DEPARTMENT OF FOOD TECHNOLOGY

Criteria I

1.1.1 Curricula developed and implemented have relevance to the local, national, regional and global developmental needs which are reflected in Programme Outcomes (POs), Programme Specific Outcomes (PSOs) and Course Outcomes (COs) of the various Programmes offered by the Institution:

1. Classification / Mapping of course with their societal needs

Excel Engineering College
(Autonomous)
Department of Food Technology

1.1.1 Curricula developed and implemented have relevance to the local, national, regional and global developmental needs which are reflected in Programme Outcomes (POs), Programme Specific Outcomes (PSOs) and Course Outcomes (COs) of the various Programmes offered by the Institution:

Classification / Mapping of Course with their societal needs

Course code and name	Local needs	Regional Needs	National Needs	Global Needs
B.Tech Food Technology [Regulation 2020]				
20MA101 - Mathematics – I for Biosciences			✓	✓
20EC103 - Basics of Electrical and Electronics Engineering			✓	✓
20ENE01 - Communicative English	✓	✓	✓	✓
20CH101 - Chemistry for Biosciences			✓	✓
20FT101 – Introduction to Biochemistry and Nutrition			✓	✓
20ME101 - Engineering Graphics			✓	✓
20MC101 - Induction Program	✓	✓	✓	✓
20MA201 - Mathematics – II for Biosciences			✓	✓
20FT201 - Food Microbiology	✓	✓	✓	✓
20ENE02 - Advanced Communicative English	✓	✓	✓	✓
20PH201 - Physics for Biosciences			✓	✓
20CS201 - Problem Solving using Python		✓	✓	✓
20FT202 - Food Practices Laboratory		✓	✓	✓
20MC201 - Environmental Science	✓	✓	✓	✓
20MA301 - Transforms and Boundary Value Problems			✓	✓
20FT301 - Fundamentals of Food Processing		✓	✓	✓
20FT302 - Applied Thermodynamics for Food Technology			✓	✓
20FT303 - Food Process Calculation		✓	✓	✓
20FT304 - Instrumental Methods of Analysis		✓	✓	✓
20FT305 - Food Chemistry and Nutrition			✓	✓
20FT306 - Instrumental Methods of Analysis		✓	✓	✓

Excel Engineering College
(Autonomous)
Department of Food Technology

Laboratory				
20FT307 - Food Chemistry Laboratory			✓	✓
20MC301 - Interpersonal skills	✓	✓	✓	✓
20MA403 - Probability and Statistical Methods			✓	✓
20FT401 - Fundamentals of Fluid Mechanics			✓	✓
20FT402 - Unit Operations in Food Technology			✓	✓
20FT403 - Food Processing and Preservation		✓	✓	✓
20FT404 - Food Additives		✓	✓	✓
20FT405 - Refrigeration and Cold Chain Management			✓	✓
20FT406 - Unit Operations Laboratory			✓	✓
20FT407 - Food Processing and Preservation Laboratory		✓	✓	✓
20MC401 - Soft Skill	✓	✓	✓	✓
20FT501 – Dairy Processing Technology		✓	✓	✓
20FT502 – Heat and Mass Transfer in Food Processing		✓	✓	✓
20FT503 – Biochemical Engineering in Food Technology		✓	✓	✓
20FT504 – Food Equipment Design			✓	✓
20FTE07 – Beverage Processing Technology			✓	✓
20AGO03 – Introduction to Bioenergy and Biofuels			✓	✓
20FT505 – Dairy Processing Technology		✓	✓	✓
20FT506 – Biochemical Engineering Laboratory		✓	✓	✓
20FT601 – Baking and Confectionary Technology	✓	✓	✓	✓
20FT602 – Food Process Engineering and Economics			✓	✓
20FTE02 – Meat and Fish Processing Technology		✓	✓	✓
20SFO02 – Disaster Management			✓	✓
20FT603 – Fruits and Vegetable Processing Technology	✓	✓	✓	✓

Excel Engineering College

(Autonomous)

Department of Food Technology

20FT604 – Baking and Confectionary Technology Laboratory	✓	✓	✓	✓
20FT605 – Mini Project	✓	✓	✓	✓
20FT606 - Internship	✓	✓	✓	✓
B.Tech Food Technology [Regulation 2017]			
FD8701 - Dairy Process Technology		✓	✓	✓
FD8702 - Food Safety, Quality and Regulation		✓	✓	✓
FD8703 - Food Packaging Technology			✓	✓
FD8014 – Beverage Technology			✓	✓
FD8018 – Management of Food Waste	✓	✓	✓	✓
OME754 – Industrial Safety	✓	✓	✓	✓
FD8711 - Testing of Packaging Materials Laboratory			✓	✓
FD8712 - Dairy Process Technology Laboratory		✓	✓	✓
FD8811 - Project Work	✓	✓	✓	✓
B.Tech Food Technology – Professional Elective Subjects			
20FTE01 - Fat and Oil Processing Technology			✓	✓
20FTE02 - Meat and Fish Processing Technology		✓	✓	✓
20FTE03 - Poultry and Husbandry Processing Technology		✓	✓	✓
20FTE04 - Cereals and Pulses Processing Technology			✓	✓
20FTE05 - Mushroom Processing Technology	✓	✓	✓	✓
20FTE06 - Emerging Technologies in Food Processing			✓	✓
20FTE07 - Beverage Processing Technology			✓	✓
20FTE08 - Enzyme Technology			✓	✓
20FTE09 - Protein Technology			✓	✓

Excel Engineering College
(Autonomous)
Department of Food Technology
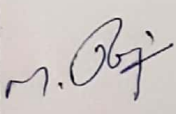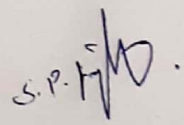
Course				
20FTE10 - Ready to Eat Processing Technology			✓	✓
20FTE11 - Food Process Equipment Design			✓	✓
20FTE12 - Food Storage Engineering			✓	✓
20FTE13 - Design and Formulation of Food			✓	✓
20FTE14 - Instrumentation and Process Control in Food Industry			✓	✓
20FTE15 - Food Plant Utilities and Services			✓	✓
20FTE16 - Food Packing Technology and Equipment			✓	✓
20FTE17 - Optimization Techniques in Food Engineering			✓	✓
20FTE18 - Food Plant Design and Layout			✓	✓
20FTE19 - Modelling and Simulation of Food Processes			✓	✓
20FTE20 - Material Science and Technology			✓	✓
20FTE21 - Applications of Renewable Energy in Food Processing		✓	✓	✓
20FTE22 - ICT Application in Food Industry		✓	✓	✓
20FTE23 - Microbial and Food Technology			✓	✓
20FTE24 - Application of Nanotechnology and Cryogenic in Food Technology			✓	✓
20FTE25 - Milling Technology			✓	✓
20FTE26 - Downstream Processing		✓	✓	✓
20FTE27 - Creativity, Innovation and New Food Product Development			✓	✓
20FTE28 - Renewable Energy Technology	✓	✓	✓	✓
20FTE29 - Functional Foods & Nutraceuticals	✓	✓	✓	✓
20FTE30 - Instrumental Techniques in Food Analysis	✓	✓	✓	✓
B.Tech Food Technology – One Credit Courses				
20FTA01 - Interpersonal Skills	✓	✓	✓	✓

Excel Engineering College

(Autonomous)

Department of Food Technology

20FTA02 - Analytical Skill	✓	✓	✓	✓
20FTA03 - Value Education	✓	✓	✓	✓
20FTA04 - Halal Compliance in Food Audits	✓	✓	✓	✓
20FTA05 - Health Fitness	✓	✓	✓	✓
20FTA06 - Social Psychology	✓	✓	✓	✓
Open Elective Courses for other Branches				
20FTO01 - Analytical Techniques		✓	✓	✓
20FTO02 - Process Instrumentation and Control			✓	✓
20FTO03 - Intellectual Property Rights		✓	✓	✓
20FTO04 - Process Economics and Industrial Management			✓	✓
20FTO05 - Product Development and Management			✓	✓
20FTO06 - Optimization Techniques in Product Development			✓	✓

	Prepared by	Reviewed by	Approved By
SIGN			
NAME	M. Raja	S. P. Rajesh	HoD / FT

EXCEL ENGINEERING COLLEGE
(Autonomous)
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
Accredited by NBA, NAAC with "A⁺" and Recognized by UGC (2F &12B)
KOMARAPALAYAM - 637303

DEPARTMENT OF FOOD TECHNOLOGY
REGULATION 2020
B. TECH Food Technology
Curriculum for Semesters – I to VIII

	I – SEMESTER								
Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Course(s)									
20MA101	Mathematics – I for Biosciences	BS	3	2	0	4	40	60	100
20EC103	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	40	60	100
Theory with Practical Courses									
20ENEXX	Language Elective – I	HSS	2	0	2	3	50	50	100
20CH101	Chemistry for Biosciences	BS	3	0	2	4	50	50	100
20FT101	Introduction to Biochemistry and Nutrition	BS	3	0	2	4	50	50	100
20ME101	Engineering Graphics	ES	1	0	4	3	50	50	100
Mandatory Course									
20MC101	Induction Program	MC	2 Weeks			0	100	0	100
	TOTAL		15	2	10	21	330	370	700

Language Electives – I									
Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
20ENE01	Communicative English	HSS	2	0	2	3	50	50	100
20ENE02	Advanced Communicative English	HSS	2	0	2	3	50	50	100

Passed in Board of studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

	II- SEMESTER								
Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Courses									
20MA201	Mathematics – II for Biosciences	BS	3	2	0	4	40	60	100
20FT201	Food Microbiology	BS	3	0	0	3	50	50	100
Theory with Practical Courses									
20ENEXX	Language Elective – II	HSS	2	0	2	3	50	50	100
20PH201	Physics for Biosciences	BS	3	0	2	4	50	50	100
20CS201	Problem Solving using Python	ES	3	0	2	4	50	50	100
Practical Courses									
20FT202	Food Practices Laboratory	BS	0	0	4	2	50	50	100
Mandatory Course									
20MC201	Environmental Science	MC	2	0	0	0	100	0	100
Total			16	2	10	20	340	360	700

Language Electives – II

Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
20ENE02	Advanced Communicative English	HSS	2	0	2	3	50	50	100
20ENE03	Hindi	HSS	2	0	2	3	50	50	100
20ENE04	French	HSS	2	0	2	3	50	50	100
20ENE05	German	HSS	2	0	2	3	50	50	100

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

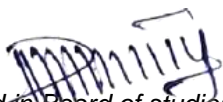*Approved in Academic Council Meeting*
CHAIRMAN - ACADEMIC COUNCIL

			Periods/Week				Maximum Marks		
Code No.	Course	Category	L	T	P	C	CA	FE	Total
III- SEMESTER									
Theory Courses									
20MA301	Transforms and Boundary Value Problems	BS	3	2	0	4	40	60	100
20FT301	Fundamentals of Food Processing	PC	3	2	0	4	40	60	100
20FT302	Applied Thermodynamics for Food Technology	ES	3	0	0	3	40	60	100
20FT303	Food Process Calculation	ES	3	2	0	4	40	60	100
20FT304	Instrumental Methods of Analysis	PC	3	0	0	3	40	60	100
20FT305	Food Chemistry and Nutrition	PC	3	0	0	3	40	60	100
Practical Courses									
20FT306	Instrumental Methods of Analysis Laboratory	PC	0	0	2	1	50	50	100
20FT307	Food Chemistry Laboratory	PC	0	0	2	1	50	50	100
Mandatory Course									
20MC302	Interpersonal skills	MC	0	0	2	0	100	0	100
Total			18	6	6	23	390	510	900

Passed in Board of studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

			Periods/Week				Maximum Marks		
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
IV- SEMESTER									
Theory Courses									
20MA403	Probability and Statistical Methods	BS	3	2	0	4	40	60	100
20FT401	Fundamentals of Fluid Mechanics	ES	3	0	0	3	40	60	100
20FT402	Unit Operations in Food Technology	ES	3	0	0	3	40	60	100
20FT403	Food Processing and Preservation	PC	3	2	0	4	40	60	100
20FT404	Food Additives	PC	3	0	0	3	40	60	100
20FT405	Refrigeration and Cold Chain Management	PC	3	2	0	4	40	60	100
Practical Courses									
20FT406	Unit Operations Laboratory	PC	0	0	2	1	50	50	100
20FT407	Food Processing and Preservation Laboratory	PC	0	0	2	1	50	50	100
Mandatory Course									
20MC401	Soft Skill	MC	2	0	0	0	100	0	100
Total			20	6	4	23	390	510	900

			Periods/Week				Maximum Marks		
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
V- SEMESTER									
Theory Courses									
20FT501	Dairy Processing Technology	PC	3	0	0	3	40	60	100
20FT502	Heat and Mass Transfer in Food Processing	PC	3	2	0	4	40	60	100
20FT503	Biochemical Engineering in Food Technology	PC	3	2	0	4	40	60	100
20FT504	Food Equipment Design	PC	3	2	0	4	40	60	100
20FTEXX	Professional Elective-I	PE	3	0	0	3	40	60	100
20FTOXX	Open Elective-I	OE	3	0	0	3	40	60	100
Practical Courses									
20FT505	Dairy Processing Laboratory	PC	0	0	2	1	50	50	100
20FT506	Biochemical Engineering Laboratory	PC	0	0	2	1	50	50	100
Total			18	6	4	23	350	450	800

Passed in Board of studies Meeting   *Approved in Academic Council Meeting*

CHAIRMAN - BOARD OF STUDIES   **CHAIRMAN - ACADEMIC COUNCIL**

Code No.	Course	Category	L	T	P	C	CA	FE	Total
VI- SEMESTER									
Theory Courses									
20FT601	Baking and Confectionary Technology	PC	3	0	0	3	40	60	100
20FT602	Food Process Engineering and Economics	HSS	3	2	0	4	40	60	100
20FTEXX	Professional Elective-II	PE	3	0	0	3	40	60	100
20FTOXX	Open Elective-II	OE	3	0	0	3	40	60	100
Theory with Practical Courses									
20FT603	Fruits and Vegetable Processing Technology	PC	3	0	2	4	50	50	100
Practical Courses									
20FT604	Baking and Confectionary Technology Laboratory	PC	0	0	4	2	50	50	100
20FT605	Mini Project	EEC	0	0	4	2	50	50	100
20FT606	Internship	EEC	2 Weeks			1	100	0	100
Total			15	2	10	22	360	440	800

Code No.	Course	Category	L	T	P	C	CA	FE	Total
VII- SEMESTER									
Theory Courses									
20FT701	Food Packing Materials Technology	PC	3	0	0	3	40	60	100
20FT702	Food Quality and Safety Regulation	PC	3	0	0	3	40	60	100
20FTEXX	Professional Elective-III	PE	3	0	0	3	40	60	100
20FTEXX	Professional Elective-IV	PE	3	0	0	3	40	60	100
20FTOXX	Open Elective-III	OE	3	0	0	3	40	60	100
Practical Courses									
20FT703	Food Packing Materials Laboratory	PC	0	0	2	1	50	50	100
20FT704	Design Project	EEC	0	0	4	2	50	50	100
Total			15	0	4	18	350	450	700

Passed in Board of studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

VIII- SEMESTER									
Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Courses									
20FTEXX	Professional Elective-V	PE	3	0	0	3	40	60	100
20FTEXX	Professional Elective-VI	PE	3	0	0	3	40	60	100
20FT801	Major Project	EEC	0	0	20	10	50	50	100
Total			**6**	**0**	**20**	**16**	**130**	**170**	**300**

OPEN ELECTIVE COURSES (For Other Branches)									
Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
20FTO01	Analytical techniques	OE	3	0	0	3	40	60	100
20FTO02	Process Instrumentation and Control	OE	3	0	0	3	40	60	100
20FTO03	Intellectual Property Rights	OE	3	0	0	3	40	60	100
20FTO04	Process Economics and Industrial Management	OE	3	0	0	3	40	60	100
20FTO05	Product Development and Management	OE	3	0	0	3	40	60	100
20FTO06	Optimization Techniques in Product Development	OE	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVES (PE)									
Stream – I (Food Processing Technology)									
Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
20FTE01	Fat and Oil Processing Technology	PE	3	0	0	3	40	60	100
20FTE02	Meat and Fish Processing Technology	PE	3	0	0	3	40	60	100
20FTE03	Poultry and Husbandry Processing Technology	PE	3	0	0	3	40	60	100
20FTE04	Cereals and Pulses Processing Technology	PE	3	0	0	3	40	60	100
20FTE05	Mushroom Processing Technology	PE	3	0	0	3	40	60	100
20FTE06	Emerging Technologies in Food Processing	PE	3	0	0	3	40	60	100
20FTE07	Beverage Processing Technology	PE	3	0	0	3	40	60	100
20FTE08	Enzyme Technology	PE	3	0	0	3	40	60	100

Passed in Board of studies Meeting   *Approved in Academic Council Meeting*

CHAIRMAN - BOARD OF STUDIES   **CHAIRMAN - ACADEMIC COUNCIL**

20FTE09	Protein Technology	PE	3	0	0	3	40	60	100
20FTE10	Ready to Eat Processing Technology	PE	3	0	0	3	40	60	100
Stream – II (Food Design Engineering)									
20FTE11	Food Process Equipment Design	PE	3	0	0	3	40	60	100
20FTE12	Food Storage Engineering	PE	3	0	0	3	40	60	100
20FTE13	Design and Formulation of Food	PE	3	0	0	3	40	60	100
20FTE14	Instrumentation and Process Control in Food Industry	PE	3	0	0	3	40	60	100
20FTE15	Food Plant Utilities and Services	PE	3	0	0	3	40	60	100
20FTE16	Food Packing Technology and Equipment	PE	3	0	0	3	40	60	100
20FTE17	Optimization Techniques in Food Engineering	PE	3	0	0	3	40	60	100
20FTE18	Food Plant Design and Layout	PE	3	0	0	3	40	60	100
20FTE19	Modeling and Simulation of Food Processes	PE	3	0	0	3	40	60	100
20FTE20	Material Science and Technology	PE	3	0	0	3	40	60	100
Stream – III (Advanced Food Technology)									
20FTE21	Applications of Renewable Energy in Food Processing	PE	3	0	0	3	40	60	100
20FTE22	ICT Application in Food Industry	PE	3	0	0	3	40	60	100
20FTE23	Microbial and Food Technology	PE	3	0	0	3	40	60	100
20FTE24	Application of Nanotechnology and Cryogenic in Food Technology	PE	3	0	0	3	40	60	100
20FTE25	Milling technology	PE	3	0	0	3	40	60	100
20FTE26	Downstream Processing	PE	3	0	0	3	40	60	100
20FTE27	Creativity, Innovation and New Food Product Development	PE	3	0	0	3	40	60	100
20FTE28	Renewable Energy Technology	PE	3	0	0	3	40	60	100
20FTE29	Functional Foods & Nutraceuticals	PE	3	0	0	3	40	60	100
20FTE30	Instrumental Techniques in Food Analysis	PE	3	0	0	3	40	60	100

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Code No.	Course	Category	L	T	P	C	CA	FE	Total
ONE CREDIT COURSES									
			Periods/Week			**C**	**Maximum Marks**		
20FTA01	Interpersonal Skills	EEC	1	0	0	1	40	60	100
20FTA02	Analytical Skill	EEC	1	0	0	1	40	60	100
20FTA03	Value Education	EEC	1	0	0	1	40	60	100
20FTA04	Halal Compliance in Food Audits	EEC	1	0	0	1	40	60	100
20FTA05	Health Fitness	EEC	1	0	0	1	40	60	100
20FTA06	Social Psychology	EEC	1	0	0	1	40	60	100

CREDITS DISTRIBUTION – SEMESTER WISE

S.No	Category	Credits per Semester								Total Credits	Credits in %	Total Credits (AICTE)
		I	II	III	IV	V	VI	VII	VIII			
1.	HSS	3	3				4			10 (10-14)	6.06%	11
2.	BS	12	13	4	4					33 (22-28)	20.00%	27
3.	ES	6	4	7	6					23 (24)	13.94%	15
4.	PC			12	13	17	9	7		58 (48)	35.15%	89
5.	PE					3	3	6	6	18 (18)	10.91%	18
6.	OE					3	3	3		9	5.45%	6
7.	EEC						3	2	10	14 (12-16)	8.48%	13
8.	MC	**Non-Credit Courses**								0	0.0%	0
Total		21	20	23	23	23	22	18	16	166	100%	179

HSS - Humanities and Social Sciences

BS   - Basic Sciences

ES   - Engineering Sciences

PC   - Professional Core

PE   - Professional Elective

OE   - Open Elective

EEC - Employability Enhancement Course

MC - Mandatory Courses (Non-Credit Courses)

CA   - Continuous Assessment

FE   - Final Examination

Passed in Board of studies Meeting   *Approved in Academic Council Meeting*

CHAIRMAN - BOARD OF STUDIES

CHAIRMAN - ACADEMIC COUNCIL

20MA101	Mathematics - I for Bio Sciences (Common to AGRI and FOODTECH)	L	T	P	C
		3	2	0	4
Nature of Course	Basic Sciences				
Pre requisites	Fundamentals of Basic Mathematics				

Course Objectives

The course is intended to

1. Acquire the concept of matrix algebra techniques.
2. Acquaint the mathematical tools needed in evaluating limits, derivatives and differentiation of one variable.
3. Learn the concept of calculus for solving the problems mathematically and obtaining solutions.
4. Learn the concepts of algebraic and transcendental functions.
5. Introduce the concept of evaluating multiple integrals and their usage in find the area and volume of two and three dimensional objects.

Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO1	Apply the idea of reducing complex problems into simple form using matrix technique.	Apply
CO2	Use both the limit definition and rules of differentiation to differentiate functions.	Understand
CO3	Identify the circle of curvature, evaluate and envelope of the curves.	Understand
CO4	Explain different methods of Integration used in Engineering problems	Understand
CO5	Apply Double and Triple integrals in Engineering real life problems.	Apply

Course Contents:

Unit –I Matrices 12

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties(statement only) – Cayley-Hamilton theorem and its applications – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

Unit – II Limits and Continuity 12

Representation of functions – Limit of a function – continuity – derivatives- Differentiation rules – Maxima and Minima of a function of one variables

12

Unit – III Differential Calculus

Curvature – Curvature in Cartesian Co-ordinates Centre and Radius of curvature–Circle of curvature – Evolutes and Involutes – envelope

12

Unit – IV Integral Calculus I

Basic integration formulae for algebraic and transcendental functions - Integration by special devices - integration by parts - rationalizing substitution or trigonometric substitution - partial fractions - reduction formulas - improper integrals - convergence tests.

Unit – V Integral Calculus II 12

Basic integration formulae for algebraic and transcendental functions-Integration by special devices: enclosed by plane curves - Change of variables in double integrals (Polar coordinates) - Triple integrals - Volume of solids.

Total: 60 Periods

Passed in Board of studies
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Grewal B.S, "Higher Engineering Mathematics",KhannaPublishers, 44th Edition,2019
2. Veerarajan.T,"Engineering Mathematics for Semester I and II",Tata McGraw Hill,3rd Edition,2014.
3. Smith RT and Minton RB, Calculus, , McGraw Hill, 2nd Edition,2002

ReferenceBooks:
1. Ramana B.V,"Higher Engineering Mathematics",TataMcGrawHillCompany, 1stEdition,2018
2. Bali.N.P and ManishGoyal N.P, "A text book of Engineering Mathematics", Laxmi Publications, 6th Edition,2015

Additional References:
1.https://nptel.ac.in/courses/111/105/111105121
2.https://nptel.ac.in/courses/122101003/2

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2										2		
CO2	3	3	2										1		
CO3	3	2	2										1		
CO4	3	2	1										2		
CO5	3	3	2										1		
	3	High			2		Medium					1	Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class /Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Exam			Final Examination
	IAEI (7.5)	IAE II (7.5)	IAE III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

20EC103	Basics of Electrical and Electronics Engineering (Common to Aeronautical, Mechanical, Safety and Fire Engineering & Food Technology)	L	T	P	C
		3	0	0	3

Nature of Course	Engineering Sciences
Pre requisites	Nil

Course Objectives

1. The course is intended to understand the basic concepts of electrical elements and measuring instruments.
2. Gain knowledge of circuitlaws.
3. Understand the various components used in electricalinstallations.
4. Illustrate the construction and operation of various electricalmachines.
5. Explore the knowledge on semiconductor and digitalcircuits

Course Outcomes

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

CO.No.	Course Outcome	Bloom's Level
CO1	Explain the basic concepts of electrical elements and measuring instruments	Understand
CO2	Apply various circuit laws for solving complex circuits	Apply
CO3	Analyze the functions of various components used in electrical systems	Apply
CO4	Classify the static and dynamic machines and explain their Operation.	Apply
CO5	Understand the basic functionalities of electronic circuits and devices	Apply

Course Contents:

Unit– I Electrical Elements andMeasuringInstruments 9
Resistance, Inductance, Capacitance, Wires and Cables Ammeter, Voltmeter, Wattmeter, Energy meter, Thermistor and Anemometer

Unit—II Electrical CircuitsandTheorems 9
Ohm'sLaw–Kirchoff'sLaws–SteadyStateSolutionofDCCircuits–IntroductiontoACCircuits– Theorems; Thevinin's, Norton's, Superposition,Maximumpowertransfer

Unit–III ElectricalInstallationsDevices: 9
Types of Protection devices: Fuses, MCB, ELCB, equipments for house wiring, simple house wiringand pump motor wiring.

