

तार : विश्वविद्यालय
Gram : UNIVERSITY



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बुन्देलखण्ड विश्वविद्यालय, झाँसी
BUNDELKHAND UNIVERSITY, JHANSI

झाँसी (उ.प्र.) 284128

संदर्भ... FT/IET/2022/148

दिनांक... 03/12/2022

The Minutes of Meeting of BOS

In reference to the BOS of department of Food
Technology, Institute of Engineering and
Technology, B.U. held on 18/08/2017 regarding the
revision of syllabus in tune with CBCS/NEP-2020 and subsequent
approval from Academic Council. This is to certify that the syllabus is
100% revised.

Registrar
Bundelkhand University
JHANSI

(Dr. Ravi Kumar)
HOD/Coordinator



**Minutes of Meeting of Board of Studies
Academic Session (2020-21)**

A meeting of Board of Studies was held on 16/12/2020 to discuss various issues related with the course running in Department of Food Engineering & Technology and to update the panel of examiners for session 2020-21.

The following members were present:

1. Prof. S. K. Katiyar, Convener and Director/Dean Engineering
2. Er. Brajendra Shukla, Academic Coordinator, I.E.T., B.U., Jhansi
3. Er. Ravi Kumar, Coordinator, Dept. of Food Engg. & Tech., B.U., Jhansi
4. Dr. Shubhangi Nigam, Dept. of Food Engg. & Tech, B.U., Jhansi

AGENDA

1. To update the list of External and Internal Examiners of B. Tech (1st, 2nd, 3rd and 4th year) of B. Tech (Food Tech./Food Engg. & Tech.) for the session 2020-21.
2. Amendment in intake criteria for admission to second year through lateral entry scheme
3. Inclusion of D. Voc. Stream in eligibility criteria for admission to second year through lateral entry scheme

PROCEEDINGS:

1. To update the list of External and Internal Examiners for session 2020-21 examination.

The updated panel of external and internal examiners for even and odd semester examinations (theory and practical) has been proposed for session 2020-2021.

2. Amendment in intake criteria for admission to second year through lateral entry scheme

As per the discussion among all members of B.O.S. and in view of AICTE guidelines it was proposed that Lateral entry to the second year of the B. Tech. (Food Engg. & Technology) programme shall be permissible up to a maximum of 10% of the "Approved Intake" which shall be over and above, supernumerary to the "Approved Intake" plus the unfilled vacancies of the first year.

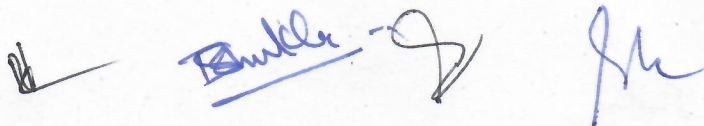
3. Inclusion of D. Voc. Stream in eligibility criteria for admission to second year through lateral entry scheme

In view of the latest guidelines of AICTE and as per the discussion among all members of B.O.S. the modified eligibility criteria for admission to second year through lateral entry scheme including D. Voc. was proposed as under:

(A) Candidates who have passed 3/4 year Diploma with at least 50% marks (45% in case of candidates belonging to reserved category) in any branch of Engineering/Technology.

(B) Candidates who have passed B.Sc. Degree from a recognized University as defined by UGC, with at least 50% marks (45% in case of candidates belonging to reserved category).

(C) Provided that the students belonging to B.Sc. Stream, shall clear the subjects Engineering Graphics/ Engineering Drawing and Engineering Mechanics of the First




Year Engineering Programme along with the Second year subjects.

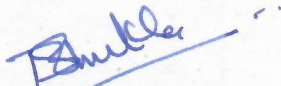
(D) Provided that the students belonging to B.Sc. Stream shall be considered only after filling the supernumerary seats in this category with students belonging to the Diploma stream.

(E) Passed D. Voc. Stream in the same or allied sector.

The B.O.S. also recommended to modify the intake criteria (as mentioned in point no. 2) and eligibility criteria by including B.Sc. and D. Voc. Along with diploma candidate (as mentioned in point no. 3) above for all the other branches of Institute of Engineering & Technology, Bundelkhand University, Jhansi.


16/12/20

(Er. Ravi Kumar)
Internal Member



(Er. Brajendra Shukla)
Academic Coordinator



(Dr. Shubhangi Nigam)
Internal Member



(Prof. S. K. Katiyar)
Convener/ Dean Engg.



BUNDELKHAND
UNIVERSITY JHANSI

B++ NAAC Accredited, ISO Certified,
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CURRICULUM & SYLLABUS
UNDER
CHOICE BASED CREDIT SYSTEM



DEPARTMENT OF FOOD TECHNOLOGY
INSTITUTE OF ENGINEERING & TECHNOLOGY

CURRICULUM & SYLLABUS

FOR

B. TECH.

FOOD ENGINEERING & TECHNOLOGY



BUNDELKHAND UNIVERSITY
KANPUR ROAD, JHANSI
UTTAR PRADESH-284128

www.bujhansi.ac.in



CHAPTER 1

VISION, MISSION, PROGRAM OUTCOMES, PROGRAM EDUCATIONAL OBJECTIVES, PROGRAM SPECIFIC OUTCOMES

Undergraduate Degree in Engineering & Technology

Program
B. TECH. (FOOD ENGINEERING & TECHNOLOGY)

Offered by

Department of Food Technology
Institute of Engineering & Technology
Bundelkhand University, Jhansi



Department of Food Technology
Curriculum for
Undergraduate Degree Course in Engineering & Technology

B. TECH. (FOOD ENGINEERING & TECHNOLOGY)

Chapter-1

**Vision, Mission, Program Outcomes, Program Educational Objectives,
Program Specific Outcomes**

INSTITUTE OF ENGINEERING & TECHNOLOGY, B. U., JHANSI

I. Vision of Institute

To emerge as an institution of excellence in engineering education and research that emphasizes on the human values, competence and professionalism integrated with the course curriculum as per global standards to serve the nation as well as the society with innovating mindset to take up any challenge they come across in industrial, scientific or academic fields within or outside the country.

II. Mission of Institute

M1	To equip with the latest tools and equipment matching the state-of-art technologies to facilitate the academic and research activities at par with the best institutions.
M2	To inculcate a proper mix of creativity, innovation, competence, entrepreneurial leadership, and professionalism in the minds of the students so as to yield the internationally accepted best products.
M3	To provide proper ambience for the teaching-learning system that preserves universal human values, ethics and morals to meet the aspirations of all the stakeholders for sustainable development of the institute.
M4	To develop a potential pool of intellectuals and professionals that can serve anywhere efficiently in decision making and policy adoption according to the local, national and global needs

DEPARTMENT OF FOOD TECHNOLOGY

I. Vision of Department

To emerge as a center of excellence for producing competent professionals with human values and innovating and humanistic mindset, in food and agriculture engineering along with allied areas in science and technology as per global standards to cater the needs of the food industry, R&D and academic institutions within or outside the country with the capability to take up any challenge they come across in their profession.



II. Mission of Department

M1	To equip with the latest tools and equipment matching the state-of-art technologies to facilitate the academic and research activities at par with the best institutions in the field of food engineering, technology and related areas.
M2	To inculcate proper mix of creativity, innovation, competence, entrepreneurial skill, leadership and professionalism in the minds of the students so as to yield the internationally accepted best professionals for food, agriculture and allied sectors.
M3	To provide proper ambience for the teaching-learning system that preserves universal human values, ethics and morals to meet the aspirations of all the stakeholders for sustainable development of the food, agriculture and allied sectors.
M4	To develop a potential pool of intellectuals and qualified professionals that can serve anywhere efficiently and contribute to the growth of the national economy through boosting qualitatively and quantitatively enhanced food production.

III. Program Outcomes (POs) of B. Tech. (Food Engineering & Technology)

Graduating Students of B. Tech. (Food Engg. & Technology) program will be able to:

Program Outcomes (POs)		Graduate Attributes(GAs)
PO1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	Engineering Knowledge
PO2	Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	Problem Analysis
PO3	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	Design/Development of solutions
PO4	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.	Conduct Investigations of complex problems
PO5	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.	Modern Tool Usage



PO6	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.	The Engineer & Society
PO7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	Environment and sustainability
PO8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	Ethics
PO9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	Individual and team work
PO10	Communicate effectively on complex engineering activities with the engineering community and with 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.	Communication
PO11	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.	Project management and finance
PO12	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	Life-long learning

IV. Program Educational objectives (PEOs) for B. Tech. (Food Engineering & Technology)

The educational objectives of B. Tech. Food Engineering & Technology program are:

PEO1	Graduate will have successful professional careers in the field of Food Engg. & Technology with innovative ideas while serving the Government firm, industry, corporate, academic and research organization or being an entrepreneur.
PEO2	Graduate will be able to work effectively in different fields as a team member or individual with the ability of solving engineering problems with core expertise in analysis, design and development using advanced tools in food engineering and technology.
PEO3	Graduate will be able to show the leadership in diverse cultures, nationalities and fields while working efficiently with interdisciplinary teams locally and internationally to meet global challenges in the field of Food Engg. & Technology.
PEO4	Graduate will be able to develop themselves professionally by continuous and lifelong learning and advance their careers through activities such as participation in professional certification programs,



	and seeking higher education innovation and research while benefitting the society.
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V. Program specific outcomes (PSOs) for B. Tech. Food Engineering & Technology programare:

Graduating students of B. Tech. Food Engineering & Technology program will be able:

PSO1	to implement technical knowledge practically in the field of processing, designing, manufacturing specifically in engineering & technology part of food industries
PSO2	to place themselves in the research and development field as well as pursue higher studies in food technology and interdisciplinary programs



CHAPTER 2

GENERAL, COURSE STRUCTURE, THEME & SEMESTER WISE CREDIT DISTRIBUTION

Undergraduate Degree in Engineering & Technology

Program

B. TECH. (FOOD ENGINEERING & TECHNOLOGY)

Offered by

**Department of Food Technology
Institute of Engineering & Technology
Bundelkhand University, Jhansi**



Department of Food Technology
Curriculum for
Undergraduate Degree Course in Engineering & Technology

B. TECH. (FOOD ENGINEERING & TECHNOLOGY)

Chapter-2
General, Course structure &
Theme &
Semester-wise credit distribution

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits
2 Hours Practical(Lab)/week	1 credit

B. Total number of credits - 160

C. Structure of the program:

S. No.	Category	Breakup of Credits
1	Humanities and Social Sciences including Management courses	6
2	Basic Science courses	18
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	37
4	Professional Core courses	82
5	Professional Elective courses	4
6	Open subjects – Electives from other technical and /or emerging subjects	2
7	Project work, seminar and internship in industry or elsewhere	11
8	Mandatory Courses [Environmental Sciences, Induction Program etc.]	(non-credit)
	Total	160*



D. Credit distribution in the First year of Undergraduate Engineering program:

	Lecture	Tutorial	Laboratory /Practical	Total credits
Elementary Mathematics/Elementary Biology	2	1	0	3
Engineering Physics - I	2	0	0	2
Engineering Mechanics	3	0	0	3
Computer Concepts and Programming in C	2	1	0	3
Professional Communication	3	0	0	3
Engineering Mechanics Lab	0	0	2	1
Computer Programming Lab	0	0	2	1
Computer Aided Engineering Graphics	0	0	2	1
Professional Communication Lab	0	0	2	1
Engineering Mathematics - I	2	1	0	3
Engineering Physics - II	2	0	0	2
Engineering Chemistry	3	0	0	3
Electrical Engineering	2	1	0	3
Electronics Engineering	3	0	0	3
Manufacturing Processes	2	0	0	2
Engineering Chemistry Lab	0	0	2	1
Electrical Engineering Lab	0	0	2	1
Workshop Practice	0	0	2	1
Physics Lab	0	0	2	1

E. Course code and definition:

Course code	Definitions
BS	Basic Science courses
HSM	Humanities, Social Sciences including Management
ES	Engineering Science course
PC	Professional Core Courses
PE	Professional Elective Courses
OE	Open Elective Course
M	Mandatory Course
SI	Summer Internship
S	Seminar
Proj	Project

BASIC SCIENCES COURSE [BS]

Sl. No	Code No.	Subject	Semester	Credits
1	BSMA-1842/ BSBL-1852	Elementary Mathematics/ Elementary Biology	1	3



2	BSPH-1843	Engineering Physics - I	1	2
3	BSMA-1855	Engineering Mathematics - I	2	3
4	BSPH-1857	Engineering Physics - II	2	2
5	BSCY-1858	Engineering Chemistry	2	3
6	ESPH-10873	Physics Lab	2	1
7	BSMA-2481	Engineering Mathematics-II	3	4
Total Credits:				18

ENGINEERING SCIENCE COURSES [ES]

Sl. No	Code No.	Subject	Semester	Credits
1	ESME-1845	Engineering Mechanics	1	3
2	ESCS-1847	Computer Concepts and Programming in C	1	3
3	ESME-10854	Engineering Mechanics Lab	1	1
4	ESCS-10856	Computer Programming Lab	1	1
5	ESME-10858	Computer Aided Engineering Graphics Lab	1	1
6	ESEC-1860	Electrical Engineering	2	3
7	ESEC-1862	Electronics Engineering	2	3
8	ESME-1864	Manufacturing Processes	2	2
9	ESCY-10867	Engineering Chemistry Lab	2	1
10	ESEE-10869	Electrical Engineering Lab	2	1
11	ESWS-10871	Workshop Practice	2	1
12	ESCH-2482	Instrumentation and Process Control	3	2
13	ESCS-2846	Cyber Security	3	2
14	ESMA-2491	Numerical Methods and Computer Programming	4	2
15	ESCH-2492	Process Calculations	4	3
16	ESCH-2493	Chemical Engineering Thermodynamics	4	2
17	ESMA-20497	NMCP Lab.	4	1
18	ESME-3489	Machine Design	6	3
19	ESCH-4490	Industrial Safety and Hazard Management	8	2
Total Credits:				37

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES [HSM]

Sl. No	Code No.	Subject	Semester	Credits
1	HSMHU-1849	Professional Communication	1	3
2	HSMHU-10860	Professional Communication Lab	1	1
3	HSMHU-3481	Industrial Economics and Principles of Management	5	2
Total Credits:				6



PROFESSIONAL CORE COURSES [PC]

Sl. No	Code No.	Subject	Semester	Credits
1	PCFET-2483	Food Composition & Human Nutrition	3	3
2	PCFET-2484	Basic and Food Microbiology	3	3
3	PCFET-2845	Engineering Properties of Foods	3	3
4	PCFET-20487	Food Composition & Human Nutrition Lab	3	2
5	PCFET-20488	Basic and Food Microbiology Lab.	3	2
6	PCFET-2494	Food Chemistry	4	3
7	PCFET-2495	Food Additives	4	3
8	PCFET-2496	Food Engineering-I	4	3
9	PCFET-20498	Food Chemistry Lab	4	3
10	PCFET-20499	Food Engineering-I Lab	4	1
11	PCFET-3482	Food Biochemistry and Biotechnology	5	3
12	PCFET-3483	Food Analysis	5	3
13	PCFET-3484	Traditional and Fermented Foods	5	3
14	PCFET-3485	Food Safety and Food Laws	5	2
15	PCFET-3486	Food Engineering-II	5	3
16	PCFET-30487	Food Biochemistry and Biotechnology Lab	5	2
17	PCFET-30488	Food Analysis Lab	5	2
18	PCFET-34089	Food Engg.-II Lab.	5	1
19	PCFET-3486	Dairy Technology	6	2
20	PCFET-3487	Flavour Technology	6	2
21	PCFET-3488	Food Preservation and Processing Principles	6	3
22	PCFET-3490	Cereals, Pulses and Oil Seed Products	6	3
23	PCFET-3491	Food Engineering-III	6	3
24	PCFET-30492	Food Engineering-III Lab	6	1
25	PCFET-30493	Food Preservation and Processing Principles Lab.	6	3
26	PCFET-4481	Fruits, Vegetables and Plantation Products	7	3
27	PCFET-4482	Food Quality	7	3
28	PCFET-4485	Bakery and Confectionary Technology	7	3
29	PCFET-40486	Food Quality Evaluation Lab.	7	2
30	PCFET-4487	Meat, Fish & Poultry Products Technology	8	3
31	PCFET-4488	Food Plant Layout and Design	8	3
32	PCFET-4489	Food Packaging	8	3
			Total Credits:	82

**PROFESSIONAL ELECTIVE COURSES [PE]**

Sl. No	Code No.	Subject	Semester	Credits
1	PEFET	Departmental Elective – I	7	2
2	PEFET	Departmental Elective-II	8	2
			Total Credits:	4

OPEN ELECTIVE COURSES [OE]

Sl. No	Code No.	Subject	Semester	Credits
1	OE	Open Elective Course (Course from other technical and /or emerging Subjects)	7	2
2	OEFET	Nutritional Aspects of Natural & Processed Foods (Except Food Engg. & Technology Students)	7	3

SEMINAR [S], SUMMER INDUSTRY INTERNSHIP [SI], & PROJECT [Proj.]

Sl. No	Code No.	Subject	Semester	Credits
1	SFET-30495	Seminar	6	1
2	SIFET-40488	Industrial Training	7	1
3	Proj.FET-40487	Project	7	3
4	Proj.FET-40491	Project	8	6
			Total Credits:	11



CHAPTER 3

STUDY & EVALUATION SCHEME

Undergraduate Degree in Engineering & Technology

Program

B. TECH. (FOOD ENGINEERING & TECHNOLOGY)

Offered by

**Department of Food Technology
Institute of Engineering & Technology
Bundelkhand University, Jhansi**



CHAPTER-3
STUDY AND EVALUATION SCHEME
B. TECH. (FOOD ENGINEERING & TECHNOLOGY) FIRST YEAR, FIRST SEMESTER
 [Effective from the Session 2022-23]

S.N.	Category	Course Code	Course Title	Periods (Hours per week)			Evaluation Scheme			Total	Credits	
				L	T	P	Sessional Exam.		ESE			
							CT	TA				Total
THEORY												
1	Basic Science	BSMA-1842/ BSBL-1852	Elementary Mathematics/ Elementary Biology	2	1	0	30	20	50	100	150	3
2	Basic Science	BSPH-1843	Engineering Physics - I	2	0	0	15	10	25	50	75	2
3	Engg. Science	ESME-1845	Engineering Mechanics	3	0	0	30	20	50	100	150	3
4	Engg. Science	ESCS-1847	Computer Concepts and Programming in C	2	1	0	30	20	50	100	150	3
5	Humanities, Social Sciences including Management	HSMHU-1849	Professional Communication	3	0	0	30	20	50	100	150	3
6	Mandatory non-credit course	MEV-1851	Environment and Ecology (Non Credit)	2	0	0	10	10	20	30	50	-
PRACTICALS												
1	Engg. Science	ESME-10854	Engineering Mechanics Lab	0	0	2			25	50	75	1
2	Engg. Science	ESCS-10856	Computer Programming Lab	0	0	2			25	50	75	1
3	Engg. Science	ESME-10858	Computer Aided Engineering Graphics	0	0	2			25	50	75	1
4	Humanities, Social Sciences including Management	HSMHU- 10860	Professional Communication Lab	0	0	2			25	50	75	1
5		GP-10861	General Proficiency (Non Credit)	0	0	0			50		50	-
			Total	14	2	8					975	18

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, ESE: End Semester Examinations



CHAPTER-3
STUDY AND EVALUATION SCHEME
B. TECH. (FOOD ENGINEERING & TECHNOLOGY) FIRST YEAR, SECOND SEMESTER
 [Effective from the Session 2022-23]

S.N.	Course Category	Course Code	Course Title	Periods (Hours per week)			Evaluation Scheme			Total	Credits	
				L	T	P	Sessional Exam.		ESE			
							CT	TA				Total
THEORY												
1	Basic Science	BSMA-1855	Engineering Mathematics - I	2	1	0	30	20	50	100	150	3
2	Basic Science	BSPH-1857	Engineering Physics - II	2	0	0	15	10	25	50	75	2
3	Basic Science	BSCY-1858	Engineering Chemistry	3	0	0	30	20	50	100	150	3
4	Engg. Science	ESEC-1860	Electrical Engineering	3	0	0	30	20	50	100	150	3
5	Engg. Science	ESEC-1862	Electronics Engineering	3	0	0	30	20	50	100	150	3
6	Engg. Science	ESME-1864	Manufacturing Processes	2	0	0	10	10	20	30	50	2
PRACTICALS												
1	Engg. Science	ESCY-10867	Engineering Chemistry Lab	0	0	2			25	50	75	1
2	Engg. Science	ESEE-10869	Electrical Engineering Lab	0	0	2			25	50	75	1
3	Engg. Science	ESWS-10871	Workshop Practice	0	0	2			25	50	75	1
4	Basic Science	ESPH-10873	Physics Lab	0	0	2			25	50	75	1
5		GP-10875	General Proficiency (Non Credit)	0	0	0			50		50	-
			Total	15	1	8					1025	20

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, ESE: End Semester Examinations



CHAPTER-3
STUDY AND EVALUATION SCHEME
B. TECH. (FOOD ENGINEERING & TECHNOLOGY) SECOND YEAR, THIRD SEMESTER
 [Effective from the Session 2022-23]

S.N.	Category	Course Code	Course Title	Periods (Hours per week)			Evaluation Scheme			Total	Credits	
				L	T	P	Sessional Exam.		ESE			
							CT	TA				Total
THEORY												
1	Basic Science	BSMA-2481	Engineering Mathematics-II	3	1	0	30	20	50	100	150	4
2	Engg. Science	ESCH-2482	Instrumentation and Process Control	2	0	0	15	10	25	50	75	2
3	Professional Core	PCFET-2483	Food Composition & Human Nutrition	3	0	0	30	20	50	100	150	3
4	Professional Core	PCFET-2484	Basic and Food Microbiology	3	0	0	30	20	50	100	150	3
5	Professional Core	PCFET-2845	Engineering Properties of Foods	3	0	0	30	20	50	100	150	3
6	Engg. Science	ESCS-2846	Cyber Security	2	0	0	15	10	25	50	75	2
PRACTICALS												
1	Professional Core	PCFET-20487	Food Composition & Human Nutrition Lab	0	0	4	30	20	50	100	150	2
2	Professional Core	PCFET-20488	Basic and Food Microbiology Lab.	0	0	4	20	20	40	60	100	2
3		GP-20489	General Proficiency (Non Credit)	0	0	0			50		50	-
			Total	16	1	8					1000	21

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, ESE: End Semester Examinations



CHAPTER-3
STUDY AND EVALUATION SCHEME
B. TECH. (FOOD ENGINEERING & TECHNOLOGY) SECOND YEAR, FOURTH SEMESTER
 [Effective from the Session 2022-23]

