge of various methods of food handling, storage, and preservation for ensuring food quality and safety.
3. Learn large-scale food processing techniques and their role in extending shelf life and value addition.
4. Analyze the impact of food wastes, disposal methods, and pest management in food industries.
5. Apply principles of food hygiene, sanitation, and safety to maintain quality standards and prevent foodborne hazards.

UNIT 1	PROCESSING OF FOOD AND ITS IMPORTANCE	9

Source of food - plant, animal and microbial origin; different foods and groups of foods as raw materials for processing – cereals, pulses, grains, vegetables and fruits, milk and animal foods, sea weeds, algae, oil seeds & fats, sugars, tea, coffee, cocoa, spices and condiments, additives; need and significance of processing these foods.

UNIT 2	METHODS OF FOOD HANDLING AND STORAGE	9

Nature of harvested crop, plant and animal; storage of raw materials and products using low temperature, refrigerated gas storage of foods, gas packed refrigerated foods, sub atmospheric storage, Gas atmospheric storage of meat, grains, seeds and flour, roots and tubers; freezing of raw and processed foods.

UNIT 3	LARGE-SCALE FOOD PROCESSING	9

Milling of grains and pulses; edible oil extraction; Pasteurisation of milk and yoghurt; canning and bottling of foods; drying – Traditional and modern methods of drying, Dehydration of fruits, vegetables, milk, animal products etc; preservation by use of acid, sugar and salt; Pickling and curing with microorganisms, use of salt, and microbial fermentation; frying, baking, extrusion cooking, snack foods.

UNIT 4	FOOD WASTES IN VARIOUS PROCESSES	9

Waste disposal-solid and liquid waste; rodent and insect control; use of pesticides; ETP; selecting and installing necessary equipment.

UNIT 5	FOOD HYGIENE	9

Food related hazards – Biological hazards – physical hazards – microbiological considerations in foods. Food adulteration – definition, common food adulterants, contamination with toxic metals, pesticides and insecticides; Safety in food procurement, storage handling and preparation; Relationship of microbes to sanitation, Public health hazards due to contaminated water and food; Personnel hygiene; Training& Education for safe methods of handling and processing food; sterilization and disinfection of manufacturing plant; use of sanitizers, detergents, heat, chemicals, Cleaning of equipment and premises.

COURSE OUTCOMES:

At the end of the course, students would

CO1:Identify different food sources and raw materials used in processing and explain their importance.

CO2:Demonstrate knowledge of handling and storage practices for raw and processed foods under different environmental conditions.

CO3:Explain large-scale food processing operations such as milling, oil extraction, canning, drying, fermentation, and cooking methods.

CO4:Evaluate waste management strategies, pest control, and environmental safety measures in food processing industries.
CO5:Apply hygienic practices, sanitation techniques, and food safety measures to ensure safe processing, handling, and distribution of foods.
.

TOTAL: 45 PERIODS

REFERENCES:

1. Karnal, Marcus and D.B. Lund "Physical Principles of Food Preservation". Rutledge, 2003.
2. VanGarde, S.J. and Woodburn. M "Food Preservation and Safety Principles and Practice".Surbhi Publications, 2001.
3. Sivasankar, B. "Food Processing & Preservation", Prentice Hall of India, 2002.
4. Khetarpaul, Neelam, "Food Processing and Preservation", Daya Publications, 2005.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-
CO2	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-
CO3	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-
CO4	3	2	2	1	1	1	1	1	-	-	-	1	1	1	-
CO5	3	2	2	1	1	1	1	1	-	-	-	1	2	2	-

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23FTO14 SDG: 4	Fundamentals of Food Engineering	Category: OEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. Introduce the engineering properties of food materials relevant to processing, handling, and quality evaluation.
2. Provide theoretical and practical knowledge of drying and dehydration methods in food preservation
3. Develop understanding of size reduction principles, energy requirements, and related equipment used in food processing.
4. Familiarize students with mixing operations, their theories, and equipment for different food systems.
5. Explain the principles and applications of mechanical separation techniques including centrifugation, filtration, and membrane processes in food industries.

UNIT 1	**Engineering properties of food**	**9**

Engineering properties of food materials: physical, thermal, aerodynamic, mechanical, optical and electromagnetic properties

UNIT 2	**Drying and dehydration:**	**9**

Drying and dehydration: Basic drying theory, heat and mass transfer in drying, drying rate curves, calculation of drying times, dryer efficiencies; classification and selection of dryers; tray, vacuum, osmotic, fluidized bed, pneumatic, rotary, tunnel, trough, bin, belt, microwave, IR, heat pump and freeze dryers; dryers for liquid: Drum or roller dryer, spray dryer and foammat dryers

UNIT 3	**Size reduction**	**9**

Size reduction: Benefits, classification, determination and designation of the fineness of ground material, sieve/screen analysis, principle and mechanisms of comminution of food, Rittinger's, Kick's and Bond's equations, work index, energy utilization; Size reduction equipment: Principal types, crushers (jaw crushers, gyratory, smooth roll), hammer mills and impactors, attrition mills, buhr mill, tumbling mills, tumbling mills, ultra fine grinders, fluid jet pulverizer, colloid mill, cutting machines (slicing, dicing, shredding, pulping)

UNIT 4	**Mixing**	**9**

Mixing: theory of solids mixing, criteria of mixer effectiveness and mixing indices, rate of mixing, theory of liquid mixing, power requirement for liquids mixing; Mixing equipment: Mixers for lo.w- or medium-viscosity liquids (paddle agitators, impeller agitators, powder-liquid contacting devices, other mixers), mixers for high viscosity liquids and pastes, mixers for dry powders and particulate solids.