Unit –IV ElectricalMachines 9
Constructionand operating characteristics: DC Motor, Single Phase Transformer, Three phase Induction motor, single phase induction motors, Synchronous Motor, and Stepper Motor.

Unit – V Semiconductor Devices andDigitalElectronics 9
Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/AConversion

Total: 45 Periods

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

Text Books
1. Thereja .B.L.,"Fundamentals of Electrical Engineering and Electronics ",S. Chand & Co. Ltd.,2008.
2. D P Kothari and I.J Nagarath, "Electrical Machines – Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, ThirdReprint, 2016.
3. Leonard S Bobrow, "Foundations of Electrical Engineering", Oxford University Press,2013.

Reference Books:
1. T.K.Nagsarkar and M.S.Sukhija, "Basic of Electrical Engineering",Oxford University Press,2011.
2. Laszlo Solymar, Donald Walsh, Richard R. A. Syms, "Electrical Properties of Materials", Oxford University press, 2014.
3. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India,2014.
4. Mehta V K, "Principles of Electronics", S.Chand& Company Ltd,(1994).

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2										3	1	2
CO2	3	3	2										3	1	2
CO3	3	3	2										3	1	2
CO4	3	3	2										3	1	2
CO5	3	3	2										3	1	2

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

| 3 | High | 2 | Medium | 1 | Low |

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Understand	Quiz / Presentation/Tutorial	5	
Understand	Assignment/Video presentation	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	IAE 1 (7.5)	IAE 2 (7.5)	IAE 3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyse				
Evaluate				
Create				

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

20ENE01	**COMMUNICATIVE ENGLISH**	**L**	**T**	**P**	**C**
	(Common to all B.E. / B.Tech. Programmes)	**2**	**0**	**2**	**3**
Nature of Course	Humanities and Social Science				
Pre requisites	Nil				

Course Objectives

The course is intended to
1. Improve lexical, grammatical and semanticcompetence.
2. Enhance communicative skills in real lifesituations.
3. Augment thinking in all forms ofcommunication.
4. Equip with oral and written communicationskills.
5. Gain employabilityskills.

Course Outcomes

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

CO.No.	Course Outcome	Bloom's Level
CO1	Use effectively the lexical, grammatical and semantic knowledge	Remember
CO2	Communicate with clarity using intentional vocabulary in English	Apply
CO3	Articulate perfectly and express their opinions confidently using communicative strategies	Remember
CO4	Accomplishlistening and reading skills for lifelong learning	Understand
CO5	Comprehend, interpret and present data	Understand

Course Contents

Unit - I Basic structureand Usage 6

Parts of Speech –- Articles –Tenses - Subject-Verb Agreement – Different Grammatical forms of the same word - Listening to Speeches and Conversations from Communication software – Listening to Announcements – Listening and Gap Filling.

Unit - II Vocabulary andLanguage Development 6

Intentional vocabulary used in and around Airport, Hospital, Hotel, Court –Abbreviations and acronyms - One Word Substitution - Compound words– Homophones and Homonyms – Types of sentences -Ordering Jumbled Sentences Letter writing – informal.

Unit –III Oral Communication Skills 6

Improving fluency – Articulation with pronunciation – Voice modulation in Speaking – One minute talk -Self Introduction and introducing ones friend – Telephonic conversations – Group Discussion – Modal Auxiliaries –discoursemarkers.

Unit –IV Comprehensive Listening andReading 6

Effective listening Strategies –– Listening to Interviews from Communication software– Phrasal verbs – ReadingComprehension– "AnAstrologer‛sDay"byR.K.Narayanand"BuildingaNewState"byDr.A.P.J. AbdulKalam.

Unit –VEffective Writing 6

Interpretation and presentation of data – developing Hints – general essays and paragraph writing – Report Writing – survey report and accident report - Instructions and Recommendations.

Total:30 Periods

Passed in Board of studies
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council
CHAIRMAN - ACADEMIC COUNCIL

Laboratory Components

S.No	List of Exercises	CO Mapping	RBT
1	Role-play – One minute talk	3	Understand
2	Role-play – Telephonic conversations	3	Understand
3	Listening to speeches and lectures and gap filling	4	Understand
4	Group Discussion.	4	Understand
5	Articulation with pronunciation practice	3	Apply
6	Listening to Announcements – Listening and Gap Filling	4	Understand
7	Listening to Interviews &Native speakers'Conversations	4	Understand
8	Reading practice with articles in magazine and newspapers.	4	Understand
9	Model – Job Interviews	4	Understand
10	Introspective report – Personal analysis	5	Understand
11	Telephone etiquette	3	Remember
12	Reading – Shorter texts and News Articles	4	Understand
13	Role Play – Getting and Giving Permission	3	Remember
14	Self-Introduction(Formal)	3	Understand
15	Recommendations/Suggestions	3	Apply

Total: 30 Periods

Text Books
1. Rizvi, Ashraf M., "Effective Technical Communication", Tata McGraw Hill Publishing Company Limited, New Delhi, 5th Edition,2007.
2. Board of Editers,"Using English – A Coursebook for Undergraduate Engineers and Technologists", Orient BlackSwan Private Limited, Hyderabad, 2nd Edition,2017.

Reference Books:
1. MeenakshiRaman andSangeethaSharma, "Technical Communication",Oxford University Press, USA, 10th Edition,2007.
2. John CunnisonCatford, "A Practical Introduction to Phonetics", Clarendon Press, Jamaica, 2nd Edition,2001.
3. Hewings. M, "Advanced English Grammar",Cambridge University Press, Chennai, 3rd Edition, 2000.
4. S P Dhanavel "English and Soft Skills", Orient BlackSwan Private Limited, Hyderabad, 1st Edition, 2010.

Web reference:

https://www.googleadservices.com/pagead/aclk?sa=L&ai=DChcSEwij4dCTucfsAhXE1pYKHch4A BMYAB ABGgJ0bA&ohost=www.google.com&cid=CAASEuRo76H-Vx9BpazOOBfXeJSKVQ&sig=AOD64_3O- HNEnUO4A5sc31MsUfaTBGG-dQ&q&adurl&ved=2ahUKEwjC3ceTucfsAhXBeisKHatlBewQ0Qx6BAgfEAE

Passed in Board of studies
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council
CHAIRMAN - ACADEMIC COUNCIL

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)																
COs	**POs**													**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	
CO1							1			3	2	2	2			
CO2							1			3	2	2	2			
CO3							1			3	2	2	2			
CO4							1			3	2	2	2			
CO5							1			3	2	2	2			
	3	**High**				**2**	**Medium**				**1**	**Low**				

Summative assessment						
Bloom's Level	**Continuous Assessment**					**Final Examination (Theory)**
	Theory Marks				**Practical**	
	IAE-I [7.5]	**IAE-II [7.5]**	**IAE -III [10]**	**Attendance [5]**	**Rubric based CIA [20 Marks]**	**[50 marks]**
Remember	20	20	20		40	40
Understand	20	20	20		40	40
Apply	10	10	10		20	20
Analyze						
Evaluate						
Create						

Passed in Board of studies   *Approved in Academic Council*

CHAIRMAN - BOARD OF STUDIES   CHAIRMAN - ACADEMIC COUNCIL

20CH101	CHEMISTRY FOR BIOSCIENCES	L	T	P	C
		3	0	2	4
Nature of Course	Basic Sciences				
Prerequisites	Nil				

Course Objectives

The course is intended to
1. Learn the basic principles of analytical techniques.
2. Introduce the students to dairy industry, properties and processing of milk.
3. Understand the chemistry of sugar.
4. Learn about the nature, types and problems of the soil.
5. Gain knowledge about suitable fertilizers for different types of soil.

Course Outcomes

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

CO.No.	Course Outcome	Bloom's Level
CO1	Implement the analytical techniques like filtration and evaporation	Understand
CO2	Interpret the properties of proteins	Understand
CO3	Summarize the chemistry of sugar	Understand
CO4	Identify the nature and problems of the soil	Understand
CO5	Decide fertilizer for a particular soil depending on its nature	Apply

Course Contents

Unit-I Analytical Techniques 9

Basic Principles: Precipitation, filtration, sample drying, transfer of precipitates. Distillation, vacuum distillation, fractional distillation and steam distillation, sublimation and crystallization.

Unit-II Proteins 9

Chemistry of proteins: structure, N-terminal and C - terminal, hydrogen bond, disulphide bond and salt linkages. Outlines of primary, secondary and tertiary structure of proteins. Physical properties of milk proteins: electrical properties, hydration and solubility.

Unit-III Chemistry of Sugar 9

Manufacture of sucrose from cane sugar, purification, concentration, crystallization, separation and refining of crystals, recovery of sucrose from molasses. Properties and uses of sucrose. Fermentation process: manufacture of alcohol from molasses.

Unit-IV Soil Chemistry 9

Types of soil: saline soil, acidic soil and alkaline soil. Formation: acid, acid sulphate, salt affected and calcareous soil. Charateristics and Reclamation. Methods of reclamation: mechanical, chemical and biological methods. Chemistry of submerged soils.

Unit-V Fertilizers 9

Effect of N, P, K, Secondary nutrients and micro nutrients on plant growth and development. Importance of nitrogenous fertilizers. Nitrogen cycle and fixation of atmospheric nitrogen. Uses of mono and diammonium phosphates, super phosphates and triple super phosphates. Potassium fertilizers: examples and uses. Green manuring: definition and examples (red-clover and peas).

Total: 45 Periods

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

Laboratory Component

S.No.	Name of the Experiment	CO Mapping	RBT
1	Potentiometric precipitation titration of barium chloride and sodium sulphate	CO1	Apply
2	Finding out the melting point of ice and boiling point of water	CO1	Understand
3	Identification of the type of hardness of water by EDTA method	CO2	Understand
4	Determination of calcium in milk by EDTA method	CO2	Apply
5	Conductometric titration of strong acid vs strong base	CO3	Apply
6	Determination of strength of HCl by pH metry	CO3	Apply
7	Measurement of pH of different soil samples using litmus paper and pH strips to classify the nature of the soil	CO4	Apply
8	Determination of the nature of sample solution of fertilizer (acidic, alkaline, neutral) using universal indicator	CO5	Apply

Total: 30 Periods

Text Books
1. A.Tolanur, "Soil Chemistry, CBS Publishers, 2nd edition, 2015.
2. B.S. Bahl and ArunBahl, "Advanced Organic Chemistry", S.Chand & Company Ltd, 22nd Edition, 2010.

Reference Books
1. Havlin Tisda, "Soil Fertility and Fertilizers", Pearson Publishers, 2nd edition, 2013.
2. G. C. Banerjee, "The Text Book of Animal Husbandry", Oxford Book Company, 1st Edition, 2010.
3. N. S. R. Sastry and C. K. Thomas, "Livestock Production Management", Kalyani Publishers, 4th Edition, 2005.

Additional Resources
1. https://fac.ksu.edu.sa/sites/default/files/9_determination_of_calcium_in_milk.pdf
2. https://www.youtube.com/watch?v=xIz2YPBXuZU
3. https://www.youtube.com/watch?v=jFQeDef6bug

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2									1				
CO2	3	2									1				
CO3	3	2									1				
CO4	3	2									1				
CO5	3	2									1				
	3		High			2		Medium			1		Low		

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes(PSO)

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

Bloom's Level	Summative Assessment					
	Continuous Assessment					Final Examination (Theory) [50]
	Theory				Practicals	
	IAE-I [7.5]	IAE-II [7.5]	IAE-III[10]	Attendance [5]	Rubric based CIA[20]	
Remember	30	20	10		20	40
Understand	10	20	30		20	40
Apply	10	10	10		10	20
Analyze						
Evaluate						
Create						

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

20FT101	Introduction to Biochemistry and Nutrition	L	T	P	C
		3	0	2	4

Nature of Course	Professional Core
Pre requisites	Nil

CourseObjectives

The course is intended to

1. Enable students; learn the fundamentals of Biochemical Processes andBiomolecules.
2. Provide an advanced understanding of the core principles and topics ofBiochemistry.
3. Enable the students to understand roles of each nutrients in growth andmetabolism.
4. Acquire a specialized knowledge and understanding inmicronutrients.
5. Understand the concept of metabolic function and itssynthesis.

CourseOutcomes

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

Sl.No.	Course Outcome	Bloom's Level
CO1	Demonstrate the fundamentals of biomolecules, biochemical reactions in a living organism.	Understand
CO2	Identify the of importance of nutrients in physiological function and biochemical pathways	Understand
CO3	Interpret the biochemical data using appropriate quantitative, technological and critical thinking skills	Apply
CO4	Classify the biochemical techniques, understanding both the principles and its applications	Apply
CO5	Recognition of nutritive values of foods and deficiency diseases of different nutrients	Understand

Course Contents:

UNIT I   Introduction to Biochemistry   9

Basic principles of organic chemistry, role of carbon, types of functional groups, biomolecules, chemical nature of water, pH and biological buffers. Proteins and protein structures; Essential amino acids. Metabolism of proteins (digestion and absorption); transamination, deamination and decarboxylation, Nitrogen balance and nitrogen pool; Urea Cycle, Evaluation of quality of proteins

UNIT II   Metabolism Concepts and Regulation   9

Carbohydrates; Definition & classification; General chemistry of carbohydrates; Metabolic pathways for breakdown of carbohydrates: glycolytic pathway, pentose phosphate pathway, citric acid cycle, electron transport chain, ATP balance, gluconeogenesis; General chemistry of lipids; Essential fatty acids; Digestion & absorption of lipids. β- oxidation of long chain fatty acids, Ketosis, breakdown of phospholipids, Biosynthesis of fatty acids, triglyceridesand phospholipids

UNIT III   Concepts of Food and Nutrition   9

Functions of food; Basic food groups; nutrients supplied by food; Water and energy balance, water intake and losses, basal metabolism Formulation of diets, classification of balanced diet, preparation of balanced diet for various groups; Recommended dietary allowances for various age groups; Malnutrition; Assessment of nutritionalstatus; Food fad and faddism; Potentially toxic substance in human food.

UNIT IV   Vitamins, Minerals and Hormones   9

Water Soluble Vitamins and Fat Soluble Vitamins. Function, recommended intakes, food sources of vitamin deficiencies and toxicities. Major Minerals such as sodium, potassium and calcium, Trace Minerals and transport of iron and zinc and importance of selenium, copper, fluoride, and chromium. Water balance, functions, deficiencies and recommended intakes; fluid/electrolyte balance, acid-base balance.

UNIT V   Nutrition and Energy Balance   9

Definition, six classes of nutrients, Energy Balance using the RDA, nutritional status, nutritional requirement, malnutrition, nutritional assessment, dietary recommendations, Balanced Diet planning principles, dietary guidelines; Glycemic and Non-glycemic carbohydrates, health effects of fiber and starch intake food groups, exchange lists, personal diet analysis; Digestion, Absorption and Transport Anatomy and physiology ofthedigestive tract, mechanical and chemical digestion, absorption of nutrients. Energy balance; body weight and body composition; health implications; obesity, BMR and BMI calculations.

Total: 45 Periods

Passed in Board of studies   *Approved in Academic Council*

CHAIRMAN · BOARD OF STUDIES   **CHAIRMAN · ACADEMIC COUNCIL**

LIST OF EXPERIMENTS

S.No	Name of the Experiment	CO Mapping	RBT
1.	Protein estimation by Biuret and Lowry's methods. Protein estimation by Bradford and spectroscopic methods. Estimation of protein content by Micro-Kjeldahl Method 1	2	Analyze
2.	Quantitative method for amino acid estimation using Ninhydrin test, Millon's Test, Nitroprusside Test – distinguishing amino from amino acid.	2	Evaluate
3.	Qualitativetestsforcarbohydrates(Molisch'sTest, Fehling'sTest, Benedict Test, Iodine Test, etc.)– distinguishing reducing from non-reducing sugars and keto from aldo sugars.	3	Analyze
4.	Qualitative tests for lipids (saponification test, unsaturated fatty acid test, etc)	3	Evaluate
5.	Nutritional anthropometry - Standards for reference – WHO, Body Mass Index and reference value	2	Analyze
6.	Techniques of measuring height, weight, head, chest and arm circumference, waist to hip ratio, skin-fold thickness, Calculation of percent Body fat using skin folds callipers	2	Evaluate
7.	Calculation of the calories from nutrient composition of foods	2	Evaluate
8.	Determination of crude fat by Soxhlet Method	3	Analyze
9.	Determination of ash content of given sample	2	Evaluate
10.	Determination of crude fiber content of given sample	2	Analyze
			Total : 30 Periods

TEXT BOOKS:
1. Nelson D.L. and Cox. M.M., "Lehninger's Principles of Biochemistry", W.H. Freemen & Co, 4thEdition, 2005.
2. Satyanarayana U. and Chakerapani U., "Biochemistry", Books & Allied (P) Ltd, 3rd Rev. Edition2006.
3. Rastogi S.C., "Biochemistry", Tata McGraw-Hill, 2nd Edition,2003.
4. Mann J. and Stewart T., "Essentials of Human Nutrition", Oxford University Press, 3rd Edition2007.
5. Michael J.G, Susan A. L-N, Aedin C and Hester H.V. "Introduction to Human Nutrition". Wiley Blackwell, 2nd Edition,2009.

REFERENCES:
1. Berg, Jeremy M, Tymoczko J.L, Stryer and Lubert. "Biochemsitry", W.H. Freeman & Co., 6th Edition, 2006.
2. Voet D. and Voet J.G., "Biochemistry", John Wiley & Sons Inc, 3rd Edition,2004.
3. Sareen S.G and Jack L. S., "Advanced Nutrition and Human Metabolism", Wadsworth Publishing, 5th Edition,2008.

Web References:
1. http://unaab.edu.ng/funaab-ocw/index.php/biochemistry-80342/lecture-notes-32095
2. http://egyankosh.ac.in/handle/123456789/32934
3. https://microbenotes.com/amino-acids-properties-structure-classification-and-functions/
4. https://www.coursehero.com/file/17782635/Nutritional-Biochemistry/
5. https://www.pinterest.com/lianashep/biochemistry-notes/
6. http://www.biosciencenotes.com/

Passed in Board of studies
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council
CHAIRMAN - ACADEMIC COUNCIL

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										1	2		
CO2	3	2										1	2		
CO3	3	2										1	2		
CO4	3	3										1	2		
CO5	3	2										1	2		
	3	High			2	Medium					1	Low			

Bloom's Level	Summative assessment					
	Continuous Assessment					Final Examination (Theory) [50 marks]
	Theory Marks				Practical	
	IAE-I [7.5]	IAE-II [7.5]	IAE-III [10]	Attendance [5]	Rubric based CIA[20 Marks]	
Remember	20	20	20		40	40
Understand	20	20	20		40	40
Apply	10	10	10		20	20
Analyze						
Evaluate						
Create						

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

20ME101	Engineering Graphics (Common to Aeronautical, Agriculture, Civil, Mechanical, Safety and Fire Engineering & Food Technology)	L	T	P	C
		1	0	4	3
Nature of Course	Engineering Sciences				
Pre requisites	Nil				

Course Objectives:

The course is intended to

1. Understand technical drawings in various fields ofengineering
2. Imagine and visualize the geometric details of engineering objects.
3. Translate the geometric information of engineering objects into engineeringdrawings.
4. Develop the graphical skills for communication of concepts, ideas and design of engineering products through technicaldrawings.
5. Visualize and draw isometric and perspectiveviews

Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO 1	Develop the conic sections, special curves, and draw orthographic views from pictorial views.	Apply
CO 2	Apply the principles of orthographic projections of points in all quadrants, lines and planes in first quadrant.	Apply
CO 3	Construct the projections of simple solids like prisms, pyramids, cylinder and cone.	Apply
CO 4	Build the sectional views of solids like cube, prisms, pyramids, cylinders & Cones and development of its lateral surfaces.	Apply
CO 5	Organize and draw isometric and perspective sections of simple solids.	Apply

Course Contents

Concepts and Conventions (Not for Examination) 1

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

UNIT–I Plane Curves and FreeHand Sketching (3+12)

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

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three-Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT–II Projection of Points, Lines and Plane Surfaces (3+12)

Orthographic projection- principles-Principal Planes-First angle projection-projection of points Projection of straight lines (only First angle projections) inclined to both the principal planes -Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating objectmethod.

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

UNIT –III Projection of Solids **(3+12)**
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.

UNIT- IV Projection of Sectioned Solids and Development of Surface **(3+12)**
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section, Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

UNIT–V Isometric and Perspective Projections **(3+12)**
Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

TOTALPeriods: (15+60)

TEXT BOOKS
1. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited,2011
2. Natarajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai,2012.

REFERENCE BOOKS
1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition,2010.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi,2008.
3. Parthasarathy N S and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi,2015.

Web References
1. http://nptel.ac.in/courses/112103019/Engineeringdrawing
2. http://pioneer.netserv.chula.ac.th/~kjirapon/self-practice.html

Publication of Bureau of Indian Standards
1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawingsheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation –Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technicaldrawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of TechnicalDrawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – ProjectionMethods.

Special points applicable only to Final Examinations of Engineering Graphics:
1. There will be five questions, each of either-or type covering all units of thesyllabus.
2. All questions will carry equal marks of 20 each making a total of100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3size.
4. The examination will be conducted in appropriate sessions on the sameday

Passed in Board of studies   *Approved in Academic Council*
CHAIRMAN - BOARD OF STUDIES   CHAIRMAN - ACADEMIC COUNCIL

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										1	2		
CO2	3	2										1	2		
CO3	3	2										1	2		
CO4	3	3										1	2		
CO5	3	2										1	2		
	3	High			2	Medium				1	Low				

Summative assessment						
Bloom's Level	**Continuous Assessment**					**Final Examination (Theory) [50 marks]**
	Theory				**Practical**	
	IAE-I [7.5]	**IAE-II [7.5]**	**IAE-III [10]**	**Attendance [5]**	**Rubric based CIA [20 Marks]**	
Remember	10	10	10		20	20
Understand	20	20	20		40	40
Apply	20	20	20		40	40
Analyse						
Evaluate						
Create						

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

20MC101	Induction Programme	L	T	P	C
		2	0	0	0
Nature of Course	Mandatory, Non Credit				
Pre requisites	Completion of Schooling at Higher Secondary Level				

Course Objectives

The course is intended to
1. To nurture the character and behavior as a student.
2. To have broad understanding of society and relationships.
3. To impart interpersonal and soft skills.
4. To inspire the students in the field of engineering.
5. To provide exposure to industries.

Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO 1	Perform curricular and co-curricular activities excellently.	Knowledge
CO 2	Do the skill based training with excellence.	Understand
CO 3	Work as team for the given task	Apply
CO 4	Gain character and behavior	Knowledge
CO 5	Demonstrate the acquired skills effectively	Apply

Course Contents
PHYSICAL ACTIVITY

Yoga, Sports creative arts (students can select any one of their choice) Painting, sculpture, pottery, music, craft making and so on universal human values enhancing soft skills

LITERARY AND PROFICIENCY MODULES

Reading, Writing, Speaking- Debate, Role play etc., Communication and computer skills

LECTURES BY EMINENT PEOPLE

Guest lecture by subject experts

VISIT TO LOCAL CITIES

Meditation centers / Industry

FAMILARIZATION TO DEPARTMENT / BRANCH INNOVATION

Lectures by Departments Head and senior faculty members

Total Periods: 45

Passed in Board of studies
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council
CHAIRMAN - ACADEMIC COUNCIL

Mapping of COs with POs and PSOs

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme SpecificOutcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1						2	1	2				3	2		
CO2						2	1	2				3	2		
CO3						2	1	2				3	2		
CO4						2	1	2				3	2		
CO5						2	1	2				3	2		
	3		High			2		Medium				1	Low		

Bloom's Level	Continuous Assessment (Non-Credit, Mandatory)				
	Test -I [20]	Test -II [20]	Test - III [20]	Assignment/ Activity [20]	Attendance [20]
Remember	10	10	10		
Understand	20	20	20	10	
Apply	20	20	20	10	
Analyse					
Evaluate					
Create					

Passed in Board of studies
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council
CHAIRMAN - ACADEMIC COUNCIL

20MA201	Mathematics-II for Bio Sciences (Common to AGRI and FOODTECH)	L	T	P	C
		3	2	0	4
Nature of Course	Basic Sciences				
Pre requisites	Fundamentals of Basic Mathematics				

Course Objectives

The course is intended to
1. Acquire the mathematical skills to solve the differential equations.
2. Acquaint the concept of Vector calculus needed in Agriculture engineering field.
3. Acquire knowledge of analytic approach to analyze the conformal mapping.
4. An understanding of Fourier Series to solve real world problems
5. Learn the mathematical analysis to understand the sequences.

Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO1	Explain various techniques in solving Ordinary differential equations with constant coefficients	Understand
CO2	Apply complex variables in finding ,Gradient, divergence, curl of a vector point function	Apply
CO3	Identifytheconceptsofanalyticfunctionsanditspropertiesandapplyitin conformal mapping.	Apply
CO4	Represent periodic functions using Fourier series	understand
CO5	Observe how the term of a sequence is represented graphically.	Understand

Course Contents:

Unit – I Ordinary Differential Equations   12

First order linear Differential equations- Exact differential equations- Second order linear differential equations with constant coefficients – Method of variation of parameters – Homogenous equation of Euler"s and Legendre"s Equations.

Unit – II Vector calculus   12

Differentiation of vectors -scalar and vector point functions - Gradient of a scalar point function - Divergence and Curl of a vector point function operator – line - surface and volume integrals - Stoke"s - divergence and Green"s theorems (Statement only) and applications.