S.N.	Category	Course Code	Course Title	Periods (Hours per week)			Evaluation Scheme			Total	Credits	
				L	T	P	Sessional Exam.		ESE			
							CT	TA				Total
THEORY												
1	Engg. Science	ESMA-2491	Numerical Methods and Computer Programming	2	0	0	15	10	25	50	75	2
2	Engg. Science	ESCH-2492	Process Calculations	2	1	0	30	20	50	100	150	3
3	Engg. Science	ESCH-2493	Chemical Engineering Thermodynamics	2	0	0	15	10	25	50	75	2
4	Professional Core	PCFET-2494	Food Chemistry	3	0	0	30	20	50	100	150	3
5	Professional Core	PCFET-2495	Food Additives	3	0	0	30	20	50	100	150	3
6	Professional Core	PCFET-2496	Food Engineering-I	3	0	0	30	20	50	100	150	3
PRACTICALS												
1	Engg. Science	ESMA-20497	Numerical Methods and Computer Programming Lab.	0	0	2	10	10	20	30	50	1
2	Professional Core	PCFET-20498	Food Chemistry Lab	0	0	6	30	20	50	100	150	3
3	Professional Core	PCFET-20499	Food Engineering-I Lab	0	0	2	10	10	20	30	50	1
4		GP-20500	General Proficiency (Non Credit)	0	0	0			50		50	-
			Total	15	1	10					1000	21

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, ESE: End Semester Examinations



CHAPTER-3
STUDY AND EVALUATION SCHEME
B. TECH. (FOOD ENGINEERING & TECHNOLOGY) THIRD YEAR, FIFTH SEMESTER
 [Effective from the Session 2022-23]

S.N.	Category	Course Code	Course Title	Periods (Hours per week)			Evaluation Scheme			Total	Credits	
				L	T	P	Sessional Exam.		ESE			
							CT	TA				Total
THEORY												
1	Humanities, Social Sciences including Management	HSMHU-3481	Industrial Economics and Principles of Management	2	0	0	15	10	25	50	75	2
2	Professional Core	PCFET-3482	Food Biochemistry and Biotechnology	3	0	0	30	20	50	100	150	3
3	Professional Core	PCFET-3483	Food Analysis	3	0	0	30	20	50	100	150	3
4	Professional Core	PCFET-3484	Traditional and Fermented Foods	3	0	0	30	20	50	100	150	3
5	Professional Core	PCFET-3485	Food Safety and Food Laws	2	0	0	15	10	25	50	75	2
6	Professional Core	PCFET-3486	Food Engineering-II	3	0	0	30	20	50	100	150	3
PRACTICALS												
1	Professional Core	PCFET-30487	Food Biochemistry and Biotechnology Lab	0	0	4	20	20	40	60	100	2
2	Professional Core	PCFET-30488	Food Analysis Lab	0	0	4	20	20	40	60	100	2
3	Professional Core	PCFET-34089	Food Engg.-II Lab.	0	0	2	10	10	20	30	50	1
4		GP-34090	General Proficiency (Non Credit)	0	0	0			50		50	-
			Total	16	0	10					1000	21

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, ESE: End Semester Examinations



CHAPTER-3
STUDY AND EVALUATION SCHEME
B. TECH. (FOOD ENGINEERING & TECHNOLOGY) THIRD YEAR, SIXTH SEMESTER
 [Effective from the Session 2022-23]

S.N.	Category	Course Code	Course Title	Periods (Hours per week)			Evaluation Scheme			Total	Credits	
				L	T	P	Sessional Exam.		ESE			
							CT	TA				Total
THEORY												
1	Professional Core	PCFET-3486	Dairy Technology	2	0	0	15	10	25	50	75	2
2	Professional Core	PCFET-3487	Flavour Technology	2	0	0	15	10	25	50	75	2
3	Professional Core	PCFET-3488	Food Preservation and Processing Principles	3	0	0	30	20	50	100	150	3
4	Engg. Science	ESME-3489	Machine Design	2	1	0	30	20	50	100	150	3
5	Professional Core	PCFET-3490	Cereals, Pulses and Oil Seed Products	3	0	0	30	20	50	100	150	3
6	Professional Core	PCFET-3491	Food Engineering-III	3	0	0	30	20	50	100	150	3
PRACTICALS												
1	Professional Core	PCFET-30492	Food Engineering-III Lab	0	0	2	10	10	20	30	50	1
2	Professional Core	PCFET-30493	Food Preservation And Processing Principles Lab.	0	0	6	30	20	50	100	150	3
3		FET-30495	Seminar	0	0	2			50		50	1
4		GP-30494	General Proficiency (Non Credit)	0	0	0			50		50	-
			Total	15	1	10					1000	21

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, ESE: End Semester Examinations



CHAPTER-3
STUDY AND EVALUATION SCHEME
B. TECH. (FOOD ENGINEERING & TECHNOLOGY) FOURTH YEAR, SEVENTH SEMESTER
 [Effective from the Session 2022-23]

S.N.	Category	Course Code	Course Title	Periods (Hours per week)			Evaluation Scheme			Total	Credits	
				L	T	P	Sessional Exam.		ESE			
							CT	TA				Total
THEORY												
1	Professional Core	PCFET-4481	Fruits, Vegetables and Plantation Products	3	0	0	30	20	50	100	150	3
2	Professional Core	PCFET-4482	Food Quality	3	0	0	30	20	50	100	150	3
3	Open Elective	OE	Open Elective Course*	2	0	0	15	10	25	50	75	2
4	Professional Elective	PEFET-4484	DE-I: 1. Food Product development & Sensory Evaluation 2. Post harvest management of fruits and vegetables 3. Engineered, Texturized & Fabricated Foods 4. Nutraceutical & Functional Foods	2	0	0	15	10	25	50	75	2
5	Professional Core	PCFET-4485	Bakery and Confectionary Technology	3	0	0	30	20	50	100	150	3
PRACTICALS												
1	Professional Core	PCFET-40486	Food Quality Evaluation Lab.	0	0	4	30	20	50	100	150	2
2	Project	Proj.FET-40487	Mini Project	0	0	6			150		150	3
3	Summer Internship	SIFET-40488	Industrial Training	0	0	2			100		100	1
4		GP-40489	General Proficiency (Non Credit)	0	0	0			50		50	-
			Total	13	0	12					1000	19

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, ESE: End Semester Examinations



CHAPTER-3
STUDY AND EVALUATION SCHEME
B. TECH. (FOOD ENGINEERING & TECHNOLOGY) FOURTH YEAR, EIGHTH SEMESTER
 [Effective from the Session 2022-23]

S.N.	Category	Course Code	Course Title	Periods (Hours per week)			Evaluation Scheme			Total	Credits	
				L	T	P	Sessional Exam.		ESE			
							CT	TA				Total
THEORY												
1	Professional Elective	PEFET-4486	DE-II: 1. Speciality Foods 2. Food Process Equipment Design 3. Food Processing Waste Management 4. Novel Food Processing Technologies	2	0	0	15	10	25	50	75	2
2	Professional Core	PCFET-4487	Meat, Fish & Poultry Products Technology	3	0	0	30	20	50	100	150	3
3	Professional Core	PCFET-4488	Food Plant Layout and Design	2	1	0	30	20	50	100	150	3
4	Professional Core	PCFET-4489	Food Packaging	3	0	0	30	20	50	100	150	3
5	Engg. Science	ESCH-4490	Industrial Safety and Hazard Management	2	0	0	15	10	25	50	75	2
PRACTICALS												
1	Project	Proj.FET-40491	Project	0	0	12			150	250	400	6
2		GP-40492	General Proficiency (Non Credit)	0	0	0			50		50	-
			Total	12	1	12					1000	19

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, ESE: End Semester Examinations



***List of Open Elective Courses:**

S.N.	Category	Course Code	Course Title	Periods (Hours per week)			Evaluation Scheme			Total	Credits	
				L	T	P	Sessional Exam.		ESE			
							CT	TA				Total
1	Open Elective (Humanities)	OEHU-4483	Entrepreneurship Development	2	0	0	15	10	25	50	75	2
2	Open Elective (Humanities)	OEHU	Human Values	2	0	0	15	10	25	50	75	2
3	Open Elective (Electronics & Communication)	OEEC	Artificial Neural Network & Fuzzy Logic	2	0	0	15	10	25	50	75	2
4	Open Elective (Maths)	OEMA	Operations Research	2	0	0	15	10	25	50	75	2
5	Open Elective (Computer Science)	OECSE	Human Computer Interaction	2	0	0	15	10	25	50	75	2
6	Open Elective (Mechanical Engg.)	OEME	Solar Energy	2	0	0	15	10	25	50	75	2
7	Open Elective (Instrumentation)	OEEI	Industrial Instrumentation	2	0	0	15	10	25	50	75	2
8	Open Elective (Biomedical Engg.)	OEBM	Health, Hospital and Equipment Management	2	0	0	15	10	25	50	75	2
9	Open Elective (Biotechnology Engg.)	OEBT	Fermentation Technology	2	0	0	15	10	25	50	75	2
10	Open Elective (Food Engg. & Technology)	OEFET	Nutritional Aspects of Natural & Processed Foods (Except Food Engg. & Technology Students)	3	0	0	30	20	50	100	150	3



CHAPTER-3
STUDY AND EVALUATION SCHEME
B. TECH. (FOOD ENGINEERING & TECHNOLOGY)
[Effective from the Session 2022-23]

List of Value Added Courses
Institute of Engineering and Technology

SEM -I	SEM-II
Photography	Cyber security & ethical hacking
Google Ads	Digital marketing
Goal Setting	Bio-CNG (Green Fuel)
SEM-III	SEM-IV
IELTS IID	E- waste recycling business
Mushroom Cultivation Business	Advance Excel
Introduction to MATLAB	Mobile App Development
SEM-V	SEM-VI
Internet of things (IOT)	Marketing Content Writer
Bakery Technology	Milk Processing Business
Drone technology	Organic Waste Management

Note-

- ✓ The Students have to choose any one value added course in each semester from the list.
- ✓ The course will be of no - evaluative and non – credit in nature
- ✓ Each value-added course shall be of 30 hrs.



CHAPTER 4

COURSE OBJECTIVES, COURSE OUTCOMES (COS), CO-PO MAPPING & DETAILED 4-YEAR CURRICULUM CONTENTS

Undergraduate Degree in Engineering & Technology

Program

B. TECH. (FOOD ENGINEERING & TECHNOLOGY)

Offered by

**Department of Food Technology
Institute of Engineering & Technology
Bundelkhand University, Jhansi**



Course Title	ELEMENTARY MATHEMATICS													
Course code	BSMA-1842													
Category	Basic Science Course													
Scheme and Credits	L	T	P	C	Semester I									
	2	1	0	3										
Pre-requisites (if any)	None. Desirable – Knowledge of basic mathematics													
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • The knowledge about the elementary mathematics for the students other than mathematics group in 10+2 level • The knowledge about basics of algebra and calculus 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand basic algebra and statistics												Understanding	
CO2	Understand the use of matrices												Understanding	
CO3	Understand basics of differential calculus												Understanding	
CO4	Solve differential equations												Applying	
CO5	Understand basics of integral calculus												Understanding	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	1	-	-	-	-	-	-	-	-	1	2
CO2	1	2	2	1	-	-	-	-	-	-	-	-	1	1
CO3	1	2	2	1	-	-	-	-	-	-	-	-	1	1
CO4	1	2	2	1	-	-	-	-	-	-	-	-	1	1
CO5	1	2	2	1	-	-	-	-	-	-	-	-	1	1
Average	1	2	2	1	-	-	-	-	-	-	-	-	1	1.2



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Algebra: Binomial Theorem (for positive integral index only). Arithmetic Progression (A. P.). Arithmetic Mean (A.M.) Geometric Progression (G.P.), general term of a G.P., sum of n terms of a G.P., infinite G.P. and its sum, geometric mean (G.M.), relation between A.M. and G.M. Statistics: Mean, Median, Mode, Probability	6	3
II	Matrices (Addition, Subtraction), Product of Matrices, Transpose, Adjoint, Inverse of matrices by adjoint method, solution of linear equations, Determinants (of order three only), Permutation and combination.	6	3
III	Differential Calculus: Function, Limit of Function, Differentiation of function, Product rule, Quotient Rule of Differentiation, Differentiation of Function of a Function, Inverse of Trigonometric Function, Differentiation of Logarithmic Form, Parametric Form, Differentiation by substitution, maxima & minima of one variable.	6	3
IV	Differential equations: Definition, order & degree, General & particular solutions of a differential equation, Differential equations of first order & first degree, Solutions of differential equations by method of separation of variables, homogenous differential equations, linear differential equation, Exact differential equation.	6	3
V	Integral calculus: Integration as inverse process of differentiation, Infinite integrals of standard form, Integration of functions by substitution, by partial fraction parts, Basic properties of definite integrals & evaluation of definite integrals.	6	3
	Total	30	15

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books:

S.N.	AUTHOR	TITLE
1	H.K. DASS	Introduction to Engineering <i>Mathematics</i> Volume-I



Course Title	ELEMENTARY BIOLOGY													
Course code	BSBL-1852													
Category	Basic Science Course													
Scheme and Credits	L	T	P	C	Semester I									
	2	1	0	3										
Pre-requisites (if any)	The knowledge about basic science.													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • The knowledge about the diversity of life including bacteria, protists, plants, fungi, and animals. • The knowledge about the human physiology. 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand fundamentals of plant & animal kingdom and morphology of plants											Understanding		
CO2	Explain about plant physiology											Understanding		
CO3	Understand about basic zoology and cytology											Understanding		
CO4	Explain about the plant and human physiology											Understanding		
CO5	Understand the genetics and molecular biology											Understanding		
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO1	PSO2
CO1	2	1	-	-	-	1	2	-	-	-	-	-	2	2
CO2	1	1	-	-	-	-	2	-	-	-	-	-	2	2
CO3	2	-	-	-	-	1	-	-	-	-	-	-	2	2
CO4	1	1	2	-	-	2	2	-	-	-	-	-	2	2
CO5	2	2	2	2	-	2	2	-	-	-	-	-	2	2
Average	1.6	1.0	0.8	0.4	-	1.2	1.6	-	-	-	-	-	2	2



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Introduction to plant and animal kingdom and broad outlines of their classification. Study of plant and animal tissue; morphology of root, stem, leaf and flower.	6	3
II	Reproduction in flowering plants. Inflorescence and its types; Fruit and types of fruit. Study of seed, its structure and seed germination with special reference to maize, pea, wheat, rice.	6	3
III	Definition and branches of Zoology. Idea of living and non-living matter. Structure of cell; Plant and animal cell. Protoplasm and its structure. Properties of protoplasm. Cell division; amitosis, mitosis and meiosis. Chromosome- structure and functions. Brief idea of Nucleic acids – DNA, RNA and Extra Nuclear Genomes	6	3
IV	Plant physiology: Nutrient transport in plants, Growth and development, Respiration and Photosynthesis. Human Physiology: Digestive System – Digestion of food, Absorption; Circulatory System, Excretory System, Endocrine System – Glands and Hormones	6	3
V	Concept of gene, Protein synthesis, Chromosome alterations, Mutation and its types. Recombinant DNA Technology.	6	3
	Total	30	15
L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes			
Suggested Books			
S.N.	AUTHOR	TITLE	
1	Biswa, S. & Biswas, A. (2007)	A text book of Biology, Pradeep Publications.	
2	NCERT Publication	Text books of Biology (Class XI and XII)	



Course Title	ENGINEERING MATHEMATICS - I													
Course code	BSMA-1855													
Category	Basic Science Course													
Scheme and Credits	L	T	P	C	Semester II									
	2	1	0	3										
Pre-requisites (if any)	Knowledge of elementary mathematics													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> Basic Mathematical skills of engineering students that are imperative for effective understanding. 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Solve the <i>matrix</i> equation using elementary <i>matrix</i> operations and use systems of linear equations and <i>matrix</i> equations to determine linear dependency.												Applying	
CO2	Formulate complete, concise, and correct mathematical proof and frame problems using multiple mathematical and statistical representations of relevant structures and relationships and solve using standard techniques.												Applying	
CO3	classify differential equations that can be solved by each of the three methods – direct integration, separation of variables and integrating factor method – and use the appropriate method to solve them.												Analysis	
CO4	Evaluate <i>multiple integrals</i> for regions in the plane and to find area of the region bounded by curves and to find volume, surface area, Mass, etc. & apply central concepts in multivariable analysis, including space curves; directional <i>derivative</i> ; gradient												Applying	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	2	1	2	-	-	-	-	-	-	2	1
CO2	2	2	1	1	2	2	-	-	-	-	-	-	2	1
CO3	2	3	2	2	1	3	-	-	-	-	-	-	1	2
CO4	2	2	2	2	1	2	-	-	-	-	-	-	1	2
Average	2.0	2.0	1.8	1.8	1.3	2.3	-	-	-	-	-	-	1.5	1.5



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Matrices: elementary row and column transformation, rank of a matrix, characteristics equation, eigen values, eigen vectors, Cayley- Hamilton theorem.	6	3
II	Statistics: Moments, Moment generating functions, Skewness, Kurtosis, Correlation and Regression, Binomial distribution, Poisson distribution, Normal distribution, Chi square test, T test, F test, Z test, analysis of variance. Curve Fitting: Method of least squares and curve fitting of straight line and parabola.	6	3
III	Differential Calculus: Leibnitz theorem, Partial differentiation, Eulers theorem, Expansion of function of several variables, Jacobian, , Approximation of errors, Exterma of functions of several variables, Lagranges method of multipliers (Simple applications).	6	3
IV	Multiple Integrals: Double and triple integral, Change of order, Change of variables, Beta and Gamma functions, Application to area, volume.	6	3
V	Vector differentiation: Gradient, Curl and Divergence and their Physical interpretation, Directional derivatives, Tangent and Normal planes. Vector Integration: Line integral, Surface integral, Volume integral, Gauss's Divergence theorem, Green's theorem, Stoke's theorem (without proof) and their applications.	6	3
	Total	30	15

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books:

S.N.	AUTHOR	TITLE
1	B.S.Grewal B.S.Grewal	Engineering Mathematics, Khanna Publishers, 2004. Higher Engineering Mathematics, Khanna Publishers, 2005.



Course Title	ENGINEERING MATHEMATICS-II													
Course code	BSMA-2481													
Category	Basic Science Course													
Scheme and Credits	L	T	P	C	Semester III									
	3	1	0	4										
Pre-requisites (if any)	Elementary Mathematics & Basic Engineering Mathematics													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • The knowledge of the theory of ordinary differential equations through applications, methods of solution, and numerical approximations • The knowledge about identifying curves and regions in the complex plane defined by simple expressions, describing basic properties of complex integration, computing such integrals and deciding when and where a given function is analytic and be able to find it series development. 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Classify the <i>differential equations</i> with respect to their <i>order</i> and linearity & Explain the meaning of solution of a <i>differential equation</i>												Analyzing	
CO2	Understand the basic properties of PDEs and to the basic analytical techniques to solve them												Understanding	
CO3	Represent complex numbers algebraically & geometrically and Understand Cauchy-Riemann equations, analytic functions and various properties of analytic functions												Understanding	
CO4	Understand Cauchy theorem and Cauchy integral formulas and apply these to evaluate complex contour integrals												Applying	
CO5	Understand different solution techniques and use tools like <i>Fourier transforms</i> , <i>Fourier series</i> , <i>Z. – transforms</i> .												Applying	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	2	1	2	-	-	-	-	-	-	2	1
CO2	2	2	1	1	2	2	-	-	-	-	-	-	2	1
CO3	2	3	2	2	1	3	-	-	-	-	-	-	1	2
CO4	2	2	3	2	3	2	-	-	-	-	-	-	1	2
CO5	2	1	2	1	2	3	-	-	-	-	-	-	2	2
Average	2	1.8	2	1.6	1.8	2.4	-	-	-	-	-	-	1.6	1.6



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Differential Equations of second order with constant coefficients, Method of variation of parameters, Homogenous differential equations, simultaneous linear differential equations with constant coefficients, applications of differential equations in engineering.	9	3
II	Introduction of partial differential equations, Linear partial differential equations with constant coefficients of 2nd order and their classifications - parabolic, elliptic and hyperbolic with illustrative examples. Method of separation of variables for solving partial differential equations, Wave equation up to two-dimensions, Heat conduction equations up to two-dimensions.	9	3
III	Function of complex variables: Analytic functions, CR equations, Harmonic functions, Conformal mapping, Bilinear transformation.	9	3
IV	Complex Integration: Line integral, Cauchy's integral theorem, Cauchy's integral formula, Taylor's and Laurent's series (without proof), Residues, Cauchy Residue theorem, Application of residue theorem for evaluation of real integrals.	9	3
V	Integral transform: Fourier transform, Fourier complex transform, Fourier sine and cosine transform, Z transform and its application to solve differential equation. Fourier series, Half range Fourier sine and cosine series.	9	3
	Total	45	15

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

S.N.	AUTHOR	TITLE
1	H.K. DASS	Introduction To Engineering Mathematics Volume-II



Course Title	INSTRUMENTATION AND PROCESS CONTROL													
Course code	ESCH-2482													
Category	Engg. Science Course													
Scheme and Credits	L	T	P	C	Semester III									
	2	0	0	2										
Pre-requisites (if any)	None. Desirable – Knowledge of basic physics													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • Fundamental knowledge of process control • Knowledge about various types of measuring instruments used in different types of processes • Knowledge about characteristics of different types of controllers for controlling a process and process automation 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand the basic principles & importance of process control in industrial process plants												Understanding	
CO2	Choose/specify the required instrumentation and final elements to ensure that well-tuned control is achieved												Applying	
CO3	Apply mathematical basis for the design of control systems for various processes carried out in the industry.												Applying	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	2	-	-	-	-	-	-	-	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3
Average	3	2.7	3	2.7	2.7	-	-	-	-	-	-	-	3	3



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Elements of measurement, functions and general classifications of measuring instruments. Indicating and recording type of instruments. Elements of measuring instruments, static and dynamic characteristics of measuring instruments.	7	-
II	Principle of operation, construction and application of important industrial instruments for the measurement of temperature, flow, liquid level and composition.	6	-
III	Dynamic behavior of first order, second order and two or more first order systems in series.	5	-
IV	Block and physical diagrams of control system. Open and closed loop control systems. Characteristics of measuring elements, controllers and final control elements. Mods of control actions.	6	-
V	Response of closed loop control systems for various kind of control actions and measurement lag.	6	-
	Total	30	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

S.N.	
1	Coughanowr, D. R., & Koppel, L. B. (1965). Process systems analysis and control (Vol. 2). New York: McGraw-Hill.
2	Jain, R. K. (1996). Mechanical and industrial Measurements. Khanna Publishers.
3	Dunn, W. C. (2018). <i>Fundamentals of industrial instrumentation and process control</i> . McGraw-Hill Education.
4	Kress-Rogers, E., & Brimelow, C. J. (Eds.). (2001). Instrumentation and sensors for the food industry (Vol. 65). Woodhead Publishing.
5	Douglas, O. J. (2019). Instrumentation fundamentals for process control. Routledge.
6	Prasad, J., Jayaswal, M. N., & Priye, V. (2013). Instrumentation and process control. IK International Pvt Ltd.
7	Romagnoli, J. A., & Palazoglu, A. (2005). Introduction to process control. CRC press.
8	de Sa, D. O. (2004). Applied technology and instrumentation for process control. CRC Press.