UNIT 5	**Mechanical Separations**	**9**

Mechanical Separations: Theory, centrifugation, liquid-liquid centrifugation, liquid-solid centrifugation, clarifiers, desludging and decanting machine, Filtration: Theory of filtration, rate of filtration, pressure drop during filtration, applications, constant-rate filtration and constant-pressure filtration, derivation of equation; Filtration equipment; plate and frame filter press, rotary filters, centrifugal filters and air filters, filter aids, Membrane separation: General considerations, materials for membrane construction, ultra-filtration, microfiltration, concentration, polarization, processing variables, membrane fouling, applications of ultra-filtration in food processing, reverse osmosis, mode of operation, and applications; Membrane separation methods, demineralization by electro dialysis, gel filtration, ion exchange, per-evaporation and osmotic dehydration.

COURSE OUTCOMES:

At the end of the course, students would

CO1:Explain the physical, thermal, mechanical, and other engineering properties of food materials and their importance in processing.

CO2:Analyze drying and dehydration processes, calculate drying times, and select appropriate dryers for specific food products.

CO3:Apply principles of size reduction, utilize comminution equations, and evaluate suitable equipment for grinding and cutting operations.

CO4:Demonstrate knowledge of mixing theories and assess the effectiveness of mixers for liquids, pastes, and solids.

CO5:Evaluate mechanical separation methods (centrifugation, filtration, membrane separations) and recommend suitable techniques for different food processing applications.

TOTAL: 45 PERIODS

TEXT BOOKS

1. R.L. Earle. 2004. Unit Operations in Food Processing. The New Zealand Intitute of Food Science & Technology, Nz. Warren L. McCabe, Julian Smith, Peter Harriott. 2004.

2. Unit Operations of Chemical Engineering, 7th Ed. McGraw-Hill, Inc., NY, USA. Christie John Geankoplis. 2003.

3. Transport Processes and Separation Process Principles (Includes Unit Operations), 4th Ed. Prentice-Hall, NY, USA.

4. George D. Saravacos and Athanasios E. Kostaropoulos. 2002. Handbook of Food Processing Equipment. Springer Science+Business Media, New York, USA.

5. J. F. Richardson, J. H. Harker and J. R. Backhurst. 2002. Coulson & Richardson's Chemical Engineering, Vol. 2, Particle Technology and Separation Processes, 5th Ed.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1	2	2	-	-	-	-	-	-	-	-	-	1	2	2
CO2	1	3	1	-	-	-	-	-	-	-	-	1	1	3	1
CO3	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	-	-	-	-	2	-	-	-	-	-	-	3	-	-
CO5	3	1	-	-	-	-	-	-	-	-	3	-	3	1	-

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23FTO15 SDG: 4	FOOD SAFETY AND QUALITY REGULATIONS	Category: OEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. Provide knowledge of food safety and security, hygienic design, contaminants, adulteration, and food packaging & labeling.
2. Introduce food quality attributes and methods for quality control using instrumental, chemical, microbial, and sensory techniques.
3. Explain the HACCP system, food laws, risk assessment, and food inspection in ensuring food safety.
4. Familiarize students with Indian and global food safety regulations and international organizations governing food trade and safety.
5. Highlight the role of Codex Alimentarius, Codex India, and National Codex bodies in implementing food safety standards.

UNIT 1	Introduction to food safety and security	9

Introduction to food safety and security: Hygienic design of food plants and equipments, Food Contaminants (Microbial, Chemical, Physical), Food Adulteration (Common adulterants), Food Additives (functional role, safety issues), Food Packaging & labeling. Sanitation in warehousing, storage, shipping, receiving, containers and packaging materials. Control of rats, rodents, mice, birds, insects and microbes. Cleaning and Disinfection, ISO 22000 – Importance and Implementation

UNIT 2	Food quality:	9

Food quality: Various Quality attributes of food, Instrumental, chemical and microbial Quality control. Sensory evaluation of food and statistical analysis. Water quality and other utilities.

UNIT 3	HACCP	9

Critical Quality control point in different stages of production including raw materials and processing materials. Food Quality and Quality control including the HACCP system. Food inspection and Food Law, Risk assessment – microbial risk assessment, dose response and exposure response modelling, risk management, implementation of food surveillance system to monitor food safety, risk communication

UNIT 4	Indian and global regulations:	9

Indian and global regulations: FAO in India, Technical Cooperation programmes, Bio-security in Food and Agriculture, World Health Organization (WHO), World Animal Health Organization (OIE), International Plant Protection Convention (IPPC)

UNIT 5	Regulatory bodies	9

Codex Alimentarius Commission - Codex India – Role of Codex Contact point, National Codex contact point (NCCP), National Codex Committee of India – ToR, Functions, Shadow Committees etc.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Explain the principles of food safety, contaminants, adulteration, and the importance of hygienic design in food processing.