Unit - III Complex Differentiation and Conformal Mapping   12

Functions of a complex variable – Analytic functions –Statement of Cauchy –Riemann equations – Harmonic functions–Harmonic conjugate –Construction of analytic functions –Conformal mapping : w= z+c, cz, 1/z and Bilinear transformation.

Unit IV Fourier Series   12

Fourierseries-Euler"sformulae–Dirichlet"sconditions-functionshavingarbitraryperiod-evenandodd functions - half range series - Harmonic analysis -Fourier Sine and Cosine Series - Fourier series for function having period 2L.

Unit – V Sequence and Series

12Sequenc esand series - convergence and divergence of series - absolute convergence- conditional convergence - test for convergence and divergence - Power series for functions- interval of convergence - Taylor and Maclaurin series - Taylors Theorem with remainder.

Total: 60 Periods

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers,Delhi, 44th Edition,2019.
2. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons (Asia) Limited, 10th Edition,2016.

Reference Books:
1. Ramana B.V, "Higher Engineering Mathematics",Tata McGraw Hill Publishing Company, 1stEdition,2018.
2. Bali.N.P and ManishGoyal N.P, "A text book of Engineering Mathematics",8th Laxmi Publications, 6th Edition,2015.

Additional References:
1. https://onlinecourses.nptel.ac.in/noc16_ma05
2. https://nptel.ac.in/courses/122/104/122104017

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2										2		
CO2	2	3	2										1		
CO3	3	2	1										2		
CO4	3	2	1										1		
CO5	3	1	1										1		
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class /Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Exam**			**Final Examination (60)**
	IAE I (7.5)	**IAE II (7.5)**	**IAE 3 (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

20FT201	**Food Microbiology**	L	T	P	C
		3	0	0	3

Nature of Course	Professional Core
Pre requisites	Nil

Course Objectives

The course is intended to

1. Understand the morphology of different microorganisms and its isolation methods.
2. Provide an idea about the general principles of food microbiology.
3. Grasp the various microbiological techniques in identifying the microbes.
4. Evaluate the role of microbes in food spoilage and food borne illness.
5. Identify the importance and significance of microbes in food.

Course Outcomes

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

Sl.No.	Course Outcome	Bloom's Level
CO1	Demonstrate a broad understanding the diversity of microorganism.	Understand
CO2	Describe the structure of microbes associated with food	Understand
CO3	Accomplish the knowledge of microbes in food preservation and spoilage.	Understand
CO4	Infer the role of pathogens in food borne infections and to recognize them.	Understand
CO5	Apply and interpret the experimental data using appropriate quantitative, technological and critical thinking skills.	Apply

Course contents:

UNIT I   Introduction to Microorganism   9

Introduction- definition, historical development and significance of food microbiology, Microbial classification, nomenclature, structural organization and multiplication of bacteria, viruses, algae and fungi. Taxonomic groups and general methods of classifying bacteria. Nutritional requirements and nutrient transport phenomenon: passive diffusion, facilitated diffusion, group translocation and active transport. Types of media used for growth and detection for microbes

UNIT II   Role of Microorganism in Food   9

General principles underlying spoilage of food, fitness and unfitness of food for consumption, contamination and spoilage of non-perishable and perishable foods. Factors affecting spoilage of foods, Microbial flora associated with various food groups their spoilage potential. Microbiological spoilage problems associated with typical food products. Role of antimicrobial agents like organic acids, sugars, sodium chloride, nitrites, phosphates, sulphites, Benzoates, Sorbates / Propionates naturally occurring antimicrobials. Physical methods- Low and high temperatures, drying, radiation and high pressure; Tolerance of microbes to chemical and physical methods in various foods.

UNIT III   Microbes in Food Fermentations   9

Microorganism's importance in food - Factors affecting the growth of microorganisms in food - Intrinsic and Extrinsic parameters that affect microbial growth. Role of microbes in fermented foods and genetically modified foods. Microbes of importance in food fermentations, Homo & hetero-fermentative bacteria, yeasts & fungi; Biochemistry of fermentations - pathways involved, Lactic acid bacteria fermentation and starter cultures, Alcoholic fermentations -Yeast fermentations - characteristics and strain selection, Fungal fermentations. Microbes associated with typical food fermentations- yoghurt, cheese, fermented milks, breads, idly, soy products, fermented vegetables and meats.

Passed in Board of studies   *Approved in Academic Council*
CHAIRMAN - BOARD OF STUDIES   CHAIRMAN - ACADEMIC COUNCIL

UNIT IV   **Control of Microbes in Foods**   **9**

Disinfection & disinfectants; Energy metabolism of aerobic & anaerobic microbes; Thermal inactivation of microbes; Concept, determination & importance of TDT, F, Z & D values; Factors affecting heat resistance; Pasteurization and sterilization. Microbiology of milk & milk products like cheese, butter, ice cream, milk powder; Microbiology of meat, fish, poultry & egg and their products.

UNIT V   **Microbial Examination of Foods**   **9**

Detection & Enumeration of microbes in foods; Indicator organisms and microbiological criteria; Rapid and automated microbial methods - development and impact on the detection of food borne pathogens; Applications of immunological, techniques to food industry; Detection methods for E.coli, Staphylococci, Yersinia, Campylobacter, B. Cereus, Cl. Botulinum & Salmonella, Listeria monocytogenes, Norwalk virus, Rotavirus, Hepatitis A virus from food samples

Total: 45 Periods

TEXT BOOKS:

1. Prescott Harley, Klein "Microbiology ": Authored by Wiley, Sherwood, Woolverton, McGraw-Hill Higher Education, 10th edition, 2017.
2. Ananthanarayanan, R. and C.K. JayaramPaniker, "Textbook of Microbiology", Orient Longman, 9th Edition, 2013.
3. Vijaya Ramesh "Food Microbiology". MJP Publishers, 1st Edition, 2007.
4. Jay, J.M. "Modern Food Microbiology", CBS Publishers, 4th Edition, 2003.
5. Adams, M.R and M.O. Moss. "Food Microbiology". New Age International, 2nd Edition, 2002.

REFERENCES:

1. Pawsey, R.K. "Case Studies in Food Microbiology for Food Safety and Quality", The Royal Society of Chemistry, 2nd Edition, 2001.
2. Forsythe, S.J. "The Microbiology of Safe Food". Blackwell Science, 3rd Edition, 2000.
3. Harrigan, W.F. "Laboratory Methods in Food Microbiology", Academic Press, 3rd Edition, 1998.
4. Ray, B. and Arun B. "Fundamental Food Microbiology" CRC press, 4th Edition, 2004.

Web References:

1. https://thebiologynotes.com/category/food-microbiology/
2. https://microdok.com/potentials-of-microbes-in-food-production/
3. https://app.knovel.com/web/toc.v/cid:kpFMAIE017/viewerType:toc/
4. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=5108
5. https://www.docsity.com/en/introduction-to-food-microbiology-food-microbiology-lecture-slides/208954/
6. https://www.cliffsnotes.com/study-guides/biology/microbiology/food-microbiology/foods-from-microorganisms

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2										2	1		
CO2	3	2										3	2		
CO3	3	1										3	1		
CO4	3	2										3	2		
CO5	3	2										3	1		
	3	High		2		Medium					1		Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Understand	Quiz / Presentation/Tutorial	5	
Understand	Assignment / Video presentation	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Terminal Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyse				
Evaluate				
Create				

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

20ENE02	**Advanced Communicative English** (Common to all B.E./ B.Tech Programmes)	L	T	P	C
		2	0	2	3
Nature of Course	Humanities and Social Sciences				
Pre requisites	Basics of Communicative English				

Course Objectives
The course is intended to
1. Demonstrate satisfactory control over complex structures and mechanics in English.
2. Develop fluency and accuracy in oral communication.
3. Communicate effectively and actively in social interactions.
4. Read English at inspectional level.
5. Face interviews with confidence.

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

CO. No.	Course Outcome	Bloom's Level
CO1	Apply knowledge of English grammar for effective communication	Remember
CO2	Make use of common English phrases and vocabulary strength.	Understand
CO3	Build self-confidence and enhance professionalism	Apply
CO4	Implement listening, reading and writing skills in real - life situations	Apply
CO5	Speak fluently in English with proper pronunciation, intonation, tone and accent.	Understand

Course Contents
Unit – I Grammar and usage 6

Active voice and passive voice – Prefixes and suffixes – Connotation – Clauses - If conditionals – Idioms & Phrases - Right forms of verbs– Modal Auxiliaries – Spotting errors.

Unit - II Lexical competence 6

Technical Vocabulary- Expressions – Frequency – Cause and effect - Words often Miss-spelled – Syntax and structure - Homophones and Homonyms- Verbal analogy - Idioms and Phrases.

Unit – III Conversational etiquette 6

Processes description– Tone and accent in speech– Role-play (Job-Interview) – Presentation skills – Mechanics of presentation - Telephone etiquette – Group Discussion strategy - Formal & Informal subjective and objective introduction – Body Language – Mock Interview.

Unit – IV Listening reading and writing 6

Listen to Scientific/Technical talks and gap filling – Listening to TED/INK Talks – Reading – "Water: The Elixir of Life" by Sir. C.V.Raman. "Progress" by St. John Ervine - Instructions and Recommendations – Letter writing formal–Job application- Report writing–Introspective report – Creative writing – Essays and Paragraphs.

Unit– V Phonetics 6

Production and classification of speech sound – International Phonetic Alphabet and transcriptions – Phonological rules – way and Place of articulation – Vowels, consonants and diphthongs. Specific characteristics feature of vowel sounds. **Total: 30Periods**

Passed in Board of studies
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council
CHAIRMAN - ACADEMIC COUNCIL

Laboratory Components

S.No	List of Exercises	CO Mapping	RBT
1	Role-play – Processes Description	2	Remember
2	Listening to TED/INK Talks and gap filling	4	Understand
3	Group Discussion	3	Understand
4	Articulation with pronunciation practice	3	Apply
5	Reading – Longer texts and Technical Articles (Skimming & Scanning).	4	Apply
6	Presentation skills – Mechanics of presentation	5	Understand
7	Individual presentation on given topics	5	Remember
8	Telephone etiquette	5	Understand
9	Instructions and Recommendations	5	Remember
10	Writing – General Essays.	4	Apply
11	Report writing technique- write up	4	Remember
12	Introspective report – Personal analysis	4	Understand
13	Model Job Interviews	3	Understand
14	Job Interviews(Role play)	3	Apply
15	Body Language	3	Understand

Total: 30 Periods

Text Books
1. Rizvi, Ashraf.M, "Effective Technical Communication", Tata McGraw Hill Publishing Company Limited, New Delhi, 5th Edition,2007.
2. Hewings. M, "Advanced English Grammar", 3rd Edition, Cambridge University Press, Chennai, 5th Edition,2000.
3. Board of Editers, "Using English – A Coursebook for Undergraduate Engineers and Technologists", Orient BlackSwan Private Limited, Hyderabad, 2nd Edition,2017.

Reference Books:
1. Raman M & Sangeetha Sharma,"Technical Communication",Oxford University Press,USA,10th Edition,2007.
2. John CunnisonCatford, "A Practical Introduction to Phonetics",Clarendon Press, Jamaica,2nd Edition,2001.
3. Norman Whitby, Business Benchmark – "Pre-Intermediate to Intermediate, Students Book", Cambridge University Press, 1st Edition,2006.
4. DhanavelS. P., "English and Soft Skills", 1stEdition,OrientBlackSwan Private Limited, Hyderabad, 1st Edition,2010.

Web reference:

1. https://www.coursera.org/lecture/tesol-speaking/video-2-listening-strategies-for-learners-3AeBL?utm_source=mobile&utm_medium=page_share&utm_content=vlp&utm_campaign=top_bu tton

2. blob:https://www.youtube.com/73f7256d-d302-4563-bed5-9e84c94a26ac

Passed in Board of studies
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council
CHAIRMAN - ACADEMIC COUNCIL

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1										3	1	2	2		
CO2										3	1	2	2		
CO3										3	1	2	2		
CO4										3	1	2	2		
CO5										3	1	2	2		

3	High		2	Medium		1	Low

Summative assessment						
Bloom's Level	**Continuous Assessment**					**Final Examination (Theory)** [50 marks]
	Theory Marks				**Practical**	
	IAE-I [7.5]	IAE-II [7.5]	IAE -III [10]	Attendance [5]	Rubric based CIA [20 Marks]	
Remember	20	20	20		40	40
Understand	20	20	20		40	40
Apply	10	10	10		20	20
Analyse						
Evaluate						
Create						

Passed in Board of studies
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council
CHAIRMAN - ACADEMIC COUNCIL

20ENE03	HINDI	L	T	P	C
		2	0	2	3
Nature of Course	Humanities and Social Sciences				
Pre requisites	Basic Perceptive of Language				

Course Objectives

The course is intended for learners.

1. To help students acquire the basics of Hindi
2. To teach them how to converse in Hindi on simple day-to-day situations
3. To help students acquire the ability to understand a simple technical text in Hindi

Course Outcomes

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

CO.No.	Course Outcome	Bloom's Level
CO.1	Construct simple sentences and use vocabulary required for day-to-day conversation	Remember
CO.2	Distinguish and understand the basic sounds of Hindi language.	Remember
CO.3	Appear for Hindi examinations conducted by Daksh in Bharat Hindi Prachar Sabha.	Remember

Course Contents:

UNITI: Introduction 6

Hindi Alphabet: Introduction - Vowels - Consonants - Plosives - Fricatives - Nasal sounds - owel Signs- Chandra Bindu & Visarg -Table of Alphabet -Vocabulary.

UNITII: Reading 6

Nouns: Genders (Masculine & Feminine Nouns long vowels and short vowels -Masculine & Feminine - Reading Exercises

UNIT III: Grammar *6*

Pronouns and Tenses: Categories of Pronouns - Personal Pronouns - Second person you & honorific) - Definite & Indefinite pronouns - Relative pronouns - Present tense - Past tense - Future tense - Assertive & Negative Sentences – Interrogative Sentences.

UNIT IV: Vocabulary *6*

Classified Vocabulary: Parts of body - Relatives - Spices - Eatables - Fruit & Vegetables - Clothes - Directions - Seasons - Professions

UNIT V: Speaking *6*

Speaking: Model Sentences and Rhymes - Speaking practice for various occasions.

Total: 30 Periods

Reference:

1. Hindi Prachar Vahini-1 by Dakshin Bharat Hindi Prachar SabhaChennai
2. B.R.Kishore, Self-Hindi Teacher for Non-Hindi Speaking People, VeeKumar Publications(P)Ltd.,NewDelhi,2009
3. Videos, Stories, RhymesandSongs.

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

20ENE04	FRENCH	L	T	P	C
		2	0	2	0
Nature of Course	Humanities and Social Sciences				
Pre requisites	Basic Perceptive of Language				

Course Objectives

The course is intended for learners.
1. To prepare the students forDELFA1Examination
2. To teach them to converse fluently in French in day-to-day scenarios

Course Outcomes

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

CO.No.	Course Outcome	Bloom's Level
CO1	To help students acquire familiarity in the French alphabet &basic vocabulary	Remember
CO2	Listen and identify individual sounds of French	Remember
CO3	Use basic sounds and words whiles peaking	Remember
CO4	Read and understand short passages on familiar topics	Understand
CO5	Understand and use basic grammar and appropriate vocabulary in completing language tasks	Understand

Course Contents:

UNIT I: EntrerEnContact 6

La langue francaise, alphabets, les numeros, les jours, les mois. Grammaire Les verbes s"appeler,etre, avoir, les articles definis, indefinis Communication - Saluer, s"informer sur quelquun, demander de se presenter Lexique - Les alphabets, les nationalites, age, les pays, les couleurs, les jours de la semaine, les mois de l"annee, lesprofessions

UNIT II: Partager Son LieuDe Vie 6

Lesfrancaisetleur habitat, deshabitation s in solitesGrammaire- Verbes - Conjugaison : Present (Avoir / etre / ER, IR, RE : RegulieretIrregulier) –AdjectifsldelieuCommunication - Chercher un logement, d"ecrire son voisin, s"informersur un logementLexique - L"habitat, les pieces, l"equipement, ladescriptionphysiqu

UNIT III: Vivre AuQuotidien 6

Grammaire - Articles contractes, verbesvouloir, pouvoir, devoir, adjective interrogative, future proche Communication- Exprimersesgouts, parler de sesloisirs, justifier un choix, exprimeruneenvieLexique - le tempslibreetlesloisirs, lessaisons, lesactivitesquotidiennes,letemps (lematin,lesoir,lanuit)

UNIT IV: Comprendre Son EnvironnementOuvrirLaCulture 6

Grammaire - Verbes- Finir, Sortir, les adjectifsdemonstratifs, le passe compose, l"imparfait Communication - Propose aÃƒ?Ã‚Âquelqu""un de faire quelque chose, raconteur une sortie au passeparlerunfilmLexique - Les sorties, la famille, art, les vetementsetlesaccessoires

Passed in Board of studies
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council
CHAIRMAN - ACADEMIC COUNCIL

UNIT V: GouterALa Campagne   6

Grammaire La forme negative, les verbesacheter, manger, payer, articles partitifs, le pronomen de quantite Communication Accepter et refuse rune invitation, donner des instructions, commander au restaurant Lexique Les services et les commerces, les aliments, les ustensiles, argent.

Total: 30 Periods

COs	POs												PSOs		
Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1										2					
CO2										2					
CO3										3					
CO4										3					
CO5										2					
	3	High			2	Medium						1	Low		

Passed in Board of studies
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council
CHAIRMAN - ACADEMIC COUNCIL

20ENE05	GERMAN	L	T	P	C
		2	0	2	3
Nature of Course	Humanities and Social Sciences				
Pre requisites	Basic Perceptive of Language				

Course Objectives

The course is intended for learners.
1. To help students appear for the A1levelExamination
2. To teach them how to converse fluently in German in day-to-day scenarios

Course Outcome

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

CO.No.	Course Outcome	Bloom's Level
CO1	listen and identify individual sounds of German	Remember
CO2	use basic sounds and words while speaking	Remember
CO3	read and understand short passages on familiar topics	Remember
CO4	use basic sentence structures while writing	Understand
CO5	understand and use basic grammar and appropriate vocabulary in completing language tasks	Understand

Course Contents:

UNITI Introduction   **6**

Introduction to German language: Alphabet - Numbers - Greetings - Days and Seasons- Working with Dictionary

UNITII Pronunciation   **6**

Nouns - articles - Speaking about one self - Listening to CD supplied with the books, paying special attention to pronunciation

UNIT III Basic Syntax   **6**

Regular & Irregular verbs - Personal pronouns - family - Introduction to type's of sentences

UNIT IV Vocabulary   **6**

Question words-Types of Questions - Nominative case- Verb Conjugation - country - nationalities

UNIT V: Action Words   **6**

Verbs - to be & to have - conjugation - Hobby's - Framing basic Questions and answers

Total: 30 Periods

References

1. Kursbuch and Arbeitsbuch, NETZWERK A1 DEUTSCH ALSFREMDSPRACHE,Goyal Publishers & Distributers Pvt. Ltd.,NewDelhi,2015
2. Langenscheidt Eurodictionary - German - English / English - German, Goyal Publishers & Distributers Pvt. Ltd.,NewDelhi,2009
3. Grundkurs, DEUTSCH LehrbuchHueberMunichen,2007

Passed in Board of studies
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council
CHAIRMAN - ACADEMIC COUNCIL

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1										2					
CO2										2					
CO3										3					
CO4										3					
CO5										2					
	3	High			2	Medium						1	Low		

20PH201	**Physics for Bio Sciences**	L	T	P	C
	(Common to Agricultural Engineering & Food Technology)	3	0	2	4
Nature of Course	Basic Sciences				
Pre requisites	Fundamentals of Basic Physics				

Course Objectives:
The course is intended to

1. Impart knowledge of properties of matter like elasticity and its applications
2. Provide knowledge of optics, especially laser and their applications in fiber optics.
3. Understand the thermal properties of materials and their applications.
4. Develop the clear understanding about the concept of crystal structure.
5. Deliver knowledge on basic concept of seismic and flood hazard.

Course Outcomes

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

CO.No	Course Outcome	Bloom's Level
CO1	Explain the knowledge about elastic modulus	Understand
CO2	Compare the working of lasers and propagation of light through optical fibers and its applications	Understand
CO3	Demonstrate the thermal conductivity of good and bad Conductors.	Understand
CO4	Demonstrate about the atomic arrangement in crystals	Understand
CO5	Classify the natural calamities like seismic hazards, flood hazards in detail	Understand

Course Contents:
UNIT I Properties of Matter 9
Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever – uniform and non-uniform bending
- I-shaped girders - stress due to bending in beams.

UNIT II Laser and Fiber Optics 9
Lasers: population of energy levels, Einstein"s A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibers (material, refractive index, mode) – optical fiber communication system- fiber optic endoscope.

UNIT III Thermal Physics 9
Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever – uniform and non-uniform bending- I-shaped girders - stress due to bending in beams.

Passed in Board of studies
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council
CHAIRMAN - ACADEMIC COUNCIL

UNIT IV Crystal Physics 9

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures.

UNIT V Hazards 9

Seismology and Seismic waves - Earth quake ground motion - Basic concepts and estimation techniques - site effects - Probabilistic and deterministic Seismic hazard analysis - Cyclone and flood hazards - Fire hazards and fire protection, fire-proofing of materials, fire safety regulations and firefighting equipment - Prevention and safety measures.

Total: 45 Periods

Laboratory Components

S.No	List of Experiments	COMapping	RBT
1	Determination of rigidity modulus – Torsion pendulum	CO1	Apply
2	Determination of Young's modulus by non-uniform bending method.	CO1	Apply
3	Determination of wavelength, and particle size using Laser	CO2	Apply
4	Determination of acceptance angle in an optical fiber	CO2	Apply
5	Determination of thermal conductivity of a bad conductor by Lee's Disc method	CO3	Apply
6	Determination of velocity of sound and compressibility of liquid - Ultrasonic interferometer	CO1	Apply
7	Determination of Coefficient of viscosity of liquid	CO1	Apply

Total 30 Periods

TEXT BOOKS:

1. Bhattacharya, D.K and Poonam, T, "Engineering Physics", 2nd edition, Oxford University Press,2015.
2. M.N.Avadhanulu,M.N.&KshirsagarPG."ATextbookofEngineeringPhysics",10thedition,S.Chand and company, Ltd., New Delhi,2014.
3. UlrichRanke.,"NaturalDisasterRiskmanagement",SpringerInternationalPublishing,1stEdition,2016

REFERENCES:

1. David Halliday. Robert Resnick. and Jearl Walker., "Principles of Physics", Wiley, 10th Edition,2014.
2. Raymond A Serway. and John W Jewett., "Physics for Scientists and Engineers", Cengage Learning, 9th Edition,2019.

Web References:

1. https://nptel.ac.in/courses/115/107/115107095/
2. https://scienceworld.wolfram.com/physics/TorsionalPendulum.html
3. https://spaceplace.nasa.gov/laser/en/
4. https://www.youtube.com/watch?v=uv0LxMoalEQ

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1												
CO2	3	1	1												
CO3	3	2	1												
CO4	3	1	1												
CO5	3		2												
	3	High			2		Medium				1	Low			

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

Summative assessment

Bloom's Level	Continuous Assessment					Final Examination(Theory) [50 marks]
	Theory Marks				Practical	
	IAE-I [7.5]	IAE-II [7.5]	IAE-III [10]	Attendance [5]	Rubric based CIA[20 Marks]	
Remember	10	10	10		-	20
Understand	35	35	35		40	70
Apply	5	5	5		60	10
Analyse	-	-	-		-	-
Evaluate	-	-	-		-	-
Create	-	-	-		-	-

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

20CS201	PROBLEM SOLVING USING PYTHON (Common to all Branches)	L	T	P	C
		3	0	2	4
Nature of Course	Engineering Sciences				
Pre requisites	Mathematical and Logical Knowledge				

Course Objectives

The course is intended
1. To think logically and write algorithm and draw flow charts for problems.
2. To read and write simple Python programs.
3. To develop Python programs with conditionals and loops.
4. To define Python functions and call them.
5. To use Python data structures –- lists, tuples, dictionaries and files.

Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO1	Develop algorithmic solutions to simple computational problems and read, write, execute by simple python programs.	Apply
CO2	Structure simple python programs for solving problems.	Understand
CO3	Administer the role of control statements and functions involving the idea of modularity.	Apply
CO4	Represent compound data using python strings and lists.	Apply
CO5	Read and write data from/to files in python Programs.	Understand

Course Contents:

Unit I Basics of Computers &Problem Solving   **9**

Computer Basics – Components-Computer organization - Computer Software- Types of software - Software Development steps -Need for logical analysis and thinking- Algorithms – Flowchart - Number system.

Unit II Introduction of Python Programming   **9**

Introduction-Python Interpreter-Interactive and script mode -Values and types, variables, operators, expressions, statements, precedence of operators, Multiple assignments, comments, Input and Output Statements.

Unit III Control statements and Functions   **9**

Conditional (if), alternative (if-else), chained conditional (if-elif-else)-Iteration-while, for, break, continue, pass – Functions - Introduction, inbuilt functions, user defined functions, passing parameters, return values, recursion, Lambda functions.

Unit IV Strings and Lists   **9**

Strings-String slices, immutability, string methods and operations -Lists-creating lists, list operations, list methods, mutability, aliasing, cloning lists, list and strings, list and functions-list processing-list comprehension, searching and sorting.