Course Title	FOOD COMPOSITION AND HUMAN NUTRITION													
Course code	PCFET-2483													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester III									
	3	0	0	3										
Pre-requisites (if any)	None. Desirable – Knowledge of basic chemistry													
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • The knowledge about the major and minor constituents of foods and their functions • The knowledge about basics of human nutrition 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand desirable and undesirable food constituents and basics of human nutrition interpret												Understanding	
CO2	Compare and classify foods and their constituents according to their nutritional value and role in human health												Analyzing	
CO3	Prepare a dietary plan for different age groups of Indian considering RDA and interpret the effect of processing on food components												Applying	
CO4	Assessment of nutritional status of human by various techniques												Evaluating	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	1	-	3	-	-	-	-	-	-	2	2
CO2	2	2	3	2	-	3	-	-	-	-	-	-	3	3
CO3	2	2	3	3	-	3	-	-	-	-	-	2	3	3
CO4	1	3	3	3	-	3	-	-	-	-	-	2	3	3
Average	1.8	2.3	3	2.3	-	3	-	-	-	-	-	1.0	2.8	2.8



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Composition: Chemical constituents of foods: Desirable and Potentially undesirable food constituents and their importance. General and specific composition for different foods of plant and animal origin.	9	-
II	Carbohydrates: Classes, Nomenclature and structure. Dietary utilization and disturbances. Lipids: Definition, Classification and structure: Fatty acids composition of natural lipids of plants and animal origin, Essential fatty acids. Role and use of natural lipids and tailor made fats in foods.	9	-
III	Protein: Physico-chemical properties of amino acids, peptides and proteins, structure - function relationship of proteins, Essential Amino acids. Vitamins and minerals: Types of vitamins and minerals, functions, sources and deficiency diseases.	9	-
IV	Nutrition: Food groups and their typical composition. Recommended Dietary Intakes (RDI) and its uses. Factors affecting nutritional requirement of an individual. The exchange list system and diet planning principles. General causes of loss of nutrients. Restoration, Enrichment, Fortification and Supplementation of foods.	9	-
V	Malnutrition: Type of Malnutrition, Multi-factorial causes, Epidemiology of under nutrition and over nutrition. Assessment of nutritional status; Diet surveys, Anthropometry, Clinical examination, Biochemical assessment, Additional medical information. Digestion, Absorption and Metabolism of food in human body. In-born error of metabolism. Balanced diets for normal individuals. Calorific value of foods.	9	-
	Total	45	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

S.N.	
1	Gopalan, C., Rama Sastri, B. V., & Balasubramanian, S. C. (1971). Nutritive value of Indian foods.
2	Potter, N. N., & Hotchkiss, J. H. (2012). Food science. Springer Science & Business Media.
3	Damodaran, S., Parkin, K. L., & Fennema, O. R. (Eds.). (2007). Fennema's food chemistry. CRC press.
4	Shubhangini A. Joshi, Nutrition and Dietetics
5	"human nutrition Importance, Essential Nutrients, Food Groups, & Facts" . Encyclopedia Britannica.
6	Lean, Michael E.J. (2015). "Principles of human nutrition". Medicine. 43 (2): 61–65.



Course Title	BASIC AND FOOD MICROBIOLOGY				
Course code	PCFET-2484				
Category	Professional Core Course				
Scheme and Credits	L	T	P	C	Semester III
	3	0	0	3	
Pre-requisites (if any)	The knowledge about basic biology.				
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • The knowledge about the role of microorganisms in food spoilage • The knowledge about pathogens, mycotoxin, viruses and parasites • The knowledge about the food poisoning and food borne infections 				

Course Outcomes

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

CO1	Understand the general characteristics of microorganism: classification, morphology, physiology, growth, nutrition, reproduction & their occurrence in various foods and its consequences	Understanding
CO2	Use techniques of preservation of various foods from spoilage due to microbial contamination	Applying
CO3	Evaluate foods for their potential health risks and implement the microbial quality assurance systems in food industry including GMP and HACCP	Evaluating
CO4	Utilize beneficial microorganisms in food processing industry to develop various fermented foods	Applying

CO-PO Mapping

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	2	2	-	-	-	-	-	3	3
CO2	3	3	2	2	2	3	3	-	-	-	-	-	3	3
CO3	3	3	3	2	2	3	2	-	-	-	-	-	3	3
CO4	3	2	3	2	-	2	-	-	-	-	-	-	3	3
Average	2.8	2.5	2.5	2.0	0.4	2.5	1.75	-	-	-	-	-	3	3



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	General characteristics of microorganism: Classification, morphology, physiology, growth, nutrition and reproduction; Pure culture techniques and maintenance of cultures, control of microorganism.	9	-
II	Incidence of microorganism in foods, source of contamination. Principle underlying spoilage and preservation of foods.	6	-
III	Contamination, spoilage and preservation of cereal products, sugar products, fruit and vegetable products, meat products, fish and sea foods egg and poultry products milk and milk products and other foods, Microbiological standard of foods.	15	-
IV	Food poisoning and food borne infections, food plant sanitation, inspection and control, personnel hygiene, HACCP in food industry. Beneficial microorganisms and their utilization in food fermentation.	15	-
	Total	45	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

S.N.	
1	Pelczar, M. J., & Reid, R. D. (1958). Microbiology. Krishna Prakashan Media.
2	Jay, J. M., Loessner, M. J., & Golden, D. A. (2008). Modern food microbiology. Springer Science & Business Media.
3	Frazier, W. C., & Westhoff, D. C. (1988). Food microbiology, New York (NY): McGraw-Hill Book.
4	Fratamico PM (2005). Bayles DO (ed.). Foodborne Pathogens: Microbiology and Molecular Biology. Caister Academic Press. ISBN 978-1-904455-00-4.
5	Ray, B. Fundamental Food Microbiology, 3rd Ed. (2005)
6	Adams, M. R., Moss, M. O., & Moss, M. O. (2000). Food microbiology. Royal society of chemistry.
7	Garbutt, J. (1997). Essentials of food microbiology. Arnold, Hodder Headline plc.
8	Matthews, K. R., Kniel, K. E., & Montville, T. J. (2017). Food microbiology: an introduction. John Wiley & Sons.
9	Doyle, M. P., Diez-Gonzalez, F., & Hill, C. (Eds.). (2020). Food microbiology: fundamentals and frontiers. John Wiley & Sons.
10	Erkmen, O., & Bozoglu, T. F. (2016). Food microbiology, 2 volume set: Principles into practice. John Wiley & Sons.



Course Title	ENGINEERING PROPERTIES OF FOODS													
Course code	PCFET-2845													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester III									
	3	0	0	3										
Pre-requisites (if any)	None. Desirable – Knowledge of basic chemistry													
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • The knowledge of various engineering properties of food materials • The knowledge of the concepts in designing of food process equipment and storage conditions 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Explain the mass volume and area related properties												Understanding	
CO2	Analyze rheological, textural, hydrodynamics and aerodynamics properties of foods												Analyzing	
CO3	Explain the thermal, electrical and dielectric properties of foods												Analyzing	
CO4	Explain surface and optical properties and analyze the colour of the food products												Analyzing	
CO5	Relate water activity with food stability and use it to extend shelf life of foods												Applying	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	1	3	-	-	-	-	-	-	3	3
CO2	3	3	3	3	3	2	-	-	-	-	-	-	3	3
CO3	3	3	3	2	2	1	-	-	-	-	-	-	3	3
CO4	3	3	3	3	3	3	-	-	-	-	-	1	3	3
CO5	3	3	3	3	2	3	-	-	-	-	-	1	3	3
Average	3	2.6	2.6	2.4	2.2	2.4	-	-	-	-	-	0.4	3	3



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Mass-Volume-Area-Related Properties of Foods: volume, density, porosity, Surface area, pore size distribution.	9	-
II	Mechanical properties (strain and stress), viscosity, elasticity, viscoelasticity, Newtonian and non-Newtonian fluid, time dependent fluids, creep and relaxation phenomena, texture profile. Dough Testing Instruments. hydrodynamics and aerodynamics properties of foods	9	-
III	Thermal Properties of Foods: Specific heat. thermal conductivity, enthalpy and latent heat, thermal diffusivity. Electrical Conductivity and Dielectric Properties of Foods.	9	-
IV	Surface and optical Properties of foods: surface and interfacial tension, measurement of color and color order systems.	9	-
V	Water Activity and Sorption Properties of Foods: prediction and measurement of water activity, effects of temperature and pressure, moisture sorption isotherms	9	-
	Total	45	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

S.N.	
1	Welti-Chanes, J., & Aguilera, J. M. (Eds.). (2002). Engineering and Food for the 21st Century. CRC Press.
2	Heldman, D. R. (Ed.). (2012). Food process engineering. Springer Science & Business Media.
3	Singh, R. P., & Heldman, D. R. (2001). Introduction to food engineering. Gulf Professional Publishing.
4	Singhal, O.P. and Samuel, D.V.K, Engineering Properties of Biological Materials
5	Rao, M. Anandha, et al., eds. Engineering properties of foods. CRC press, 2014.
6	Barbosa-Cánovas, G. V., Juliano, P., & Peleg, M. (2009). Engineering properties of foods. Food engineering, 1, 39.
7	Sahin, S., & Sumnu, S. G. (2006). Physical properties of foods. Springer Science & Business Media.
8	Figura, L., & Teixeira, A. A. (2007). Food physics: physical properties-measurement and applications. Springer Science & Business Media.



Course Title	CYBER SECURITY													
Course code	ESCS-2846													
Category	Engg. Science Course													
Scheme and Credits	L	T	P	C	Semester III									
	2	0	0	2										
Pre-requisites (if any)	Knowledge of basic computer applications													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • The knowledge about developing secure information system • The knowledge of security threats, digital security, public key cryptography, www policies and email security. 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand need for information, application & data security, security threats, security policies, laws and standards												Understanding	
CO2	Analyze security risks due to security threats												Analyzing	
CO3	Develop secure information system												Applying	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	1	-	3	-	3	-	-	-	2	2	1
CO2	1	3	3	3	2	3	-	1	-	-	-	2	3	2
CO3	3	2	3	3	3	3	-	3	-	-	-	2	3	3
Average	2.0	2.3	3	2.3	1.7	3	-	2.3	-	-	-	2.0	2.7	2.0



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis.	6	-
II	Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control.	6	-
III	Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce-Electronic Payment System, e- Cash, Credit/Debit Cards. Digital Signature, public Key Cryptography.	6	-
IV	Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control, CCTV and intrusion Detection Systems, Backup Security Measures.	6	-
V	Security Policies, Why Policies should be developed, WWW policies, Email Security policies, Policy Review Process-Corporate policies-Sample Security Policies, Publishing and Notification Requirement of the Policies. Information Security Standards-ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law: Copy Right Law, Software License, Semiconductor Law and Patent Law.	6	-
	Total	30	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

1	Charles P. Pfleeger, Shari Lawerance Pfleeger, "Analysing Computer Security", Pearson Education India.
2	V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.
3	Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen kumar Shukla, "Introduction to Information Security and Cyber Law" Willey Dreamtech Press.
4	Schou, Shoemaker, "Information Assurance for the Enterprise", Tata McGraw Hill.
5	CHANDER, HARISH, "Cyber Laws And It Protection", PHI Learning Private Limited



Course Title	FOOD COMPOSITION AND HUMAN NUTRITION LAB													
Course code	PCFET-20487													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester III									
	0	0	4	2										
Pre-requisites (if any)	Basic knowledge of nutrition, nutrients and food constituents Desirable – Knowledge of basic chemistry and mathematics													
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • The knowledge about determining the proximate constituents of foods • The knowledge about analytical techniques related to human nutrition 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Prepare the samples of different kinds of foods for subsequent analysis												Applying	
CO2	Determine the proximate constituents of foods												Evaluating	
CO3	Analyze nutritional status using techniques of nutritional anthropometry												Analyzing	
CO4	Evaluate micro nutrients, cholesterol, sugar, total and differential count etc by applying biochemical and clinical test methods for urine, blood and serum tests												Evaluating	
CO5	Evaluate energy value in a food sample using bomb calorimeter												Evaluating	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	2	-	-	-	-	-	-	-	1	2
CO2	3	2	3	2	2	3	-	-	-	-	-	-	3	3
CO3	1	2	3	2	2	3	-	-	-	-	-	-	2	3
CO4	2	2	3	3	3	3	-	-	-	-	-	2	2	3
CO5	1	3	3	3	1	3	-	-	-	-	-	-	3	3
Average	1.8	1.8	2.4	2	2	2.4	-	-	-	-	-	0.4	2.2	2.8



List of Practical	
S.N.	Practical
1	Sampling requirements, procedures and methods.
2	Determination of moisture content of foods by oven drying and distillation methods.
3	Determination of Total and Acid insoluble ash content in foods.
4	Determination of Crude fat content by solvent extraction methods in foods.
5	Determination of crude Protein by Kjeldhal Lowry methods.
6	Determination of reducing and total sugar content in foods.
7	Determination of crude fibre content in foods.
8	Nutritional anthropometry - Standards for reference – WHO Growth Charts from birth to 18 years, Body Mass Index and reference value
9	Techniques of measuring height, weight, head, chest and arm circumference, waist to hip ratio, skin-fold thickness
10	Calculation of percent Body fat using skin fold calipers
11	Normal weight, underweight and obesity classification based on percent body fat and BMI of individuals, Protein Energy Malnutrition in children, Chronic Energy deficiency in adults
12	Biochemical and Clinical tests/methods: urine, blood and serum tests for micro nutrients, cholesterol, sugar, total and differential count etc.
13	Determination of energy value; Bomb Calorimeter
L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes	
Reference Books and Suggested Readings:	
S.N.	
1	Laboratory Manual
2	BIS and AOAC Methods of Food analysis
3	“Hand Book of analysis and quality control for fruit and Vegetable Products”. II nd edition. Tata McGraw-Hill Publishing Company Ltd. New Delhi.
4	Pomeranz, Y. (Ed.). (2013). Food analysis: theory and practice. Springer Science & Business Media.
5	James, C. S. (Ed.). (2013). Analytical chemistry of foods. Springer Science & Business Media.
6	Nielsen, S. S. (2017). Food analysis laboratory manual. Springer.



Course Title	BASIC AND FOOD MICROBIOLOGY LAB													
Course code	PCFET-20488													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester III									
	0	0	4	2										
Pre-requisites (if any)	Basic knowledge of food microbiology Desirable – Knowledge of basic biology													
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • The knowledge to utilize laboratory techniques to detect, quantify, and identify microorganisms in foods • The knowledge of preparation of media and sterilization techniques 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Demonstrate the microscope parts and its functions of the microscopes and viewing microorganisms using with/ without staining techniques												Applying	
CO2	Isolate microorganisms by using specialized techniques												Applying	
CO3	Identify of different pathogenic microbes												Analyzing	
CO4	Prepare media and apply sterilization techniques												Applying	
CO5	Examine potable water microbiologically												Evaluating	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	2	-	-	-	-	-	-	-	3	3
CO2	3	2	3	2	2	3	-	-	-	-	-	-	3	3
CO3	1	2	3	2	2	3	-	-	-	-	-	-	3	3
CO4	2	2	3	3	3	3	-	-	-	-	-	-	3	3
CO5	1	3	3	3	1	3	-	-	-	-	-	-	3	3
Average	1.8	2.2	2.8	2.6	2	2.4	-	-	-	-	-	-	3	3



List of Practical	
S.N.	Practical
1	Microscope its parts and utility in identification and differentiation of bacteria, yeast and mold.
2	Familiarization with common techniques for handling pure culture serial dilution, Inoculation, slide preparation incubation, counting etc.
3	Micrometry and determination of size of different microbes.
4	Simple and differential staining of microorganisms and their examination.
5	Direct total, viable, and non-viable count of microorganisms in milk.
6	Preparation and sterilization of media and glassware for microbial counts.
7	Determination of Standard Plate Count (SPC) in natural and/or processed foods.
8	Microbiological examination of some selected natural and processed foods.
9	Microbiological examination of potable water: Total and coliform count.
10	Enumeration of coliform organisms in some selected processed foods.

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Reference Books and Suggested Readings:

S.N.	
1	H. W. Selley Jr. and Paul J. Van- Microbes in action
2	Frazier W. C. & Westhoff D.C- Food Microbiology
3	Refai M. K.- Manual of Food Quality Control- Microbiological Analysis
4	Harrigan, W. F. (1998). Laboratory methods in food microbiology. Gulf professional publishing.
5	Patel, P. (Ed.). (1994). Rapid analysis techniques in food microbiology. Springer Science & Business Media.
6	Tortorello, M. L., & Gendel, S. M. (1997). Food Microbiology and Analytical Methods: New Technologies. CRC Press.
7	Garg, N., Garg, K. L., & Mukerji, K. G. (2010). Laboratory manual of food microbiology. IK International Pvt Ltd.
8	Yousef, A. E., & Carlstrom, C. (2003). Food microbiology: a laboratory manual. John Wiley & Sons.
9	Erkmen, O. (2021). Microbiological analysis of foods and food processing environments. Academic Press.
10	Da Silva, N., Taniwaki, M. H., Junqueira, V. C. A., de Arruda Silveira, N. F., Okazaki, M. M., & Gomes, R. A. R. (2018). Microbiological examination methods of food and water: a laboratory manual. CRC Press.



DETAILED SYLLABUS: B. TECH. (FOOD ENGG. & TECHNOLOGY)

Course Title	NUMERICAL METHODS AND COMPUTER PROGRAMMING													
Course code	ESMA-2491													
Category	Engineering Science Course													
Scheme and Credits	L	T	P	C	Semester IV									
	2	0	0	2										
Pre-requisites (if any)	Programming in C Desirable – Knowledge of Mathematical preliminaries.													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • Knowledge to evaluate basic computational errors • Knowledge to understand algorithms and flow chart of the programs • Knowledge to understand and implement C programming 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand basics of C & C++ and apply it to simple programs												Applying	
CO2	Understand algorithms and flow charts												Understanding	
CO3	Solve different interpolation, extrapolation, differential equations, partial differential equations and algebra equations, numerical integration and simultaneous linear equations.												Applying	
CO4	Prepare simple program in BASIC/PASCAL												Applying	
CO5	Design simple computer programs with selected examples from electrical/mechanical/civil/chemical engineering.												Applying	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1	3	-	-	-	-	-	-	-	1	1
CO2	3	2	3	2	2	-	-	-	-	-	-	-	1	1
CO3	3	2	3	3	3	-	-	-	-	-	-	-	2	2
CO4	3	1	2	2	1	-	-	-	-	-	-	-	1	1
CO5	2	3	3	3	3	-	-	-	-	-	-	-	1	1
Average	2.8	2	2.8	2.2	2.4	-	-	-	-	-	-	-	1.2	1.2



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	C Language and C++ Language: Overview, structure of C and C++ programs, charter set, key words, identifiers, constants, variables, data types, declarations, operators, expressions, control structures, arrays, functions, pointers, etc. Simple programs.	8	-
II	Algorithms and flow charts. Introduction to numerical methods, Interpolation and extrapolation, solution of differential equations and partial differential equations and algebra equations. Numerical integration solution of simultaneous linear equations.	8	-
III	Elements of BASIC/PASCAL/C/C++ oriented programming.	4	-
IV	Control and input - output statements, subscripted variables, functions and subroutines	4	-
V	Writing simple computer programs in BASIC/PASCAL/C/C++. Selected examples from electrical/mechanical/civil/chemical engineering.	6	-
	Total	30	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books

S.N.	AUTHOR	TITLE
1	Rajaraman V	Computer Oriented Numerical Methods, Pearson Education
2	Sastry S. S.	Introductory Methods of Numerical Analysis, Pearson Education.
3	Grewal B. S.	Numerical methods in Engineering and Science
4	Manish Goyal	Computer Based Numerical & Statistical Techniques.
5	Jeri R. Hanly, Elliot B. Koffman	Problem Solving and Program Design in C



Course Title	PROCESS CALCULATIONS													
Course code	ESCH-2492													
Category	Engineering Science Course													
Scheme and Credits	L	T	P	C	Semester IV									
	2	1	0	3										
Pre-requisites (if any)	None. Desirable – Knowledge of basic physics, chemistry and mathematics													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • The knowledge about the behavior of gases, liquids and solids and basic calculation techniques. • The knowledge on laws of chemistry and its application to solution of mass and energy balance problems 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand the fundamentals of units and stoichiometric equations and perform unit conversions and basic chemical calculations												Understanding	
CO2	Understand the fundamentals of ideal gas behavior, concepts of humidity and saturation												Understanding	
CO3	Solve the problems related to gases, vapours, humidity and saturation												Applying	
CO4	Solve material balance problems by developing mathematical relations for different chemical processes												Applying	
CO5	Solve energy balance problems by developing mathematical relations for different chemical processes												Applying	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	-	-	-	-	-	-	-	-	2	1
CO2	3	3	2	2	-	2	-	-	-	-	-	-	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
Average	2.8	2.8	2.6	2.4	-	2.2	-	-	-	-	-	-	2.8	2.6



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Units their dimensions and conversions, Mass and volume relations, Stoichiometric and composition relations, Concept of mole, mole fraction, composition of mixtures of solids, liquids and gases, Concept of Normality, Molarity, Molality and ppm.	6	3
II	Ideal gas law, Dalton's Law, Amagat's Law, and Average molecular weight of gaseous mixtures. Vapour Pressure: Effect of temperature on vapour pressure, Vapour pressure plot (Cox chart), Vapour pressures of miscible and immiscible liquid and solutions, Raoult's Law and Henry's Law.	6	3
III	Humidity and saturation, Relative Humidity and percent saturation, Dew point, Dry and Wet bulb temperatures, Use of humidity charts for engineering calculations.	6	3
IV	Material Balance: Material balances for systems without chemical reactions-unit operations like distillation, crystallization, evaporation, absorption, drying, mixing, extraction etc. Material balances for systems with chemical reactions-Concept of excess and limiting reactants, degree of completion, conversion, selectivity and yield. Recycling operations, analysis of systems with by-pass, and purge.	6	3
V	Energy Balance: Heat capacity of gases, liquids and solutions, Heat of fusion and Vaporization. Steady state energy balance for systems with and without chemical reactions. Calculations and application of heat of reaction, combustion, formation, neutralization and solution. Enthalpy-concentration charts. Combustion of solids, liquids and gaseous fuels, Calculation of theoretical and actual flame temperatures.	6	3
	Total	30	15

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

S.N.	References:
1	Himmelblau, D.M. "Basic Principles & Calculations in Chemical Engineering", 6th ed. Prentice Hall (1996).
2	Felder & Rousseau, R.W. "Elementary Principles of Chemical Processes", 3rd edition. John Wiley.
3	Bhatt., B.I. and Vora S.M. "Stoichiometry" 2nd edition, Tata McGraw Hill (1984) Reference Books
4	Hougan D. A., Watson K.M. & Ragatz R. A. "Chemical Process Principles" Asia Publishing House
5	Luben W.L. and Wenzel, L.A. "Chemical Process Analysis Mass and Energy Balance" Prentice Hall
6	Narayanan, K. V., & Lakshmikutty, B. (2016). Stoichiometry and process calculations. PHI Learning Pvt. Ltd..