CO2: Identify quality attributes of food and apply instrumental, microbial, chemical, and sensory evaluation techniques for quality control.

CO3: Describe HACCP principles, food inspection, food law, and risk assessment methods for ensuring food safety.
CO4: Discuss the role of FAO, WHO, OIE, IPPC, and other organizations in global and Indian food regulations.
CO5: Evaluate the functioning of Codex Alimentarius Commission, Codex India, and National Codex Committees in food standardization and regulation.. **TOTAL: 45 PERIODS**

REFERENCE BOOKS

1. Handbook of food toxicology by S. S. Deshpande, 2002
2. The food safety information handbook by Cynthia A. Robert, 2009
3. Nutritional and safety aspects of food processing by Tannenbaum SR, Marcel Dekker Inc., New York 1979
4. Microbiological safety of Food by Hobbs BC, 1973

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	1	2	-	-	-	-	-	-	2	2	2	-
CO4	3	2	2	1	2	-	-	-	-	-	-	2	2	2	-
CO5	3	2	2	1	2	-	-	-	-	-	-	2	2	2	-

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23FTO16 SDG: 4	NUTRACEUTICALS	Category: OEC			
		L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. Introduce the concept, significance, and classification of nutraceuticals and functional foods.
2. Explain phytochemicals as nutraceuticals and their production, formulation, and labeling in functional foods.
3. Provide knowledge on the assessment of antioxidant activity and the effect of processing on bioactive compounds.
4. Discuss the role of nutraceuticals and functional foods in health promotion and disease prevention.
5. Highlight safety, toxicity, regulations, and health claims related to nutraceuticals and functional foods.

UNIT 1	INTRODUCTION AND SIGNIFICANCE	9

Introduction to Nutraceuticals and functional foods; importance, history, definition, classification, list of functional foods and their benefits, Phytochemicals, zoochemicals and microbes in food, plants, animals and microbes.

UNIT 2	PHYTOCHEMICALS AS NUTRACEUTICALS	9

Phytoestrogens in plants; isoflavones; flavonols, polyphenols, tannins, saponins, lignans, lycopene, chitin, caratenoids. Manufacturing practice of selected nutraceuticals such as lycopene, isoflavonoids, glucosamine, phytosterols. Formulation of functional foods containing nutraceuticals - stability, analytical and labelling issues.

UNIT 3	ASSESSMENT OF ANTIOXIDANT ACTIVITY	9

In vitro and in vivo methods for the assessment of antioxidant activity, Comparison of different in vitro methods to evaluate the antioxidant, antioxidant mechanism, Prediction of the antioxidant activity of natural phenolics from electrotopological state indices, Optimising phytochemical release by process technology; Variation of Antioxidant Activity during technological treatments, new food grade peptidases from plant sources.

UNIT 4	ROLE IN HEALTH AND DISEASE	9

The health benefit of - Soy protein, Spirulina, Tea, Olive oil, plant sterols, Broccoli, omega3 fatty acid and eicosanoids. Nutraceuticals and Functional foods in Gastrointestinal disorder, Cancer, CVD, Diabetic Mellitus, HIV and Dental disease; Importance and function of probiotic, prebiotic and synbiotic and their applications, Functional foods and immune competence; role and use in obesity and nervous system disorders. .

UNIT 5	SAFETY ISSUES	9

Health Claims, Adverse effects and toxicity of nutraceuticals, regulations and safety issues International and national.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Explain the introduction, significance, and classification of nutraceuticals and functional foods.

CO2: Identify key phytochemicals in foods and describe their production, formulation, and labeling in functional foods.

CO3: Apply methods for assessing antioxidant activity and analyze the impact of processing on bioactive compounds.

CO4: Discuss the role of nutraceuticals and functional foods in health maintenance and the prevention of diseases.

CO5: Evaluate safety issues, toxicity, health claims, and regulatory aspects of nutraceuticals and functional foods **TOTAL: 45 PERIODS**

REFERENCE BOOKS

1. Bisset, Normal Grainger and Max Wich H "Herbal Drugs and Phytopharmaceuticals", 2nd Edition, CRC, 2001.

2. Handbook of Nutraceuticals and Functional Foods: Robert Wildman, CRC, Publications. 2006

3. WEBB, PP, Dietary Supplements and Functional Foods Blackwell Publishing Ltd (United Kingdom), 2006 .

REFERENCES:

1. Asian Functional Foods (Nutraceutical Science and Technology) by John Shi (Editor), Fereidoon Shahidi (Editor), Chi-Tang Ho (Editor), CRC Publications, Taylor & Francis, 2007