Unit V Tuples, Dictionaries and Files   **9**

Tuples- Tuple assignment, lists and tuples, Tuple as return value- Dictionaries-operations and methods, Files and Exception-Text files, reading and writing files, format Operator, Exception handling.

                                             TOTAL: 45 Periods

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

Laboratory Components

S.No	List of Experiments	COMapping	RBT
1	Write a algorithm & draw flowchart for simple computational problems	CO1	Understand
2	Write a program to perform different arithmetic operations on numbers in python.	CO2	Understand
3	Write a python program to implement the various control structures	CO3	Apply
4	Write a python program for computational problems using recursive function.	CO3	Apply
5	Demonstrate use of list for data validation.	CO4	Apply
6	Develop a python program to explore string functions	CO4	Analyze
7	Implement linear search and binary search.	CO4	Apply
8	Develop a python program to implement sorting methods	CO4	Analyze
9	Develop python programs to perform operations on dictionaries.	CO5	Analyze
10	Write a python program to read and write into a file	CO5	Apply

TOTAL: 30 Periods

Text Books:

1. Reema Thareja, "Problem Solving and Programming with Python", Oxford University Press, 2018
2. Dr. R. Nageswara Rao, "Core Python Programming", Dreamtech Press, 2017Edition

Reference Books:

1. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning,2012
2. Ashok Namdev Kamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python" , Mc-Graw Hill Education,2018.
3. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem Solving Focus", Wiley India Edition,2013
4. Timothy A. Budd," Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,2015

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)																
COs	**POs**													**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1										3	1	
CO2	3	2	1										3	1	
CO3	3	2	2										3	1	
CO4	3	2	2										3	1	
CO5	3	2	2										3	1	
	3	High			2		Medium				1	Low			

Summative assessment						
Bloom's Level	**Continuous Assessment**					**Final Examination (Theory) [50 marks]**
	Theory Marks				**Practical**	
	IAE-I [7.5]	**IAE-II [7.5]**	**IAE-III [10]**	**Attendance [5]**	**Rubric based CIA [20 Marks]**	
Remember	10	10	10			20
Understand	20	20	20		30	50
Apply	20	20	20		50	30
Analyse	-	-	-		20	-
Evaluate	-	-	-		-	-
Create	-	-	-		-	-

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

20FT202	FOOD PRACTICES LABORATORY	L	T	P	C
		3	0	2	4
Nature of Course	Professional Core				
Pre requisites	NA				

Course Objective:

The course is intended to

1. Enable students; learn the fundamentals of chemistry of food.
2. Understand the concept of flavours and sensory attributes.
3. Provide an advanced understanding of the basic principles of microbiology.
4. Enable the students to understand the roles of microorganism in food industry.
5. Acquire a specialized knowledge and understanding in micronutrients.

Course Outcomes

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

Sl.No.	Course Outcome	Bloom's Level
CO1	Explain the specific techniques in food chemical processes.	Understand
CO2	Describe the hands-on-opportunity and observe the principles of food chemistry.	Understand
CO3	Clarify the principles of microorganisms during various food processing and preservation steps.	Understand
CO4	Demonstrate the Isolation,identification, and enumeration of the most common microorganisms found in specific food products.	Understand
CO5	Recognize specific types of microbial spoilage during various food shelf life stages.	Understand

Course Content: Food Nutrition

Laboratory List of Experiments:

S.No	Name of the Experiment	CO Mapping	RBT
1.	Determination of moisture content of foods	CO2	Analyze
2.	Studies of sorption isotherms of different foods	CO2	Evaluate
3.	Solubility and Swelling characteristics of starch	CO3	Analyze
4.	Determination of reducing and non-reducing sugars	CO3	Evaluate
5.	Determination of fibre content in food	CO2	Analyze
6.	Determination of viscosity and Texture profile analysis of food samples.	CO2	Evaluate
7.	Determination of crude proteins by micro-kjeldhal method and by spectroscopy method.	CO2	Evaluate
8.	Determination of fat content in food by Soxhelet method	CO3	Analyze
9.	Determination of soapnification value and Iodine number of fat/oil.	CO2	Evaluate
10.	Isolation of egg and milk protein	CO2	Analyze

Course Content: Food Microbiology Laboratory

This course is designed to give students an understanding of the role of microorganisms in food processing and preservation; the relation of microorganisms to food spoilage, food borne illness, and intoxication; general food processing and quality control; the role of microorganisms in health promotion; and federal food-processing regulations. The listed laboratory exercises are aimed to provide a hands-on opportunity for the student to practice and observe the principles of food microbiology. Students will familiarize themselves with the techniques used to research, regulate, prevent, and control the microorganisms found in food and understand the function of beneficial microorganisms during the food manufacturing process.

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

List of Experiments:

S.No	Name of the Experiment	CO Mapping	RBT
1.	Introduction to equipments commonly used in Food Technology	CO2	Analyze
2.	Sterilization of glassware used in microbiology laboratory in Food Technology	CO2	Evaluate
3.	Gram Staining and Study of morphology of bacterial cells.	CO3	Analyze
4.	Study of autoclave, Preparation and sterilization of nutrient broth and agar	CO3	Evaluate
5.	Sub culturing of a bacterial strain in liquid and solid medium.	CO2	Analyze
6.	Preparation of synthetic medium for yeast, mould, and inoculation with standard strains of yeasts and moulds.	CO2	Evaluate
7.	Isolation of microorganisms using Streak plate method	CO2	Evaluate
8.	Isolation and enumeration of microorganisms using Spread plate method	CO3	Analyze
9.	Isolation and enumeration of microorganisms using Pour plate method	CO2	Evaluate
10.	Microbial examination of air. Microbiological examination of water for coli forms by MPN technique	CO2	Analyze

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme SpecificOutcomes (PSO)															
COs	**POs**												**PSOs**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		3			2			1					3	
CO2	3		3			1									
CO3			3			1			2						
CO4	3		3				1							3	
CO5			3										3		
	3	High				2			Medium			1		Low	

Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	**Rubric based Continuous Assessment [50 marks]**	**End Semester Examination [50 marks]**
Remember	20	20
Understand	30	30
Apply		
Analyze		
Evaluate		
Create		

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

20MC201	ENVIRONMENTAL SCIENCE (Common to Agriculture, Food Technology, Aero, Civil, Mechanical and Fire & Safety Engineering)	L	T	P	C
		2	0	0	0
Nature of Course	Mandatory				
Prerequisites	Nil				

Course Objectives
The course is intended to
1. Understand the concept of eco system and environment.
2. Become conversant with ecological balance and values of bio diversity.
3. Know the role of human in prevention of pollution and making a clean environment.
4. Get knowledge about conservation of non-conventional energy resources.
5. Study about the nature and management of e-waste and solid waste.

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

CO.No.	Course Outcome	Bloom's Level
CO1	Describe the ecosystem and environment	Understand
CO2	Understand the ecological balance and preservation of bio diversity	Understand
CO3	Demonstrate various types of pollution in order to control pollution	Apply
CO4	Classify the energy sources for the conservation of non-conventional energy sources	Understand
CO5	Identify the nature and management of e-waste and solid waste	Apply

Course Contents
Unit-I   Ecosystem   6

Ecosystem-Food chains, Food webs and Ecological pyramids. Ecosystem-(a) Forest eco system,(b) Aquatic eco system(pond ecosystem and marine ecosystem).

Unit-II Biodiversity   6
Introduction to Bio diversity, Values of Bio diversity, Threads to Bio diversity, endangered and Endemic species of India, Hotspots of biodiversity. Conservation of Bio diversity: In-Situ and Ex-Situ conservation of bio diversity.

Unit-III Environmental Pollution   6
Definition, Causes, Effects and Control of (a) Air pollution (b) Water pollution (c) Soil pollution. Electrostatic Precipitator for controlling air pollution.

Unit-IV Non-Conventional Energy Resources   6
Introduction, Types: Solar Energy, Wind Energy and Geo Thermal Energy.

Unit-V   Environmental Management   6
Sustainable Development, Role of Information technology in Environment and Human.HIV and AIDS: causes and control measures. Green chemistry: Definition and Principles
                                                                Total: 30 periods

Passed in Board of studies   *Approved in Academic Council*
CHAIRMAN - BOARD OF STUDIES   CHAIRMAN - ACADEMIC COUNCIL

Activity Component

S.No	Name of the Experiment	CO Mapping	RBT
1	Field study of simple eco system: pond, river and hill slopes	CO1	Understand
2	Case study regarding environmental management	CO5	Apply

TextBooks
1. AnubhaKaushik and C.P. Kaushik, "Environmental Science and Engineering, New Age International Publishers, New Delhi, 2nd Edition,2015.
2. V. Kumar, "An Introduction to Green Chemistry" Vishal publishing Co. ReprintEdition,2010.

Reference Books
1. Masters, Gilbert M, "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi, 2nd Edition,2012.
2. Santosh Kumar Garg andRajeshwariGarg"Ecological and Environmental Studies",Khanna Publishers, NaiSarak, Delhi, 2nd Edition,2014.

Additional Resources
1. https://nptel.ac.in/courses/122103039/38
2. https://bch.cbd.int/cms/ui/collaboration/download/download.aspx?id=909
3. https://nptel.ac.in/courses/105102089/air%20pollution%20(Civil)/Module-3/3a.htm

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1							3					3			
CO2							3					3			
CO3							3					3			
CO4							3					3			
CO5							3					3			
	3	High			2	Medium			1	Low					

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

Bloom's Level	Continuous Assessment				
	IAE-I [20]	IAE-II [20]	IAE-III [20]	Attendance [10]	Activity [30]
Remember	30	20	20		
Understand	10	20	20		
Apply	10	10	10		
Analyze					
Evaluate					
Create					

Passed in Board of studies

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council

CHAIRMAN - ACADEMIC COUNCIL

20MA301	**TRANSFORMS AND BOUNDARY VALUE PROBLEMS** **(Common to Aero, Mech, S&F,Civil, FT and Agri)**	**L**	**T**	**P**	**C**
		3	2	0	4
Nature of Course	Basic Sciences				
Pre requisites	Mathematics-I & II for Mechanical, Building and Bio Sciences				

Course Objectives
The course is intended to
1. Familiarize linear and non-linear partial differential equations with different methods.
2. Acquire the knowledge of Fourier series.
3. Acquaint with the Fourier series techniques in solving one dimensional wave and heat equations**.**
4. Learn the concept of Fourier transforms and it's inverse.
5. Introduce the concept of Z-transforms and difference equations.

Course Outcomes
   On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Classify the linear and non-linear partial differential equations.	Understand
CO2	Determine the Fourier series expansion.	Apply
CO3	Interpret the solution of boundary value problems.	Understand
CO4	Apply transform techniques to solve engineering problems.	Apply
CO5	Illustrate the Z-transforms and difference equations.	Understand

Course Contents:

UNIT I Partial Differential Equations **12**
Solution of standard types of first order non-linear partial differential equations: (i) f(p,q)=0, (ii) Clairaut's type - Lagrange's linear equation - Homogeneous linear partial differential equations of second and higher order with constant coefficients (R.H.S =Constant, e^{ax+by} , $cos(ax+by)$, $sin(ax+by)$).

UNIT II   Fourier analysis **12**
Condition for Fourier expansion -Fourier series for periodic functions- Determination of Fourier coefficients - Expansion of periodic functions with Period (0, 2L) and period (0, 2π) -Root mean square value on Fourier coefficients - Parseval's identity.

UNIT III   Boundary Value Problems **12**
Classification of Partial differential equations–Method of separation of variables – Solutions of one dimensional wave equation – Solutions of one dimensional heat equation.

UNIT IV   Fourier Transforms **12**
Statement of Fourier integral theorem – Fourier transforms pair: Fourier transforms and Inverse Fourier transforms – Fourier sine transforms -Fourier cosine transforms – Transforms of simple functions – Parseval's identity.

UNIT V Z -Transforms and Difference Equations **12**
Z-transforms - Properties – Inverse Z-transform: partial fraction and Convolution theorem - Formation of difference equations –Solution of difference equations using Z – transform.

Total: 60 Periods

Passed in Board of Studies Meeting   *Approved in Academic Council Meeting*

CHAIRMAN - BOARD OF STUDIES   CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., 3rd edition, 2016.
2. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, 2017.

Reference Books:
1. Bali N.P and Manish Goyal, "A Text book of Engineering Mathematics", Lakshmi Publications Pvt Ltd, 9th Edition, 2016.
2. Ramana.B.V,"Higher Engineering Mathematics", Tata Mc-Graw Hill Publishing Company Limited, 4th Edition, 2016.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India Publications, 10th Edition, 2015.

Additional References:
1. https://pvpsitrealm.blogspot.com/2016/09/higher-engineering-mathematics-by-bs.html
2. https://reference.wolfram.com/language/tutorial/DSolvePartialDifferentialEquations.html

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	1	2	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	1	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	1	2	-	-
	3	High			2	Medium			1	Low					

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment			
Bloom's Category	**Internal Assessment Examinations**		**Final Examination (60)**
	IAE- I (7.5)	IAE - II (7.5)	IAE - III (10)
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

20FT301	FUNDAMENTALS OF FOOD PROCESSING	L	T	P	C
		3	2	0	4

Nature of Course	Professional Core
Prerequisites	Food Microbiology

Course Objectives

The course is intended to
1. To understand the basic principles involved in food process engineering.
2. Provide an advanced understanding of the principles of food storage.
3. Enable the students to understand roles of food preservation and processing.
4. Acquire a specialized knowledge and understanding in food irradiation.
5. Understand the concept of preservation by uses of chemicals.

Course Outcomes

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

CO. No	Course Outcome	Bloom's Level
CO 1	Demonstrate the knowledge of food processing	Understand
CO 2	Explain the food storage methods	Understand
CO 3	Understand the concept of food preservation and processing	Understand
CO 4	Proficiency in core biochemical techniques for food irradiation	Understand
CO 5	Interpret biochemical data of food chemical preservation	Apply

Course Contents

Unit – I Introduction to Food Processing 9

Introduction: Definition & classifications of food; constituents of foods; current scenario in food processing - food preservation; food spoilage, intoxication; raw materials for processing, Food processing need and its significance.

Unit – II Principles of Storage 9

Nature of harvested crop - plant and animal; Raw materials storage, methods and its importance. Advancement in food storage - refrigerated gas storage, Gas atmospheric storage of raw materials; freezing of raw and processed foods. Dehydration by solar dryer and sun drying.

Unit – III Food preservation and processing 9

Food Preservation – Introduction, need and its principles. Methods of Preservation – High temperature and Low temperature, Preservation by dehydration; factors affecting refrigerated & frozen storage of foods; effect of freezing on constituents of foods.

Unit – IV Food irradiation 9

Introduction, radiation sources, mechanism and types of irradiation, factors affecting food irradiation; Preservation using sugar, salt and acids: Osmotic pressure – definition & factors affecting osmotic pressure of sugar solution; salt- antimicrobial activity of salt, estimation of salt; acid – mechanism, common foods preserved using acids

Unit – V Preservation by use of chemicals 9

Introduction; objectives; factors affecting antimicrobial activity of preservatives; type of chemical preservatives; sulphur dioxide, benzoic acid, etc; use of other chemicals like acidulants, antioxidants, mold inhibitors, antibodies

Total : 45 Periods

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

Text Books

1. Gould WA. Fundamentals of food processing & technology. Elsevier; 1st Edition, 2013 Dec 1.
2. Toledo RT, Singh RK, Kong F. Fundamentals of food process engineering. New York: Springer; 4th Edition, 2007 Mar 6.

Reference Books

1. Paul Singh R, and Dennis R.Heldman."Introduction to Food Engineering". Academic Press – Elsevier India Private Ltd. New Delhi, 4th Edition, 2004.
2. Park SH, Lamsal BP, Balasubramaniam VM. Principles of food processing. Food Processing: Principles and Applications. 2nd Edition, 2014 Apr 7; 2.

Additional Reference

1. https://nptel.ac.in/courses/126/105/126105018/
2. https://ncert.nic.in/textbook/pdf/lehe105.pdf

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1				1	1						2	1	2
CO2	2						2						2	1	1
CO3	2	2				2							2	2	1
CO4	2	2					1						2	1	1
CO5	3	2											2	1	2
	3	High			2		Medium			1			Low		

Table title: **Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)**

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – 1 (7.5)	**IAE – 2 (7.5)**	**IAE – 3 (10)**	
Remember				
Understand	30	30	20	50
Apply	10	20	20	40
Analyze	10	10	10	10
Evaluate				
Create				

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

20FT302	APPLIED THERMODYNAMICS FOR FOOD TECHNOLOGY	L	T	P	C
		3	0	0	3
Nature of course	Engineering science				
Pre requisites	Nil				

Course Objectives
The course is intended to
1. Fundamental thermo dynamic principles and their application.
2. Understand the importance of thermodynamics in food system.
3. Apply the concept of statistical thermodynamics for various food system
4. Develop an efficient system using thermodynamic principle
5. Design the food processing equipments

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

CO. No	Course Outcome	Bloom's Level
CO1	Identify the thermodynamic variables that will affect the food processing	Understand
CO2	Estimate the effect of various thermodynamic properties on food system	Apply
CO3	Solve the problems related to food processing using thermodynamic principles	Analyze
CO4	Design and Model the food system based on thermodynamic concept	Analyze
CO5	Develop an efficient food processing method	Understand

Course Contents
Unit – I   THERMODYNAMIC LAW AND PROPERTIES OF FLUIDS   **9**
First Law of thermodynamics, a generalized balance equation, Volumetric properties of fluids exhibiting non ideal behavior; residual properties; estimation of thermodynamic properties using equations of state; calculations involving actual property exchanges; Maxwell's relations and applications

Unit – II   SOLUTION THERMODYNAMICS   **9**

Partial molar properties; concepts of chemical potential and fugacity; ideal and non-ideal solutions; concepts and applications of excess properties of mixtures; activity coefficient; composition models; Gibbs Duhem equation.

Unit – III   PHASE EQUILIBRIA   **9**
Introduction, Criteria for phase equilibria; VLE calculations for binary and multi component systems; liquid-liquid equilibria and solid-solid equilibria

Unit – IV   CHEMICAL REACTION EQUILIBRIA   **9**

Equilibrium criteria for homogeneous chemical reactions; evaluation of equilibrium constant; effect of temperature and pressure on equilibrium constant; calculation of equilibrium conversion and yields for single and multiple reactions.

Unit – V   **THERMODYNAMIC DESCRIPTION OF MICROBIAL GROWTH AND PRODUCT FORMATION**   **9**

Thermodynamics of microbial growth stoichiometry thermodynamics of maintenance, Calculation of the operational stoichiometry of a growth process at different growth rates, Including Heat using the Herbert –Pirt Relation for Electron Donor.

Total : 45 Periods

Passed in Board of Studies Meeting   *Approved in Academic Council Meeting*

CHAIRMAN - BOARD OF STUDIES   CHAIRMAN - ACADEMIC COUNCIL

Text Books

1. Smith J.M., Van Ness H.C., and Abbot M.M. "Introduction to Chemical Engineering Thermodynamics", Tata McGraw-Hill, VI Edition, 2003.
2. Christiana D. Smolke, "The Metabolic Pathway Engineering Handbook Fundamentals", CRC Press Taylor & Francis Group, 1st Edition, 2010.

Reference Books

1. Nag P.K., Engineering Thermodynamics, McGraw Hill Education (India) Pvt Ltd, 2nd Edition, 2014
2. Roy Choudhury T., Basic Engineering Thermodynamics, Tata McGraw Hill, 5th Edition, 2000

Additional Reference

1. https://nptel.ac.in/courses/127/106/127106135/
2. https://nptel.ac.in/courses/112/103/112103275/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO 1	3	1											1	1	2
CO 2	3	2	1										1	1	2
CO 3	3	2	2										1	2	1
CO 4	2	2	2										1	2	2
CO 5	2	1											2	2	2
	3	High			2	Medium				1	Low				

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – 1 (7.5)	**IAE – 2 (7.5)**	**IAE – 3 (10)**	
Remember				
Understand	30	30	20	50
Apply	10	20	20	40
Analyze	10	10	10	10
Evaluate				
Create				

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

20FT303	FOOD PROCESS CALCULATION	L	T	P	C
		3	2	0	4
Nature of Course	Engineering Sciences				
Pre requisites	Nil				

Course Objectives

The course is intended to
1. Apply the principles in food processing.
2. Perform calculations for basic operations in food processing
3. Perform calculations for mass balances operations in food processing
4. Understand the Drying characteristics of Food processing
5. Understand the importance of Unit conversion in food Processing

Course Outcomes

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

CO. No	Course Outcome	Bloom's Level
CO 1	Enumerate the units and dimensions of various physical quantities	Apply
CO 2	Evaluate theIdeal gas laws and theory of gases and vapors.	Evaluate
CO 3	Calculation of the material balance in food processing	Analyze
CO 4	Determine the heat balance in food processing	Evaluation
CO 5	Investigate the performance of processing units	Analyze

Course Contents

Unit – I   Units and Dimensions   9

Basic and derived quantity, use of model units in calculations, Mole, Mole fraction, weight and weight fraction, compositions of mixture and solutions. Ideal and real gas laws –Gas constant. calculations of pressure, volume and temperature using ideal gas law constant

Unit – II Fundamental Calculations and Humidity   9

Fundamental Calculations and Humidity: Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity -Use of humidity in condensation and drying-Humidity chart, dew point.

Unit – III Basic Principles of Material Balances   9

Importance of material balance, conversion factors and their use –Data sources, Humidity and applications. Material Balance-Stoichiometric principles, Application of material balance to unit operations like distillation, evaporation, crystallization, drying, extraction, Leaching

Unit – IV Energy Balance.   9

Energy Balance: Heat capacity of solids, liquids, gases and solutions, use of mean heat capacity in heat calculations, problems involving sensible heat and latent heats, evaluation of enthalpy.

Unit – V Enthalpy Changes   9

Standard heat of reaction, heats of formation, combustion, solution, mixing. Calculations of standard heat of reaction -Effect of pressure and temperature on heat of reaction, Energy balance for systems without chemical reaction.

Total : 45 Periods

Passed in Board of Studies Meeting   *Approved in Academic Council Meeting*

CHAIRMAN - BOARD OF STUDIES   CHAIRMAN - ACADEMIC COUNCIL

Text Books

1. Bhatt, B.L and Vora, S.M., "Stoichiometry", McGraw-Hill, New York, Third Edition, 2004.
2. Gavhane, K.A "Introduction to Process Calculations"(Stoichiometry), Nirali Prakashan Publications, Pune, 22nd Edition, 2009

Reference Books

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

Additional Reference

1. https://nptel.ac.in/courses/103/103/103103165/
2. https://nptel.ac.in/courses/102/106/102106069/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1										1	1	1
CO2	3	2	2										1	2	1
CO3	3	2	2										2	1	1
CO4	3	3	2										1	1	1
CO5	2	2	2										1	2	2
	3	High		2		Medium			1		Low				

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Understand	Quiz / Presentation/Tutorial	5	
Understand	Assignment / Video presentation	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – 1 (7.5)	**IAE – 2 (7.5)**	**IAE – 3 (10)**	
Remember				
Understand	30	30	30	50
Apply	10	10	10	40
Analyze	10	10	10	10
Evaluate				
Create				

Passed in Board of Studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

20FT304	INSTRUMENTAL METHODS OF ANALYSIS	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Physics for Bio Sciences				

Course Objectives

The course is intended to
1. Expose the principles of chemical and instrumental methods of food analysis
2. Expose the methods of chemical and instrumental methods of food analysis
3. Expose the techniques of chemical and instrumental methods of food analysis

Course Outcomes

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

CO. No	Course Outcome	Bloom's Level
CO1	Demonstrate the principles behind analytical techniques in food analysis.	Understand
CO2	Identify the different methods of selecting appropriate techniques in the analysis of food products.	Understand
CO3	Investigate the role of food analysis in food standards and regulations for the manufacture and the sale of food products	Analyze
CO4	Discover the food quality control in food industries	Apply
CO5	Compare with the current state of knowledge in food analysis	Understand

Course Contents

Unit – I INTRODUCTION   **9**

Introduction, Types of analysis, steps in analysis, choice of methods; sampling procedures, considerations and sample preparation; Evaluation of analytical data accuracy and precision, sources of errors, specificity, sensitivity and detection limits, Regression analysis, reporting results .

Unit – II   LIPIDS, PROTEINS, MOITURE, ASH AND CARBOHYDRATE ANALYSIS   **9**

Analysis of oils and fats for physical and chemical parameters and quality standards, protein analysis by different techniques; analysis of carbohydrates by different techniques. Analysis of moisture, ash, titrable acidity in foods; determination of crude fiber and dietary fiber.

Unit – III   SPECTROSCOPIC TECHNIQUES   **9**

Spectroscopic analysis of foods–basic principles, UV, visible, fluorescence, IR, AAS, MS and NMR. Spectroscopy in online determination of components of food- FT-IR tint meter in color intensity determination; application of Atomic Absorption Spectrophotometer and ICP-AES in analysis of mineral elements and fluorimeter in vitamin analysis.
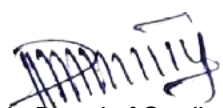
Unit – IV   CHROMATOGRAPHIC TECHNIQUES   **9**

Basic principles and types of chromatography-application of paper chromatography and TLC in food analysis; detection of adulterants in foods; Column chromatography for purification analysis, Ion exchange and affinity chromatography; HPLC and GC in food analysis; Significance of MS detectors in HPLC and GC;

Unit – V   ELECTROPHORESIS, REFRACTOMETRY AND POLARIMETRY   **9**

Basic principles; type - paper, starch, gel, Application of the electrophoresis in food analysis, Brixs value of fruit juices; total soluble solids in fruit products; specific rotations of sugars; simple sugars and di saccharides by polarimeter.