Course Title	CHEMICAL ENGINEERING THERMODYNAMICS													
Course code	ESCH-2493													
Category	Engineering Science Course													
Scheme and Credits	L	T	P	C	Semester IV									
	2	0	0	2										
Pre-requisites (if any)	Knowledge of basic physics													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> The knowledge of theory and applications of classical thermodynamics, thermodynamic properties and equations of state The knowledge of methods used to describe and predict phase equilibria 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand the basic of thermodynamics and the terminology associated with engineering thermodynamics.												Understanding	
CO2	Understand the thermodynamic properties of substances in gas or liquid state of ideal and real mixture												Understanding	
CO3	Understand multicomponent system												Understanding	
CO4	Understand and apply the knowledge of phase equilibria in two-component and multicomponent systems												Applying	
CO5	Understand chemical equilibrium												Understanding	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	1	2
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	2
CO3	3	2	1	-	-	-	-	-	-	-	-	-	1	2
CO4	3	2	1	1	-	-	-	-	-	-	-	-	1	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	1	2
Average	3	2.2	1.2	0.6	-	-	-	-	-	-	-	-	1.6	2



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Basic Concept The first law and conservation of energy. Applications to steady, nonsteady flow and other engineering problems. The second law. Applications to engineering problems relating to equilibrium, maximum and minimum work.	6	-
II	Properties of Pure Substances Changes in thermodynamic properties and their inter-relationships. The ideal gas. Fugacity and Fugacity coefficients for real gases.	6	-
III	Multicomponent System Partial molal properties. Mathematical models for the chemical potential. Ideal and non-ideal solutions. Activity and activity coefficients. The Gibbs Duhem equations. Excess properties of mixtures.	6	-
IV	Phase Equilibria Criteria for equilibrium between different phases in Multicomponent nonreacting systems. Applications to systems of engineering interest, particularly to vapour – liquid equilibria and solubility	6	-
V	Chemical Equilibrium The equilibrium constant and the variation of yield in chemical reactions with pressure, temperature and composition.	6	-
	Total	30	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

S.N.	AUTHOR	TITLE
1	J.M. Smith and H.C. Van Ness	Introduction to Chemical Engineering Thermodynamics
2	Y.V.C. Rao	Chemical Engineering Thermodynamics
3	Sandler, S. I. (2017).	Chemical, biochemical, and engineering thermodynamics. John Wiley & Sons.
4	Elliott, J. R., Lira, C. T., & Lira, C. T. (2012).	Introductory chemical engineering thermodynamics (Vol. 668). Upper Saddle River, NJ: Prentice Hall.



DETAILED SYLLABUS: B. TECH. (FOOD ENGG. & TECHNOLOGY)

Course Title	FOOD CHEMISTRY													
Course code	PCFET-2494													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester IV									
	3	0	0	3										
Pre-requisites (if any)	Desirable– Knowledge of chemical constituents of foods and chemistry													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • knowledge about the chemistry underlying the properties and reactions of various food components • knowledge about the important chemical/biochemical reactions amongst various food components and how they influence food quality • knowledge about the physical, chemical, thermal properties of various food constituents 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand the importance of water for stability & quality of foods												Understanding	
CO2	Understand reaction chemistry of carbohydrates, their composition and nutritional properties												Understanding	
CO3	Explain properties and reactions of lipids and proteins during storage and processing of food and their influence on the quality and properties of the food												Understanding	
CO4	Explain overview of the main classes of compounds influencing color and flavor of food and have knowledge on important sources of vitamins and minerals in food												Understanding	
CO5	Demonstrate processes taking place during storage of muscle tissue and their effect on quality aspects of food												Applying	
CO-PO Mapping														
1:Slight(Low) 2:Moderate(Medium) 3:Substantial(High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	1	-	2	-	-	-	-	-	1	3	3
CO2	3	2	3	2	-	2	-	-	-	-	-	1	3	3
CO3	3	2	3	2	-	2	-	-	-	-	-	1	3	3
CO4	3	2	3	2	-	2	-	-	-	-	-	1	3	3
CO5	3	3	3	3	-	2	-	-	-	-	-	1	3	3
Average	3	2	1	2	-	2	-	-	-	-	-	1	3	3



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	(a) Water in Foods: Structure. Properties, Interactions, Water activity, and stability. (b) Carbohydrates: Functions, Reactions and properties of simple and complex carbohydrate, Selection of Natural or Modified carbohydrates for incorporation into processed food.	9	-
II	Lipids: Consistency of commercial fats Lipolysis, Auto oxidation, Thermal Decomposition and effect of ionizing radiation, Refining of oils, Modification of oils and fats, Role of food lipids in flavor, Nutritional aspects of natural and modified fats.	9	-
III	Proteins: Nutritive and supplementary value of food protein, Chemical reactions and interactions of amino acids and proteins, Denaturation and its implications, Functional properties of food proteins, Modification of food proteins in processing and storage and its implications.	9	-
IV	Vitamins, Minerals, Pigments and Flavours: Chemistry and stability of water and fat soluble vitamins, Chemical properties of minerals and their bioavailability, Enrichment and fortification. Natural pigments in foods and their retention in processed foods. Flavoring constituents in foods, Development of process and reaction flavour volatiles.	9	-
V	Characteristics of muscle tissues, Milk, Egg and edible plant tissues, Integrated approach to food chemistry.	9	-
	Total	45	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References

S.N.	AUTHOR	TITLE
1	O. R. Fennema	Food Chemistry
2	N. Shakuntala Manay & M. Shadaksharaswamy	Food Facts and Principles
3	C. Gopalan	Nutritive value of Indian Foods
4	L.H. Meyer	Food Chemistry
5	Lehninger	Principles of Biochemistry
6	S.N. Mahindru	Food Additives
7	N.N. Potter	Food Science
8	Varelis, P., Melton, L., & Shahidi, F. (2018). Encyclopedia of food chemistry. Elsevier.	



DETAILED SYLLABUS: B. TECH. (FOOD ENGG. & TECHNOLOGY)

Course Title	FOOD ADDITIVES													
Course code	PCFET-2495													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester IV									
	3	0	0	3										
Pre-requisites (if any)	None. Desirable – Knowledge of basic food processing methods/operations													
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • The knowledge about the role of food additives in food quality and safety. • The knowledge of additives and ingredients that are relevant to food industry for improving shelf life, processing and sensory attributes. 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand the basic definitions, function and applications of food additives such as acids, base, buffer, salt, chelating agents, masticatory and different sweeteners												Applying	
CO2	Understand the applications of food additives (emulsifier & stabilizer, anti-caking, thickeners, firming, flour bleaching and bread improvers) for maintaining and enhancing the characteristic and structure in bakery product.												Applying	
CO3	Understand the application of anti-microbial agent, class I & II preservatives for improving the stability and shelf life of food.												Applying	
CO4	Understand the application of colorants, flavoring agents and related substances, Clarifying agents. Gases and Propellants. Tracers and other additives												Applying	
CO5	Understand the relevant laws and regulations associated with food additives												Understanding	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	3	-	-	-	-	-	-	3	3
CO2	3	2	2	2	-	3	-	-	-	-	-	-	3	3
CO3	3	2	2	2	-	3	-	-	-	-	-	-	3	3
CO4	3	2	1	2	-	3	-	-	-	-	-	-	3	3
CO5	1	1	1	1	-	3	1	1	-	-	-	-	3	3
Average	2.6	1.8	1.4	1.8	-	3	0.2	0.2	-	-	-	-	3	3



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Definitions, uses and functions of: Acid, Base, Buffer systems, Salts and chelating/sequestering agents, Masticatory substances. Low calorie and nonnutritive sweeteners, Polyols	12	-
II	Antioxidants, Emulsifying and stabilizing agents, Anti-caking agents, thickeners, Firming agents. Flour bleaching agents and Bread improvers.	12	-
III	Anti-microbial agents / Class I and Class II preservatives as per PFA Act.	9	-
IV	Colorants, Flavoring agents and related substances, Clarifying agents. Gases and Propellants. Tracers and other additives. Scope and application standards of food additives. Relevant laws and regulations.	12	-
	Total	45	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

S.N.	AUTHOR	TITLE
1	Michael and Irene Ash	Handbook of Food Additives
2	George A Burdock	Food and color additives
3	Victor O. Sheftel	Indirect food additive and polymer
4	S N Mahindru	Food additive
5	D. Baines, R Seal	Natural food additives, ingredient and Flavorings
6	Saltmarsh, M., & Saltmarsh, M. (Eds.). (2013). Essential guide to food additives. Royal Society of Chemistry.	
7	Msagati, T. A. (2012). The chemistry of food additives and preservatives. John Wiley & Sons.	



Course Title	FOOD ENGINEERING- I													
Course code	PCFET-2496													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester IV									
	3	0	0	3										
Pre-requisites (if any)	Basic knowledge of physics and mathematics													
Course Objectives	<p>This course is aimed to impart</p> <ul style="list-style-type: none"> • The knowledge of fluid flow in food process engineering. • Core knowledge of material handling equipment and separation processes 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Explain the principles of flow of fluids and its properties.											Understanding		
CO2	Understand various food material handling equipment and their applications											Applying		
CO3	Understand types, designs and working principle of grading, sorting, cleaning and size reduction equipment and their applications in food processing.											Applying		
CO4	Illustrate the mixing terminology (agitating, kneading, blending, and homogenizing) and application of mixing equipment.											Applying		
CO5	Illustrate the filtration terminology and application of filtration equipment in food processing.											Applying		
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs											PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO1	PSO2
CO1	3	2	3	1	2	3	-	-	-	-	2	-	3	3
CO2	2	2	3	2	1	3	-	-	-	-	2	-	3	3
CO3	3	3	3	2	2	3	-	-	-	-	2	1	3	3
CO4	2	3	3	2	1	2	-	-	-	-	3	2	3	3
CO5	3	3	2	2	2	2	-	-	-	-	3	1	3	3
Average	2.6	2.6	2.8	1.8	1.6	2.6	-	-	-	-	2.4	0.8	3	3



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Properties of fluids, Flow rate and pressure drop relationships for Newtonian fluids flowing through pipe, Characteristics of Non- Newtonian fluids - generalized viscosity coefficient and Reynolds number, Flow of compressible fluid, Flow measurement, Pumps and compressors; Friction losses in pipe line	9	-
II	Material handling - Theory, classification of various material handling equipment's conveyors, elevators, trucks, cranes and hoists. pneumatic conveying, Conveyance of food grain and powder in screw and vibratory conveyors. Design of conveyor belts. Methods of dust collection, Cyclones, Electrostatic precipitators.	9	-
III	Cleaning - Types, aims of cleaning, methods of cleaning- dry, wet and combination methods. Dry cleaning methods: screening, aspiration, magnetic cleaning and abrasive cleaning. Wet cleaning methods: soaking, spray washing, flotation washing and ultrasonic washing. Sorting and Grading - Advantages of sorting and grading, grading factors, methods of sorting and grading. Size Reduction: Reasons/benefits of size reduction, forces used in size reduction, criteria of size reduction, equipment selection, mode of operation of size reduction equipment. Size reduction of solid foods, fibrous foods and liquid foods. Particle size analysis and energy requirement in size reduction of solid foods; Homogenization of milk fat in high pressure homogenizer; milling of grains and recovery of various products	9	-
IV	Mixing - Mixing terminology (agitating, kneading, blending, and homogenizing). Mixing equipments - mixers for liquids of low or moderate viscosity (Paddle agitators, turbine agitators and propeller agitators), mixers for high viscosity pastes (Pan mixer, horizontal mixer and dough mixer), mixers for dry solids (tumbler mixer and vertical screw mixer), effects of mixing on foods. Power consumption and efficiencies	9	-
V	Filtration- Filtration terminology (feed slurry, filtrate, filter medium, filter cake and filter), filtration methods/equipments - pressure filtration, vacuum filtration, and centrifugal filtration. Expression - Factors affecting efficiency of expression, methods of expressing the liquid from solid-liquid food system - hydraulic pressing, roller pressing and screw pressing. Centrifugation - sedimentation and sedimentation theory; solid-liquid separation, different types of centrifuges. Fluidization, flow through packed beds/ flow distribution, pressure drop calculation	9	-
	Total	45	-
L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes			



Suggested Books/References		
S.N.	AUTHOR	TITLE
1	J.G. Brennan	Food Engineering Operations
2	R. Paul Singh	Introduction of Food Engineering
3	Heldman, D. R., Lund, D. B., & Sabliov, C. (Eds.). (2018). Handbook of food engineering. CRC press.	
4	Lozano, J. E., Anon, C., Barbosa-Canovas, G. V., & Parada-Arias, E. (2000). Trends in food engineering. CRC Press.	
5	Toledo, R. T., Singh, R. K., & Kong, F. (2007). Fundamentals of food process engineering (Vol. 297). New York: Springer.	
6	Hui, Y. H. (Ed.). (2006). Handbook of food science, technology, and engineering (Vol. 149). CRC press.	
7	Chakraverty, A., & Singh, R. P. (2014). Postharvest technology and food process engineering. CRC Press.	
8	Yanniotis, S., Taoukis, P., Stoforos, N. G., & Karathanos, V. T. (Eds.). (2013). Advances in food process engineering research and applications. Springer US.	



Course Title	NUMERICAL METHODS AND COMPUTER PROGRAMMING LAB.													
Course code	ESMA-20497													
Category	Engineering Science Course													
Scheme and Credits	L	T	P	C	Semester IV									
	0	0	2	1										
Pre-requisites (if any)	Basic knowledge of C/C++													
Course Objectives	<p>Objective of this course is to impart</p> <ul style="list-style-type: none"> The knowledge of C/C++ for developing numerical method programs The knowledge to understand, design and develop various numerical method problems used in Engineering 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Apply the knowledge of mathematics to solve nonlinear algebraic equation											Applying		
CO2	Apply the knowledge of mathematics to solve linear simultaneous equations											Applying		
CO3	Design solution for interpolation formulae											Applying		
CO4	Identify, formulate and implement numerical differentiation and integration											Applying		
CO5	Apply the knowledge of mathematics to solve ordinary differential equations											Applying		
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	-	-	-	-	-	-	-	2	-	2	2
CO2	3	2	3	-	-	-	-	-	-	-	2	-	3	2
CO3	3	2	3	-	-	-	-	-	-	-	2	-	2	2
CO4	3	3	3	-	-	-	-	-	-	-	2	-	3	2
CO5	3	2	3	-	-	-	-	-	-	-	2	-	2	2
Average	3	2.2	3	-	-	-	-	-	-	-	2	-	2.4	2.0



List of Practical	
S.N.	Practical
1	Solution of a single nonlinear algebraic equation by Newton Raphson method.
2	Solution of a single nonlinear algebraic equation by Regula Falsi method.
3	Solution of two simultaneous nonlinear algebraic equation by Newton Raphson method.
4	Solution of linear simultaneous equations by Gauss Jordan method.
5	Solution of linear simultaneous equations by Gauss Elimination method.
6	Solution of linear simultaneous equations by Gauss Seidel and Successive over Relaxation method.
7	Implementation of interpolation formulae.
8	Implementation of least squares approximation of a function.
9	Implementation of numerical differentiation formulae.
10	Implementation of numerical integration formulae.
11	Solutions of single first order ordinary differential equation by 4 th order Runge Kutta method.
12	Solutions of second order ordinary differential equation by 4 th order Runge Kutta method.
13	Solutions of simultaneous first order ordinary differential equation by 4 th order Runge Kutta method.
14	Solution of boundary value problems by finite difference techniques.

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Reference Books and Suggested Readings:

S.N.	
1	Chapra, S. C., & Canale, R. P. (2011). Numerical methods for engineers (Vol. 1221). New York: Mcgraw-hill.
2	Epperson, J. F. (2021). An introduction to numerical methods and analysis. John Wiley & Sons.
3	Dahlquist, G., & Björck, Å. (2003). Numerical methods. Courier Corporation.



DETAILED SYLLABUS: B. TECH. (FOOD ENGG. & TECHNOLOGY)

Course Title	FOOD CHEMISTRY LAB													
Course code	PCFET-20498													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester IV									
	0	0	6	3										
Pre-requisites (if any)	Basic knowledge of nutrition, nutrients and food constituents Desirable- Knowledge of basic chemistry and mathematics													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • knowledge about the chemistry underlying the properties and reactions of various food components • knowledge about the important chemical/biochemical reactions amongst various food components and how they influence food quality • knowledge about the physical, chemical, thermal properties of various food constituents 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Demonstrate various chemical methods for the detection and estimation of chemical constituents in food												Applying	
CO2	Demonstrate the protocols of chemical properties of individual components in foods												Applying	
CO3	Demonstrate the biochemical analysis in terms of estimation of proximate analysis of foods												Analyzing	
CO4	Demonstrate the biochemical analysis in terms of estimation of nutritional value of foods												Applying	
CO5	Design, carry out, record and analyze the results of chemical experiments precisely												Analyzing	
CO-PO Mapping														
1:Slight(Low) 2:Moderate(Medium) 3:Substantial(High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	3	-	-	-	-	-	2	3	3
CO2	3	3	2	2	1	3	-	-	-	-	-	2	3	3
CO3	3	3	2	2	1	3	-	-	-	-	-	2	3	3
CO4	3	3	2	3	2	3	-	-	-	-	-	2	3	3
CO5	3	3	3	3	2	3	-	-	-	-	2	2	3	3
Average	3	3	2.5	2.5	1.4	3	-	-	-	-	-	2	3	3



List of Practical	
S.N.	Practical
1	Analysis of water for potable and food purposes
2	Moisture content in foods in relation to their stability
3	Non-enzymatic browning reactions and its determinations
4	Determination of rate/ extent of hydrolysis of sucrose/starch
5	Determination of free fatty acid content in fats and oils
6	Detection and estimation of oxidative rancidity in fats/oils
7	Determination of heat stability of vitamin C
8	Study of some reactions of proteins
9	Study of some processing changes in proteins
10	Study of some functional properties of proteins
11	Detection / Estimation of some additives in foods
12	Detection/Estimation of adulterants in some foods
L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes	
Reference Books and Suggested Readings:	
S.N.	
1	Weaver, C.M, and J.R. Daniel. "The Food Chemistry Laboratory – A Manual for Experimental Foods, Dietetics and Food Scientists." 2nd Edition, CRC Press, 2005
2	ISI hand book of food analysis
3	Hand book of analysis and quality control for fruit and vegetable products, by S. Ranganna, II Ed., Tata McGraw Hill Publishing Co. New Delhi.
4	Official Method of analysis of AOAC



DETAILED SYLLABUS: B. TECH. (FOOD ENGG. & TECHNOLOGY)

Course Title	FOOD ENGINEERING-I LAB													
Course code	PCFET-20499													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester IV									
	0	0	2	1										
Pre-requisites (if any)	Knowledge about the basic food engineering operations used in food industry.													
Course Objectives	<p>Objective of this course is to impart knowledge about the</p> <ul style="list-style-type: none"> The knowledge about engineering principles and their practical applications in various food processing operations Practical knowledge about material and energy balance, separation, filtration, size reduction and mixing operations . 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Solve the problem related to material and heat balance.												Applying	
CO2	Apply various techniques for sorting and grading of foods.												Applying	
CO3	Apply techniques for solid and liquid separation.												Applying	
CO4	Experiment to determine the particle size analysis for mean particle diameter.												Applying	
CO5	Determine the power consumption for mixing of liquids using different impellers.												Applying	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	2	2	-	-	-	-	2	1	2	2
CO2	3	2	2	-	1	2	-	-	-	-	2	1	3	2
CO3	3	2	2	2	2	3	-	-	-	-	2	-	2	2
CO4	3	3	2	-	3	3	-	-	-	-	3	2	3	2
CO5	3	2	2	1	2	3	-	-	-	-	2	-	2	2
Average	2.8	2.2	1.6	0.6	2.0	2.6	-	-	-	-	2.2	0.8	2.4	2.0



List of Practical	
S.N.	Practical
1	Problems on material balance
2	Problems on heat balance
3	Sorting and grading of foods
4	Particle size analysis for mean particle diameter
5	Study of solid liquid separation
6	Energy requirement for size reduction using different mills.
7	Homogenization
8	Mixing indices for mixing of solids
9	Power consumption for mixing of liquids using different impellers.
10	Solid/Liquid separation by centrifugation/filtration
11	Micro/ultra-filtration
12	Visit to related food industry
L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes	
Reference Books and Suggested Readings:	
S.N.	
1	Laboratory Manual



Course Title	INDUSTRIAL ECONOMICS AND PRINCIPLES OF MANAGEMENT													
Course code	HSMHU-3481													
Category	Humanities, Social Sciences including Management													
Scheme and Credits	L	T	P	C	Semester V									
	2	0	0	2										
Pre-requisites (if any)	None. Desirable –													
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • The knowledge about the concept of industrial economics. • Basic knowledge of management and organization structure. 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand the concept and importance of industrial economics, role of macro & micro economics, management principles and money & banking system briefly												Understanding	
CO2	Demonstrate the roles, skills and functions of management												Applying	
CO3	Demonstrate the ability of directing, leadership, learning and communicating effectively												Applying	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	1	2	-	2	2	2	1	3	1	3	3	1	1
CO2	-	1	1	-	-	-	1	2	3	2	3	3	3	2
CO3	-	1	2	-	-	2	-	1	3	3	3	3	3	2
Average	-	1.0	1.7	-	0.7	1.3	1.0	1.3	3.0	2.0	3.0	3.0	2.3	1.7