2. Functional Foods and Nutraceuticals in Cancer Prevention by Ronald Ross Watson (Author), Blackwell Publishing, 2007

3. Marketing Nutrition: Soy, Functional Foods, Biotechnology, and Obesity by Brian Wansink.

4. Functional foods: Concept to Product: Edited by G R Gibson and C M Williams, Wood head Publ., 2000 5. Hanson, James R. "Natural Products: The Secondary Metabolites", Royal Society of Chemistry, 2003

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	2	-	2	-	-	-	-	-	-	-	1	1		-
CO2	3	2	-	2	2	-	-	-	-	-	-	1	2	1	-
CO3	3	2	3	2	2	-	-	-	-	-	-	1	2	1	-
CO4	2	2	3	2	2	-	-	-	-	-	-	2	2	2	-
CO5	2	2	3	3	3	-	-	-	-	-	-	3	2	3	2

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23MC401 SDG: 4	DISASTER AND RISK MANAGEMENT	Category: MC L T P C 2 0 0 0

COURSE OBJECTIVE:

1. To learn what disasters, hazards, and risks are, and understand different types of disasters like floods, earthquakes, and fires.
2. To know why disasters, happen and how they affect people, the environment, and the economy, especially in India and Tamil Nadu.
3. To understand how we can reduce disaster risks, and learn the roles of people, communities, and the government in being prepared.
4. To explore how tools and technology like early warning systems and maps help in managing disasters.
5. To study real-life examples of disasters, and learn how to respond through mock drills, fieldwork, and case studies.

UNIT 1 **HAZRADS, VULNERABILITY AND DISASTER RISKS** **9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced –Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters- Structural collapse, Industrial accidents, oil spills -Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Disaster vulnerability profile of India and Tamil Nadu - Global trends in disasters: urban disasters, pandemics, Complex emergencies, - -, Inter relations between Disasters and Sustainable development Goals

UNIT 2 **DISASTER RISK REDUCTION (DRR)** **9**

Sendai Framework for Disaster Risk Reduction, Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System – Advisories from Appropriate Agencies.- Relevance of indigenous Knowledge, appropriate technology and Local resources.

UNIT 3 **DISASTER MANAGEMENT** **9**

Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA –SDMA-DDMA-NRDF- Civic Volunteers)

UNIT 4 **TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT** **9**

Early warning systems -Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment. - Elements of Climate Resilient Development –Standard operation Procedure for disaster response – Financial planning for disaster Management

UNIT 5 **DISASTER MANAGEMENT: CASE STUDIES** **9**

Discussion on selected case studies to analyse the potential impacts and actions in the contest of disasters- Landslide Hazard Zonation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.- Field work- Mock drill -

COURSE OUTCOMES:

At the end of the course, students would

CO1: To impart knowledge on the concepts of Disaster, Vulnerability and Disaster Risk reduction (DRR)

CO2: To enhance understanding on Hazards, Vulnerability and Disaster Risk Assessment prevention and risk reduction

CO3: To develop disaster response skills by adopting relevant tools and technology

CO4: Enhance awareness of institutional processes for Disaster response in the country

CO5: Develop rudimentary ability to respond to their surroundings with potential Disaster response in areas where they live, with due sensitivity

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Taimpo (2016), Disaster Management and Preparedness, CRC Publications
2. Singh R (2017), Disaster Management Guidelines for earthquakes, Landslides, Avalanches and tsunami, Horizon Press Publications
3. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN 13: 978-9380386423
4. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]

REFERENCES:

1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.
2. Government of India, National Disaster Management Policy, 2009.
3. Shaw R (2016), Community based Disaster risk reduction, Oxford University Press

CO’s-PO’s & PSO’s MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO3
CO1	-	-	2	2	-	2		3	-	2	3	-	-	2	2
CO2	-	-	2	2	-	2		3	-	2	3	-	-	2	2
CO3	-	-	2	2	-	2		3	-	2	3	-	-	2	2
CO4	2	-	2	2	-	2		3	-	2	3	2	-	2	2
CO5	-	-	2	2	-	2		3	-	2	3	-	-	2	2

Correlation levels: **1 – low** **2 – medium** **3 – high** **“-“- no correlation**

U23MC404 SDG: 4	WELL-BEING WITH TRADITIONAL PRACTICES-YOGA, AYURVEDA AND SIDDHA	Category: MC			
		L	T	P	C
		2	0	0	0

COURSE OBJECTIVE:

1. To enjoy life happily with fun filled new style activities that help to maintain health also
2. To adapt a few lifestyle changes that will prevent many health disorders
3. To be cool and handbill every emotion very smoothly in every walk of life
4. To learn to eat cost effective but healthy foods that are rich in essential nutrients
5. To develop immunity naturally that will improve resistance against many health disorders