Total : 45 Periods

Passed in Board of Studies Meeting   *Approved in Academic Council Meeting*

CHAIRMAN - BOARD OF STUDIES   CHAIRMAN - ACADEMIC COUNCIL

Text Books

1. Rehan Uddin. Instrumental Methods of Analysis. IP Innovative Publication Pvt Ltd, 1st Edition, 2020.
2. Pomeranz Y, editor. Food analysis: theory and practice. Springer Science & Business Media; 1st Edition, 2013 Dec 1.

Reference Books

1. Otles, Semih. Methods of Analysis of Food Components and Additives, CRC Press, 2nd Edition, 2005
2. Nollet, LeoM.L. Hand Book of Food Analysis II Rev. Edition. Vol.I,II&III, Marcel & Dekker, 2nd Edition, 2004

Additional Reference

1. https://nptel.ac.in/content/storage2/courses/104103071/pdf/mod9.pdf
2. https://nptel.ac.in/content/storage2/courses/102103047/PDF/mod3.pdf
3. https://nptel.ac.in/courses/102/107/102107028/

Cos	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\
Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3												3	2	1
CO2	3	1											2	2	1
CO3	3	2	2										2	1	1
CO4	3	2											2	1	1
CO5	3	1											1	2	2
	3	High			2		Medium				1		Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Understand	Quiz / Presentation/Tutorial	5	
Understand	Assignment / Video presentation	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – 1 (7.5)	**IAE – 2 (7.5)**	**IAE – 3 (10)**	
Remember				
Understand	30	30	30	40
Apply	10	10	10	40
Analyze	10	10	10	20
Evaluate				
Create				

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

20FT305	FOOD CHEMISTRY AND NUTRITION	L	T	P	C
		3	0	0	3

Nature of Course	Professional Core
Pre requisites	Physics for Bio sciences

Course Objectives

The course is intended to

1. Understand the concept of Food Chemistry and Nutrition.
2. Enable the students to understand the importance of Carbohydrates & Proteins in foods.
3. Identify the importance of taste and flavoring agent in food.
4. Understand the importance of Vitamins and minerals.
5. Understand the concept of Chemistry of food flavor.

Course Outcomes

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

CO. No	Course Outcome	Bloom's Level
CO1	Describe the basic knowledge of Food Chemistry and Nutrition.	Understand
CO2	Infer the role of Carbohydrates & Proteins in foods	Understand
CO3	Demonstrate the knowledge of Lipids in foods	Understand
CO4	Explain the basic knowledge about Vitamins and minerals	Understand
CO5	Identify the advantages Chemistry of food flavor	Understand

Course contents:

UNIT I   Introduction to Food Chemistry and Nutrition   9
Nature Scope and development of food chemistry, role of food chemist- Moisture in foods: Role and type of water in foods; Functional properties of water; role of water in food spoilage; Water activity and sorption isotherm; Molecular mobility and foods stability

UNIT II   Carbohydrates & Proteins in foods   9
Changes of carbohydrates on cooking, modification of carbohydrates, dietary fibers and carbohydrates digestibility; Enzymatic and chemical reactions of carbohydrates- Proteins in foods: Processing induced, physical, chemical and nutritional changes in protein, chemical and enzymatic modification of protein

UNIT III   Lipids in foods   9
Role and use of lipids/fat, crystallization and consistency, chemical aspects of lipids, lipolysis, auto-oxidation, thermal decomposition, chemistry of frying technology of fat and oil; Oil processing: Refining, hydrogenations, inter etherification, safety use of oils and fats in food formulation; Enzymatic and chemical reactions of fats; Rancidity and its types, detection techniques chemical aspects of lipids, antioxidants

9

UNIT IV   Vitamins and minerals
Requirements, allowances, enrichment, restorations, fortifications, losses of vitamins and minerals, optimization and retention of vitamins and minerals; Chemistry of anti-nutritional factors.

UNIT V   Chemistry of food flavor   9
Philosophy and definitions of flavour, flavourmatics/flavouring compounds, sensory assessment of flavor, technology for flavor retention- Nutracueticals in food: major nutraceuticals viz. antioxidants, phenols, tannins, etc

Total: 45 Periods

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

TEXT BOOKS:

1. John W. Brady, "Introductory Food Chemistry". Cornell University Press, Ithaca, USA. 2013
2. H.-D. Belitz, W. Grosch and P. Schieberle, "Food Chemistry". Springer-Verlag Berlin Heidelberg. 4th Edition, 2009

Reference Books

1. Damodaran, S., K.L. Parkin and O.R. Fennema. "Fennema's Food Chemistry". CRC Press, 4th Edition, 2008
2. Zakiniaeiz Y. Focus: Nutrition and Food Science: Human Nutrition. The Yale Journal of Biology and Medicine, 13th Edition, 2018 Jun; 91 (2):201.

Additional Reference:
1. https://www.researchgate.net/publication/236008821_Chemistry_in_food_Flavours
2. https://nptel.ac.in/content/storage2/courses/104103071/pdf/mod10.pdf

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1											2	2	1
CO2	3	2											2	2	1
CO3	3	1											2	2	2
CO4	3	1											2	2	1
CO5	3	2											2	1	2
	3	High		2		Medium			1		Low				

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Understand	Quiz / Presentation/Tutorial	5	
Understand	Assignment / Video presentation	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – 1 (7.5)	**IAE – 2 (7.5)**	**IAE – 3 (10)**	
Remember	10	10	10	40
Understand	40	40	40	60
Apply				
Analyze				
Evaluate				
Create				

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

20MC302	INTERPERSONAL SKILLS	L	T	P	C
		0	0	2	0
Nature of Course	Mandatory, Non Credit				
Pre requisites	Nil				

Course Objectives
The course is intended to
1. Use interpersonal communication skills to influence and build good relationships.
2. Identify and pursue personal learning goals.
3. Obtain feedback skills in service of evolving learning goals.
4. Learn about group dynamics, behaviors and feelings
5. Enhance the communication process in both formal and informal contexts

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

CO.No	Course Outcome	Bloom's Level
CO1	Practice interpersonal communication skills to influence and build good relationships	Understand
CO2	Identify and pursue personal learning goals.	Understand
CO3	Give evident feedback	Understand
CO4	Reveal group dynamics and amiable behavior	Understand
CO5	Emphasis the communication process	Understand

Course Contents:
Unit I: Fundamentals of Interpersonal Communication   6
Facts of communication and Interpersonal communication – culture and gender – Communication and Self disclosure – Presentation of Inter personal perception - Learning goals – Feeling and feedback.

Unit II: Interpersonal communication in action   6
Nature of language – language and culture – usage and abuse of language –Positive communication -Non verbal communication - Listening strategies – Barriers of listening.

Unit III: Emotional Intelligence   6
Influence of emotional experience and expressions – Accepting the responsibilities and changes - Negotiation tactics - Dealing with criticism and appreciation - Collaborative Problem Solving - Resilience Building.

Unit IV: Transactions   6
Different types of transactions - Building Positive Relationship - Managing Conflict – Connecting across Difference –Factors hampering Interpersonal interactions – Assertiveness in communication.

Unit V: Essential Interpersonal Competencies   6
Behaviour – Understanding limiting behaviour - Interpersonal and small group behavior – Critical and lateral thinking-Win –Win attitude – Positive thinking – Stress management – Assertive feedback - Personal Evaluation of Interpersonal Relationship Skills

 Total 30 Periods

Passed in Board of Studies Meeting   *Approved in Academic Council Meeting*
CHAIRMAN - BOARD OF STUDIES   CHAIRMAN - ACADEMIC COUNCIL

Activity Component

S.No	Name of the Exercises	CO Mapping	RBT
1	Self-Introduction	1	Remember
2	Presentation of Individual perception	2	Understand
3	Role play - Non-verbal communication - Body language	4	Apply
4	Role play - Interpersonal interactions &Assertive feedback	3	Remember
5	Group Discussion	4	Apply
6	Role play - Situational conversation (On spot)	5	Understand

Text Books
1. Bozeman, Jeanine C and Argile Smith, "Interpersonal Relationship Skills for Ministers"Gretna, LA: Pelican Publishing Company, 1stEdition, 2004.
2. Floyd, Kory, "Interpersonal Communication", 2d. Boston: McGraw-Hill, 2nd Edition, 2011.

Reference Books:
1. Augsburger, David, "Caring Enough to Confront How to understand and Express Your Deepest Feelings Towards Others", updated ed. Ventura, CA: Regal Books, 2nd Edition2009.
2. Vohs, Kathleen D., and Eli J., Finkel, eds,"Self and Relationships: Connecting Intrapersonal and Interpersonal Processes", New York: Guilford Press, 1st Edition, 2006.

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1										3	2	1	2		
CO2										3	2	1	2		
CO3										3	2	1	2		
CO4										3	2	1	2		
CO5										3	2	1	2		
	3	High			2	Medium			1	Low					

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

Bloom's Level	Summative Assessment (Internal Mode)	
	Assessment 1 (50 Marks)	Assessment 2 (50 Marks)
Remember	20	20
Understand	10	10
Apply	20	20
Analyze		
Evaluate		
Create		

Passed in Board of Studies Meeting   *Approved in Academic Council Meeting*

CHAIRMAN - BOARD OF STUDIES

CHAIRMAN - ACADEMIC COUNCIL

20FT306	INSTRUMENTAL METHODS OF ANALYSIS LABORATORY	L	T	P	C
		0	0	2	1

Nature of Course	Professional Core
Prerequisites	Physics for Bio Sciences

Course Objective:

The course is intended to
1. Various constituents present in food substances.
2. Learn categorizing and quality of product.
3. Identify pigments by paper chromatography
4. Evaluate the viscosity of food samples
5. impart the concept of turbidity of given food samples

Course Outcomes

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

Sl.No.	Course Outcome	Bloom's Level
CO1	Demonstrate the various experimental procedures for different food constituents	Understand
CO2	Explain the quality of food	Understand
CO3	Categorize the changes in food composition during processing and storage	Analyze
CO4	Investigate the process protocol for quality food production	Apply
CO5	Assess and generate food formulation with longer shelf life	Evaluate

Laboratory components			
S.No	List of Experiments	CO Mapping	Revised Blooms Taxonomy
1.	Estimation of pH and Titratable acidity	CO5	Evaluate
2.	Determination of moisture content and water activity	CO2	Evaluate
3.	Determination of TSS, titrable acidity and pH of fruit juice.	CO5	Evaluate
4.	Estimation of starch by (a) titrimetric method (b) calorimetric method.	CO2	Apply
5.	Analysis of turmeric: Curcum in content, Oleoresin, Moisture content	CO3	Analyze
6.	Estimation of protein by kjehdal method	CO1	Apply
7.	Extraction and estimation of chlorophyll, lycopene and Carotene	CO4	Analyze
8.	Determination of adulterants in food	CO5	Evaluate

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

Text Books

1. Zareef, Muhammad, et al. "An Overview On the Applications of Typical Non-linear Algorithms Coupled With Nir Spectroscopy In Food Analysis." *Food engineering reviews*, 2nd Edition, 2020.
2. Nielsen SS, editor. Food analysis laboratory manual. New York: Kluwer Academic/Plenum Publishers; 5th Edition, 2003 Jan.

Reference Books

1. Willard, H.H. etal. "Instrumental Methods of Analysis", VII Edition, CBS, 1986.
2. Ewing,G.W. "Instrumental Methods of Chemical Analysis", V Edition, McGraw-Hill, 1985

Mapping of Course Out comes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										2	1	1
CO2	2	2	1										2	2	1
CO3	3	3	2										2	2	1
CO4	3	3	3										1	1	2
CO5	3	3	1										3	2	1
	3	High			2	Medium			1	Low					

Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	Rubric based Continuous Assessment [25 marks]	Model examination (20 Marks)	Final Examination [50 marks]
Remember			
Understand			
Apply	30	20	30
Analyze	50	40	50
Evaluate	20	40	20
Create			

20FT307	FOOD CHEMISTRY LABORATORY	L	T	P	C
		0	0	2	1
Nature of Course	Professional Core				
Pre requisites	NIL				

Course Objective:

The course is intended to
1. Enable students learn the properties of starch
2. Understand the concept of gluten formation
3. Provide an advanced understanding of the Enzymatic Browning in foods.
4. Enable the students to measure the different properties of human body.
5. Acquire a specialized knowledge Enzymatic hydrolysis of sucrose and Viscosity of foods

Course Outcomes

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

CO.No.	Course Outcome	Bloom's Level
CO1	Explain the specific Gelling properties of starch	Understand
CO2	Describe and provide a hands-on-opportunity and observe gluten formation	Understand
CO3	Demonstrate the Enzymatic Browning in foods	Understand
CO4	Categorize the different properties of human body	Analyze
CO5	Provide the basic knowledge on Enzymatic hydrolysis of sucrose and Viscosity of foods	Analyze

Course Content: Food Chemistry Laboratory
List of Experiments:

S.No	Name of the Experiment	CO Mapping	RBT
1.	Gelling properties of starch	CO1	Understand
2.	Study of gluten formation	CO2	Understand
3.	Enzymatic Browning in foods	CO3	Analyze
4.	Enzymatic hydrolysis of sucrose and measurement of optical rotation	CO5	Analyze
5.	Techniques of measuring height, weight, head, chest and arm circumference, waist to hip ratio, skin-fold thickness, Calculation of percent Body fat using skin folds calipers	CO4	Analyze
6.	Estimation of Viscosity of foods	CO5	Analyze

Passed in Board of Studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2										1	1	2
CO2	3	2	1										1	1	2
CO3	2	2	1										2	1	1
CO4	3	3	2			2							1	2	1
CO5	3	3	2										1	2	2
	High					2	Medium				1		Low		

Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	Rubric based Continuous Assessment [25 marks]	Model examination (20 Marks)	Final Examination [50 marks]
Remember			
Understand	50	50	50
Apply			
Analyze	**50**	**50**	**50**
Evaluate			
Create			

Passed in Board of Studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

20MA403	PROBABILITY AND STATISTICAL METHODS (Common to CSE, IT & Food Tech)	L	T	P	C
		3	2	0	4

Nature of Course	Basic Sciences
Pre requisites	Mathematics-I & II for Computing and Bio Sciences

Course Objectives

The course is intended to
1. Introduce the basic concepts of random variables**.**
2. Acquire the concepts of random variables essential for the subsequent and digital communication.
3. Acquaint with the knowledge of testing of hypothesis for small and large samples.
4. Familiarize with the basic concept on types of design of experiments used in the field of engineering
5. Study the concepts on types of classifications and statistical quality control.

Course Outcomes

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

CO.No.	Course Outcome	Bloom's Level
CO1	Explain the concepts of a random variables and Probability distributions.	Understand
CO2	Examine the functions of multiples random variable.	Apply
CO3	Interpret the testing of hypothesis for small and large samples.	Understand
CO4	Apply the concepts of classifications of design of experiments in the field of engineering.	Apply
CO5	Illustrate the sampling distribution and statistical techniques	Understand

Course Contents:

UNIT I Probability and Random Variables   12
Basics of Probability-Random Variables – Types of Random Variables: Discrete random variables Continuous random variables– Probability functions, Moment Generating Functions –Discrete Distributions: Binomial and Poisson distributions–Continuous Distributions: Uniform and Exponential Distributions.

UNIT II Two – Dimensional random variables   12
Joint distributions – Marginal distributions– Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III Testing of Hypothesis   12
Sampling distributions –- Estimation of parameters –- Statistical hypothesis –- Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square for mean, variance and proportion - Contingency table (test for independent) -Goodness of fit.

UNIT IV Design of experiments   12
One way and two way classifications – Completely randomized design – Randomized block design – Latin square design – 2^2 factorial design.

UNIT V Statistical Quality Control 12   Control
charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits – Acceptance sampling.

Total: 60 Periods

Passed in Board of Studies Meeting   *Approved in Academic Council Meeting*
CHAIRMAN - BOARD OF STUDIES   CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
2. 0liver.C.Ibe, 'Fundamentals of Applied Probability and Random Processes'', Elsevier India, 2nd Edition , 2014

Reference Books:
1. Bali N.P and Manish Goyal, "A Text book of Engineering Mathematics", Lakshmi Publications Pvt Ltd, 9th Edition, 2014.

2. Ronald E. Walpole, Raymond H. Myersand Sharon L. Myers "Probability and Statistics and for Engineers and scientists", Pearson India, 9th edition, 2012.
3. Robert V. Hogg Elliot Tanis Dale Zimmermann., "Probability and Statistical inference "Pearson Education, 2021.

Additional References:
1. https://nptel.ac.in/courses/111/102/111102111
2. https://nptel.ac.in/courses/110/107/110107114

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	-	-	-	-	-	-	-	-	1	2	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	1	2	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1	1	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	2	-	-
	3	High		2	Medium						1	Low			

Formative Assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination**
	IAE -I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	**(60)**
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

20FT401	FUNDAMENTALS OF FLUID MECHANICS	L	T	P	C
		3	0	0	3

Nature of Course	**Engineering Sciences**
Pre requisites	Nil

Course Objectives

The course is intended to

1. Comprehend the fundamental properties of liquids and pressing factor estimation gadgets.
2. Make acquainted with estimation of powers in liquid construction communication.
3. Acquainted with all the fundamental working and computation dependent on stream estimation gadgets.
4. Infer the unit for any boundary utilizing dimensional examination.
5. Comprehend the essential working standards of siphons and its application

Course Outcomes

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

CO. No	Course Outcome	Bloom's Level
CO1	Describe the properties of fluids and calculations on pressure measurement devices	Understand
CO2	Demonstrate the calculation of forces in fluid structure interaction.	Apply
CO3	Implement the working and calculations on flow measurement devices.	Apply
CO4	Derive the units for any parameter using dimensional analysis.	Analyze
CO5	Formulate the working principles of pumps and its application.	Apply

Course Contents

Unit – I   PROPERTIES AND BEHAVIOURS OF FLUIDS   9

Fluids – definition, Types of fluid, Laws of fluid mechanics - Properties of Fluids - densities - kinematic viscosity- dynamic viscosity, Surface tension, vapor pressure, Velocity profiles measurement of pressure, manometers, U-tube manometer, differential manometer, inverted U-tube manometer.

Unit – II   FLUID FLOW   9

Classification of Flow - velocity and acceleration of a fluid particle - one dimensional, two dimensional, continuity equation in Cartesian co-ordinates. Laminar and turbulent flow of fluids through closed conduits Flow pattern - stream line - equipotential line - stream tube - path line , flow net - velocity potential - stream function. Principles of conservation of mass - energy - momentum - Euler''s equation of motion.

Unit – III   DIMENSIONAL ANALYSIS   9

Dimensional analysis - Principle of dimensional homogeneity - the Buckingham''s Pi theorem - non dimensional action of the basic equations- concept of geometries, kinematic and dynamic similarity. Important non-dimensional numbers - Reynolds, Froude, Euler, power dimensional analysis for scale up studies. Similitude - relationship between dimensional analysis and similitude.

Unit – IV   FLOW MEASUREMENTS and FLOW CONTROL   9

Flow measurement devices, Flow through pipes - Navier stokes equation. Reynold''s experiment - Darcy - Weisbach equation for friction head loss - Chezy''s formula – minor and major losses in pipes , Fluid flow control devices- Gate valve, check valve, Globe valve, Butterfly valve and Needle valve

Unit – V   TRANSPORTATIONS OF FLUIDS   9

Pump-definition- Classification, Positive displacement, centrifugal pump, Gear pump, Diaphragm pumps, vacuum pump, peristaltic pump, principles and application, characteristics and Performance; selection and specification, Comparison of Centrifugal and reciprocate pump. Fans, blowers and compressors.

Total : 45 Periods

Passed in Board of Studies Meeting   *Approved in Academic Council Meeting*

CHAIRMAN - BOARD OF STUDIES   CHAIRMAN - ACADEMIC COUNCIL

Text Books
1. Bansal, R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi, 9th edition, 2011.
2. Yunus A. Cengel, John M. Cimbala, Fluid Mechanics-Fundamentals and Applications, Tata McGraw Hill Publishing Co, New Delhi, 3rd Edition, 2006.

Reference Books
1. Grade, RJ.,"Fluid mechanics through problems". Wiley eastern Ltd., Madras, 10th Edition, 2002
2. McCabe W.L., Smith J.C. "Unit Operations in Chemical Engineering", 7th Edition, McGraw –Hill Int., 2006

Additional Reference
1. https://nptel.ac.in/courses/112/104/112104118/
2. https://nptel.ac.in/courses/103/104/103104043/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO 1	3	1											1	1	1
CO 2	3	2	1										1	2	1
CO 3	2	2	1										1	1	1
CO 4	3	3	2										1	2	1
CO 5	3	2	1										1	1	2
	3	High			2	Medium				1	Low				

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – 1 (7.5)	**IAE – 2 (7.5)**	**IAE – 3 (10)**	
Remember				
Understand	30	30	30	20
Apply	10	10	10	60
Analyze	10	10	10	20
Evaluate				
Create				

Passed in Board of Studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

20FT402	UNIT OPERATIONS IN FOOD TECHNOLOGY	L	T	P	C
		3	0	0	3
Nature of Course	Engineering Sciences / professional core				
Pre requisites	Process calculations				

Course Objectives

The course is intended to
1. Understand the principles involved in separation methods
2. Perform calculations for basic operations in food processing
3. Acquire a special Knowledge and understanding of the unit operations
4. Choose suitable techniques for the food processing operation
5. Enable the students to understand role of various unit operations in food Industries

Course Outcomes

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

CO.No.	Course Outcome	Bloom's Level
CO1	Describe the Principles of separation methods used in the food industry	Understand
CO2	Explain the different equipments developed for separation.	Understand
CO3	Discuss the different types of size reduction methods and of equipment used	Understand
CO4	Estimate the energy requirement for the different unit operations	Evaluate
CO5	Investigate the different operations in food processing	Analyze

Course Contents:

UNIT I   EVAPORATION AND CONCENTRATION   9
Definition, Types of evaporators -single and multiple effect evaporators – Methods of feed in evaporators. Performance – evaporator capacity – boiling point elevation and Duhring's rule. Enthalpy balance of single effect evaporator – multiple effect evaporator, Evaporator performance, Industrial evaporators.

UNIT II   MECHANICAL SEPARATION   9
Definition–filter media – Selection criteria, Types-constant rate filtration, Industrial filtration equipment – rotary vacuum filter, sedimentation – Stokes law, sedimentation of particles in gas-cyclones -centrifugal separations –centrifuge equipment

UNIT III   SIZE REDUCTION   9
Size reduction & types, principles of comminuting, characteristics of comminuted products – particle size distribution in comminuted products, energy and power requirements in comminuting – Rittinger's, Bond's and Kick's laws for crushing, crushing efficiency; size reduction equipment's – crushers –jaw crusher, gyratory crusher, crushing rolls, grinders and hammer mills

UNIT IV   CRYSTALLIZATION AND DISTILLATION   9
Crystallization–equilibrium and solubility, equilibrium diagram, rate of crystal growth; crystallization equipment and its classification. Distillation–binary mixtures –types of distillation, Relative volatility and significance, Method of distillation, McCabe Thiele Method and its advantages and limitations, Industrial distillation equipment

UNIT V   EXTRACTION AND LEACHING   9

Contact equilibrium separation processes – liquid-liquid and solid-liquid equilibrium, Material balance for extraction and its stage calculation, absorption Factor –rate of gas absorption, absorption equipment, packing materials and method of packing; Leaching - equipment for leaching .

Total: 45 Periods

Passed in Board of Studies Meeting   *Approved in Academic Council Meeting*

CHAIRMAN - BOARD OF STUDIES   CHAIRMAN - ACADEMIC COUNCIL

TEXT BOOKS
1. Geankoplis, C.J. "Transport Processes and Separation Process Principles", 4thEdition, Prentice Hall, 2003.
2. D.G Rao "Fundamentals of Food Engineering' 'PHI Learning Private Limited, New Delhi, 1st & 2nd Edition, 2007

Reference Books
1. Paul Singh R, and Dennis R. Heldman . "Introduction to Food Engineering". Academic Press – Elsevier India Private Ltd. New Delhi, 4th Edition, 2004
2. McCabe W.L., Smith J.C. "Unit Operations in Chemical Engineering", 4McGraw –Hill Int., 7th Edition, 2006

Additional Reference
1. https://nptel.ac.in/courses/103/103/103103155/
2. https://nptel.ac.in/courses/103/103/103103035/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1											1	1	1
CO2	3	2	1										2	1	1
CO3	3	2											1	1	1
CO4	3	2	2	1									1	1	1
CO5	3	2	1				1						1	2	1
	3	High		2		Medium			1		Low				

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Understand	Quiz / Presentation/Tutorial	5	
Understand	Assignment / Video presentation	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – 1 (7.5)	**IAE – 2 (7.5)**	**IAE – 3 (10)**	
Remember				
Understand	30	30	30	50
Apply				
Analyze				
Evaluate	20	20	20	50
Create				

Passed in Board of Studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

20FT403	FOOD PROCESSING AND PRESERVATION	L	T	P	C
		3	2	0	4

Nature of Course	Professional Core
Pre requisites	Food Analysis and Food chemistry and Nutrients

Course Objectives
The course is intended to
1. Understand the principles food processing and the in impact on the she if life and quality of food materials and products.
2. Learn various methods of food processing viz., drying, milling, freezing, thermal treatments etc.
3. Introduce novel food processing techniques

Course Outcomes

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

CO.No.	Course Outcomes	Bloom's Level
CO1	Identify the different methods of high and low temperature processing techniques.	Apply
CO2	Discuss the selection of the suitable dryers for different food to increase the shelf life	Understand
CO3	Examine the shelf life of foods processed and preserved by natural and chemical agents	Analyze
CO4	Explain the unit operations of different non-thermal processing techniques	Understand
CO5	Deliberate the principle of advanced novel techniques in food processing industries.	Understand

Course contents:

UNIT I   HIGH AND LOW TEMPERATURE PROCESSING OF FOODS   10
Methods of applying heat to food - Blanching, Pasteurization, Sterilization-thermo bacteriology, commercial sterility, calculation of process time – methods of sterilization-equipment. Methods of low temperature preservation - Chilling, Freezing, freeze drying and freeze concentration – theory and principles.