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Introduction: Nature and Significance of economics. Meaning of Science, Engineering and Technology and their relationship with economic development.	6	-
II	Basic Concept: The concept of demand and supply. Elasticity of Demand and Supply. Indifference curve analysis, Price effect, Income effect and Substitution.	6	-
III	Money and Banking: Functions of Money. Value of Money, Inflation and Measures to control it. Brief idea of functions of banking system, viz., Commercial and Central Banking.	6	-
IV	Management: Introduction: Definition, Nature and Significance of Management. Evaluation of Management thought Contribution of Max Weber, Taylor and Fay	6	-
V	Human Behaviour: Factors of Individual Behaviour, Perception, Learning and Personality development, Interpersonal Relationship and Group Behaviour.	6	-
	Total	30	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

S.N.	AUTHOR	TITLE
1	Luthers Fred	Organizational Behaviour
2	Prasad L.M	Principles of Management
3	Dewett, K.K	Modern Economic Theory
4	S.K.Sharma, Savita Sharma	Industrial Economics and Principles of Management



Course Title	FOOD BIOCHEMISTRY & BIOTECHNOLOGY													
Course code	PCFET-3482													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester V									
	3	0	0	3										
Pre-requisites (if any)	None. Desirable – Knowledge of basic biology and microbiology													
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • The knowledge about enzymes, its classification and its kinetics • The knowledge about various metabolic pathways taking place in our body 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand the basic concepts about enzymes												Understanding	
CO2	Understand various metabolic pathways and digestion, absorption and Assimilation of nutrients in human beings												Understanding	
CO3	Evaluate the quality alterations in food due to post-mortem and post-harvest changes												Evaluating	
CO4	Use various enzymes in food processing and modification												Applying	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	2	-	-	-	-	-	-	-	-	3	3
CO2	-	2	3	2	-	3	-	-	-	-	-	-	3	3
CO3	2	2	3	3	-	3	-	-	-	-	-	2	3	3
CO4	1	3	3	3	-	3	-	-	-	-	-	2	3	3
Average	1.3	2.3	3.0	2.5	-	2.3	-	-	-	-	-	1.0	3.0	3.0



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Nomenclature, Classification and specificity of enzymes and cofactors, Enzyme Kinetics: Factors affecting the rate of enzyme catalyzed reaction, regulation and control of enzyme action.	9	-
II	Metabolic Pathways: Carbohydrates, proteins and fats; catabolism and anabolism.	9	-
III	Digestion absorption, Assimilation and Transport of nutrients in human beings.	9	-
IV	Post-harvest and Postmortem biochemical changes in foods: Changes in composition, color, texture, flavor and its implications on quality of foods	9	-
V	Application of enzymes in food processing: Endogenous enzymes and their role in modification of foods, enzyme added to foods during processing sources, conversions and specific applications.	9	-
	Total	45	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

S.N.	
1	Fennema, O. R., Damodaran, S., & Parkin, K. L. (2017). Introduction to food chemistry. In Fennema's food chemistry (pp. 1-16). CRC Press.
2	Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2008). Lehninger principles of biochemistry. Macmillan.
3	Wilson, J. L. (1988). Biochemistry; (Stryer, Lubert).
4	Eskin, N. M., & Shahidi, F. (2012). Biochemistry of foods
5	Ranjha, M. M. A. N., Shafique, B., Khalid, W., Nadeem, H. R., Mueen-ud-Din, G., & Khalid, M. Z. (2022). Applications of Biotechnology in Food and Agriculture: a Mini-Review. Proceedings of the National Academy of Sciences, India Section B: Biological Sciences, 1-5.
6	Lee, B. H. (2014). Fundamentals of food biotechnology. John Wiley & Sons.



Course Title	FOOD ANALYSIS													
Course code	PCFET-3483													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester V									
	3	0	0	3										
Pre-requisites (if any)	Desirable- Knowledge of chemical constituents of foods Basic knowledge of chemistry and mathematics													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • Knowledge to students on principles and techniques of food analysis by using physical, chemical, biological and instrumental methods • To apply their knowledge and skills acquired to solve real-world problems associated with food analysis 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand the regulations and standards pertaining to Food analysis and concept of sampling											Understanding		
CO2	Apply the methods for compositional analysis of food											Applying		
CO3	Analyzing foods using Spectroscopy instrument											Analyzing		
CO4	Analyzing foods by chromatographic techniques											Analyzing		
CO5	Analyzing foods by using electrophoresis, refractometry, polarimetry and Immunoassay techniques											Analyzing		
CO-PO Mapping														
1:Slight(Low) 2:Moderate(Medium) 3:Substantial(High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	3	1	-	1	-	-	-	1	-	3	1
CO2	2	2	1	1	1	3	1	-	-	-	1	-	3	3
CO3	3	3	3	3	3	1	3	-	-	-	2	-	3	2
CO4	3	3	3	1	3	3	2	-	-	-	2	-	1	2
CO5	1	3	3	2	3	3	1	-	-	-	2	-	3	2
Average	2.2	2.4	2.4	2	2.5	2	1.6	-	-	-	1.6	-	2.6	2



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Introduction, government regulations and recommendations related to food analysis, sampling and sample preparation for analysis, statistical evaluation of analytical data, and official methods of food analysis. Determination of moisture in foods by different methods, ash content of foods, wet, dry ashing, microwave ashing methods, significance of sulphated ash, water soluble ash and acid insoluble ash in foods, titratable acidity in foods, determination of dietary fiber and crude fiber.	9	-
II	Determination of total fat in foods by different methods, analysis of oils and fats for physical and chemical parameters, quality standards, and adulterants, different methods of determination of protein and amino acids in foods, protein separation and characterization, determination of total carbohydrates, starch, disaccharides and simple sugars in foods, analysis of vitamin and pigments.	9	-
III	Basic principles of spectroscopy, ultraviolet, visible and fluorescence spectroscopy, infrared spectroscopy, atomic absorption and emission spectroscopy, mass spectrometry, nuclear magnetic resonance and electron spin resonance.	9	-
IV	Basic principles of chromatography, chromatographic techniques: paper, thin-layer and column chromatography. High performance liquid chromatography (HPLC) and gas chromatography (GC).	9	-
V	Principles and applications of electrophoresis, refractometry and polarimetry in food analysis. Immunoassay techniques and its applications in foods.	9	-
	Total	45	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References

S.N.	Books
1	Nielsen, S. S. (2017). Food analysis laboratory manual. Springer.
2	Pomeranz, Yeshajahu and Clifton E. Meloan "Food Analysis : Theory and Practice", 3rd Edition, Springer, 2000.
3	Jacobs, Morris B. "Chemical Analysis of Food and Food Products". CBS Publishers, 1999.
4	Nollet, Leo M.L. "Handbook of Food Analysis" 2nd edition, Vol. 1-3. Marcel Dekker, 2004.
5	Nollet, Leo M.L. "Food Analysis by HPLC". 2nd Edition. Marcel Dekker, 2000.
6	Hurst, Jeffrey W. "Methods of Analysis for Functional Foods and Nutraceuticals" 2nd Edition, CRC Press, 2008.



DETAILED SYLLABUS: B. TECH. (FOOD ENGG. & TECHNOLOGY)

Course Title	TRADITIONAL AND FERMENTED FOODS													
Course code	PCFET-3484													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester V									
	3	0	0	3										
Pre-requisites (if any)	None. Desirable – Knowledge of basic food microbiology													
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • Understanding about Indian traditional food • Knowledge on processing and principles involved in the fermentation process of food product • Knowledge on industrial fermentation process 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Process Indian traditional sweet, savory and snack food products												Applying	
CO2	Prepare and maintain microbial culture for fermentation												Applying	
CO3	Apply technology to produce and preserve various fermented food products like dairy products, meat and fish product, alcoholic beverages, fermented vegetables etc.												Applying	
CO4	Apply technology for production of microbial protein and fat, food enzymes, additives, oriental fermented foods & mushrooms.												Applying	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	1	-	3	-	-	-	-	-	-	2	2
CO2	3	1	3	1	-	-	-	-	-	-	-	-	3	3
CO3	3	2	3	2	-	3	-	-	-	-	-	2	3	3
CO4	3	2	3	2	-	3	-	-	-	-	-	2	3	3
Average	2.8	1.5	2.8	1.5	-	2.3	-	-	-	-	-	1.0	2.8	2.8



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Indian traditional sweet, savory and snack food products: Sweetmeats, Namkins, Papads Idli and Dosa	9	-
II	Preparation and Maintenance of Bacterial, Yeast and Mold cultures for food fermentations. Lactic acid bacteria-activities and health-promoting effects. Mushrooms: Cultivation and preservation.	9	-
III	Fermented Dairy Products: Cheeses, Curd and Yoghurt, Butter milk and the fermented milks. Spoilages and defects of fermented dairy products and their control. Fermented meat and fish products.	9	-
IV	Fermentative Production of Beer, Wines, Cider and Vinegar. Fermented Vegetables (Pickles).	9	-
V	Production of Baker's Yeast, Microbial Proteins and fats, Food enzymes, and Food additives. Oriental fermented foods.	9	-
	Total	45	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

S.N.	
1	Wood, B. J. (2012). Microbiology of fermented foods. Springer Science & Business Media.
2	Stanbury, P. F., Whitaker, A., & Hall, S. J. (2013). Principles of fermentation technology. Elsevier.
3	Hutkins, R. W. (2008). Microbiology and technology of fermented foods. John Wiley & Sons.
4	Frazier, W. C., & Westhoff, D. C. (1967). Food Microbiology Mc Graw-Hill Book Company. Nova York, NY, 252-282.
5	Tamang, J. P., Cotter, P. D., Endo, A., Han, N. S., Kort, R., Liu, S. Q., ... & Hutkins, R. (2020). Fermented foods in a global age: East meets West. Comprehensive Reviews in Food Science and Food Safety, 19(1), 184-217.
6	Ananthanarayan, L., Dubey, K. K., Muley, A. B., & Singhal, R. S. (2019). Indian traditional foods: Preparation, processing and nutrition. In Traditional Foods (pp. 127-199). Springer, Cham.



Course Title	FOOD SAFETY AND FOOD LAWS													
Course code	PCFET-3485													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester V									
	2	0	0	2										
Pre-requisites (if any)	Desirable– Knowledge of chemical constituents of foods and food analysis													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • Basic knowledge about food safety, quality and TQM • The knowledge about the hazards, contaminants and adulterants affecting food quality • The knowledge about Food safety management systems and their implementation in food industry to ensure the quality and safety of the foods. • The knowledge about different national & international food laws and standards and their requirements and importance in controlling the quality 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Explain fundamentals of food safety, food derived hazards, common causes of food borne illness and role of food preservation in food safety												Understanding	
CO2	Explain contamination in food through various modes, food adulteration and naturally occurring toxic constituents in foods												Understanding	
CO3	Apply food safety management systems and programs like HACCP & GMP in food industry												Applying	
CO4	Analyze the safety aspects related to GMFs, irradiated foods etc.												Analyzing	
CO5	Understand about quality management systems to food production processes, food safety regulations and food standards code & laws and their implementation in food systems												Applying	
CO-PO Mapping														
1:Slight(Low) 2:Moderate(Medium) 3:Substantial(High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	-	3	1	-	1	-	-	-	3	2	2	2
CO2	1	2	1	2	2	1	-	2	-	1	2	1	2	2
CO3	3	-	2	2	3	3	1	3	1	2	1	3	3	2
CO4	2	2	2	1	2	1	2	3	1	2	2	3	3	2
CO5	1	-	-	2	-	3	1	1	2	1	2	3	3	3
Average	1.6	1.1	1	2	1.6	1.6	1	1.8	0.8	1.2	2	2.4	2.6	2.1



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	An overview of food safety, Food derived hazards: chemical, microbiological and physical hazards. Factors that contribute to food borne illness. The role of food preservation in food safety.	6	-
II	Contamination in Food: Physical and chemical. Natural food contaminants and contaminants from packaging materials. Contaminants formed during processing – nitrosamines, acrylamide etc. Food Adulteration: effects and detection. Naturally occurring toxic constituents in foods.	6	-
III	Systems and programs for food safety: Good Manufacturing Practices (GMP), Good Agricultural Practices (GAP), Hazard Analysis and Critical Control Point (HACCP).	6	-
IV	Issues in food safety: Genetically modified foods, Food irradiation, Pesticide residues in foods, drinking water quality.	6	-
V	Food Acts and Legislations: Concepts and trends in food legislations, legislations governing food industry in India; Food Safety and Standards Act 2006. AgMark, and BIS Standards. International and federal standards: Codex alimentarius, ISO series, food safety in USA. Legislation in Europe: Directives of the official journal of the EU, council regulations, food legislation in UK.	6	-
	Total	30	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References

S.N.	
1	Kirk, S., & Sawyer, R. (1991). Pearson's composition and analysis of foods (No. Ed. 9). Longman Group Ltd..
2	Ranganna, S. (1986). Handbook of analysis and quality control for fruit and vegetable products. Tata McGraw-Hill Education.
3	Meloan, C. E., & Pomeranz, Y. (1972). Food analysis laboratory experiments.
4	I.S.A HACCP & ISO-22000. ISO9000-01
5	Fung, F., Wang, H. S., & Menon, S. (2018). Food safety in the 21st century. Biomedical journal, 41(2), 88-95.
6	Mahajan, R., Garg, S., & Sharma, P. B. (2014). Global food safety: determinants are Codex standards and WTO's SPS food safety regulations. Journal of Advances in Management Research.



DETAILED SYLLABUS: B. TECH. (FOOD ENGG. & TECHNOLOGY)

Course Title	FOOD ENGINEERING-II													
Course code	PCFET-3486													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester V									
	3	0	0	3										
Pre-requisites (if any)	Knowledge of basic physics													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • The knowledge about application of heat transfer/thermal processing in foods • The knowledge about application of drying and dehydration in food processing 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand the fundamentals of transport phenomena and basic modes of heat transfer												Understanding	
CO2	Apply the knowledge of conduction, convection and radiation modes of heat transfer in food processing operations												Applying	
CO3	Use the technology of Pasteurization and Sterilization in food processing												Applying	
CO4	Apply the technologies of freezing, concentration, evaporation, drying/dehydration and their application in food processing operations												Applying	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	-	-	-	-	-	-	-	-	3	3
CO2	3	3	3	3	2	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	2	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	2	-	-	-	-	-	-	-	3	3
Average	3	2.8	3	2.8	1.6	-	-	-	-	-	-	-	3	3



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Heat transfer: Conduction: steady state heat conduction equation, heat conduction in slabs, cylinders and Spheres, Heat generation inside solid, Unsteady state heat conduction, Biot number, Fourier number and Heisler Charts, Extended surfaces, effectiveness of fins, thermal insulation and their selection, Optimum and economic thickness of insulation, Principles of heat flow in fluids, Individual and over all heat transfer coefficients.	9	-
II	Convection: Free and forced convection, dimensionless numbers in heat transfer, expressions for calculating heat transfer coefficients, Laminar and turbulent heat transfer inside and outside tubes, annuli finned tubes, Natural convection and its applications. Radiation: Kirchoffs Law, Stephdn's Law Heat flux by radiation, Heat exchanger, Classification, applications, mode of operation, Effectiveness, flow arrangement. heating fluids, thermal fluids	9	-
III	Thermal operations: Pasteurization and Sterilization - Basic concept, pasteurization of unpackaged and packaged foods, effects of pasteurization on foods. Energy requirement and rate of operations involved in process time evaluation in batch and continuous sterilization, UHT processing; aseptic packaging; irradiation and microwave processing of foods.	9	-
IV	Freezing: Plank's law and estimation of freezing time of foods; equipment, freeze concentration of liquid food. Rate of freezing. Concentration and Evaporation: Concentration of liquid foods in batch and continuous type evaporators; heat and energy balance in multiple effect evaporators; falling and rising film evaporators; mechanical and thermal vapour recompression systems.	9	-
V	Drying of Foods: various mechanisms of moisture removal in solid and liquid foods during drying; properties of air-water vapour mixture; drying operations based on conduction, convection and radiation heat transfer; different types of dryers.	9	-
	Total	45	-
L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes			
Suggested Books/References:			
1	Toledo, R. T., Singh, R. K., & Kong, F. (2007). <i>Fundamentals of food process engineering</i> (Vol. 297). New York: Springer.		
2	Heldman, D. R., Lund, D. B., & Sabliov, C. (Eds.). (2018). <i>Handbook of food engineering</i> . CRC press.		



Course Title	FOOD BIOCHEMISTRY AND BIOTECHNOLOGY LAB													
Course code	PCFET- 30487													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester V									
	0	0	4	2										
Pre-requisites (if any)	Basic knowledge of biology, food chemistry, biochemistry & biotechnology .													
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • Knowledge of effect of various enzyme activity on food • Knowledge of various application of enzyme in food 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Assess enzyme activity and specific activity												Evaluating	
CO2	Determine the effect of pH, temperature substrate concentration on enzyme activity												Analyzing	
CO3	Apply biochemical test for estimation of enzymatic reaction in a food												Applying	
CO4	Estimate enzyme activity in fruits and vegetables												Evaluating	
CO5	Apply enzymes in various processing in food.												Applying	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	2	2	1	-	-	-	-	-	-	2	2
CO2	3	2	3	3	2	3	-	-	-	-	-	1	3	3
CO3	1	2	2	2	2	2	-	-	-	-	-	2	2	3
CO4	2	2	3	3	3	3	-	-	-	-	-	2	2	3
CO5	1	3	3	3	1	2	-	-	-	-	-	2	3	3
Average	1.8	2	2.6	2.6	2	2.2	-	-	-	-	-	1.4	2.4	2.8



List of Practical	
S.N.	Practical
1	Determination of enzyme activity and specific activity (Enzyme assay)
2	Determination of effect of temperature on enzyme activity
3	Determination of effect of pH on enzyme activity
4	Determination of effect of substrate concentration on enzyme activity and estimation of K_m .
5	Estimation of enzymatic browning in a food
6	Estimation of enhancement in an enzyme activity during ripening of a fruit
7	Estimation of enhancement in an enzyme activity during sprouting of a grain
8	Detection/ estimation of catalase and peroxidase activity in vegetable
	Application of enzymes: Amylase in hydrolysis of starch. Invertase in hydrolysis of sucrose. Protease in hydrolysis of protein Lipase in hydrolysis of fat. Cellulase and hemicellulase for dehulling of a grain, etc.
L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes	
Reference Books and Suggested Readings:	
S.N.	
1	An introduction to practical biochemistry by D.T.Plummer, III Ed. Tata McGraw Hill Publishing Co. New Delhi
2	Principles of Enzymology for Food Science by J.R.Whitaker, Marcel Dekker Inc
3	Methods in Enzymology by S.P.Colwick and N.O. Kaplan, Academic Press



Course Title	FOOD ANALYSIS LAB													
Course code	PCFET-30488													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester V									
	0	0	4	2										
Pre-requisites (if any)	Basic knowledge of nutrition, nutrients and food constituents Desirable– Knowledge of basic chemistry and mathematics													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • The knowledge about carrying out proximate and physic-chemical analysis of different types of raw and processed foods. • The knowledge about analytical techniques related to food analysis • The knowledge of handling advance food analysis equipments 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Prepare the samples of different kinds of foods for subsequent analysis											Applying		
CO2	Estimate protein, fats, peroxide and iodine value, applying various analytical techniques											Evaluating		
CO3	Analyze the quantity of specific minerals present in foods by testing methodology											Analyzing		
CO4	Determine specific colouring matters and added preservatives in foods											Analyzing		
CO5	Analyze food adulterants in commercial market products											Analyzing		
CO-PO Mapping														
1:Slight(Low) 2:Moderate(Medium) 3:Substantial(High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	3	1	2	-	2	-	-	3	2	-	3	3
CO2	3	2	3	3	3	3	3	-	-	3	2	-	3	3
CO3	3	2	3	3	3	3	1	-	-	3	2	-	3	3
CO4	3	2	3	3	3	3	2	-	-	3	2	-	3	3
CO5	3	3	3	3	3	3	1	-	-	3	2	-	3	3
Average	2.8	1.8	3.0	2.6	2.8	2.4	1.8	-	-	3.0	2.0	-	3.0	3.0



List of Practical	
S.N.	Practical
1	Determination of specific mineral contents in foods such as Calcium, Iron, Phosphorus, Chloride etc.
2	Determination of specific vitamin content of food such as ascorbic acid, carotenes etc.
3	Determination of specific natural and/ or added colouring matters in foods.
4	Determination of specific added food preservatives in foods.
5	Chromatographic separation and identification of sugars and amino acids.
6	Experiment using principles of colorimetry and spectrophotometry.
7	Analysis of foods for pesticides and drug residues.
8	Test for Adulterants
L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes	
Reference Books and Suggested Readings:	
S.N.	Details
1	Food Analysis by S. Suzanne Nielsen
2	Nollet, Leo M.L. "Handbook of Food Analysis" 2nd edition, Vol. 1-3. Marcel Dekker, 2004.
3	Nollet, Leo M.L. "Food Analysis by HPLC". 2nd Edition. Marcel Dekker, 2000.
4	Hurst, Jeffrey W. "Methods of Analysis for Functional Foods and Nutraceuticals" 2nd Edition, CRC Press, 2008.



Course Title	FOOD ENGINEERING-II LAB													
Course code	PCFET-34089													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester V									
	0	0	2	1										
Pre-requisites (if any)	Basic knowledge of heat transfer operations													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • The practical knowledge about basic modes of heat transfer in foods. • Practical skills to understand, analyze and solve problems related to various food processing operations. 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Interpret and analyze modes of heat transfer in foods.												Analyzing	
CO2	Interpret and analyze various operations involving heat transfer in food industry like freezing, moisture removal, drying, evaporation and concentration etc.												Analyzing	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	2	2	-	-	-	-	-	-	3	3
CO2	3	3	2	2	2	3	-	-	-	-	-	-	3	3
Average	3.0	2.5	2.0	1.5	2.0	2.5	-	-	-	-	-	-	3.0	3.0



List of Practical	
S.N.	Practical
1	Heating and cooling of food product.
2	Freezing of food product
3	Drying of fruits and vegetables
4	Concentration of liquid foods
5	Problems of multi effect evaporators
6	Visit to related food industry
L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes	
Reference Books and Suggested Readings:	
S.N.	
1	Laboratory Manual
2	Barbosa-Cánovas, G. V., Ma, L., & Barletta, B. J. (2017). Food engineering laboratory manual. CRC Press.