UNIT 1 **HEALTH AND ITS IMPORTANCE** **9**

Health: Definition - Importance of maintaining health - More importance on prevention than treatment
Ten types of health one has to maintain - Physical health - Mental health - Social health - Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health -
Environmental health - Occupational/Professional heath.
Present health status - The life expectancy-present status - mortality rate - dreadful diseases - non-communicable diseases (NCDs) the leading cause of death - 60% - heart disease – cancer – diabetes - chronic pulmonary diseases - risk factors – tobacco – alcohol - unhealthy diet - lack of physical activities.
Types of diseases and disorders - Lifestyle disorders – Obesity – Diabetes - cardiovascular diseases – Cancer – Strokes – COPD - Arthritis - Mental health issues.
Causes of the above diseases / disorders - Importance of prevention of illness - Takes care of health - Improves quality of life - Reduces absenteeism - Increase satisfaction - Saves time
Simple lifestyle modifications to maintain health - Healthy Eating habits (Balanced diet according to age) Physical Activities (Stretching exercise, aerobics, resisting exercise) - Maintaining BMI-Importance and actions to be taken

UNIT 2 **DIET** **9**

Role of diet in maintaining health - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes – arthritis – hypertension – PCOD – infertility – ADHD – sleeplessness -helps to reduce the risk of heart diseases - keeps the teeth and bones strong.
Balanced Diet and its 7 Components - Carbohydrates – Proteins – Fats – Vitamins – Minerals - Fibre and Water.
Food additives and their merits & demerits - Effects of food additives - Types of food additives - Food additives and processed foods - Food additives and their reactions
Definition of BMI and maintaining it with diet Importance - Consequences of not maintaining BMI - different steps to maintain optimal BM
Common cooking mistakes
Different cooking methods, merits and demerits of each method

UNIT 3 **ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH** **9**

AYUSH systems and their role in maintaining health - preventive aspect of AYUSH - AYUSH as a soft therapy.
Secrets of traditional healthy living - Traditional Diet and Nutrition - Regimen of Personal and
Social Hygiene - Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) - basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducive social life.
Principles of Siddha & Ayurveda systems - Macrocosm and Microcosm theory - Pancheekarana Theory / (Five Element Theory) 96 fundamental Principles - Uyir Thathukkal (Tri-Dosha Theory) - Udal Thathukkal
Prevention of illness with our traditional system of medicine
Primary Prevention - To decrease the number of new cases of a disorder or illness - Health promotion/education, and - Specific protective measures - Secondary Prevention - To lower the rate of established cases of a disorder

or illness in the population (prevalence) - Tertiary Prevention - To decrease the amount of disability associated with an existing disorder.

UNIT 4 MENTAL WELLNESS 9

Emotional health - Definition and types - Three key elements: the subjective experience - the physiological response - the behavioral response - Importance of maintaining emotional health - Role of emotions in daily life -Short term and long term effects of emotional disturbances - Leading a healthy life with emotions - Practices for emotional health - Recognize how thoughts influence emotions - Cultivate positive thoughts - Practice self-compassion - Expressing a full range of emotions.

Stress management - Stress definition - Stress in daily life - How stress affects one's life - Identifying the cause of stress - Symptoms of stress - Managing stress (habits, tools, training, professional help) - Complications of stress mismanagement.

Sleep - Sleep and its importance for mental wellness - Sleep and digestion. Immunity - Types and importance - Ways to develop immunity

UNIT 5 YOGA 9

Definition and importance of yoga - Types of yoga - How to Choose the Right Kind for individuals according to their age - The Eight Limbs of Yoga - Simple yogasanas for cure and prevention of health disorders - What yoga can bring to our life.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Participate in fun and engaging physical activities that help improve physical and mental health.

CO2: identify and adopt simple lifestyle changes that reduce the risk of common health problems.

CO3: manage emotions calmly and respond to daily stress or challenges in a balanced and healthy way.

CO4: Choose And Prepare Low-Cost, Nutritious Meals That meet daily nutritional needs.

CO5: Develop awareness about natural ways to boost immunity and improve the body's resistance to illness.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Nutrition and Dietetics - Ashley Martin, Published by White Word Publications, New York, NY 10001, USA

2. Yoga for Beginners_ 35 Simple Yoga Poses to Calm Your Mind and Strengthen Your Body, by Cory Martin, Copyright © 2015 by Althea Press, Berkeley, California

REFERENCES:

WHAT WE KNOW ABOUT EMOTIONAL INTELLIGENCE How It Affects Learning, Work, Relationships, and Our Mental Health, by Moshe Zeidner, Gerald Matthews, and Richard D. Roberts A Bradford Book, The MIT Press, Cambridge, Massachusetts, London, England

2. The Mindful Self-Compassion Workbook, Kristin Neff, Ph.D Christopher Germer, Ph.D, Published by, The Guilford Press A Division of Guilford Publications, Inc.370 Seventh Avenue, Suite 1200, New York, NY 10001

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4799645/

Simple lifestyle modifications to maintain health

https://www.niddk.nih.gov/health-information/diet-nutrition/changing-habits-better-health#:~:text=Make%20your%20new%20healthy%20habit,t%20have%20time%20to%20cook.