UNIT II   DRYING, DEHYDRATION AND EXTRUSION   10
Drying – types of dryers. Dehydration – Osmotic dehydration – theory and principles. Water activity-sorption behavior of foods – water activity and food stability – Relationship between water activity and moisture – Equilibrium moisture content. Extrusion cooking – principles and types of extruders-Effect of different parameters-quality of the extruded products.

UNIT III   PROCESSED AND PRESERVATION OF FOOD BY CHEMICALS   10
Food preservation by sugar, salt, acid – Principles - mechanism- anti microbial activity. Preservation by chemicals – type of chemical preservatives-sulphur -dioxide, benzoic acid, etc; use of other chemicals like acidulants, antioxidants, mold inhibitors, antibodies, etc. factors affecting anti microbial activity of preservatives.
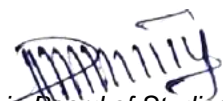
UNIT IV   NON THERMAL PROCESSING   7
Food Irradiation – High Pressure Processing –Pulse dielectric field processing, pulse delight treatment and Ultrasound – Theory and Principles – effect on micro organisms. Super Critical Technology for Preservation-Chemical preservatives, preservation by irradiations, ultrasonic, high pressure, fermentation, curing, pickling, smoking, membrane technology.

UNIT V   NOVEL METHODS OF FOOD PROCESSING   8
UV treatment, Ozone treatment, di electric heating-microwave, radio frequency, ohmic and infrared heating theory, equipment, applications and effect on foods. Hurdle technology and Nano-technology-principle-application in food processing.

Total: 45 Periods

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

TEXT BOOKS:
1. Sivasankar, B."Food Processing and Preservation". Prentice Hall of India, 1st Edition, 2002.
2. Khetarpaul, Neelam. "Food Processing and Preservation."Day a Publications,7th Sub Edition, 2005

Reference Books
1. .P.J.Fellows, Food processing Technology: Principles and practice, Second edition, Wood head publishing limited, Cambridge, 2009.
2. Da-Wen Sun, Emerging Technologies for food processing, 2ndEdition, Academic Press, 2014.

Additional Reference
1. https://nptel.ac.in/courses/126/105/126105015/
2. https://nptel.ac.in/courses/126/105/126105018/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2			1		2						1	2	1
CO2	3	1					2	1					1	2	1
CO3	3	2	2		1		2						2	2	2
CO4	3	2	1				2	1					1	3	1
CO5	3	2	1				2						1	3	1
	3	High			2		Medium						Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Understand	Quiz / Presentation/Tutorial	5	
Understand	Assignment / Video presentation	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – 1 (7.5)	**IAE – 2 (7.5)**	**IAE – 3 (10)**	
Remember				
Understand	30	30	30	50
Apply	10	10	10	30
Analyze	10	10	10	20
Evaluate				
Create				

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

20FT404	FOOD ADDITIVES	L	T	P	C
		3	0	0	3

Nature of Course	Professional Core
Pre requisites	Chemistry &Nutrients

Course Objectives

The course is intended to
1. Study the scope and safety evaluation of food additives.
2. Enable the students to understand about naturally occurring food additives.
3. Compare the various Anti-caking agents and Humectants.
4. Identify the importance of taste and flavouring agent in food.
5. The concept of Fat Substitutes and Replacers

Course Outcomes

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

Sl.No.	Course Outcome	Bloom's Level
CO1	Discuss the scope and safety evaluation of food additives.	Understand
CO2	Demonstrate the naturally occurring food additives.	Understand
CO3	Deliberate the applications of Anti-caking agents and Humectants	Understand
CO4	Identify the role of Taste and Flavouring agents in food	Understand
CO5	Explain the advantages of Fat Substitutes and Replacers	Understand

Course contents:

UNIT I   Introduction to Food Additives   9
Scope of food additives; Functions and uses of Food Additives; Classification- Intentional & Unintentional Food additives; Toxicology and Safety Evaluation of Food Additives: Effects of Food Additives; Food Additives generally recognized as safe (GRAS); Tolerance levels & Toxic levels in Foods; Legal safeguard; Risks of food additives

UNIT II   Naturally occurring food additives   9
Classification; Health Implications; Role in Foods Acidulants: Introduction; Different acidulants; Role in food processing Food colorants: Natural & Synthetic food colorants; Classification of food colorants; Chemical nature; Impact on health-Pigments: Importance; Classification: Utilization as food color.

UNIT III   Anti-caking agents and Humectants   9
Introduction; Different Anti-caking agents and Humectants; Role in food processing Starch modifiers: Chemical nature; Role in food processing. Antimicrobial agents, Clarifying agents, antifoaming agents, Fat mimetic and replacers.

9
UNIT IV   Taste and Flavoring agents
Introduction; Classification of flavors- natural & synthetic; Flavor enhancer/ Potentate; Importance of taste and flavors; Role of flavoring agents in food processing

UNIT V   Fat Substitutes and Replacers   9
Types, chemical properties, levels of additions in individual products, toxicity data of Colorants – Natural and artificial, Flavorings, Flavor enhancers, Fat substitutes and replacers

Total: 45 Periods

TEXT BOOKS:

1. Brennen, Alfred Larry. "Food Additives". CRC, 2nd Edition, 1999
2. H.D. Belitz, W. Grosh and P. Schieberle. "Food Chemistry", Springer. 4 th Revised & Extended Edition, 2009

Reference Books

1. S S Deshpande, "Handbook of Food Toxicology". Marcel Dekker, 24th Edition, 2002.
2. Peter A Williams and Glyn O Philips, "Gums and stabilizers for the Food Industry", RSC, 1st Edition, 2006.

Additional Reference

1. https://www.youtube.com/watch?v=Ut9uSlK-f-8
2. https://www.youtube.com/watch?v=ub-XdapCo18

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1											2	1	1
CO2	2	2					1	1					2	2	1
CO3	3	2	1										2	1	1
CO4	3	1	1				2						2	1	2
CO5	3	1						1					2	1	1
	3	High			2		Medium			1			Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Understand	Quiz / Presentation/Tutorial	5	
Understand	Assignment / Video presentation	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	
Remember				
Understand	30	30	30	60
Apply				
Analyze	10	10	10	20
Evaluate	10	10	10	20
Create				

Passed in Board of Studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

20FT405	**Refrigeration and Cold Chain Management**	L	T	P	C
		3	2	0	4

Nature of Course	Professional Core
Pre requisites	Fundamental of Food Processing

Course Objectives

The course is intended to
1. Learn the principles and the components involved in domestic and commercial refrigeration systems
2. Analyze refrigeration process, their application in processing
3. Provide knowledge on design aspects of cold storage systems
4. The refrigeration techniques for increasing shelf life of food
5. Learn cold chain design and storage

Course Outcomes

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

CO. No	Course Outcome	Bloom's Level
CO 1	Investigation of the basic concept of refrigeration based on the laws of thermodynamics, Carnot systems	Analyze
CO 2	Describe the vapor compression and vapor absorption cycle with P-H and T-S diagrams	Understand
CO 3	Explain the types of evaporator and condenser and their applications in food industries	Understand
CO 4	Design and construct cold storage units with proper precooling, insulation and operation by load calculation.	Analyze
CO 5	Comprehend the role of cold chain such as refrigeration, distribution and transport	Understand

Course Contents

Unit – I Introduction   9

Introduction to refrigeration, refrigeration capacity. Review of Second law of thermodynamics and interpretation. Production of low temperatures - principles and process. Refrigerants - classification and thermodynamic properties. Ozone depletion potential. Reversed Carnot cycle. Limitations of reversed Carnot systems.

Unit – II Refrigeration Systems   9

Refrigeration cycle – simple vapor compression, vapor absorption cycle, P-H and T-S diagrams, COP, Energy ratios and Power consumption of a refrigerating machine. Standard rating cycle and effect of operating conditions. Air refrigeration system – reversed Braydon cycle, Effect of super heating and sub cooling on vapor compression cycle, Temperature sensors. .

Unit – III Components of A Refrigeration System   9

Evaporator- dry and flooded type, liquid cooling evaporator. Condenser- water cooled, air cooled and evaporative condenser. Compressor - Reciprocating type compressors. Expansion valve - thermostatic expansion valve

Unit – IV Low Temperature Storage Systems   9

Pre-cooling systems, Cold storage- construction, insulation and operation. Design of cold storage unit. Calculation of refrigeration load in cold store. Prefabricated systems, walk-in-coolers. Frozen storage, Cryogenics – Linde and Claude system for liquefaction of air, freezing in air, Modified Planck's law for calculation of freezing time

Unit – V Cold Chain   9

Introduction, Components of cold chain. Refrigerated distribution and transport systems, Cold chain in retail, Traceability- Application of RFID in cold chain. Role of refrigeration in food production - candy manufacture, beverage processing, bakery products, meat products, poultry products, fishery products, fruit /vegetables and dairy products.

Total : 45 Periods

Passed in Board of Studies Meeting   *Approved in Academic Council Meeting*

CHAIRMAN - BOARD OF STUDIES   CHAIRMAN - ACADEMIC COUNCIL

Text Books

1. Sun, Da-Wen. "Advances in Food Refrigeration". Leatherhead Publishing, 2nd Edition, 2001.
2. James, S.J. and C. James. "Meat Refrigeration". CRC / Wood head Publishing, 1st Edition, 2002.

Reference Books

1. Dellino C.V.J., "Cold and Chilled Storage Technology", Springer, 2ndEdition, 2011.
2. Florkowski W.J, Shewfelt R.L, Brueckner B and Prussia S.E, "Post Harvest Handling and Sytems Approach", Academic Press, Second edition, 2009

Additional Reference

1. https://nptel.ac.in/courses/112/105/112105129/
2. https://bibop.ocg.msf.org/docs/49/L015ZCHG01E_Coldchainguide.pdf

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	2	1			1	2	1					1	2	1
CO 2	3	2				1	2						1	2	1
CO 3	3	1				1		1					1	2	2
CO 4	2	2	2			1	2						1	2	1
CO 5	2	2				1	1	1					1	2	1
	3	High			2	Medium			1	Low					

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	
Remember	10	10	10	20
Understand	30	30	30	40
Apply	10	10	10	40
Analyze				
Evaluate				
Create				

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

20MC401	**SOFT SKILL** (Common to All Branches of B.E., / B.Tech.)	**L**	**T**	**P**	**C**
		2	**0**	**0**	**0**
Nature of Course	Mandatory Course				
Pre requisites	Nil				

Course Objectives

The course is intended to
1 Improve language skills in personal and professional life.
2 Equip students with the vital communication and soft skills to succeed in the highly.
3. Competitive international arena.
4. Focus on the fundamental soft skills and of their practical social and work place usage.
5. Learn to identify and overcome the barriers in interpersonal relationships.
6. Enhance employability skills and ensure career success.

Course Outcomes

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

CO.No.	Course Outcome	Bloom's Level
CO1	Relate the significance and fundamental nature of soft skills.	Remember
CO2	Take part in a wide range of Public speaking and professional group discussions.	Understand
CO3	Plan one's time effectively and productively, especially at work.	Apply
CO4	Make use of leadership skills to manage stress &conflict.	Apply
CO5	Organize presentation effectively and participate in interview with confidence.	Apply

Course Contents

Unit – I Introduction to soft skills and Interpersonal Communication   6
An Introduction – Definition and Significance of Soft Skills; Interpersonal communication-types of interpersonal communication.

Unit - II Public Speaking and Oral Communication skills   6
Public Speaking: Skills, Methods, Strategies Group Discussion: Importance, Planning, Elements.

Unit – III Time Management and Personality Development   6
Time Management – concepts and essentials tips. Personality-development – meaning, SWOT analysis & goal setting- Stress and conflict management.

Unit – IV Leadership skills and Emotional intelligence   6
Leadership skills: Concept of Leadership and honing Leadership Skills- Problem-Solving Skills - Group and Ethical Decision-Making. Emotional Intelligence: Strategies to enhance Emotional Intelligence.

Unit-V Interview Skills   6
Interviewer - Interviewee perspectives - Self Introduction and Presentation: Types, Content and Essential Tips–before, during and after presentation, Overcoming Nervousness - Mock Interview.
                                                                                Total: 30 Periods

Passed in Board of Studies Meeting   *Approved in Academic Council Meeting*

CHAIRMAN - BOARD OF STUDIES   CHAIRMAN - ACADEMIC COUNCIL

Text Books
1. Managing Soft Skills for Personality Development–edited by B.N.Ghosh, McGraw Hill India, 2nd Edition, 2018.
2. English and Soft Skills–S.P. Dhanavel, Orient Black swan India, 1st Edition, 2017

Reference Books:
1. Sutapa Banerjee, Soft Skill Business and Professional Communication Book, 2016
2. PushpLata and Sanjay Kumar, Communication Skills Book, 2nd Edition, 2015

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1								1	2	3		2			
CO2								1	2	3		2			
CO3								1	2	3		2			
CO4								1	2	3		2			
CO5								1	2	3		2			
	3	High			2	Medium				1	Low				

Bloom's Level	Summative Assessment (Internal Mode)	
	Assessment 1 (50 Marks)	Assessment 2 (50 Marks)
Remember	10	10
Understand	10	10
Apply	30	30
Analyze		
Evaluate		
Create		

Passed in Board of Studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

20FT406	UNIT OPERATIONS LABORATORY	L	T	P	C
		0	0	2	1

Nature of Course	Professional Core
Pre requisites	Unit Operations in Food Technology

Course Objective:
The course is intended to
1. Enable students learn the properties of fluid flow in food processes
2. Understand the concept of Evaporator Performance
3. Provide an advanced separators in food processing
4. Enable the students to measure the different technology in food industries
5. Acquire the various size reduction equipments

Course Outcomes

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

Sl.No.	Course Outcome	Bloom's Level
CO1	Describe the basic principles of chemical engineering and its applications	Understand
CO2	Provide a hands-on- unit operations experiments	Understand
CO3	Estimate the flow rate in process industries	Analyze
CO4	Identify the best and economical unit operation in food processing	Apply
CO5	Calculate the material balance and energy balance in unit operations	Apply

Course Content: Unit operation Laboratory
List of Experiments:

S.No	Name of the Experiment	CO Mapping	RBT
1.	Flow measurement a) Orifice meter b) Venturimeter, c) Rotameter	CO3	Understanding
2.	Determination of economy and thermal efficiency of rotary flash evaporator	CO2	Analyze
3.	Solving problems on single and multiple effect evaporator	CO5	Analyze
4.	Determination of collection efficiency in separators	CO4	Evaluation
5.	Determination of performance characteristics in size reduction using the burr mill, Ball Mill, hammer mill and Roll Crusher.	CO2	Analyze
6.	Evaluate the efficiency of Extraction and distillation	CO1	Evaluation

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)																
COs	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1				2		1	1		1	1	1	2	2
CO2	3	1				2	1	1			1	1	1	2	1
CO3	3	2	1				1	2			1	1	2	1	2
CO4	3	2						1			1	1	1	2	1
CO5	3	2				2		2			1	1	1	2	2
	3	High			2	Medium				1	Low		

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	**Rubric based Continuous Assessment [25 marks]**	**Model examination (20)**	**Final examination [50 marks]**
Remember			
Understand	40	30	40
Apply			
Analyze	**50**	**40**	**50**
Evaluate	**10**	**30**	**10**
Create			

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

20FT407	FOOD PROCESSING AND PRESERVATION LABORATORY	L	T	P	C
		0	0	2	1

Nature of Course	Professional Core
Pre requisites	Fundamental of food processing

Course Objective:
The course is intended to
1. Enable students learn the properties of starch
2. Understand the concept of gluten formation
3. Provide an advanced the Enzymatic Browning in foods.
4. Enable the students to measure the different properties of human body.
5. Acquire a specialized knowledge Enzymatic hydrolysis of sucrose and Viscosity of foods

Course Outcomes

CO.No.	Course Outcomes	Bloom's Level
CO1	Demonstrate the different methods of high and low temperature processing techniques.	Understand
CO2	Identify the suitable dryers for different food to increase the shelf life	Apply
CO3	Determine the shelf life of foods processed and preserved by natural and chemical agents	Apply
CO4	Describe the Unit operations of different non-thermal processing techniques	Understand
CO5	Investigate the principle of advanced novel techniques in food processing industries.	Apply

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

Laboratory components			
S.No	List of Experiments	CO Mapping	Revised Blooms Taxonomy
1.	Determination of textural characteristics of foods by Extrusion cooking	CO5	Evaluate
2.	Determination of different properties of grains	CO5	Evaluate
3.	Experiment on osmotic hydration characteristics of food materials	CO5	Apply
4.	Determination of drying rate of fruits and vegetables in Tray dryer	CO5	Evaluate
5.	Effect of UV treatment on microbial quality of liquid foods and Effect of ohmic heating on microbial quality of liquid foods	CO3	Analyze
6.	Determination of freezing point of food materials	CO5	Evaluate
7.	Canning & bottling of vegetable and fruit products	CO3	Analyze

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1		2	1	2	1	1		1	2	1	2	1
CO2	3	3	2		2	2	1		1	2	1	1	1	1	1
CO3	3	3	1		1	2	2	1	1	1		2	1	1	2
CO4	3	2	1		1	1		1		1	2	2	1	2	1
CO5	2	2	2		2	1	2		1		1	3	1	2	1
	3	High				2	Medium				1	Low			

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Rubric based Continuous Assessment [25 marks]	Model examination (20 Marks)	Final Examination [50 marks]
Remember			
Understand			
Apply	30	30	40
Analyze	40	40	40
Evaluate	30	30	20
Create			

Passed in Board of Studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

20FTA03	Value Education	L	T	P	C
		1	0	0	1
Nature of course	Farm Enterprises				
Pre requisites	NIL				

Course Objectives

The course is intended to
1. Know the basics of mushroom and its varieties
2. Learn about spawn production, bed preparation and mushroom production
3. Importance of value addition and its production economics

Course Outcomes

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

CO. No	Course Outcome	Bloom's Level
CO 1	Demonstrate the basics of mushroom and its varieties, production of spawn and mushroom	Understand
CO 2	Investigate the Importance of value addition and its economics	Apply

Course Contents

Unit -I   Basics of mushroom and spawn production   8

Introduction, Mushroom production of Tamil Nadu, Varieties of Mushroom, Preparation of Mushroom Fungal culture – Preparation of culture media, sterilization of glass wares, worktable, culture room and preparation of nucleus culture; Preparation of mother spawn

Unit- II   Production of mushroom and value addition   7

Preparation of bed spawn, mushroom bed preparation, mushroom production technology – paddy straw, oyster, milky and button, post-harvest technology and value addition, edible mushroom and mushroom poisoning, Economics for mushrooms and Industrial visit

	Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**POs**												**PSOs**			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	2				2	3	1	2		1	2	1	3	
CO 2	3	3				3	2	1	1		1	2	1	3	
	3	**High**			**2**		**Medium**				**1**		**Low**		

Bloom's Level	Summative Assessment (Internal Mode)	
	Assessment 1 (50 Marks)	**Assessment 2 (50 Marks)**
Remember	10	10
Understand	10	10
Apply	30	30
Analyze		
Evaluate		
Create		

Passed in Board of Studies Meeting   *Approved in Academic Council Meeting*

CHAIRMAN - BOARD OF STUDIES

CHAIRMAN - ACADEMIC COUNCIL

20FTA04	Halal Compliance in Food Audits	L	T	P	C
		1	0	0	1
Nature of course	Halal Auditing Course				
Pre requisites	NIL				

Course Objectives

The course is intended to
1. Acquire the requirements and international standards in halal food production
2. Learn the concept of halal accreditation and certification by auditing techniques and the concept of on-site visit to halal food testing laboratory

Course Outcomes

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

CO. No	Course Outcome	Bloom's Level
CO 1	Describe the use of principles of standards and requirements in halal production	Understand
CO 2	Formulate the halal compliance from the technical & view point along with its application & implementation in our daily life	Apply

Course Contents

Unit I – Standards in Halal food production   8

Introduction; A benchmarking on international halal food standards; Food production, international legislation, and halal requirements-processed meat; Halal food inspection and traceability; uses of laboratory testing in halal food production; On-site visit to halal food testing laboratory.
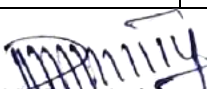
Unit II – Halal food products auditing and accreditation   7

Halal certification schemes; Halal accreditation bodies and certification; Auditing techniques, Internal auditing IA; Halal food fight requirements according to the international halal standards.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO 1	3	1				2	1	2				1	1	3	
CO 2	3	3				1	1	2				1	1	3	
	3	**High**			**2**		**Medium**			**1**		**Low**			

Bloom's Level	**Summative Assessment (Internal Mode)**	
	Assessment 1 (50 Marks)	**Assessment 2 (50 Marks)**
Remember	10	10
Understand	10	10
Apply	30	30
Analyze		
Evaluate		
Create		

Passed in Board of Studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

20FT501	**Dairy Processing Technology**	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Unit Operations in Food Technology				

Course Objectives
The course is intended to
1. To understand about dairy industries
2. To understand the properties of milk
3. To learn the process of milk products
4. To understand about manufacture of milk powder and its substitutes
5. To gain the knowledge about the storage of milk products

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Demonstrate the dairy processing and manufacturing processes of various dairy products	Understand
CO2	Explain the dairy process and its quality control	Understand
CO3	Deliberate the manufacture of milk products	Understand
CO4	Clarify the manufacture of milk powder and its ingredients	Understand
CO5	Investigate the storage and sanitations in milk industries	Apply

Course contents:

Unit I   Properties of Milk   9
Milk-Types-Composition-Physical-Chemical and Thermal Properties-Heat Capacity, Density-Freezing-Boiling point- Expansion-Agitation-Viscosity-Classification of milk and Special Milk, Handling effects of Milk-toxicity of metals

Unit II   Processing and Quality Parameters of Milk   9
Processing of Milk- Pasteurization-HTST, UHT, sterilization, Homogenization, Filtering and Clarification of Milk- cream separation-Methods and Equipment's, Emulsification, Fortification, judging and grading of milk, national and international standards of milk and milk products.

Unit III   Milk Products   9
Traditional dairy products, Manufacturing of Yogurt, Cheese, Butter, Ghee, Ice-cream, malted products, evaporated milk products - properties, Classification, processing Methods, and Equipments.

Unit IV   Milk Powder Processing and Milk Substitutes   9
Processing of Milk Powder – Composition, Properties. Methods of drying, substitutes for milk and milk products – casein, lactose and other by-products, weaning foods, therapeutic foods, fortification and enrichment.

UNIT V   Storage Sanitation and Effluent Treatment   9
Storage of Milk in Tanks-Storage of ice cream and other milk products in cold storage - Cleaning and Sanitation- Importance, Detergents, Properties and Cleaning procedures - Cleaning in place-Dairy effluent treatment and disposal.

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Ananthakrishnan, C.P., and Sinha, N.N., "Technology and Engineering of Dairy Plant Operations, Laxmi Publications, New Delhi, 1984.
2. Walstra, P., "Diary Technology: Principles of Milk Properties and Processes". Marcel Dekker, 1999

References:
1. Tufail Ahmed., "Dairy Plant Engineering and Management", Kitab Mahal Publishers, Allahabad, 1997.
2. Lampert, Lincoln M. "Modern Dairy Products: Composition, Food Value, Processing, Chemistry, Bacteriology, Testing, Imitation Dairy Products". Chemical Publishing Company, 1998.