Course Title	DAIRY TECHNOLOGY													
Course code	PCFET-3494													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester VI									
	2	0	0	2										
Pre-requisites (if any)	Desirable– Knowledge of chemical constituents of foods and chemistry													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • Milk composition and its various properties and different adulterant • Working of equipment and process technology for various milk products • Process technology for milk powder and fermented milk products • Cleaning and sanitation of dairy industry & utilization of milk by-products 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand about milk composition and physicochemical aspects along with procurement & transportation and national & international standards												Understanding	
CO2	Understand the fundamental aspects of testing of milk quality and application methodology of pasteurization, standardization, toning, homogenization and cream separation from milk												Understanding	
CO3	Understand basics of cleaning procedures, methods of manufacture, packaging, storage & defects in Butter, Ghee and Ice cream												Understanding	
CO4	Understand the application and technology applied for the development of evaporated and condensed milk and various dairy products based on coagulation, concentration, reconstitution and drying												Applying	
CO5	Explain about byproducts of dairy industry and their effective application												Applying	
CO-PO Mapping														
1:Slight(Low) 2:Moderate(Medium) 3:Substantial(High) “-”: No Correlation														
COs	POs												PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO1	PSO2
CO1	2	1	-	-	1	1	-	-	-	-	1	-	2	1
CO2	3	1	2	3	1	3	-	-	-	-	1	-	3	2
CO3	3	1	-	-	2	3	-	-	-	-	2	-	3	3
CO4	3	2	2	2	2	3	-	-	-	-	2	-	3	3
CO5	3	2	2	2	2	3	-	-	-	-	2	-	3	3
Average	2.8	1.4	1.2	1.4	1.4	2.6	-	-	-	-	1.6	-	2.8	2.4



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Fluid Milk: Composition of milk and factor affecting it. Physico-chemical characteristics of milk and milk constituents. Production and collection, cooling and transportation of milk. Packaging storage and distribution of pasteurized milk	6	-
II	Whole, Standardized, Toned, Double toned and skim milk. Test for milk quality and Adulteration. UHT processed milk, flavoured, Sterilized milk. Cleaning and sanitization of dairy equipment. Definition, Classification, Composition and physico-chemical properties of cream. Production processes and quality control	6	-
III	Butter: Definition, Classification, Composition and methods of manufacture, Packaging and storage. Butter oil/Ghee. Ice cream: Definition, Classification and Composition, Constituents and their role. Preparation of mixes and freezing of Ice cream, Overrun, Judging, Grading, and defects of Ice cream.	6	-
IV	Evaporated and Condensed milk: Method of manufacture, Packaging and storage. Defects, Causes, and prevention. Roller and Spray Drying of milk solids. Instantization. Flow ability, Dustiness, Reconstituability, Dispersibility, Wet ability, Sink ability and appearance of milk powders.	6	-
V	Byproducts of Dairy Industry and their effective utilization. Manufacture of casein, Whey protein, Lactose from milk and their use in formulated foods. Quality Control tests in Dairy industry	6	-
	Total	30	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books

S.N.	AUTHOR	TITLE
1	Sukumar Dey	Outlines of Dairy Technology
2	R Robinson	Advances in Milk Processing
3	N.N. Potter	Food Science
4	O. R. Fennema	Food Chemistry



Course Title	FLAVOR TECHNOLOGY													
Course code	PCFT- 3487													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester- VI									
	2	0	0	2										
Pre-requisites (if any)	None Desirable – Knowledge of food additives													
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • Knowledge about food flavoring agents • Knowledge of flavor technology in formulating flavor profile • Knowledge about analysis of flavor 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand flavor and it's principle chemical constituent												Understanding	
CO2	Apply the knowledge gained to determine flavors in beverages and the factors affecting the flavor												Applying	
CO3	Understand the chemistry of natural and artificial source of flavor												Understanding	
CO4	Understand the effects of processing, storage, transportation and environmental conditions on flavor components												Understanding	
CO5	Apply the knowledge gained in recent developments in flavour research, processing and technology												Applying	
CO-PO Mapping														
1:Slight (Low) 2:Moderate (Medium) 3:Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	1	-	-	-	-	-	-	1	2	3
CO2	3	2	2	2	3	2	-	-	-	-	-	2	3	3
CO3	2	3	-	2	2	-	-	-	-	-	-	1	3	3
CO4	3	3	1	3	2	-	-	-	-	-	-	1	3	2
CO5	3	2	3	3	3	2	-	-	-	-	-	2	3	3
Average	2.8	2.2	1.4	2.2	2.2	0.8	-	-	-	-	-	1.4	2.8	2.8



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Definition and description of flavour, flavour profile and its principal chemical constituents. Sensation of flavour vs taste odor/smell and mouth feel influence of chemical constituents on flavour and their interaction with flavour characteristics.	6	-
II	Factors that affect the flavour and control of flavour in processed foods. Measurement of flavour, particularly for wine, tea, coffee, species and condiments.	6	-
III	Flavour intensifiers and their effects. Chemistry and technology (commercial preparations) of various flavour intensifiers Natural and synthetic flavouring substances and their chemical characteristics. Flavour components/constituents of fruit and vegetables, coffee, tea and cocoa bean, spices and condiments	6	-
IV	Changes in flavouring components and characteristics during cooking/processing of various foods. Effects of storage, processing, transportation and environmental conditions on flavour components/constituents.	6	-
V	Production and Processing (industrial/commercial) technologies/methods of flavouring compounds of plant foods and their utilization and applications. Recent developments in flavour research, processing and technology	6	-
	Total	30	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books

S.N.	AUTHOR	TITLE
1	Andrew J. Taylor and Robert S.T. Linforth	Food flavor technology
2	Gary Reineccius.	Flavor chemistry and technology



Course Title	FOOD PRESERVATION & PROCESSING PRINCIPLES													
Course code	PCFET-3488													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester- VI									
	3	0	0	3										
Pre-requisites (if any)	None Desirable – Knowledge of basic science													
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • Knowledge of basic preservation methods. • Knowledge of processing for preservation of food from spoilage. • Knowledge about technological aspects of processing and equipment . 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand the basic principles and objective of food preservation												Understanding	
CO2	Understand the principles of preservation by low temperature												Understanding	
CO3	Understand the principle of high temperature preservation and applying thermal processing techniques in food industry for preservation												Applying	
CO4	Understand the preservation method by water removal and its technological aspects												Understanding	
CO5	Understand the principles of preserving food by various non-thermal methods												Understanding	
CO-PO Mapping														
1:Slight(Low) 2:Moderate(Medium) 3:Substantial(High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	1	-	1	1	-	-	-	-	1	2	1
CO2	3	2	-	1	-	1	1	-	-	-	-	1	3	3
CO3	2	2	-	1	-	1	1	-	-	-	-	1	3	3
CO4	3	2	1	1	-	1	-	-	-	-	-	1	3	2
CO5	3	2	1	-	-	-	-	-	-	-	-	1	3	3
Average	2.8	1.8	0.4	0.8	-	0.8	0.6	-	-	-	-	1	2.8	2.4



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Basic considerations: Aims and objectives of preservation & processing of foods, Characteristics of tissues and non-tissues foods, Degree of perishability of unmodified foods, Causes of quality deterioration and spoilage of perishable foods, intermediate moisture foods, wastage of foods.	9	-
II	Preservation of foods by low temperatures: (A) Chilling temperatures: Consideration relating to storage of foods at chilling temperatures, Applications and procedures, Controlled and Modified atmosphere storage of foods, Post storage Handling of foods. (B) Freezing temperatures: Freezing process, Slow and fast freezing of foods and its consequence, other occurrences associated with freezing of foods. Technological aspects of pre freezing, Actual freezing, Frozen storage and thawing of foods.	9	-
II I	Preservation of foods by high temperatures: Basic concepts in thermal destruction of microorganisms D,Z,F values. Heat resistance and thermophilic microorganisms. Cooking, Blanching, Pasteurization and Sterilization of foods. Assessing adequacy of thermal processing of foods, General process of canning of foods, Spoilage in canned foods.	9	-
IV	Preservation by water removal: (a) Principles, Technological aspects and application of evaporative concentration process; Freeze concentration and membrane process for food concentrations. (b) Principles, Technological aspects and application of drying and dehydration of foods, Cabinet, tunnel, belt, bin, drum, spray, vacuum, foam mat, fluidized-bed and freeze drying of foods.	9	-
V	Principles, Technological aspects and application of sugar and salt, Antimicrobial agents, Biological agents, non ionizing and ionizing radiations in preservation of foods. Hurdle technology.	9	-
	Total	45	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books

S.N.	AUTHOR	TITLE
1	B. Sivasankar	Food processing and preservation
2	V.Kyzlink	Principle of Food Preservation
3	G. W Gould	New method of food preservation



Course Title	MACHINE DESIGN													
Course code	ESME-3489													
Category	Engineering Science Course													
Scheme and Credits	L	T	P	C	Semester VI									
	2	1	0	3										
Pre-requisites (if any)	Basic knowledge of manufacturing science													
Course Objectives	This Course objective is to impart <ul style="list-style-type: none"> • The knowledge of machine parts • Understanding of machine design and manufacturing 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand basic methodology of Engineering design and its Consideration												Understanding	
CO2	Estimate the design load under static and dynamic conditions												Evaluating	
CO3	Understand about engineering materials and selection of materials and their classification												Understanding	
CO4	Apply design of power transmission systems like belt, pulley and shafts; riveted and welded joints; keys, couplings, lever and brackets												Applying	
CO5	Apply design of pressure vessels like thick and thin cylinders, pipe and joints and general introduction to AutoCAD												Applying	
CO-PO Mapping														
1:Slight(Low) 2:Moderate(Medium) 3:Substantial(High) “-”: No Correlation														
COs	POs												PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO1	PSO2
CO1	1	1	1	1	1	-	-	-	-	-	-	-	2	1
CO2	1	1	1	1	2	-	-	-	-	-	-	-	1	2
CO3	1	1	2	1	1	-	-	-	-	-	-	-	2	1
CO4	1	1	1	1	1	-	-	-	-	-	-	-	1	1
CO5	1	2	1	1	1	-	-	-	-	-	-	-	1	1
Average	1	1.2	1.2	1	1.2	-	-	-	-	-	-	-	1.4	1.2



Detailed Contents			
Module	Contents	L(Hours)	T(Hours)
I	Introduction to the methodology of Engineering design; Design circle for a product/ system; Important considerations in design; Formulation of design concepts; Miscellaneous considerations like wear, environmental, human and aesthetic aspects; Ergonomics considerations.	6	3
II	Estimation of design load under static and dynamic conditions; Design for safety; Stress concentration and its effect and its prevention; Consideration of creep, fatigue and thermal stresses in design	6	3
III	Material selection in design; Important engineering materials- Their classification and properties; Elementary idea of rubber, plastic ceramics and composites; Advantages over conventional metals and alloys.	6	3
IV	Design of power transmission systems- belt, pulley and shafts; Design of riveted and welded joints; Design of keys, couplings, lever and brackets.	6	3
V	Design of pressure vessels- thick and thin cylinders, pipe and joints; Elementary ideas and importance of computer aided design; Basics of computer graphics - general introduction to AutoCAD.	6	3
	Total	30	15

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books

S.N.	AUTHOR	TITLE
1	R.S Khurmi	Machine multicolor edition
2	Robert L. Northon	Safety Management in Industry



Course Title	CEREALS, PULSES & OIL SEED PRODUCTS													
Course code	PCFT-3490													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester VI									
	3	0	0	3										
Pre-requisites (if any)	None. Desirable – Knowledge of unit operations and food processes, food composition													
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • knowledge about cereal, pulses and grains. • knowledge about various milling, refining technologies. 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand the basic concept about composition and structure of cereals												Understanding	
CO2	Understand various milling of wheat												Understanding	
CO3	Understand dry and wet milling of corn												Understanding	
CO4	Understand milling of legumes												Understanding	
CO5	Understand refining of oil												Understanding	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO 12	PSO1	PS O2
CO1	2	1	1	-	-	-	-	-	-	-	-	-	1	1
CO2	2	1	1	-	-	-	-	-	-	-	-	-	1	1
CO3	1	1	1	-	-	-	-	-	-	-	-	-	2	1
CO4	1	1	1	-	-	-	-	-	-	-	-	-	2	2
CO5	1	1	1	-	-	-	-	-	-	-	-	-	1	1
Average	1	1	1	-	-	-	-	-	-	-	-	-	1.4	1.2



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Composition, Structure and Processing characteristic of Cereal grains, Legumes and oilseeds, Post harvest, Post processing practices for their safe storage. Parboiling and Milling of paddy, Quality characteristics, Curing and aging of rice, Processed rice products.	9	-
II	Wheat and its quality characteristics for milling into flour and semolina, Flour milling, Turbo grinding and air classification, Flour grades and their suitability for baking purposes, Assessment of flour quality and characteristics, Milling of Durum wheat, Macaroni products.	9	-
III	Dry and Wet milling of corn, Starches and its conversion products, Cornflakes Manufacture. Malting of barley	9	-
IV	Milling of legume-pulses by traditional and improved processes. Pearling of Millets.	9	-
V	Processing of oil seeds for direct use and consumption, Oil and protein products. Processing of extracted oil refining, hydrogenation, interesterification. Processing of deoiled cake into protein concentrates and isolates, Textured protein, Functional protein preparations. Peanut butter, Margarine and Spread	9	-
	Total	45	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books:

S.N.	AUTHOR	TITLE
1	C.F.T.R.I. Mysore	Manuals on Rice and its Processing
2	S.A.Matz	Cereal Technology
3	S.A.Matz	Bakery Technology
4	N.N.Potter	Food Science



DETAILED SYLLABUS: B. TECH. (FOOD ENGG. & TECHNOLOGY)

Course Title	FOOD ENGINEERING-III													
Course code	PCFET-3491													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester VI									
	3	0	0	3										
Pre-requisites (if any)	Understand the theory and application of basic food engineering operations.													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • To illustrates various aspects of food engineering • To understand mechanism of mass transfer in food processing • Explain the methods of gas absorption, Distillation, Crystallization and liquid-liquid extraction 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand the mass transfer operation in food materials												Understanding	
CO2	Explain the gas absorption process												Understanding	
CO3	Interpret psychometric charts to determine the properties of air and its applications in drying, humidification and dehumidification process												Applying	
CO4	Solve the Equilibrium for immiscible and partially miscible systems and use of triangular diagrams												Applying	
CO5	Understand the gas solid isotherms for one and more sorbates, Chemisorption, Liquid and solid isotherm and Distillation process.												Understanding	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	2	3	-	-	-	-	2	-	2	3
CO2	3	3	2	1	1	2	-	-	-	-	3	-	2	3
CO3	3	2	2	2	2	3	-	-	-	-	3	2	3	3
CO4	3	2	3	2	2	2	-	-	-	-	2	2	3	3
CO5	3	3	3	2	2	3	-	-	-	-	3	2	3	3
Average	3	2.6	2.4	1.6	1.8	2.6	-	-	-	-	2.6	1.2	2.6	3



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Mass transfer: Diffusion and Mass Transfer in Food Materials: Molecular diffusion in solids and fluids: Fick's 1st law for molecular diffusion, diffusion through varying cross-sectional area, molecular diffusion in liquids, molecular diffusion in biological solutions and gels, molecular diffusion in solids, diffusion coefficients in gas, liquid and solid, numerical solution of steady state diffusion,	9	-
II	Gas Absorption: Equilibrium relationship, mass transfer theories, concept of driving force, individual and overall mass transfer coefficients.	9	-
III	Air properties, dry and wet bulb temperature, Wet and dry bulb hygrometry, Humidity charts, Methods of humidification and dehumidification, Air conditioning	9	-
IV	Liquid- Liquid Extraction: Equilibrium for immiscible and partially miscible systems, Use of triangular diagram. Calculation of number of stages for co-current and counter-current contacting. Crystallization: theory, Nuclei formation, Crystal growth, Theory of crystallization, Batch and continuous crystallization, Fractional crystallization.	9	-
V	Adsorption: Gas solid isotherms for one and more sorbates, Chemisorption, Liquid and solid isotherm, Adsorption unit- Fixed bed equations, Isothermal operation, non-isothermal operation, pressure swing adsorption, Extraction, supercritical extraction. Leaching Distillation, steam distillation, batch distillation, vacuum distillation	9	-
	Total	45	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books

S.N.	AUTHOR	TITLE
1	Chanes J.W., Gustavo (2002)	Engineering and Food for the 21st Century CRC Press.
2	R. Paul Singh	Introduction of Food Engineering
3	Heldman and Singh	Food Process Engineering
4	R.T. Toledo	Fundamentals of food process Engineering



Course Title	FOOD ENGINEERING-III LAB													
Course code	PCFET-30492													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester VI									
	0	0	2	1										
Pre-requisites (if any)														
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> To demonstrate the applications of current analytical and instrumental techniques. To exhibit practical skills in the conduct of laboratory scale experiments related to the food industry. 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Apply the appropriate method and instrument to perform extraction of oil from food samples											Applying		
CO2	Understand the distillation process of distilled water											Understanding		
CO3	Explain the different drying methods and quality of dried foods											Understanding		
CO4	Explain about the basics, working principle, applications of humidification method used in food industry											Understanding		
CO5	Explain about the basics, working principle, applications of dehumidification method used in food industry											Understanding		
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO1	PSO2
CO1	3	1	1	1	2	2	-	-	-	-	1	1	2	3
CO2	2	2	2	-	2	2	-	-	-	-	2	-	3	2
CO3	3	2	3	-	2	3	-	-	-	-	1	1	2	2
CO4	3	2	2	2	2	2	-	-	-	-	2	-	2	2
CO5	3	2	2	1	2	2	-	-	-	-	2	-	2	2
Average	2.8	1.8	2.0	0.8	2.0	2.2	-	-	-	-	1.6	0.4	2.2	2.2



List of Practical	
S.N.	Practical
1	Experiment on extraction of oil from food samples.
2	Experiment on distillation process for production of distilled water.
3	Experiment of absorption of water by dried food product / grain.
4	Experiment on crystallization process in food processes.
5	Experiment on humidification process in food processing
6	Experiment on dehumidification process in food processing
7	Visit to related food industry
L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes	
Reference Books and Suggested Readings:	
S.N.	
1	Laboratory Manual
2	BIS and AOAC Methods of Food analysis
3	FSSAI Manual
4	Theodoros V.C., Food Engineering Handbook (2011) CRC Press
5	Toledo, R. T. (1997). Fundamentals of Food Process Engineering (2 ed.): CBS Publications, New Delhi.



Course Title	FOOD PRESERVATION AND PROCESSING PRINCIPLES LAB													
Course code	PCFET-30493													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester VI									
	0	0	6	3										
Pre-requisites (if any)	knowledge of food preservation system Desirable– Knowledge of basic processing of instruments.													
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • The knowledge about preservation of food by different method • The knowledge about the impact of preservation on nutrition & shelf life of food 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand processing of different kinds of foods and their preservation											Understanding		
CO2	Apply various low and high temperature for preservation											Applying		
CO3	Apply osmotic concentration and dehydration method for preservation of foods by salt and sugar.											Applying		
CO4	Apply the natural preservation methods like sugar, salt and processing of jam, jelly, fruit juices.											Applying		
CO5	Understand the processing of various bakery product like bread, biscuit, buns											Understanding		
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO1	PSO2
CO1	2	1	1	-	2	2	-	-	-	-	-	2	1	2
CO2	3	2	3	2	2	3	-	-	-	-	-	2	3	3
CO3	1	2	2	2	2	3	-	-	-	-	-	1	2	3
CO4	2	2	2	3	3	3	-	-	-	-	-	2	2	3
CO5	1	3	3	3	1	3	-	-	-	-	-	2	3	3
Average	1.8	2	2.2	2	2	2.8	-	-	-	-	-	1.8	2.2	2.8



List of Practical	
S.N.	Practical
1	Extension of shelf life/ preservation of foods by use of low temperature.
2	Processing and preservation of Peas by use of high temperature.
3	Preservation and processing of certain vegetables by drying and dehydration (water removal)
4	Osmotic concentration/dehydration of certain fruits and vegetables using concentrated sugar and salts solutions (reduction in water activity)
5	Preparation of Jam/Jelly and its preservation by sugar.
6	Preparation of tomato puree/ketchup and its preservation by chemical preservatives.
7	Preparation of fruit juice/pulp and its preservation by chemical preservatives/thermal processing.
8	Preparation of cordials and squash as per FPO specification.
9	Preparation of Bread/test baking.
10	Pre-treatment and milling of legume-pulses / dehulling of oil seeds.
11	Preparation of certain baked products – Buns, Biscuits, Cookies, Cakes, Pizza etc.
L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes	
Reference Books and Suggested Readings:	
S.N.	
1	G.Lal, G.S.Siddappa & G.L.Tondan- Preservation of Fruits and Vegetables
2	S.C.Dubey- Basic Baking: Science and Craft
3	E.J.Pyler- Baking Science and Technology



SEMINAR (FET-30495)

L: T: P: C
0: 0: 2: 1

The student will be required to prepare and deliver a seminar as well as submit a written report on the topic assigned to him/her



Course Title	FRUITS, VEGETABLES & PLANTATION PRODUCTS													
Course code	PCFET-4481													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester VII									
	3	0	0	3										
Pre-requisites (if any)	None. Desirable – Basic knowledge of food composition and unit operations													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • The knowledge about processing and preservation of various fruits, vegetables and their products • The knowledge about production process of tea, coffee, chocolate, various dry fruits and their products 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand the basic concepts about structure and composition of fruits and vegetables												Understanding	
CO2	Apply the technology for production of various fruits and vegetable products												Applying	
CO3	Apply the technology for processing of various spices and their products												Applying	
CO4	Apply the technology for production of dry fruits, tea, coffee, cocoa beans and their products												Applying	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	-	-	-	-	-	-	-	-	2	2
CO2	3	2	2	2	-	-	-	-	-	-	-	-	3	3
CO3	3	2	2	2	-	-	-	-	-	-	-	-	3	3
CO4	3	2	2	2	-	-	-	-	-	-	-	-	3	3
Average	2.8	2.0	2.0	1.8	-	-	-	-	-	-	-	-	2.8	2.8



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Structural, Compositional and Nutritional aspects of fruits and vegetables. Physiological development: Growth, Maturation, Ripening and Senescence. Post harvest handling including controlled and modified storage. Techniques of processing and preservation of fruits & vegetables by refrigeration and freezing, canning and bottling, drying & dehydration.	9	-
II	Technology of fruits and vegetable products: Juices and pulps, Concentrates and powders, Squashes and cordials. Beverage: Still and carbonated. Jams, Jellies and Marmalades. Preserves, candies and crystallized fruits. Tomato products: Puree, Paste, Ketchup, Sauce and soup. Chutneys, pickles and other products.	9	-
III	Spices: Composition, Structure and characteristics. Preservation and processing of major and minor spices of India; whole spice, Spice powder, Paste and extracts, Spice oils and oleoresins.	9	-
IV	Composition, Structure and characteristics of cashew nut and other dry fruits. Composition, Production and processing of Tea Leaves: Black tea, Green tea and Oolong tea. Instant tea. Production and processing of coffee cherries by wet and dry methods to obtain coffee beans, grinding, storage and preparation of brew, Soluble /Instant coffee, Use of chicory in coffee, decaffeinated coffee	9	-
V	Production, processing and chemical composition of cocoa beans. Cocoa Processes: Cleaning, roasting, alkalization, cracking and fanning, Nib grinding for cocoa liquor, cocoa butter and cocoa powder. Manufacturing process for chocolate: Ingredients, Mixing, Refining, Conching, Tempering, Moulding etc. to obtain chocolate slabs, chocolate bars. Enrobed and other confectionery products.	9	-
	Total	45	-
L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes			
Suggested Books/References:			
S.N.			
1	Lal, G., Siddappa, G. S., & Tandon, G. L. (1960). Preservation of fruits and vegetables. Indian Council of Agricultural Research.		
2	Srilakshmi, B. (2003). Food science. New Age International.		
3	Minifie, B. (2012). Chocolate, cocoa and confectionery: science and technology. Springer Science & Business Media.		
4	R.H.H. Wills et.al., An introduction to the Post-harvest physiology and handling of fruits and vegetables		
5	Ramaswamy, H. S. (2014). Post-harvest technologies of fruits & vegetables. DEStech Publications, Inc.		
6	Peters, K. (2019). Technology of fruits and vegetable processing.		