3. Read more: https://www.legit.ng/1163909-classes-food-examples-functions.html

4. https://www.yaclass.in/p/science-state-board/class-9/nutrition-and-health-5926

5. Benefits of healthy eating https://www.cdc.gov/nutrition/resources-publications/benefits of-healthy-eating.html

6. Food additives https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/food additives

7. BMI https://www.hsph.harvard.edu/nutritionsource/healthy-weight/https://www.who.int/europe/news-room/fact-sheets/item/a-healthy-lifestyle---who recommendations

8. Yoga https://www.healthifyme.com/blog/types-of-yoga/

https://yogamedicine.com/guide-types-yoga-styles/ Ayurveda : https://vikaspedia.in/health/ayush/ayurveda-1/concept-of-healthy-living-in ayurveda
9. Siddha : http://www.tkdl.res.in/tkdl/langdefault/Siddha/Sid_Siddha_Concepts.asp
10. CAM : https://www.hindawi.com/journals/ecam/2013/376327/
11. Preventive herbs : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3847409/

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO3
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CO2	-	-	-	-	-	-	-	3	3	3	-	3	-	1	3
CO3	-	-	-	-	-	-	-	3	3	3	-	3	-	1	3
CO4	-	-	-	-	-	-	-	3	3	3	-	3	-	1	3
CO5	-	-	-	-	-	-	-	3	3	3	-	3	-	1	3

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation

U23MC501 SDG: 4	HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA	Category: MC L T P C 2 0 0 0

COURSE OBJECTIVE:

1. To help students understand the meaning and methods of history, especially how it relates to science and technology.
2. To introduce important Indian thinkers and writers who studied the history of science and technology.
3. To learn about science and technology in ancient and medieval India, including fields like farming, medicine, and astronomy.
4. To study how British rule affected Indian science and technology, and how Indians responded to it.
5. To understand the growth of science and technology in India after independence, and how it affects our lives today

UNIT 1 **CONCEPTS AND PERSPECTIVES** **9**

Meaning of History Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation verses evidence, concept of historical inevitability, Historical Positivism. Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

UNIT 2 **HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDIA** **9**

Introduction to the works of D.D. Kosambi, Dharmpal, Debiprasad Chattopadhyay, Rehman, S. Irfan Habib, Deepak Kumar, Dhruv Raina, and others.

UNIT 3 **SCIENCE AND TECHNOLOGY IN ANCIENT INDIA** **9**

Technology in pre-historic period Beginning of agriculture and its impact on technology Science and Technology during Vedic and Later Vedic times Science and technology from 1st century AD to C-1200.

UNIT 4 **SCIENCE AND TECHNOLOGY IN MEDIEVAL INDIA** **9**

Legacy of technology in Medieval India, Interactions with Arabs

Development in medical knowledge, interaction between Unani and Ayurveda and alchemy

Astronomy and Mathematics: interaction with Arabic Sciences

Science and Technology on the eve of British conquest

UNIT 5 **SCIENCE AND TECHNOLOGY IN COLONIAL INDIA** **9**

Science and the Empire Indian response to Western Science Growth of techno-scientific institutions

UNIT 6 **SCIENCE AND TECHNOLOGY IN A POST-INDEPENDENT INDIA** 9

Science, Technology and Development discourse Shaping of the Science and Technology Policy Developments in the field of Science and Technology Science and technology in globalizing India Social implications of new technologies like the Information Technology and Biotechnology

COURSE OUTCOMES:

At the end of the course, students would

CO1: Explain basic ideas in history like objectivity, cause and effect, and how history is written.

CO2: Describe the work of Indian historians who studied science and technology.

CO3: Talk about the growth of science and technology in ancient and medieval India.

CO4: Understand the changes brought by British rule in science and technology in India.

CO5: Science and technology developed in modern India, including IT and biotechnology.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Irfan Habib (2016). Technology in Medieval India (c. 650–1750). Tulika Books.
2. Dharampal (2000). Indian Science and Technology in the Eighteenth Century: Some Contemporary European Accounts. Other India Press.
3. D.P. Chattopadhyaya (1986). History of Science and Technology in Ancient India: The Beginnings. Firma KLM.
4. Deepak Kumar (1995). Science and the Raj: A Study of British India. Oxford University Press.

REFERENCES:

1. Dhruv Raina & S. Irfan Habib (2004). Domesticating Modern Science: A Social History of Science and Culture in Colonial India. Tulika Books.
2. D.D. Kosambi (1965). The Culture and Civilization of Ancient India in Historical Outline. Monthly Review Press.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO3
CO1	-	-	-	-	-		-	3	3	3	-	3	-	1	3
CO2	-	-	-	-	-	-	-	3	3	3	-	3	-	1	3
CO3	-	-	-	-	-	-	-	3	3	3	-	3	-	1	3
CO4	-	-	-	-	-	-	-	3	3	3	-	3	-	1	3
CO5	-	-	-	-	-	-	-	3	3	3	-	3	-	1	3

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23MC504 **ENTREPRENEURSHIP AND INNOVATION** **Category: MC**

SDG: 4

L	T	P	C
2	0	0	0

COURSE OBJECTIVE:

1. Learn basic concepts in entrepreneurship, develop mind-set and skills necessary to explore entrepreneurship
2. Apply process of problem - opportunity identification and validation through human centred approach to design thinking in building solutions as part of engineering projects
3. Analyse market types, conduct market estimation, identify customers, create customer persona, develop the skills to create a compelling value proposition and build a Minimum Viable Product
4. Explore business models, create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture ideas & solutions built with domain expertise
5. Prepare and present an investible pitch deck of their practice venture to attract stakeholders

UNIT 1 **ENTREPRENEURIAL MINDSET** **4L, 8P**

Introduction to Entrepreneurship: Definition – Types of Entrepreneurs – Emerging Economics – Developing and Understanding an Entrepreneurial Mindset – Importance of Technology Entrepreneurship – Benefits to the Society.

Case Analysis: Study cases of successful & failed engineering entrepreneurs – Foster Creative Thinking: Engage in a series of Problem-Identification and Problem-Solving tasks

UNIT 2 **OPPORTUNITIES** **4L, 8P**

Problems and Opportunities – Ideas and Opportunities – Identifying problems in society –Creation of opportunities – Exploring Market Types – Estimating the Market Size, -Knowing the Customer and Consumer - Customer Segmentation - Identifying nichemarkets – Customer discovery and validation; Market research techniques, tools for validation of ideas and opportunities

Activity Session: Identify emerging sectors / potential opportunities in existing markets -Customer Interviews: Conduct preliminary interviews with potential customers for Opportunity Validation - Analyse feedback to refine the opportunity.

UNIT 3 **PROTOTYPING & ITERATION** **4L, 8P**

Prototyping – Importance in entrepreneurial process – Types of Prototypes – Different methods – Tools & Techniques.

Hands-on sessions on prototyping tools (3D printing, electronics, software), Develop a prototype based on identified opportunities; Receive feedback and iterate on the prototypes.

UNIT 4 **BUSINESS MODELS & PITCHING** **4L, 8P**

Business Model and Types - Lean Approach - 9 block Lean Canvas Model – Riskiest assumptions to Business Models – Using Business Model Canvas as a Tool – Pitching

Techniques: Importance of pitching - Types of pitches - crafting a compelling pitch – pitch presentation skills - using storytelling to gain investor/customer attention.

Activity Session: Develop a business model canvas for the prototype; present and receive feedback from peers and mentors - Prepare and practice pitching the business ideas-Participate in a Pitching Competition and present to a panel of judges - receive & reflect feedback

UNIT 5 **ENTREPRENEURIAL ECOSYSTEM** **4L, 8P**

Understanding the Entrepreneurial Ecosystem – Components: Angels, Venture Capitalists, Maker Spaces, Incubators, Accelerators, Investors. Financing models – equity, debt, crowdfunding, etc, Support from the government and corporates. Navigating Ecosystem Support: Searching & Identifying the Right Ecosystem Partner – Leveraging the Ecosystem - Building the right stakeholder network

Activity Session: Arrangement of Guest Speaker Sessions by successful entrepreneurs and entrepreneurial ecosystem leaders (incubation managers; angels; etc), Visit one or two entrepreneurial ecosystem players (Travel and visit a research park or incubator or makerspace or interact with startup founders).

COURSE OUTCOMES:

At the end of the course, students would

CO1: Develop an Entrepreneurial Mind-set and Understand the Entrepreneurial Ecosystem Components and Funding types

CO2: Comprehend the process of opportunity identification through design thinking, identify market potential and customers

CO3: Generate and develop creative ideas through ideation techniques

CO4: Create prototypes to materialize design concepts and conduct testing to gather feedback and refine prototypes to build a validated MVP

CO5: Analyse and refine business models to ensure sustainability and profitability Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders

TOTAL:60 PERIODS

TEXT BOOKS:

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGrawHill, 11th Edition
2. Ries, E. (2011). The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business
3. Blank, S. G., & Dorf, B. (2012). The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company. K&S Ranch

REFERENCES:

1. Roy, R. (2017). Indian Entrepreneurship: Theory and Practice. New Delhi: Oxford University Press
2. Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons

CO's-PO's & PSO's MAPPING

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PS O3
CO1	-	-	-	-	-	-	-	-	2	2	3	3	-	2	3
CO2	-	-	-	-	-	-	-	-	2	2	3	3	-	2	3
CO3	-	-	-	-	-	-	-	-	2	-	3	3	-	2	3
CO4	-	-	-	-	-	-	-	-	2	3	3	3	-	2	3
CO5	-	-	-	-	-	-	-	-	2	2	3	3	-	2	3

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23MC601 SDG: 4	INDUSTRIAL SAFETY	Category: MC L T P C 2 0 0 0

COURSE OBJECTIVE:

1. To Understand the Introduction and basic Terminologies safety.
2. To enable the students to learn about the Important Statutory Regulations and standards.
3. To enable students to Conduct and participate the various Safety activities in the Industry.
4. To have knowledge about Workplace Exposures and Hazards.
5. To assess the various Hazards and consequences through various Risk Assessment Techniques. .