Web References
http://ecoursesonline.iasri.res.in/mod/page/view.php?id=147892
https://www.rotronic.com/media/news/files/1466670855_FF-Milk-Powder.pdf

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1				2	1						1		
CO2	3	1	1										2	1	
CO3	3	2				1	2						1		1
CO4	3	1	1			1	2						2	1	2
CO5	3	2	2				2						1		2
	3	High		2		Medium							Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FT502	Heat and Mass Transfer in Food Processing	L	T	P	C
		3	2	0	4
Nature of Course Professional Core					
Pre requisites Food Process Calculation					

Course Objectives
The course is intended to
1. Understand the principles of mode of heat transfer
2. Understand and applications of heat transfer operation
3. Understand and apply the principles of heat exchanger
4. Apply the heat transfer principles in evaporators
5 Understand the principles and applications of mass transfer operations

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Discuss and apply the principles in heat transfer phenomena & conduction	Understand
CO2	Explain the concepts of convection	Understand
CO3	Discover the principles of radiations	Understand
CO4	Demonstrate the principles of heat exchangers	Apply
CO5	Investigate the mass transfer by diffusion	Apply

Course contents:
 Unit I   Heat transfer by conduction   12
Modes of heat transfer- Conduction, Convection and Radiation, Fourier's Law of Heat conduction, Thermal Conductivity of gases, liquids and solids, Thermal diffusivity, thermal resistance, Heat conduction in simple geometry-simple wall/slab-composite wall, hollow cylinder and hollow sphere, Critical radius of insulation

 Unit II   Heat transfer - Convection   12
Convection heat transfer, types- Natural convection and Forced Convection, Individual and overall heat transfer coefficient for Turbulent flow & Laminar flow - Solving problems in heat transfer by convection

 Unit III   Heat Transfer - radiations   12
Basics of Radiation heat transfer & Types of surfaces, radiations laws - Kirchhoff's Law, Stephan Boltzmann Law, Planck's Distribution law, Wien's Displacement law, and Lambert's law. Absortivity, emissivity Combined Radiation and Convection Heat Transfer, problems solving in heat transfer by radiations

 Unit IV   Heat Transfer – Heat exchanger & Evaporator   12
Heat Exchanger -Types of Heat exchanger- parallel, counter and cross flow, heat exchanger equipment -Shell and tube, double pipe and plate type, Number of passes. Overall heat transfer coefficient, problem solving in the heat transfer by exchanger. Evaporation- Types of evaporators-single and multiple effect evaporator mass and heat balances, Evaporator capacity, Evaporator economy LMTD-Significance of LMTD, Industrial equipment – Solving the problems.
 UNIT V   Mass Transfer operations   12
Introduction of mass Transfer, Concentration and fluxes, Fick's law- mass transfer Diffusion types- Molecular diffusion and eddy diffusion , Steady state - equimolar diffusion in gas, liquid and solid. Non equimolar diffusion in gases. Mass Transfer coefficient and convective mass transfer.

Total: 60 Periods

Text Books:
1. C. P. Kothandaraman and S. Subramanyan, Fundamentals of Heat and Mass Transfer, New Age International private limited, New Delhi, 2014.
2. Gean koplis C.J. Transport Process and Unit operations. Prentice-Hall of India Private limited ,New Delhi, 2005

References:
1. R. C. Sachdeva, Fundamentals of Engineering Heat and Mass Transfer, New Age International private limited, New Delhi, 2010.
2. Coulson,J.M and et al. Coulson and Richardsons Chemical Engineering, 6th Edition Vol.I and II, Butterworth- Heinman, 2004

Web References
1. https://nptel.ac.in/courses/103/103/103103145/
2. https://nptel.ac.in/courses/103/103/103103032/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1				2	1						1	1	
CO2	3	2											2		2
CO3	3	2	1			1	2						1	1	1
CO4	3	2	2	1		1	2						2		2
CO5	3	3	1	1			2						1	1	1
	3	High			2		Medium						Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

20FT503	**Biochemical Engineering in Food Technology**	L	T	P	C
		3	2	0	4

Nature of Course	Professional Core
Pre requisites	Food Process Calculation

Course Objectives

The course is intended to

1. Understand the mechanism of enzyme binding with substrate and energy changes
2. Acquire the knowledge of enzyme kinetics, inhibition kinetics and parameter evaluation
3. Learn the methods of enzyme immobilization and mass transfer resistance
4. Learn the concepts of growth kinetics and overview of fermentation process
5. Understand the medium requirements and its sources, volumetric mass transfer coefficient

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Classification of enzymes	Understand
CO2	Derive the enzyme kinetics and different models	Apply
CO3	Demonstrate the various types of enzyme immobilization	Understand
CO4	Discuss the growth of microorganisms and basics of fermenter	Understand
CO5	Formulate the media and optimization	Apply

Course contents:

Unit I   Introduction to Enzyme   12

Introduction – Enzyme and Fermentation, Nomenclature of enzymes, commercial application of enzymes, classification of enzymes, Mechanisms of enzyme action, concept of active site and energetics of enzyme substrate complex formation, specificity of enzyme action, principles of catalysis – Arrhenius law, collision theory, transition state theory and role of entropy in catalysis

Unit II   Enzyme Kinetics   12

Kinetics of single substrate reactions, estimation of Michaelis – Menten approach and parameter identification, multisubstrate reactions, turnover number, types of inhibition & models – competitive inhibition, non-competitive inhibition and un-competitive inhibition, Allosteric regulation of enzymes, and other influences on enzyme activity – pH, Temperature and shear

Unit III   Enzyme Immobilization   12

Physical and Chemical methods of enzyme immobilization – adsorption, matrix entrapment, encapsulation, cross- linking, covalent binding, effect of mass-transfer resistance – internal, external and effective diffusivities in biological gels

Unit IV   Cell Kinetics and Fermentation   12

Introduction – Growth cycle of microorganisms, binary fission, calculation of number of cells, overview of fermentation process and its advantages, historical development of fermentation industry, general requirements of fermentation processes, basic configuration of fermenter and ancillaries, main parameters to be monitored and controlled in fermentation processes

UNIT V   Raw materials and Media design for fermentation process   12

Medium requirements for fermentation processes – carbon, nitrogen, minerals, vitamins and other complex nutrients, criteria for good medium, basic mass transfer concepts, collelation for mass-transfer coefficient and determination of volumentric-mass transfer rate – sodium sulfite oxidation method, gassing-out technique, oxygen balance technique, types of media and medium optimization methods

Total: 60 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Grewal B.S, "Higher Engineering Mathematics",Khanna Publishers, 44th Edition, 2019
2. Veerarajan.T,"Engineering Mathematics for Semester I and II",Tata McGraw Hill,3rd Edition, 2014.

References:
1. Ramana B.V,"Higher Engineering Mathematics",Tata Mc GrawHill Company, 1st Edition,2018
2. Bali.N.P and ManishGoyal N.P, "A text book of Engineering Mathematics", Laxmi Publications, 6th Edition, 2015

Web References
1. https://nptel.ac.in/courses/111/105/111105121
2. https://nptel.ac.in/courses/122101003/2

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1											1		
CO2	3	2	1										2		
CO3	3	1											1		
CO4	3	2											2		
CO5	3	2	1										1		
	3	High		2		Medium							Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	1
	Attendance	5	5

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FT504	Food Equipment Design	L	T	P	C
		3	2	0	4
Nature of Course Professional Core					
Pre requisites Food Process Calculation					

Course Objectives
The course is intended to
1. To enable the student to design and develop equipment used in Food Processing operations.
2. To Identify and discuss critical design of typical processing equipment.
3. Understand the relationship between process design and Safety

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Identify the factors that will affect the design of equipments	Understand
CO2	Classify the variables based on various properties	Understand
CO3	Design the concepts of storage vessel design	Apply
CO4	Investigate the critical variables for the design of reaction vessels	Evaluate
CO5	Develop a conceptual design model	Analyze

Course contents:

Unit I   Basic Design Considerations and Materials of Construction   12

Basic considerations in process equipment design. Types of Engineering materials, properties - mechanical and chemical, Process flow diagrams (PFD) – symbols used in PFD

Unit II   Design of Pressure Vessels   12

Basic design of vessel, design of a shell and its components – cylindrical and spherical. Vessels subjected to optimum proportions of a vessel and vessel size

Unit III   Design of Storage tank   12

Storage of fluids – storage of volatile, non-volatile liquids and storage of gases. Design of rectangular tanks and horizontal tanks

Unit IV   Design of reaction vessels   12

Classification of reaction vessels, heating system. Design considerations – jacket design, coil and channel design

UNIT V   Design of Heat Exchangers equipment and Evaporator   12

Types of heat exchangers – double pipe heat exchangers, shell and tube heat exchangers. Design of shell and tube heat exchanger. Design of single effect evaporator

Total: 60 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Shrikant D Dawande. "Process design of equipments". Central Techno Publications, ISBN: 81-89188-14-8, Nagpur, 2005.
2. Mahajani V.V and Umarji S.B. "Joshi's process equipment design". Trinity Press. ISBN: 978-93-5138-091-1, New Delhi, 2014.

References:
1. Jasim Ahmed and Mohammad Shafiur Rahman (Editors), Handbook of Food Process Design, John Wiley and Sons, Ltd., U.K., 2012
2. Rajesh Mehta and J. George "Food Safety Regulation Concerns and Trade- The Developing Country Perspective," Published by Macmillan India Ltd., New Delhi. 2005

Web References

https://nptel.ac.in/courses/103/107/103107143/

https://imtk.ui.ac.id/wp-content/uploads/2014/02/Chemical-Process-Equipment-Selection-and-Design-by- Stanley-M.-Walas.pdf

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1											1		
CO2	3	2											2		2
CO3	3	3	1										1	2	
CO4	3	3	3										2		1
CO5	3	2	2										1		
	3	High		2	Medium								Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	1
	Attendance	5	5

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FT505	Dairy Processing Laboratory	L	T	P	C
		0	0	2	1
Nature of Course	Professional Core				
Pre requisites	Dairy Processing Technology				

Course Objective:

The course is intended to

1. Understand physico-chemical and colloidal properties of milk
2. Assess the quality of raw milk and their implications on safety standards of milk and milk Products
3. Apply the unit operations in milk processing: separation, standardization, homogenization, Pasteurization methods, spray drying

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Identify the presence of macro components in milk & detect the adulterants in milk	Understand
CO2	Find the pasteurization efficiency of milk using different methods of pasteurization.	Understand
CO3	Demonstrate the construction details and milk flow pattern of plate heat exchanger	Apply
CO4	Calculate the efficiency of various equipment for the processing of milk	Analyze
CO5	Determine the drying efficiency of different dryers for the production of milk powder	Evaluate

Laboratory components			
S. No	**List of Experiments**	**CO Mapping**	**Revised Blooms Taxonomy**
1.	Estimation of specific gravity of milk	CO5	Evaluate
2.	Determination of fat content of milk by Gerber's method	CO2	Evaluate
3.	Standardization of milk by Pearson square method	CO5	Apply
4.	Study on (Low temperature low time) LTLT process vat	CO2	Apply
5.	Study on construction details and milk flow pattern in Plate heat exchanger	CO3	Understand
6.	Construction of parts and working of cream separator	CO1	Understand
7.	Detection of Adulteration of milk	CO4	Analyze
8.	Quality analysis of raw milk	CO5	Evaluate
9.	Preparation of ice cream	CO5	Analyze
10.	Construction and working of homogenizer for reduction of fat globules	CO5	Understand

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1											1		1
CO2	3	2	1										2		2
CO3	3	3	2										3	2	
CO4	3	3	3										2		2
CO5	3	2	2										1		
	3	High		2		Medium							Low		

Assessment based on Continuous and Final Examination			
Bloom's Level	**Continuous Assessment (50 marks) (Attendance – 5 marks)**		**Final Examination [50 marks]**
	Rubric based Continuous Assessment [25 marks]	**Model Examination [20 marks]**	
Remember			
Understand	40	40	40
Apply	60	60	60
Analyze			
Evaluate			
Create			

20FT506	Biochemical Engineering Laboratory	L	T	P	C
		0	0	2	1

Nature of Course	Professional Core
Pre requisites	Biochemical Engineering in Food Technology

Course Objective:

The course is intended to

1. Understand the growth kinetics of microorganisms
2. Learn production methods of acids and proteins
3. Understand the enzymatic kinetics
4. Understand the optimization techniques
5. Impart the concepts of mass transfer coefficient

Course Outcomes

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

Sl.No.	Course Outcome	Bloom's Level
CO1	Comprehend the growth the microorganisms and doubling rate	Understand
CO2	Develop the production methods and parameter variation	Apply
CO3	Determine the kinetics of enzyme by varying different parameter	Analyze
CO4	Design and Implement the process of media optimization	Apply
CO5	Calculate volumetric mass transfer coefficient	Evaluate

Laboratory components			
S. No	List of Experiments	CO Mapping	Blooms Taxonomy
1.	Growth kinetics	CO1	Understand
2.	Production of amino acid	CO2	Analyze
3.	Enzyme kinetics	CO3	Analyze
4.	Media design by Plackett Burmann Method	CO4	Analyze
5.	Comparative study between free and immobilized enzymes	CO3	Analyze
6.	Enzyme specificity of alpha amylase on different substrates	CO3	Analyze
7.	Production of citric acid	CO2	Analyze
8.	Estimation of volumetric-mass transfer coefficient	CO5	Evaluate
9.	Production of single cell protein	CO2	Analyze
10	Production of amylase	CO2	Analyze

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										1	1	
CO2	3	2	1										2		2
CO3	3	3	2	1									2	2	
CO4	3	3	3	1									2		3
CO5	3	2	2	1									1		
	3	High			2		Medium						Low		

Assessment based on Continuous and Final Examination			
	Continuous Assessment (50 marks) (Attendance – 5 marks)		Final Examination [50 marks]
Bloom's Level	Rubric based Continuous Assessment [25 marks]	Model Examination [20 marks]	
Remember			
Understand	40	40	40
Apply	60	60	60
Analyze			
Evaluate			
Create			

20FT601	**Baking and Confectionery Technology**	L	T	P	C
		3	0	0	3
Nature of Course Professional Core					
Pre requisites Food Processing and Preservation					

Course Objectives

The course is intended to

1. Acquire the knowledge on raw materials and equipments required for baking
2. Acquaint the process of producing a chocolate confectionery
3. Learn the basic knowledge on confectionery
4. Students able to learn the products and process of making sugar confectionery
5. Describe the different baking process and the types of dough used

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Identify the various raw materials used in baking	Understand
CO2	Discuss the processes involved in biscuits and cookies	Understand
CO3	Explain the basic concepts of confectionery	Understand
CO4	Formulate the products and process of making sugar confectionery	Apply
CO5	Demonstrate the principles and operations of machineries	Understand

Course contents:

Unit I   Introduction to baking and its products   8

Bakery - introduction - baking principles - classification - role of ingredients in bakery products - chemistry and technology. Dough rheology - Farinograph, Amylograph, Alveograph and Extensiograph - equipments used for quality evaluation. Bread - ingredients - additives and improvers - different types of bread - methods of bread preparation - bread spoilage and remedies - quality aspects of bread and standards.

Unit II   Processing of Bakery products   8

Biscuits and cookies - role of ingredients - various types of biscuits - basic procedure in production. Sponge goods - role of ingredients - types of cakes - methods of preparation - fancy cakes and techniques - quality - cake faults and remedies. Bakery decorations - classification - basic preparation techniques - tools and equipments. Production process for Wafers- type of flour, raising agents and maturing. Pastry - basic formulation - different types - flaky, puff and danish pastry. Pie - types and methods. Commercial manufacture of bakery items

Unit III   Confectionery   10

Confectionery - introduction - development - ingredients used in confectionery - sugars - types and role - thickening, gelling agents, binding agents and its application in confectionery - role of chemical additives in confectionery - Cocoa products and its uses in confectionery, Chemistry of Hydrocolloids, Hydrocolloid pretreatment Processes - product quality parameters, faults and corrective measures.

Unit IV   Processing of chocolate and sugar confectionery   12

Importance of sugar confectionery. General technical aspects of industrial sugar confectionery manufacture - compositional effects. Sugar cookery - stages and factors affecting sugar cookery. Fondant and fudge - characteristics. Soft candy - principle, methods and uses. Hard candy - principle, methods and uses. Caramel and its applications in food industry. Decoration of confectionery goods. Commercial manufacture of cocoa and sugar confectionery products. Aerated confectionery- Methods of aeration- Manufacturing process, Methods of manufacture–Types–Center–filled, lollipops, coextruded products. Manufacture of gums and jellies–Quality aspects, Spoilage of confectionery products

UNIT V   Machineries and quality control of bakery and confectionery products   7

Machineries required for bakery and confectionery. Packaging requirements. Standards, regulations and quality control for bakery and confectionery products. Floor plan lay out for a small scale bakery and confectionery unit. Cost economic of the bakery and confectionery products.

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Khetarpaul, N., Grewal, R., and Jood, S., (2005). Bakery Science and Cereal Technology, Daya Publishing House.
2. Matz, Samuel A, (2004). The Chemistry and Technology of Cereals as Food and Feed, (3rd Edition) CBS Publishers, New Delhi, first reprint.

References:
1. Tufail Ahmed., "Dairy Plant Engineering and Management", KitabMahal Publishers, Allahabad, 1997.
2. Lampert, Lincoln M. "Modern Dairy Products: Composition, Food Value, Processing, Chemistry, Bacteriology, Testing, Imitation Dairy Products". Chemical Publishing Company, 1998.

Web References
1. http://ecoursesonline.iasri.res.in/course/view.php?id=647
2. http://www.eiilmuniversity.co.in/downloads/Bakery_&_confectionery.pdf

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	\multicolumn{12}{c}{Pos}											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2											1	2	
CO2	3	1											2		1
CO3	3	1											1	1	
CO4	3	2	1										2		1
CO5	2	1	1										1	1	
	3	High			2		Medium						Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

20FT602	**Food Process Engineering and Economics**	L	T	P	C
		3	2	0	4

Nature of Course	Professional Core
Pre requisites	Fundamentals of Fluid Mechanics

Course Objectives

The course is intended to

1. To expose the students to the fundamental knowledge of food processing, management and organization.
2. Introduce knowledge the students about the food process equipment selection and economic process.
3. Acquaint the developing basic tools needed in food process economics.
4. Learn the concept of food process plant design.
5. Students learn about the economic balance, quality and quality control in process plant.

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Explain the basic ideas and knowledge of process plant and Production management.	Understand
CO2	Discuss the select food process equipment based on constructional and operational characteristics	Understand
CO3	Identify the managerial functions and interpret national project Profitability	Apply
CO4	Demonstrate the elements of food plan design and food plant economics	Understand
CO5	Calculate the economic feasibility analysis of a food industry.	Evaluate

Course contents:

Unit I   Process Engineering, Production Management and Organization   12

Planning, organization, staffing, coordination, directing, controlling, communicating, organization as a process and a structure; types of organizations Method study; work measurement techniques; basic procedure; motion study; motion economy; principles of time study; elements of production control; forecasting; planning; routing; scheduling; dispatching; costs and costs control, inventory and inventory control.

Unit II   Selection of Food Processing Equipment   12

Construction characteristics. Operational characteristics- reliability, convenience, safety, instrumentation, ergonomics, efficiency, accuracy, environmental impact. Testing of equipments. Equipment specifications.

Unit III   Developing Food process economics   12

Introduction-Money flow- flow diagram-Capital cost; Fixed cost-working capital cost; Manufacturing cost; Flow diagram- Estimation of project profitability, sensitivity analysis, Replacement policy.

Unit IV   Food Plant Design   12

Elements of Food Plant Design- General aspects, new food plants, plant improvement, plant expansion, mobile food plants, advanced food plants. Good Manufacturing Practices, Food Plant Economics.

UNIT V   Economic Balance and Quality and Quality Control   12

Essentials of economic balance – Economic balance approach, economic balance for insulation, evaporation, heat transfer. Elements of quality control, role of control charts in production and quality control.

Total: 60 Periods

Text Books:
1. Peters, M. S. and Timmerhaus, C. D., "Plant Design and Economics for Chemical Engineers", 5th Edition. McGraw Hill, 2002.
2. Holand, F.A., Watson, F.A. and Wilkinson, J.K.," Introduction to process Economics ", 2nd Edition. John Wiley, 1983.

References:
1. Perry, R. H. and Green, D., "Chemical Engineer"s Handbook ", 9th Edition. McGraw Hill, 2018.
2. William J. Stevenson, —Operations Managementǁ, 14th Edition, McGraw-Hill Education, 2021.

Web References
1. https://onlinecourses.nptel.ac.in/noc22_ag03/preview
2. https://nptel.ac.in/courses/103/105/103105166/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1									1	3	1	2
CO2	3	2										1		1	2
CO3	3	2	1								2	2	2	2	1
CO4	3	2									1	2	1	2	1
CO5	3	2	1	1							2	2	1	1	1
	3	High			2		Medium						Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FT603	Fruits and Vegetable Processing Technology	L	T	P	C
		3	0	2	4
Nature of Course	Professional Core				
Pre requisites	Fundamentals of Food Processing				

Course Objectives
The course is intended to
1. Enable students to learn the basic harvesting and post-harvest physiology of fruits and vegetables
2. Learn the pre-processing methods of fruits and vegetables.
3. Aims to develop the knowledge of students in the area of vegetable and fruit processing and technology.
4. Enable the students to understand the importance of freezing and dehydration of fruits and vegetable products
5. To acquaint students with principles and methods of preservation and processing of fruits and vegetables into various products

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Discuss the concepts of physiological characteristics of fruits and vegetables	Understand
CO2	Demonstratethe importance of pre-processing methods involved in fruits and vegetable processes	Understand
CO3	Demonstrate about method of canning	Apply
CO4	Explain the importance of freezing and dehydration methods	Understand
CO5	Classify different processed products from fruits and vegetables	Understand

Course contents

Unit I   Introduction   12
Indian and global scenario on production and processing of fruits and vegetable; Classification and Nutritive value of Fruits and Vegetables; Harvesting and Post-Harvest physiology of Fruits and Vegetables: Physical, Textural characteristics, structure and composition. Maturity standards; Importance, methods of Maturity determinations maturity indices for selected fruits and vegetables. Fruit ripening- chemical changes, regulations, methods.
Unit II   Pre-processing methods of fruits and vegetables   12
Physical and chemical techniques to increase the post-harvest life of fresh Fruits and Vegetables; Prepackaging of fresh Fruits and Vegetables; Storage practices: Control atmospheric, Bead atmosphere, hypotactic storage, cool store, Zero emerge cool chamber, stores striation. General steps of processing of Fruits and Vegetables: Washing, sorting/grading, peeling blanching, coring, destoning. Physiological post-harvest diseases chilling injury and disease.
Unit III   Fresh and Processed products technology   12
Fresh fruits and vegetables preservation techniques – cold storage, cold chain, CAS, MAP, Processing and preservation of Fresh cut fruit and vegetable products; Preservation using nanotechnology in fresh and vegetables; Canning of Fruits and Vegetables–General process and equipment. Aseptic canning of Fruits and Vegetables: Process and Equipment, UHT. Containers for conventional and aseptic canning. Spoilage of canned Fruits and Vegetables. Labeling requirements of Fruits and Vegetables products.

Unit IV   Freezing and Dehydration of Fruits and Vegetables   12

General preprocessing, different freezing methods and equipment's, problems associated with specific fruits and vegetables; Dehydration – General preprocessing, different methods of drying including sun, tray, tunnel drying, fluidized bed drying, freeze drying, spray drying and low temperature, osmotic dehydration and other modern methods; Applications to raisins, dried figs, vegetables, intermediate moisture fruits and vegetables; Indian Food Regulation and Quality assurance.

UNIT V Fruit and Vegetable Products   12

Methods of preparation of Ready to eat fruit and vegetable products, Jams/Marmalades, Squashes/cordials, Ketchup/sauces, Chutneys, Fruit Bar, Toffees, Soup powders, Candied Fruits, Natural colors, pickles, different packing including aseptic packaging and its defects and remedies. Study of Food safety Standards: HACCP, ISO 22000, GMP, and FSSAI. Importance of personal Hygiene, Cleaning & Sanitary standards in Fruits and Vegetable preservation. Good Handling Processes (GHP), Traceability aspects of processed product.

Total: 60 Periods

List of experiments

S. No	Name of the experiment	CO Mapping	RBT
1.	Examination of fresh fruits and vegetables for processing.	CO1	Apply
2.	Pre– Packaging of Fresh fruits and vegetables, modified atmosphere packaging, controlled atmosphere packaging.	CO2	Apply
3.	Canning of fruits.	CO3	Apply
4.	Canning of vegetables.	CO3	Apply
5.	Preparation and analysis of syrups and Brines.	CO3	Apply
6.	Experimental dehydration of fruits and vegetables.	CO4	Apply
7.	Experiment on comparison between conventional and mechanical drying methods of fruits and vegetables		Analyze
8.	Freezing of fruits and vegetables	CO4	Apply
9.	Preparation of Jam, Jelly and Marmalade	CO5	Apply
10.	Preparation of Ketchup and Pickle	CO5	Apply
11	Preparation of Preserves and Candies	CO5	Apply
12	Manufacture of squash, RTS	CO5	Apply
13	Visit to a fruits and vegetables processing industry	CO5	Apply

Text Books:

1. Fellows, P J. Food Processing Technology: Principles and Practice. 2nd Edition, CRC/ Woodhead, 1997.
2. Salunke,D. K and S. S Kadam Hand Book of Fruit Science and Technology: Production, Composition, Storage and Processing. Marcel Dekker, 1995.