Course Title	FOOD QUALITY													
Course code	PCFET - 4482													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester-VII									
	3	0	0	3										
Pre-requisites (if any)	Knowledge of food characteristics.													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • The knowledge of various quality attributes of food. • The knowledge of the roles of various governing bodies for maintaining food quality standards • The knowledge of quality evaluation methods and programs 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand food quality, quality deterioration, quality control programs, quality assurance systems, product quality standards for the food industry												Understanding	
CO2	Evaluate food attributes organoleptically and instrumentally												Evaluating	
CO3	Apply techniques to control deterioration in food quality due to various changes in processing and storage												Applying	
CO4	Implement quality management systems to produce the food products with consistent quality as per standards and specifications												Applying	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	2	1	3	-	-	-	-	-	1	3	3
CO2	3	3	3	3	3	3	-	-	-	-	-	1	3	3
CO3	3	3	3	3	1	3	-	-	-	-	-	1	3	3
CO4	2	1	3	2	3	3	-	-	-	-	-	2	3	3
Average	2.5	2.3	3.0	2.5	2.0	3.0	-	-	-	-	-	1.3	3.0	3.0



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Ways of describing Food Quality, Quality programs and quality systems for the food industry: Quality control programs, Quality assurance systems, Quality management systems, Total quality management (TQM), Quality system standards, ISO quality management system. Statistical quality control (SQC). Quality costs	9	-
II	Application of sensory evaluation in Quality Management of foods. Analysis and Interpretation of sensory scores. Instrumental measurements of sensory attributes of foods: Appearance, color, volume, density and specific gravity, rheological and textural characteristics, Texture profile analysis (TPA). Correlation between instrumental and Sensory analysis of food quality attributes.	9	-
III	Nutritional Quality of foods and its assessments: Food proteins (Digestibility, Biological value, NPU, PER), Modifications of foods constituents due to processing and storage and their nutritional implications.	9	-
IV	Chemical and biochemical reactions that can lead to deterioration of food quality and their effects. Microbiological quality of foods. Application of chemical analysis in quality control.	9	-
V	Food standards and Specifications: Compulsory and voluntary trade and Company standards. Consumer, company, In-process and finished product specifications.	9	-
	Total	45	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References

S.N.	
1	Medina, D. A., & Laine, A. M. (2011). Food Quality: control, analysis and consumer concerns. Nova Science Publishers.
2	Deshpande H.W. Katke S., Food quality assurance and certification
3	Prem Kumar Jaiswal, Food quality and safety
4	Luning, P. A., Marcelis, W. J., & Jongen, W. M. F. (2002). Food quality management. A technico-managerial approach. Wageningen Pers., Wageningen, The Netherlands.
5	Theuvsen, L., Spiller, A., Peupert, M., & Jahn, G. (Eds.). (2007). Quality management in food chains.
6	Lawless, H. T., & Heymann, H. (2010). Sensory evaluation of food: principles and practices (Vol. 2). New York: Springer.
7	Kapiris, K. (Ed.). (2012). Food Quality. BoD–Books on Demand.



DETAILED SYLLABUS: B. TECH. (FOOD ENGG. & TECHNOLOGY)

Course Title	ENTREPRENEURSHIP DEVELOPMENT													
Course code	OEHU-4483													
Category	Open Elective													
Scheme and Credits	L	T	P	C	Semester VII									
	2	0	0	2										
Pre-requisites (if any)	None. Desirable–													
Course Objectives	The objective of this course is to impart Knowledge about various qualities required for entrepreneurship Knowledge about various entrepreneurship models Knowledge about various tools and techniques like five S													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand the qualities of entrepreneurs, various entrepreneurship Models, various schemes supporting entrepreneurship, company laws, regulations and incorporation												Understanding	
CO2	Evaluate demand, feasibility, risks, economic viability, expected costs to identify, plan and control projects												Evaluating	
CO3	Prepare balance sheets, financial reports, accounts and stores studies												Applying	
CO-PO Mapping														
1:Slight(Low) 2:Moderate(Medium) 3:Substantial(High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	1	2	-	-	3	2	2	2	2	1
CO2	2	3	3	2	3	2	-	-	3	2	3	2	2	2
CO3	1	1	1	1	2	-	-	-	-	-	3	-	2	1
Average	1.3	1.7	1.7	1.3	2.0	1.3	-	-	2	1.3	2.7	1.3	2.0	1.3



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Entrepreneurship- definition. growth of small scale industries in developing countries and their positions vis-a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale food industries; demand based and resources based ancillaries and sub-control types. Government policies for small scale industry; stages in starting a small scale industry	6	-
II	Project identification- assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods, benefit cost analysis, discounted cash flow, internal rate of return and net present value methods.	6	-
III	Accountancy- Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control, quality control, marketing, industrial relations, sales and purchases, advertisement, wages and incentive, inventory control, preparation of financial reports, accounts and stores studies.	6	-
IV	Project Planning and control: The financial functions, cost of capital approach in project planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. profit planning and programming, planning cash flow, capital expenditure and operations. control of financial flows, control and communication.	6	-
V	Incorporation of company, Laws concerning entrepreneur viz, partnership, business ownership, GST, environment and workman compensation etc. Role of MSME, various national, state agencies which render assistance to small scale industries.	6	-
	Total	30	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References

S.N.	AUTHOR	TITLE
1	Dr. Gupta & Dr. Srinivasan	Entrepreneurship Development in India
2	Vasant Desai	Dynamics of Entrepreneurial Development and Management
3	T.N.Chhabra	Entrepreneurship Development
4	Dr.R.K.Singal.Shruti Singal	Entrepreneurship Development
5	Forbat, John, "Entrepreneurship" New Age International.	
6	Havinal, Veerbhadrappa, "Management and Entrepreneurship" New Age International	
7	Joseph, L. Massod, "Essentials of Management", Prentice Hall of India.	



Course Title	NUTRITIONAL ASPECTS OF NATURAL & PROCESSED FOODS				
Course code	OEFET-				
Category	Open Elective Course				
Scheme and Credits	L	T	P	C	Semester VII
	3	0	0	3	

Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Food and its functions, Role of nutrients, Effects of deficient or excess intake of the individual essential nutrients. Recommended Dietary Intakes (RDI) and its uses. Factors affecting nutritional requirement of an individual.	10	-
II	Composition of Foods: General and Specific for different foods of plant and animal origin. General causes. of loss, of nutrients. Nutritional changes during processing & storage and their implications. Potentially undesirable constituents in foods. Restoration, Enrichment, Fortification and Supplementation of foods.	10	-
III	Digestion, Absorption and Metabolism of food in human body.	6	-
IV	Balanced diets for normal individuals. Therapeutic diets for people suffering from various ailments and disorders. Functional foods.	10	-
V	Assessment of calorific value and nutritional quality of natural and processed foods by chemical and biological means. Sensory qualities and acceptability of foods.	9	-
	Total	45	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

S.N.	
1	'Dietetics' by B. Srilakshmi, H' edn., New Age International (P)Ltd.New Delhi.
2	'Nutrition and Dietetics' by Shubhangini A. Joshi, Tata McGrawHill Co.Ltd
3	'Nutritive Value of Indian Foods' by C. Gopalan, B.V. Ramasastry and S.C. Balasubramanian; NIN, Hyderabad
4	'Food Chemistry' by O.R. Fennema, 2' edn. Marcel Dekkar Inc.
5	'Basic Nutrition in Health & Disease' by P. S. Howe, W.B. Saunders Company London.



Course Title	FOOD PRODUCT DEVELOPMENT & SENSORY EVALUATION				
Course code	PEFET-				
Category	Professional Elective Course				
Scheme and Credits	L	T	P	C	Semester VII
	2	0	0	2	

Detailed Contents					
Module	Contents	L (Hours)	T (Hours)	P (Hours)	C (Credits)
I	Innovation and product development concept. Generation of ideas. Desk Research. Screening/ appraisal of initial ideas. Detailed study of product, process and market, Planning and developmental activities and evaluating them. Development of prototype product and its testing for acceptance. Development of process and planning for production trials. Planning the test market. Actual production trials and test marketing. Evaluation of test results. Launching of the product. Advertising and marketing plans. Suggestions for improving success.	8	-	-	-
II	Overview of sensory principles and practices: General consideration in sensory testing, flowcharts of sensory evaluation. Anatomy, physiology and function of various senses. Chemesthesis, multi-modal sensory interactions. Test protocol considerations and experimental design, Tabulation and analysis.	7	-	-	-
III	Psychological methods: Selection and screening of panel, types of panel. Maintaining suitable environmental conditions: laboratory setup and equipments. Sample preparation. Methodology for sensory evaluation: Difference, Rating, Sensitivity tests. Descriptive analysis techniques: Flavor profile, Quantitative descriptive analysis, Texture profile, Sensory spectrum. Sensory texture measurements. Context effects and biases in sensory judgment.	8	-	-	-
IV	Basic statistical concepts for sensory evaluation: Hypothesis testing and sensory inference, variation of T Test, Nonparametric and binomial based, Statistical methods, Chi-square test, analysis of variation, Correlation regression	7	-	-	-
	Total	30	-	-	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

S.N.	
1	MacFie, H. (Ed.). (2007). Consumer-led food product development. Elsevier.
2	Lawless, H. T., & Heymann, H. (2010). Sensory evaluation of food: principles and practices (Vol. 2). New York: Springer.



Course Title	POST HARVEST MANAGEMENT OF FRUITS AND VEGETABLES				
Course code	PEFET-				
Category	Professional Elective Course				
Scheme and Credits	L	T	P	C	Semester VII
	2	0	0	2	

Detailed Contents				
Module	Contents	L (Hours)	T (Hours)	
I	Harvesting vs. physiological maturity, Harvester indices, Importance & scope of post harvest management of fruits and vegetables in Indian economy, methods of maturity determinations, Physiological post harvest disorders - chilling injury and disease; prevention of post harvest diseases and infestation.	8	-	
II	Causes of post-harvest losses, Factors affecting post harvest losses; Standards and specifications for fresh fruits and vegetable. Harvesting and handling of important fruits and vegetables, Harvesting tools and their design aspects; primary processing for sorting and grading at farm and cluster level	8	-	
III	Post-harvest physiological and biochemical changes in fruits and vegetables; ripening of climacteric and non-climacteric fruits; Storage practices: pre-cooling and cold storage, Zero energy cool chamber; Commodity pretreatments - chemicals, wax coating, prepackaging, VHT and irradiation.	7	-	
IV	Handling and packaging of fruits and vegetables; Post Harvest handling system for fruits and vegetables of regional importance such as citrus, mango, banana, pomegranate, tomato, papaya and carrot etc., packaging house operations; principles of transport and commercial transport operations.	7	-	
	Total	30	-	

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

S.N.	
1	Kadar AA.1992. Post-harvest Technology of Horticultural Crops. 2nd Ed. University of California.
2	Lal G, Siddapa GS & Tandon GL.1986. Preservation of Fruits and Vegetables. ICAR.
3	Verma LR. & Joshi VK. 2000. Post Harvest Technology of Fruits and Vegetables. Indus Publ.
4	Agmark standards by DMI, GoI.
5	Cold chain standards by NHB, GoI.



Course Title	ENGINEERED, TEXTURIZED & FABRICATED FOODS													
Course code	PEFET - 4484													
Category	Professional Elective Course													
Scheme and Credits	L	T	P	C	Semester VII									
	2	0	0	2										
Pre-requisites (if any)	The knowledge about extruded food products and textured vegetable protein products													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • Knowledge about the working of equipment and process technology of extruders • Knowledge about the process technology for textured vegetable protein products, imitation milk and various engineered & fabricated food products 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Apply extrusion cooking process methods used in food industry for production of various extruded products											Applying		
CO2	Apply the technology for production of textured vegetable protein products											Applying		
CO3	Apply the technology for processing of fabricated RTS beverages, bakery products, imitation milks, weaning, therapeutic, geriatric and various other such foods											Applying		
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2	-	-	-	-	-	-	-	3	3
CO2	3	2	1	1	2	-	-	-	-	-	-	-	3	3
CO3	3	2	1	1	2	-	-	-	-	-	-	-	3	3
Average	3.0	2.0	1.0	1.0	2.0	-	-	-	-	-	-	-	3.0	3.0



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Extruders. Single Screw & Multiple Screw Extruders. Extrusion process. Extrusion cooking. Physical & Chemical Changes during Extrusion Process.	7	-
II	Textured vegetable protein products. Puffing Gun, Puffed Products. Meat Analogues., Imitation Paneer	5	-
III	Fabricated RTS Beverages, Bakery Products, Margarine, Peanut Butter, Imitation Milks Designer Lipids etc.	7	-
IV	Weaning Foods/ Baby Foods. Therapeutic Foods. Geriatric Foods.	6	-
V	Technology and manufacture of Macaroni, Pasta, Noodles, Vermicelli etc.	5	-
	Total	30	-
L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes			
Suggested Books			
S.N.	AUTHOR	TITLE	
1	S.A. Matz	Cereal Technology, CBS Publishers	
2	Zeki Berk	Food Process Engineering and Technology, Academic Press	
3	Shubhangini A. Joshi	Nutrition and Dietetics, Tata McGraw-Hill Education, 2010	



Course Title	NUTRACEUTICAL & FUNCTIONAL FOODS				
Course code	PEFET -				
Category	Professional Elective Course				
Scheme and Credits	L	T	P	C	Semester- VII
	2	0	0	2	

Detailed Contents

Module	Contents	L (Hours)	T (Hours)
I	Defining nutraceuticals and functional foods, Nature, type and scope. Nutraceuticals and functional foods applications and their health benefits, classification based on chemical and biochemical nature with suitable and relevant descriptions.	6	-
II	Nutraceuticals for specific situations such as cancer , heart diseases, stress, Osteoarthritis, hypertension etc. Antioxidants and other phytochemicals, isoflavones, lycopenes, their role in nutraceuticals and functional foods, dietary fibers and complex carbohydrates as functional food ingredients.	6	-
III	Protein as a functional food ingredient, Probiotic foods and their functional role ,Herbs as functional foods, health promoting activity of common herbs. Cereals products as functional foods- Oats, Wheat bran, rice bran etc.	6	-
IV	Functional vegetable products, oil seeds and sea foods. Coffee, tea and other beverages as functional foods/ drinks and their protective effects. Effects of processing and storage and interaction of various environmental factors on the potentials of such foods.	6	-
V	Marketing and regulatory issues for functional foods and nutraceuticals Recent developments and advances in the area of nutraceuticals and functional foods.	6	-
	Total	30	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books

S.N.	AUTHOR	TITLE
1	Robert E.C. Wildman, Robert Wildman, Taylor C. Wallace	Handbook of Nutraceuticals and Functional Foods
2	Robert E.C. Wildman, Denis M. Medeiros	Advanced Human Nutrition
3	Flavors for nutraceutical and functional foods	M. Selvamuthukumaran and Yashwant V. Pathak



Course Title	BAKERY AND CONFECTIONARY TECHNOLOGY													
Course code	PCFET-4485													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester VII									
	3	0	0	3										
Pre-requisites (if any)	None. Desirable– Knowledge of basic cereal products.													
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • Knowledge about types of bakery products • Knowledge about processing and technology used in bakery and confectionary 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Recall the types of flour and ingredients used in bakery products and its properties.												Remembering	
CO2	Use the bakery equipment and machinery used in processing and packaging												Applying	
CO3	Apply the technology used for production of bread and cake making and their defects and remedies												Applying	
CO4	Understand the type of bakery product and their manufacturing, defects and remedies												Understanding	
CO5	Apply the technology for confectionery manufacturing												Applying	
CO-PO Mapping														
1:Slight (Low) 2:Moderate (Medium) 3:Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	2	-	-	-	-	-	-	-	3	2
CO2	3	1	2	1	3	1	-	-	-	-	-	1	3	3
CO3	3	2	1	2	3	1	-	-	-	-	-	1	3	3
CO4	2	2	3	2	1	1	-	-	-	-	-	2	2	3
CO5	3	2	3	2	-	-	-	-	-	-	-	-	3	2
Average	2.6	1.8	2.2	1.6	1.8	0.6	-	-	-	-	-	0.8	2.8	2.6



Module	Contents	L Hours)	T (Hours)
I	Wheat flour and wheat flour treatments – Grade of flour, constituents of flour – ageing of flour – Tests for flour quality. Yeast : Characteristics, Preparation, Handling & Storage, Adequacy for use in the bakery industry. Ingredients, Technology and quality parameters for baked products: Bread, Biscuits & cakes	9	-
II	Bakery equipment and machinery. Different types of Mixers, kneaders and cutters. Different types of ovens. Packaging machinery for bread and biscuits. Quality control in the bakery industry . Quality control of raw materials. Quality control of finished products. Quality control of packaging materials	9	-
III	Technology of bread making Different methods. Process steps and their significance. Characteristics of good bread. Defects in bread, their causes and remedies . Technology of Cakes Manufacturing. Different cake making processes. Sugar batter method, Flour batter method ,Modified sugar batter method Whipping method, Blending method etc. Process steps and their significance. Importance of baking time and temperature. Recipe balancing . Defects in cakes, their causes and remedies.	9	-
IV	Biscuits . Definition and types. Fermented dough biscuits. Cookies. Types of cookies and their manufacture. Cream biscuits. Process steps and their significance. Defects in biscuits their causes and remedies	9	-
V	Confectionery manufacture- raw materials and processing; cocoa, sugar, special fats, dried milk products, emulsifiers. Sugar confectionery – general technical aspects, manufacture of boiled sweets, lollipops, lozenges, gums and jellies, chewing gums, caramel, toffee, fudge. Indian Confectionery – Types , role of sugar in preparation, other ingredients and their role in preparation	9	-
	Total	45	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References

S.N.	
1	Ashokkumar, Y. (2018). Textbook of bakery and confectionery, (Revised). PHI Learning Pvt. Ltd.
2	Uttam K Singh, Theory of bakery and confectionery
3	Dr. Madhvi Daniel, Bakery and confectionery science
4	Mathuravalli, S. M. D. (2021). Handbook of Bakery and Confectionery. CRC Press.



Course Title	FOOD QUALITY EVALUATION LAB													
Course code	PCFET- 40486													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester VII									
	0	0	4	2										
Pre-requisites (if any)	knowledge of food quality parameters Desirable– Knowledge of basic food components													
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • Knowledge of quality parameters of food • Knowledge for determining quality of food in industry 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Evaluate qualitative and quantitative differences using various sensory tests												Evaluating	
CO2	Evaluate the quality parameter of bakery products												Evaluating	
CO3	Evaluate the quality attributes of dairy products instrumentally												Evaluating	
CO4	Assess quality parameters of fruits, vegetables and its products using various techniques												Evaluating	
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	3	2	-	-	-	-	-	2	3	3
CO2	2	3	3	3	3	3	-	-	-	-	-	3	3	3
CO3	2	3	3	3	3	3	-	-	-	-	-	3	3	3
CO4	2	3	3	3	3	3	-	-	-	-	-	3	3	3
Average	2.0	3.0	3.0	3.0	3.0	2.8	-	-	-	-	-	2.8	3.0	3.0



List of Practical	
S.N.	Practical
1	Sensitivity tests (Threshold/Dilution) to measure individual ability for sensory analysis
2	Difference tests to evaluate qualitative and quantitative differences and/or preference between test products.
3	Assessment of quality of wheat flour (Water Absorption Power, Gluten Content, Sedimentation Value etc.).
4	Evaluation of quality of Bakery Products: Bread, Biscuits, Cakes etc.
5	Evaluation of quality of Dairy Products: Over run and fat content in IceCream, Specific gravity of Milks etc.
6	Assessment of quality of Fruit & Vegetable Products: Tomato Products, Jam, Jelly, Marmalades, Squashes & Cordials, Canned Products.
7	Assessment of Quality of Beverages: Tea & Coffee, Carbonated and RTS Beverages.
L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes	
Reference Books and Suggested Readings:	
S.N.	Details
1	BIS Specifications - The Chemical Analysis of Foods & Food Products
2	Morris B. Jacobs- Hand Book of Analysis and Quality Control for Fruit & Vegetable Products
3	S. Rangann - Official Method of Analysis of AOAC



MINI PROJECT (Proj.FET - 40487)

L: T: P: C

0: 0: 6: 3

The student (s) will be required to search literature pertaining to design of an equipment / processing of a food commodity / production of food product, comprehend it and prepare a report for assessment.

INDUSTRIAL TRAINING (SIFET- 40488)

L: T: P: C

0: 0: 2: 1

The student(s) will be required to undertake training in the food industry after III B. Tech.VI semester for a specified period and submit its report after completion for evaluation and oral examination in the VII semester of his studies in Final B.Tech.