UNIT 1 **SAFETY TERMINOLOGIES** **9**

Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators-Flammability- Toxicity Time-weighted Average (TWA) - Threshold LimitValue (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects-Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS

UNIT 2 **STANDARDS AND REGULATIONS** **9**

ndian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Hazard Identification and Risk Analysis- code of practice IS 15656:2006

UNIT 3 **SAFETY ACTIVITIES** **9**

Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan-Safety poster and Display- Human Error Assessment

UNIT 4 **WORKPLACE HEALTH AND SAFETY** **9**

Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane Safety- Toxic gas Release

UNIT 5 **HAZARD IDENTIFICATION TECHNIQUES** **9**

Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability-Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment- Checklist Analysis-Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment

COURSE OUTCOMES:

At the end of the course, students would

CO1: Understand the basic concept of safety.
CO2: Obtain knowledge of Statutory Regulations and standards.
CO3: Know about the safety Activities of the Working Place.
CO4: Analyze on the impact of Occupational Exposures and their Remedies
CO5: Obtain knowledge of Risk Assessment Techniques.

TOTAL: 45 PERIODS

TEXTBOOKS

1. R.K. Jain and Prof. Sunil S. Rao Industrial Safety, Health and Environment Management Systems KHANNA PUBLISHER

2. L. M. Deshmukh Industrial Safety Management: Hazard Identification and Risk Control McGraw-Hill Education

REFERENCES:

1. Frank Lees (2012) 'Lees' Loss Prevention in Process Industries.Butterworth-Heinemann
2. publications, UK, 4th Edition.
3. 2. John Ridley & John Channing (2008)Safety at Work: Routledge, 7th Edition.
4. 3. Dan Petersen (2003) Techniques of Safety Management: A System Approach.
5. 4. Alan Waring.(1996).Safety management system: Chapman &Hall,England
6. 5. Society of Safety Engineers, USA

CO's-PO's & PSO's MAPPING

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CO1	3	3	3	-	-	-	2	2	-	-	-	-	2	2	1
CO2	3	3	3	-	-	-	2	2	-	-	-	-	2	2	1
CO3	3	3	2	-	-	-	2	2	-	-	-	-	2	2	1
CO4	3	3	2	-	-	-	2	2	-	-	-	-	2	2	1
CO5	3	3	3	-	-	-	2	2	-	-	-	-	2	2	1

Correlation levels: **1 – low** **2 – medium** **3 – high** **"-"- no correlation**

U23MC 602 SDG: 4	INTRODUCTION TO WOMEN AND GENDER STUDIES	Category: MC L	T	P	C
		2	0	0	0

COURSE OBJECTIVE:

1. To help students understand basic ideas like sex, gender, masculinity, femininity, patriarchy, and gender roles.
2. To introduce different feminist theories like liberal, radical, Marxist, socialist, psychoanalytic, postmodernist, and ecofeminist.
3. To study the history and development of women's movements in India and around the world.
4. To discuss how language is connected to gender, and how stories and communication reflect gender.
5. To examine how gender is shown in media, including advertisements, movies, social media, and alternative media.

UNIT 1 **CONCEPTS** **9**

Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, binaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.

UNIT 2 **FEMINIST THEORY** **9**

Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist.

UNIT 3 **WOMEN'S MOVEMENTS: GLOBAL, NATIONAL AND LOCAL** **9**

Rise of Feminism in Europe and America. Women's Movement in India.

UNIT 4 **GENDER AND LANGUAGE** **9**

Linguistic Forms and Gender. Gender and narratives.

UNIT 5 **GENDER AND REPRESENTATION** **9**

Advertising and popular visual media. Gender and Representation in Alternative Media. Gender and social media.

COURSE OUTCOMES:

At the end of the course, students would

CO1: Explain the difference between sex and gender and understand how gender roles are formed in society.

CO2: Use feminist theories to study issues related to gender and society.

CO3: Describe and compare women's movements in India and other countries.

CO4: Identify how language and stories show or support gender roles and stereotypes.

CO5: Critically examine media content to see how men and women are represented in different ways.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Geetha, V. (2007). *Patriarchy*. Kolkata: Stree.
2. Kumar, Radha. (1993). *The History of Doing: An Illustrated Account of Movements for Women's Rights and Feminism in India, 1800–1990*. New Delhi: Zubaan.
3. Menon, Nivedita. (2012). *Seeing Like a Feminist*. New Delhi: Zubaan.

REFERENCES:

1. Sangari, Kumkum, & Vaid, Sudesh (Eds.). (1989). *Recasting Women: Essays in Colonial History*. New Delhi: Kali for Women.
2. Freedman, Jane. (2001). *Feminism*. New Delhi: Rawat Publications.

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CO3	-	-	-	-	-	-	-	3	3	3	-	3	-	-	3
CO4	-	-	-	-	-	-	-	3	3	3	-	3	-	-	3
CO5	-	-	-	-	-	-	-	3	3	3	-	3	-	-	3

Correlation levels: 1 – low 2 – medium 3 – high "-"- no correlation