Course Title	SPECIALITY FOODS													
Course code	PEFT-4486													
Category	Professional Elective Course													
Scheme and Credits	L	T	P	C	Semester VIII									
	2	0	0	2										
Pre-requisites (if any)	None. Desirable –													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • The knowledge about the major and minor constituents of foods and their functions • The knowledge about basics of human nutrition 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand the nutritional/dietary requirements during normal life cycle and during metabolic disorders and disturbances											Understanding		
CO2	Understand the importance and role of Nutraceutical and functional foods in view of human health											Understanding		
CO3	Understand the modifications in the diet during attack of diseases and other health conditions for restoring normal health											Understanding		
CO4	Understand the beneficial effects of specific food constituents											Understanding		
CO5	Apply the principles of nutrition in one's daily diet											Applying		
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO1	PSO2
CO1	-	3	3	3	-	3	-	-	-	-	-	2	3	3
CO2	-	-	3	2	-	3	-	-	-	-	-	2	2	2
CO3	-	2	2	3	-	3	-	-	-	-	-	2	3	3
CO4	-	-	3	2	-	3	-	-	-	-	-	2	2	2
CO5	1	3	3	3	-	3	-	-	-	-	-	2	3	3
Average	0.2	1.6	2.8	2.6	-	3	-	-	-	-	-	2	2.6	2.6



Detailed Contents			
Module	Contents	L Hours)	T (Hours)
I	Infant and baby foods, Adolescent / Teen-age foods, Geriatric foods, Foods for pregnant ladies and nursing mothers. Nutraceutical and functional foods. Foods / Diets in metabolic disorders and disturbances.	10	-
II	Foods and Diets recommended and restricted in Gastrointestinal disorders; Fever and Infection; Liver, gallbladder and pancreatic disturbances.	7	-
III	Foods and Diets recommended and restricted in blood, circulatory and Cardiac diseases; urinary and Musculoskeletal diseases. Allergies.	7	-
IV	Beneficial Effects of Spices, gamma-linolenic acid, Spirulina, antioxidants and other food constituents. New Developments.	6	-
	Total	30	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books:

S.N.	AUTHOR	TITLE
1	Benzamin T. Burton	Human Nutrition
2	B. Srilakshmi	Dietetics
3	Arnold E. Bender	Nutrition and Dietetic foods
4	Shubhangini A. Joshi	Nutrition and Dietetics
5	Periodicals by AFST(I), CFTRI	Indian Food Industry
6	P. S. Howe, W.B. Saunders	Basic Nutrition in Health & Disease



Course Title	FOOD PROCESS EQUIPMENT DESIGN				
Course code	PEFET-				
Category	Professional Elective Course				
Scheme and Credits	L	T	P	C	Semester VIII
	2	0	0	2	

Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Application of design engineering for food processing equipments, Design parameters, codes and materials selection.	6	-
II	Design of handling and milling equipments, dryers, heat exchangers, Pressure vessels, Optimization of design with respect of process efficiency.	6	-
III	Design of evaporator, vapor separator and condenser.	6	-
IV	Design of Basket Press, Screw type Juice Extractor, Solid Mixer, Kneader; Oil Expeller, filters and extruder.	6	-
V	Design of Homogenizer, Pulping Machine, Plate Type Freezer and Freeze Drier.	6	-
	Total	30	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

S.N.	
1	Chemical Engineer's Handbook; Perry, Chilton & Green; MGH.
2	Fundamentals of Food Process Engineering, 2 nd ed; Toledo Romeo T; CBS Publishers.
3	Preservation of Fruits & Vegetables; Lal G, Sidhapa GS & Tandon GL; ICAR.
4	Introduction to Chemical Equipment Design – Mechanical Aspects; Bhattacharyya BC; CBS Publishers.
5	Process Equipment Design; Hesse HC & Rushton JH; Van Nostrand, East West Press
6	Selection of Material and Fabrication for Chemical Process Equipment; Bhattacharyya BC; Chemical engineering Education Development Centre, IIT Madras.
7	Process Equipment Design; Brownell LE & Young EH; John Wiley and Sons, Inc.
8	Computer Aided Design of Chemical Process Equipment; Bhattacharyya BC & Narayanan CM; New Central Book Agency.
9	Mechanical Design and Fabrication of Process Equipment; Bhattacharyya BC; Khanna Publishers



Course Title	FOOD PROCESSING WASTE MANAGEMENT				
Course code	PEFET-				
Category	Professional Elective Course				
Scheme and Credits	L	T	P	C	Semester VIII
	2	0	0	2	

Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Basic considerations: Standards for emission or discharge of environmental pollutants from food processing Industries as per the updated provision of Environment (Protection) Act, 1986. Elements of importance in the efficient management of food processing wastes	6	-
II	Characterization and utilization of by-products from Cereal Pulses, Oilseeds, Fruits and vegetables, Plantation products, Fermented foods, Milk, Fish, Meat, Egg and poultry processing industries.	6	-
III	Characterization of food Industry effluents, Physical and chemical parameters, Oxygen demands and their interrelationships, Residues (solids), Fats, Oils and grease, Forms of Nitrogen, Sulphur and Phosphorus, Anions and cations, Surfactants, Colour, Odour, Taste, Toxicity. Unit concept of treatment of food industry effluent, Screening, Sedimentation Floatation as pre - and primary reactants.	6	-
IV	Biological oxidations: Objects, Organisms, Reactions, Oxygen requirements, Aeration devices Systems: Lagoons, Activated sludge process, Oxidation ditches, Rotating biological contactors and their Variations and advanced modifications.	6	-
V	Advanced wastewater treatment systems. Physical separations, Micro-strainers, Filters, Ultra filtration and reverse osmosis. Physico-chemical separations: activated carbon adsorption, Ion-exchange electro-dialysis and magnetic separation. Chemical oxidations and treatment Coagulation and flocculation. Disinfection. Handling disposal of sludge.	6	-
	Total	30	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

S.N.	AUTHOR	TITLE
1	J.H. Green	Food Processing Waste Management



Course Title	NOVEL FOOD PROCESSING TECHNOLOGIES				
Course code	PEFET-				
Category	Professional Elective Course				
Scheme and Credits	L	T	P	C	Semester VIII
	2	0	0	2	

Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	High Pressure Processing: Principles of high pressure processing, Effects of high pressure on food quality: Pressure effects on microorganisms, texture and nutrients of food. Hurdle Technology Concept; effect on preservation of food	6	-
II	Pulsed electric fields processing: PEF treatment systems, main processing parameters. Mechanisms of action: mechanisms of microbial inactivation.	6	-
III	Osmotic dehydration: mechanism of osmotic dehydration, application of osmotic dehydration. Membrane separation: Principle, different types of Membrane processing, Application in Food industry	6	-
IV	Ultrasound processing: fundamentals of ultrasound, ultrasound as a food preservation and processing aid, effects of ultrasound on food properties.	6	-
V	Alternate thermal processing: Microwave heating, Radio-frequency processing: dielectric heating, radio-frequency heating; Ohmic heating, Freeze drying, freeze concentration, UV radiation	6	-
	Total	30	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books/References:

S.N.	
1	P J Fellows (2009). Food Processing Technology: Principles and Practice. Third edition. Wood Head Publishing in Food Science, Technology and Nutrition.
2	Howard Q. Zhang,, Gustavo V. Barbosa-Cánovas, V. M. Bala Balasubramaniam, C. Patrick Dunne, Daniel F. Farkas, James T. C. Yuan (2011). Nonthermal Processing Technologies for Food. Wiley-Blackwell.
3	Ortega-Rivas , Enrique (2012). Non-thermal Food Engineering Operations. Springer.
4	N S Isaacs (1998). High pressure food science, bioscience and chemistry. Wood Head Publishing limited.
5	H L M Lelieveld, S Notermans, and S W H De Haan (2007). Food preservation by pulsed electric fields: From research to application. Wood Head Publishing limited.



Course Title	MEAT , FISH & POULTRY PRODUCTS TECHNOLOGY													
Course code	PCFET-4487													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester VIII									
	3	0	0	3										
Pre-requisites (if any)	None. Desirable – Knowledge of food processing and preservation													
Course Objectives	The objective of this course is to impart <ul style="list-style-type: none"> • knowledge about meat, poultry and fish • knowledge about processing of fish and poultry • knowledge about thermal processing and hurdle technologies 													
Course Outcomes On successful completion of the course, the students will be able to														
CO1	Understand the basic concept about edible muscle												Understanding	
CO2	Understand various chemical, nutritional and microbiological properties of meat												Understanding	
CO3	Understand processing of meat and its preservation												Understanding	
CO4	Understand inspection and grading of meat and poultry												Understanding	
CO5	Understand fish products, thermal processing and hurdle technologies												Understanding	
CO-PO Mapping 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO 12	PSO 1	PSO 2
CO1	1	1	1	1	-	3	-	-	-	-	-	-	1	1
CO2	1	1	2	1	-	3	-	-	-	-	-	-	1	2
CO3	1	1	1	2	-	3	-	-	-	-	-	-	2	1
CO4	2	2	2	1	-	3	-	-	-	-	-	-	1	2
CO5	1	1	1	2	-	3	-	-	-	-	-	-	1	1
Average	1.2	1.2	1.4	2	-	3	-	-	-	-	-	-	1.2	1.4



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Introduction to meat and poultry industries; Pre-mortem selection of animals; Modern Abattoir Practices: slaughtering techniques of animal and slaughtering practices; Meat cuts and portions of meat; Inspection and grading of meat; Physico-chemical composition of muscle; Post-mortem changes in muscle; Conversion of muscle to meat.	9	-
II	Chemical and nutritional composition of meat; The eating quality of meat - color, water holding capacity (WHC) and juiciness, texture and tenderness, odour and taste; Meat microbiology and safety; Spoilage characteristics of meat; Endogenous & exogenous infections; Preventive (prophylaxis) measures for avoiding meat spoilage.	9	-
III	Meat processing- comminution, emulsification, curing, smoking, cooking, ageing and tenderization; Meat products - meat emulsion, fermented meats, sausages, ham, bacon and comminuted meat products; Meat analogs; Meat storage and preservation- by temperature control (refrigeration, freezing, thermal processing), by moisture control (dehydration, freeze drying, curing, IMF meat), by microbial inhibition (chemical preservation, ionizing radiation); Packaging of meat products. Meat production, processing and consumption trends; Meat plant sanitation and waste disposal; By-products from meat industries and their utilization.	9	-
IV	Inspection of birds, poultry slaughter and dressing, Factors affecting quality of poultry; Classification of poultry meat; Composition and nutritional value of poultry meat; Processing of poultry meat, spoilage and control; By-product utilization. Egg and egg products- Structure, composition and functions of eggs; Abnormalities in eggs; Functions of eggs in food products; Inspection and grading for egg quality; Preservation and safe handling of eggs; Coagulation of eggs, egg foams, egg powder and egg based products	9	-
V	Fish as raw material for processing and its biochemical composition. Factors affecting the quality of product and post harvest losses. Chilling and freezing of fish and other aquatic products. Physical, chemical, microbiological and sensory changes during storage. Principles of thermal processing. decimal reduction time, thermal death time, "Z" and "F" values, 12D concept, determination of process time. Canning process for fish. Value added fish products. Hurdle technology and its application. Composition and role of muscle proteins, Factors influencing denaturation of muscle proteins. Fisheries By-products Technology	9	-
	Total	45	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books:

S.N.	AUTHOR	TITLE
1	H.V.Athortone	Chemistry and testing of dairy products
2	N.Warner	Principles of dairy processing
3	R.A.Lawrie	Meat Science.
4	G.J.Mountney	Poultry Products Technology
5	B.Srilakshmi	Food Science



Course Title	FOOD PLANT LAYOUT AND DESIGN													
Course code	PCFET- 4488													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester VIII									
	2	1	0	3										
Pre-requisites (if any)	Basics of instrumentation and food processes													
Course Objectives	<p>Upon completing the course, the student will be able</p> <ul style="list-style-type: none"> To develop the skills for equipment design and plant layout for different food processing plants Gain knowledge of building materials for use in the food industry To understand worker safety and health aspects in the food industry 													
Course Outcomes														
On successful completion of this course students will be able to														
CO1	Recall basic concepts of plant layout and design with special reference to food process industries.											Remembering		
CO2	Understand the selection of process equipment and considerations involved in equipment selection & economic analysis of equipment											Understanding		
CO3	Analyze the preparation and development of plant layout and equipment symbols, electric symbols, graphic symbols for piping systems											Analyzing		
CO4	Design the plant layout for different food processing units											Applying		
CO5	Analyze the safety standards during building a food process plant											Analyzing		
CO-PO Mapping														
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: No Correlation														
COs	POs												PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO1	PSO2
CO1	3	2	2	1	2	2	2	-	-	-	2	-	2	1
CO2	2	2	1	1	2	1	1	-	-	-	3	-	2	1
CO3	3	2	2	2	3	2	2	-	-	-	2	2	3	2
CO4	3	2	3	2	3	2	-	-	-	-	3	2	3	2
CO5	2	2	2	1	2	3	2	-	-	-	3	1	2	2
Average	2.6	2.0	2	1.4	2.4	2.0	1.2	-	-	-	2.6	1	2.4	1.6



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Basic concepts of plant layout and design with special reference to food process industries. Basic understanding of equipment layout and ventilation in food process plants. Selection of site and Location of plant.	6	3
II	Feasibility Study: Design of product, product specifications, process design, process selection considering technical, economic and social aspects. Process planning and scheduling, flow sheeting, flow diagrams and process flow charts and computer aided development of flow charts; Selection of Process equipments, material handling equipment, service equipment, instruments and controls, considerations involved in equipment selection, economic analysis of equipment.	6	3
III	Types of layouts, preparation and development of layout, equipment symbols, flow sheet symbols, electric symbols, graphic symbols for piping systems, standards for space requirement and dimensions.	6	3
IV	Plant layout and design of bakery and biscuit industries. Plant layout and design of fruits and vegetables processing industries including beverages. Plant layout and design of milk and milk products.	6	3
V	Miscellaneous aspects of plant layout and design like Requirements of the steam, refrigeration, water, electricity, waste disposal, lighting, ventilation, drainage, CIP system, dust removal, fire protection etc. Workers Safety and Health Aspects, Building and Building Materials.	6	3
	Total	30	15
L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes			
Suggested Books			
S.N.	AUTHOR	TITLE	
1	Mr. M. K Sharma and Dr. B.K Kumbhar	Food Processing Plant Design & Layout	



Course Title	FOOD PACKAGING													
Course code	PCFET-4489													
Category	Professional Core Course													
Scheme and Credits	L	T	P	C	Semester VIII									
	3	0	0	3										
Pre-requisites (if any)	Desirable– Knowledge of basic food composition and polymers, metals, glasses etc.													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> • Knowledge of packaging, package developments and packaging laws and regulations in food industries • Knowledge of different forms of packaging materials used in food packaging • Knowledge about package performance and various testing of packaging materials • Knowledge about advancements in food packaging techniques 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand the objectives and functions of packaging and the various equipments involved in food packaging												Understanding	
CO2	Discuss the manufacturing and characteristics of various packaging materials viz paper, glass, metal, and plastic												Understanding	
CO3	Understand the food product characteristics and apply the knowledge in packaging various food commodities												Applying	
CO4	Explain the criteria for selection of materials, forms, machinery and methods for various food produces												Understanding	
CO5	Understand the principle and applications of advanced food packaging techniques and application of packaging laws and regulations												Applying	
CO-PO Mapping														
1:Slight(Low) 2:Moderate(Medium) 3:Substantial(High) “-”: NoCorrelation														
COs	POs												PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO1	PSO2
CO1	3	2	1	2	3	1	-	1	-	-	2	-	2	1
CO2	2	2	1	1	2	3	1	3	-	-	3	-	2	1
CO3	3	2	2	1	3	2	1	3	-	-	3	-	2	3
CO4	2	1	3	3	2	3	1	1	-	-	3	-	2	1
CO5	3	3	3	2	3	3	1	2	-	-	2	-	3	2
Average	2.6	2	2	1.8	2.6	2.4	0.8	2	-	-	2.6	-	2.2	1.6



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Basic Concepts: Concept of packaging, Functions of a Food Package, Package development factors and Food package development. Machinery for Packaging: Form fill and seal machines, vacuum packaging machine, shrink wrap packaging machine and multilayer packaging system.	9	-
II	Plastics in Food Packaging: Manufacture of plastic packaging, types of plastics used in packaging, rigid plastic containers, coating of plastic films, flexible packaging materials. Their mechanical sealing and barrier properties.	9	-
III	Glass containers: Composition, Properties, Bottle making and Closures for glass containers. Metal containers: Bulk containers; Tin-plate containers, Tin free steel containers, Aluminium containers. Can making processes. Protective lacquers for processed food cans. Paper and paperboard packaging.	9	-
IV	Food product characteristics and package requirement, Selection of materials, Forms, Machinery and methods for fresh produce (Fruits, Vegetables, Egg, Meat and Fish), Edible oils and Fats, Spice and spice products, Processed products (Fruit & Vegetable, Cereal & Pulse, Dairy, Confectionery & Snacks, Meat & Marine products).	9	-
V	Package printing, Aseptic Packaging, Novel food packaging technologies. Evaluation of food packaging materials and package performance. Packaged product quality and shelf life. Packaging and Labeling Laws and Regulations.	9	-
	Total	45	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books

S.N.	AUTHOR	TITLE
1	M. Mahadeviah and R.V. Gowramma	Food Packaging Materials
2	S. Saclarow and R.C. Griffin	Principles of Food Packaging
3	Trends in Food Science & Technology	Proceedings of IFCON-1988



Course Title	INDUSTRIAL SAFETY AND HAZARD MANAGEMENT													
Course code	ESCH-4490													
Category	Engineering Science													
Scheme and Credits	L	T	P	C	Semester VIII									
	2	0	0	2										
Pre-requisites (if any)	None. Knowledge of industrial Hygiene, Industrial Safety ,Hazard etc													
Course Objectives	<p>The objective of this course is to impart</p> <ul style="list-style-type: none"> ● knowledge of reliable and safe operation in industry ● knowledge of the set of rules and procedures in the industry ● knowledge to recognize and evaluate occupational safety and health hazards in the workplace 													
Course Outcomes														
On the successful completion of the course, students will be able to														
CO1	Understand the methods of hazard Identification and preventive measures to control it, explain industrial laws, regulation and source models												Understanding	
CO2	Apply the methods of prevention of fire & explosion												Applying	
CO3	Prepare the procedure of avoidance of losses												Applying	
CO4	Understand the process of handling, transportation and storage of hazardous industrial materials												Understanding	
CO-PO Mapping														
1:Slight(Low) 2:Moderate(Medium) 3:Substantial(High) “-”: No Correlation														
COs	POs												PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO1	PSO2
CO1	1	2	2	1	2	-	-	-	-	-	-	-	2	2
CO2	1	1	1	1	1	-	-	-	-	-	-	-	1	1
CO3	1	1	1	1	1	-	-	-	-	-	-	-	2	1
CO4	1	1	1	1	1	-	-	-	-	-	-	-	1	1
Average	1	1.3	1.3	1	1.3	-	-	-	-	-	-	-	1.5	1.3



Detailed Contents			
Module	Contents	L (Hours)	T (Hours)
I	Industrial safety, Industrial hygiene and safety aspects related to toxicity, noise, pressure, temperature, vibrations, radiation etc. Explosions including dust, vapor, cloud and mist explosion.	6	-
II	Elements of safety, safety aspects related to site, plant layout, process development and design stages, identification of hazards and its estimation, risk, risk analysis and assessment methods; fault free method, event free method, scope of risk assessment, controlling toxic chemicals and flammable materials.	6	-
III	Toxic substances and degree of toxicity, its estimation, their entry routes into the human system, their doses and responses, control techniques for toxic substances exposure, use of respirators, ventilation systems.	6	-
IV	Prevention of losses, pressure relief, provision for fire fighting, release of hazardous materials from tanks, pipes through holes and cracks, relief systems: types and location of relief's.	6	-
V	Handling, transportation and storage of flammable liquids, gases, and toxic materials and wastes, regulation and legislation, government role, risk management routines, emergency preparedness, disaster planning and management.	6	-
	Total	30	-

L: Lecture, T: Tutorial, P: Practical, C: Credits, CO: Course Outcomes, PO: Program Outcomes, PSO: Program Specific Outcomes

Suggested Books

S.N.	AUTHOR	TITLE
1	Ray Asfahl. C	Industrial safety and Health Management
2	Krishnan N.V	Safety Management in Industry
3	Mamta Vyas	Safety and hazard management



PROJECT
Proj.FET-40491

L: T: P: C
0: 0: 12: 6

The student (s) will be required to prepare a detailed project report on fabrication of an equipment / establishment of a plant for processing of a food commodity for production of food product (s) with complete lay-out and economic analysis for assessment.

**A
PROJECT REPORT
ON
“TITLE”**

Submitted for partial fulfillment of award of the degree

BACHELOR OF TECHNOLOGY

In
Food Engineering & Technology

To
Department of Food Technology
Institute of Engineering and Technology

By
<STUDENT 1>
<STUDENT 2>
<STUDENT 3>
<STUDENT 4>

Under The Supervision of

<Name of the GUIDE>



**Department of Food Technology
Institute of Engineering and Technology,
Bundelkhand University,
Jhansi. -284128 (U.P.), India**

Candidate's Declaration

I/we hereby declare that the work embodied in this dissertation entitled <"TITLE">, for the partial fulfillment of award of Degree of 'Bachelor of Technology' in 'Food Engineering & Technology' submitted in the Department of Food Technology, Institute of Engineering & Technology, Bundelkhand University, Jhansi, is an authentic work, under the guidance of <name of the GUIDE>, <Designation>. Department of Food Technology, Institute of Engineering & Technology, Bundelkhand University, Jhansi.

I/we have not submitted the work embodied here elsewhere for the award of any other degree.

<STUDENT 1 (Roll no.)>
<STUDENT 2 (Roll no.)>
<STUDENT 3 (Roll no.)>
<STUDENT 4 (Roll No.)>

Date-

Place-

Certificate

This is to certify that the work embodied in the project report entitled <“**TITLE**”> has been carried out by <**name of the students**> with roll no.....for the partial fulfillment of award of the degree of ‘**Bachelor of Technology**’ in ‘**Food Engineering & Technology**’ under my supervision. The work has been carried out by them at the Department of Food Technology, Institute of Engineering and Technology, Bundelkhand University, Jhansi (UP) is genuine and original.

Date:

NAME OF THE GUIDE

Department of Food Technology
IET, B.U. Jhansi-284128

Acknowledgement

Students have to write the acknowledgement themselves and should not copy amongst each other. Try to thank all who are directly or indirectly connected/Involved to your project.

**SEMINAR REPORT
ON
“TITLE”**

Submitted for partial fulfillment of award of the degree

BACHELOR OF TECHNOLOGY

In

Food Engineering & Technology

To

Department of Food Technology
Institute of Engineering and Technology

By

<STUDENT NAME>

<Roll. No.>



**Department of Food Technology
Institute of Engineering and Technology,
Bundelkhand University,
Jhansi. -284128 (U.P.), India**