Reference Books:

1. Preservation of Fruits and Vegetables – Girdhari Lal, Siddhapa and Tondon, ICAR, New Delhi.
2. Hand Book of Analysis and Quality Control of Fruits and Vegetable Products – S. Ranganna Tata McGraw Hill, New Delhi.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1				1						2	1	
CO2	3	1	1				1	1					2	1	1
CO3	3	2	2				1	2					1	1	2
CO4	3	1	1				1	2					2	1	1
CO5	3	2	1				1	1					1		1
	3	High			2		Medium						Low		

Summative Assessment						
Bloom's Level	Continuous Assessment					Final Examination (Theory) (50)
	Theory				Practical's	
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	Attendance (5)	Rubric based CIA (20)	
Remember	30	20	10		20	40
Understand	10	20	30		20	40
Apply	10	10	10		10	20
Analyze						
Evaluate						
Create						

		L	T	P	C
20FT604	**Baking and Confectionary Technology Laboratory**	0	0	4	2

Nature of Course	Professional Core
Pre requisites	**Baking and Confectionary Technology**

Course Objective:

The course is intended to

1. Enable students learn the Identify the ingredients used in baking.
2. Understand the concept of leavening agents.
3. Provide an advanced understanding of the preparation of different types of biscuits.
4. Enable the students to prepare different types of bread.
5. Acquire a specialized knowledge on sugar and flour confections

Course Outcomes

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

Sl.No.	Course Outcome	Bloom's Level
CO1	Identify the ingredients used in baking	Understand
CO2	Provide a hands-on-opportunity and observe the action of leavening agents	Apply
CO3	Formulate the procedure in preparation of different types of biscuits	Apply
CO4	Identify different types and properties of bread	Understand
CO5	Provide the basic knowledge on sugar and flour confections	Analysis

Laboratory components			
S. No	**List of Experiments**	**CO Mapping**	**Revised Blooms Taxonomy**
1.	Study of ingredients (major and minor): characteristics of flour, yeast, shortening, sugar, egg and salts.	CO1	Understand
2.	Experiment on leavening action of baking powder, sodium-bicarbonate and ammonium-bicarbonate.	CO2	Understand
3.	Preparation and evaluation of biscuits	CO3	Analyze
4.	Preparation and evaluation of bread	CO5	Analyze
5.	Preparation and evaluation of sugar boiled confectionary.	CO4	Analyze
6.	Preparation and evaluation of candy.	CO5	Analyze
7.	Preparation and evaluation of Indian Traditional confection	CO5	Apply
8.	Preparation and evaluation of different flour confections (Cakes)	CO5	Analyze
9.	Preparation and evaluation of different types of chocolate	CO5	Apply
10	Visit to a bakery/confectionary industry.	CO5	Analyze

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										1	1	
CO2	3	2	1										2		2
CO3	3	3	2	1									2	2	
CO4	3	1	1	1									2		3
CO5	3	2	2	1									1		
	3	High		2		Medium							Low		

Assessment based on Continuous and Final Examination			
Bloom's Level	Continuous Assessment (50 marks) (Attendance – 5 marks)		Final Examination [50 marks]
	Rubric based Continuous Assessment [25 marks]	Model Examination [20 marks]	
Remember			
Understand	40	40	40
Apply	60	60	60
Analyze			
Evaluate			
Create			

20FT605	Mini Project	L	T	P	C
		0	0	4	2

Nature of Course	Employability Enhancement Courses
Pre requisites	All Professional Core Subjects

Course Objectives

The course is intended

To provide an opportunity to students to obtain knowledge in product development process and sensory analysis

Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO1	Articulate a research problem for product development	Understand
CO2	Assess the related literatures corresponding to the problem	Understand
CO3	Identify and formulate the methods of production	Apply
CO4	Design and categorize the significance parameters	Analyse
CO5	Develop a standard technical report and its critical control points	Create

GUIDELINE FOR REVIEW AND EVALUATION

The students may be assembled into a group of 1 to 4 and work under a project supervisor. The students may develop the procedure for product development or value addition of existing in consultation with the supervisor and if possible with an industry. A project report is to be submitted by the group which will be reviewed and evaluated for internal assessment by a Committee constituted by the Department Head. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners.

Total: 60 Periods

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	1	3	3	3	3	3	3	3	2	2	3	1	1
CO2	2	1	1	3	3	3	3	3	3	3	2	2	3	2	2
CO3	3	2	1	3	3	3	3	3	3	3	2	2	3	2	3
CO4	3	3	2	3	3	3	3	3	3	3	2	2	3	2	3
CO5	3	3	3	3	3	3	3	3	3	3	2	2	3	3	3

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

3	High	2	Medium	1	Low

	Continuous Assessment [50 marks]						Final Viva Voce Examination [50 marks]
	Review I [10]	Review II[10]	Review III[10]	Formulation/ Design procedure [10]	Report [10 Marks]	Total [50 Marks]	
Marks	10	10	10	10	10	50	50

Passed in Board of Studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

20FT606	Internship	L	T	P	C
		EEC			1

Nature of Course	Employability Enhancement Courses
Pre requisites	All Professional Core Subjects

Course Objectives
The course is intended

To provide an opportunity to students to obtain knowledge the industrial environment, equipment used in food processing industries and quality analysis.

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

CO. No.	Course Outcome	Bloom's Level
CO1	Recognize the industrial environment and its process	Understand
CO2	Examine the industrial equipment's for various operations	Understand
CO3	Identify the critical control points in production process	Apply
CO4	Investigate the quality parameters and evaluation	Analyse
CO5	Develop a standard technical report	Create

GUIDELINE FOR REVIEW AND EVALUATION
The students may be assembled into a group of 1 to 4 or as an individual to apply for the internship in different sectors of the food industry. The students are instructed to do the internship for a period or minimum of 15 days in the industry. Also, a project report is to be submitted to the department after the internship along with internship completion certificate from concern industry. Further, the presentation will be given by the students and the report will be reviewed and evaluated by the committee constituted by the department head.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)																
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	1	3	3	3	3	3	3	3	2	2	3	1	1
CO2	2	1	1	3	3	3	3	3	3	3	2	2	3	2	2
CO3	3	2	1	3	3	3	3	3	3	3	2	2	3	2	3
CO4	3	3	2	3	3	3	3	3	3	3	2	2	3	2	3
CO5	3	3	3	3	3	3	3	3	3	3	2	2	3	3	3
	3	High			2		Medium			1		Low			

	Continuous Assessment [50 marks]				
	Industry Process	**Analyze the critical control points**	**Quality Parameters**	**Report**	**Total**
Marks	25	25	25	25	100

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

20FTO01	Analytical Techniques	L	T	P	C
		3	0	0	3

Nature of Course	Open Elective
Pre requisites	Nil

Course Objectives

The course is intended to

1. Acquire the morphology and types of analytical techniques.
2. To know the chromatographic principle and Methods in food Analysis.
3. Learn the concept of radio analytical techniques in food.
4. Learn the concepts of physicochemical and biochemical methods of analysis.
5. Introduce the concept of spectroscopic techniques.

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Apply the idea of theoretical aspects of key analytical techniques	Apply
CO2	Students can understand the different types of chromatographic methods	Understand
CO3	Understand the types of radio analytical techniques	Remember
CO4	Understand physio and bio chemical methods of analysis	Understand
CO5	Apply the knowledge of spectroscopic techniques	Apply

Course contents:

Unit I   Modern Analytical Techniques   9

Principle, Instrumentation and analytical applications of following techniques; Atomic Absorption spectroscopy, Flame photometry, Inductively coupled plasma-Atomic Emission spectroscopy, Scanning Electron Microscopy

Unit II   Chromatographic Methods   9

Chromatography : Gas solid Chromatography , Gas liquid Chromatography, High performance liquid chromatography, ion exchange chromatography, paper chromatography, thin layer chromatography, column chromatography, gel permeation chromatography

Unit III   Radio analytical Techniques   9

Radio analytical methods: Neutron activation analysis, isotope dilution analysis, Radiometric titrations, particle induced X-ray Emission, Use of radioisotopes - in industry, agriculture and physicochemical studies.

Unit IV   Physicochemical and Biochemical Methods of Analysis   9

Conductometry, Potentiometry Polarography, amperometry, pH metry, cyclic Voltammetry, Chronopotentiometry. Thermometric analysis: Thermogravimetry, Differential Thermal analysis, Differential Scanning Calorimetry, Thermometric titrations.

UNIT V   Spectroscopic Techniques   9

Introduction to UV spectroscopy, Lambert Beer's law, Deviation from Lambert Beer's law, instrumentation and applications. IR Introduction, basic principles, factors affecting IR group frequencies, Instrumentation and Applications.

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Instrumental methods of analysis H.H.Wilard,L.L.Merritt, J A Dean.
2. Instrumental Methods of Chemical analysis.

References:
1. Essentials of Nuclear Chemistry- H.J.Arnikar
2. A text book of quantitative Inorganic analysis A I Vogel.

Web References
1. http://shvaiko.ru/wp-content/uploads/2010/02/Analytical-Techniques-Julia-C.-Drees-Alan-H.-B.-Wu.pdf
2. https://www.lucideon.com/testing-characterization/analytical-techniques-chemical-analysis

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

		L	T	P	C
20FTO02	**Process Instrumentation and Control**	3	0	0	3
Nature of Course	Open Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Acquire the morphology and types of analytical techniques.
2. To know the chromatographic principle and Methods in food Analysis.
3. Learn the concept of radio analytical techniques in food.
4. Learn the concepts of physicochemical and biochemical methods of analysis.
5. Introduce the concept of spectroscopic techniques.

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Apply the idea of theoretical aspects of process control	Apply
CO2	Understand the different operations in process automation.	Understand
CO3	Understand the process control operation	Understand
CO4	Understand the process instrumentation models	Remember
CO5	Apply the knowledge of process control operation in industrial equipments	Apply

Course contents:

Unit I   Introduction   9

Introduction to process control, process variables, degree of freedom, Industrial measurement systems – different types of industrial variables and measurement systems elements – sensors and transducers for different industrial variables like pressure, torque, speed, temperature etc.

Unit II   Process Automation   9

Process modeling, characteristics of liquid systems, gas systems, thermal systems, mathematical model of first order level, pressure and thermal process – higher order process, interacting non-interacting systems.

Unit III   Control of Operations   9

Basic control actions, characteristics of ON-OFF, P, I and D control, PI, PD and PID control modes, Response of controllers for different types of test inputs, pneumatic and electronic controllers to realize various control actions, selection of control mode for different processes, optimum controller settings, tuning of controllers – process reaction curve method, continuous cycling method, damped oscillation method, Ziegler Nichols methods.

Unit IV   Process Instrumentation Models   9

Model predictive control – Batch Process control – Plant-wide control & monitoring – Plant-wide control design – Instrumentation for process monitoring – Statistical process control – Introduction to Fuzzy Logic in Process Control – Introduction to OPC – Introduction to environmental issues and sustainable development relating to process industries.

UNIT V   Reactors, Exchangers, Boilers and distillation column   9

Distillation column, control of top and bottom product compositions, reflux ratios, control of chemical reactors, control of heat exchanger, steam boiler, drum level control and combustion control, P&I diagrams.

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Stephanopoulos. G, "Chemical Process Control", Prentice Hall of India, New Delhi, 1984.
2. Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, "Process Dynamics and Control", Wiley Dreamtech India (P) Ltd, New Delhi, 2004

References:
1. Ernest O. Doebelin "Measurement systems application and design", McGraw Hill International Editions, McGraw Hill Publishing Company, 2004
2. B. Wayne Bequette, "Process control, modelling, Design and simulation", Prentice Hall of India (P) Ltd., 2003

Web References
1. https://www.mi-wea.org/docs/6A._Koporetz_Tom_2-Instrumentation Process_Control_custom_screen.pdf
2. https://www.eit.edu.au/resources/fundamentals-of-instrumentation-process-control-plcs-and-scada-for-plant- operators-and-other-non-instrument-personnel/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2		Medium						Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTO03	Intellectual Property Rights	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. To recognize the importance of IP and to educate the pupils on basic concepts of Intellectual Property Rights.
2. To identify the significance of practice and procedure of Patents.
3. To make the students to understand the statutory provisions of different forms of IPRs in simple forms
4. To learn the procedure of obtaining Patents, Copyrights, Trade Marks & Industrial Design
5. To enable the students to keep their IP rights alive.

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Identify criteria's to fit one's own intellectual work in particular form of IPRs.	Understand
CO2	Apply statutory provisions to protect particular form of IPRs	Apply
CO3	Develop skill of making search using modern tools and technic.	Understand
CO4	Identify procedure to protect different forms of IPRs national and international level.	Remember
CO5	Analyze rights and responsibilities of holder of Patent, Copyright, Trademark, Industrial Designate.	Apply

Course contents:

Unit I   Concept of Intellectual Property Rights   9

Importance of human creativity and its recognition and protection. Concepts of Property and Rights. History of IPRs. Different forms of IPRs. Role of IPRs in R and D

Unit II   Patents   9

Meaning of Patent, Object and Value of Patent law. Advantages of Patent to the invertors. Criteria for Patentability. Software and Business Methods Patents. Govt. use of inventions, infringement of Patent and remedies for infringement. Compulsory license.

Unit III   IP Transaction; Enforcement of IP Commercialization   9

Implications of Intellectual Property Rights in promoting innovations and their commercialization; technology transfer, Due diligence in patent transactions. Working of patents in India Compulsory license and its implications; Enforcement of Patents against infringer.

Unit IV   Industrial Designs Registrations   9

Definition of a design. Concept of Novelty and Originality; Inclusive and Exclusive Designs; Functions of Designs. Industrial Design registration in India. Duplicity of registration, Infringement of Design and remedies for infringement

UNIT V   Copyright   9

Introduction. Nature of Copyright, Subject-matter, protection requirement in Copyright Law, Neighboring/Related Rights. Economic and Moral Rights of Authors. Copyright in the Digital Context. An overview of Copyright protection in India. Transfer of Copyright. Infringement of Copyright, Copyright- fair dealing and remedies. Comparison with Patent and Copyright.

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. P.Naryan, "Intellectual Property Law", 3rd Ed, Easern Law House, 2007.
2. Dr. S.R.Myneni, "Law of Intellectual Property", 9th Ed, Asia law House, 2019.

References:
1. N.R. Subbaram.S.Viswanathan,"Hand book Indian Patent Law and, Practice"Printers and publishers Pvt, Ltd, 2008.
2. Dr.B.L.Wadehra,"Law Relating to Intellectual Property" 5thedition,Universal Law publishing Co, Dehli

Web References
1. https://nptel.ac.in/courses/110/105/110105139/
2. https://nptel.ac.in/courses/109/106/109106137/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTO04	**Process Economics and Industrial Management**	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective				
Pre requisites	Nil				

Course Objectives
The course is intended to

1. Acquire the Principles of organization and management.
2. Learn the production units and management system in food process industries.
3. Learn the quality control and quality tools needed in Food process industries.
4. Learn the basics of process economics followed in food process industries.
5. Aware the profitability and losses in various Food process operations.

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the basic principles of process plants managements.	Understand
CO2	Understand the Economic principles, designs, balancing and inventory for production and management.	Remember
CO3	Apply the quality rules and quality control techniques.	Apply
CO4	Understand the economic principles of process industries.	Understand
CO5	Analysis the profitability, alternative investment and replacements of annual reports	Analyze

Course contents:

Unit I   Principles of organization and Management   9
Introduction – Organization–Principles of organization– Process planning – Types of organization–Taylor's pure functional organization–Organizational chart– Process communication – Process directing– Motivation – Leadership– Styles of Leadership – Process coordination and controlling.

Unit II   Production and Management   9
Economy – principles of time study– elements of production control– Work system study; Work system design– Identification – recording– examination– development – installation–Work measurement techniques– forecasting– methods–sales – Inventory– classifications of Inventory–Factors– Functions–balancing supply and demand.

Unit III   Quality and quality control   9
Quality– sample Acceptance – sampling plan– simple sampling design and plan– Double and multiple sampling– Average outgoing quality maintenance– Process control; Variability – Seven quality control tools – Control chart–use of computer quality control.

Unit IV   Introduction to process economics   9
Basic principles of economics– classifications– goals– Laws of economics– use– measures of financial effectiveness Human factors– capital– accounting– Balance sheet– Income statement–Time value of money; capital investment Elements of cost– Depreciation methods–Present worth and discount.

UNIT V   Profitability, Alternative Investment and Replacement   9
Profitability – methods– Appraisal needs – project report– annual report and performance analysis; balance sheets– constructing– profit and losses account– found flow statement, Ratio analysis; management and operational control–lenders evaluation–owners view point–fundamental classifications. –computation and purpose.

Total: 45 Periods

Text Books:
1. V. Sivasubramanian, Hemalatha R., "Process Economics and Industrial Management ", Galgota Publishers, 1st Edition,2008
2. Holand, F.A., Watson, F.A. and Wilkinson, J.K.," Introduction to process Economics ", 2nd Edition. John Wiley, 1983.

References:
1. George D. Saravacos and Athanasios E. Kostaropoulos, "Handbook of Food Processing Equipment", 2nd Edition, Springer Science & Business Media, New York, 2016.
2. Perry, R. H. and Green, D., "Chemical Engineer's Handbook ", 9th Edition. McGraw Hill, 2018.

Web References
1. https://www.msubbu.in/ln/economics/
2. https://nptel.ac.in/courses/122101003/2

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	**IAE – II (7.5)**	**IAE – III (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTO05	**Product Development and Management**	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective				
Pre requisites	Nil				

Course Objectives
The course is intended to
1. Acquire the knowledge on basics of new product development
2. Acquaint the process required to develop a new product
3. Analyze the prerequisites and planning necessary to develop a new product
4. Learn the various consumer behaviour toward developing new product
5. Describe the various management practices in product development

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Apply the idea of developing a new product.	Apply
CO2	Understand the product develop strategy	Understand
CO3	Identify the prerequisites and ideas required for developing a new product	Understand
CO4	Understand different consumer behavior toward developing new product	Remember
CO5	Apply the different management practices in product development	Apply

Course contents:

Unit I   Introduction   9
Concept of product development - product success and failure, factors for success, process of product development, managing for product's success. Innovation strategy - possibilities for innovation, building up strategy, product development programme.

Unit II   Product development process   9
The product development process - product strategy, product design and process development, product commercialization, product launch and evaluation.

Unit III   Product development planning   9
The knowledge base for product development technology - knowledge and the food system, knowledge management, knowledge for conversion of product concept to new product, technological   knowledge product qualities, raw material properties, processing, packaging requirement, distribution and marketing.

Unit IV   Consumer behavior   9
Role of consumers in product development - consumer behaviour, food preferences, avoiding acceptance, integration of consumer needs in product development and sensory needs.

UNIT V   Product Development Management   9
Managing the product development process, - principles of product development management, people in product development management, designing the product development process, key decision points, establishing outcomes, budgets and constraints, managing and organizing product development process.

Total: 45 Periods

Text Books:
1. Gordon W. Fuller "New Food Product Development-From concept to market place", CRC press.,2011
2. Khandwalla, N. – "Fourth Eye (Excellence through Creativity) - Wheeler Publishing", 1992.

References:
1. Twiss, Brian. "Managing Technological Innovation", Pitman Publishing Ltd., 1992.
2. Watton, Harry B. "New Product Planning", Prentice Hall Inc., 1992.

Web References
1. https://nzifst.org.nz/resources/foodproductdevelopment/Chapter-6-8-1.htm
2. https://iastate.pressbooks.pub/foodproductdevelopment/chapter/chapter-1/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2		Medium					Low			

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment			
Bloom's Category	**Internal Assessment Examinations**		**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTO06	**Optimization Techniques in Product Development**	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to
1. Understand the basics of process optimization
2. Enable the students to analyze the importance and application of programming methods
3. Encourage the students to use RSM in new product development
4. Understand the applications of NNM in process optimization
5. Apply the technical knowledge of optimization software in practical application.

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the concept of optimization and its types	Understand
CO2	Analyze the importance and application of programming methods	Analyze
CO3	Demonstrate the usage of RSM in food product development	Understand
CO4	Understand the principles and applications involved in neural network and genetic algorithms	Remember
CO5	Apply the knowledge of optimization software techniques	Apply

Course contents:

Unit I   Introduction   9
Introduction, optimization theory, optimization methods, Graphical and numerical methods of optimization, Unconstrained optimization, Constrained optimization, Programming optimization, experimental optimization, Response surface methodology (RSM)

Unit II   Programming methods   9
Linear programming - Formulation of linear programming problem, graphical approach, general linear programming problem, simplex method, duality in linear programming and transportation problems. Dynamic programming - Introduction, principle of Optimality. Formulation and solution of Dynamic Programming problems. Traveling salesman's problems. Application to transportation problem and linear programming problems.

Unit III   Response Surface methodology (RSM)   9
Response surface functions, design of experiments, linear regression for building empirical models, analysis of second-order response surfaces, adequacy checking for regression models, multiple responses, optimization on the response surfaces, application to the optimal processing conditions of a new dairy product

Unit IV   Neural Networks and Genetic Algorithms   9
Principles of Neural Networks and genetic algorithms, Development of Neural Networks and genetic algorithms, Properties of Neural Networks, Application of Neural Networks and Genetic Algorithms

UNIT V   Project scheduling, sequencing theory and Optimization software   9
Project scheduling by PERT and CPM, network analysis, General sequencing problem jobs through 2 machine and 3 machines and 2 job through n machines. RMS, SAS, SPSS and Design Expert

Total:45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Ferruh Erdogdu, "Optimization in Food Engineering", CRC Press, 2008.
2. Edgar, T.F, Himmelblau, D.M, Ladson, L.S., Optimization of Chemical Practice, McGraw Hill International , New York, II Edition., 2003

References:
1. Singiresu, S.Rao., Engineering optimization - Theory and practices, John Wiley and Sons, Singapore,3rd edition,1996
2. Ravindran, Phillips, Solberg., Operations Research, Principles and Practice, John Wiley and Sons, Singapore, 1987

Web References
1. https://www.intechopen.com/chapters/59209
2. https://online.stat.psu.edu/stat503/lesson/11

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High		2		Medium							Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE01	Fat and Oil Processing Technology	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Fundamentals of Food Processing				

Course Objectives

The course is intended to

1. Acquire the knowledge on basics of new product development
2. Acquaint the creativity and innovation required to develop a new product
3. Analyze the prerequisites and planning necessary to develop a new product
4. Learn the various steps involved in product development
5. The various industrial applications needed to develop a new product

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Apply the idea of physical and chemical properties of fats and oils	Apply
CO2	Understand the extraction process of oils and fats	Remember
CO3	Understand the methods of oil refining process	Understand
CO4	Understand the products and packaging of oil and fats	Understand
CO5	Apply the different standards of oils and fats in food industries.	Apply

Course contents:

Unit I   Physical and Chemical Properties   9

Fats and oils – Types of oil seeds - formation – functions of oil in human body - fatty acids – double bonds and their position in oil – classification - sources of vegetable oils – Lipid class characteristics - production status-oil content – physical of fats and oils - chemical properties of oil – hydrolysis – hydrogenation, oxidation and polymerization. Modification of fatty acids.

Unit II   Fats and Oil Extraction   9

Unit operations for oilseeds extraction – Mechanical methods of edible oil extraction - Expeller or screw press extraction – Solvent extraction – Direct solvent extraction. Traditional and biotechnological process of oils and fats.

Unit III   Oil Refining Methods   9

Refining – objectives – characterization – Types of degumming – Zeneath process – deacidification process – continuous acid refining - bleaching of oil – decolourising agents - deodorization and winterization processes - Hydrogenation of Fats – Production process - Vanaspati and Margarine – Ghee and butter – Interesterification – Blending of oils – Plasticization.

Unit IV   Specialty Oil Products and Packaging   9

Conjugated Linoleic acid – Gamma linolenic acid – Oils from Microorganisms – Lecithin- Transgenic oils – Germ oils from different sources – Fish oil - Packaging of edible oils – requirements – types – tinplate, semi rigid, glass, Polyethylene Terephthalate, Poly Vinyl Chloride, flexible pouches – packaging for vanaspati and ghee-changes during storage of oil – rancidity – causes – atmospheric oxidation and enzyme action – free fatty acid – colour-non edible oils – castor oil, linseed oil, vegetable waxes – production and processing.

UNIT V   Industrial Applications and Quality Standards   9

Industrial applications of fats and oils – quality regulations - manufacture of soap, candle, paints and varnishes - ISI and AGMARK standards – site selection for oil extraction plant- safety aspects- HACCP standards in oil industries.

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Harry Lawson, "Food oils and Fats - Technology, Utilization and Nutrition", CBS Publishers and Distributors, New Delhi, 1997.
2. Richard D.O;Brien, "Fats and oils Formunation and Processing for Applications", CRC Press, Taylor and Francis Group.

References:
1. Weiss, T.J. 1970. Food Oils and their uses. The AVI Publishing Company, Inc. Westport, Connecticut.
2. Harry Lawson, "Food oils and Fats - Technology, Utilization and Nutrition", CBS Publishers and Distributors, New Delhi, 1997.

Web References
1. https://nptel.ac.in/courses/126/105/126105011/
2.https://www.academia.edu/39308280/Fundamentals_of_Food_Process_Engineering_fourth_edition

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2		Medium						Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	**IAE – II (7.5)**	**IAE – III (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE02	**Meat and Fish Processing Technology**	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Fundamentals of Food Processing				

Course Objectives

The course is intended to

1. Learn the basic knowledge of meat and meat products.
2. Understand the processing methods of meat
3. This course is designed to analyze and understand various processing, preservation methods are used for meat and fish products.

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the basic content of meat and meat products	Understand
CO2	Understand and demonstrate the different processing techniques used for meat processing	Remember
CO3	Explain the various meat products available in food market	Apply
CO4	Discuss the processing methods of fish	Understand
CO5	Explain the fish products and its quality	Understand

Course contents:

Unit I   Introduction   9

Recent trends in meat processing industries, Types of Meat & its sources, composition, structure, of meat and meat products. Postmortem muscle chemistry: Color, flavors, microbiology & spoilage factors of meat and meat products.

Unit II   Meat processing   9

Ante mortem handling, slaughtering of animals, Mechanical deboning, inspection and grading of meat. Post-mortem handling: Electrical stimulation in meat processing; Factors affecting post-mortem changes, properties and shelf-life
of meat. Meat tenderization and Meat quality evaluation. Modern abattoirs, slaughter house and its features. Quality control in slaughter house and meat processing industry

Unit III   Meat products   9

Flavours and Flavour Generation of Meat Products, Meat quality evaluation, Marination, Preservation techniques – aging, pickling, smoking. Dried and Cured meat. Canned meat, Frozen meat, Cooked and Refrigerated meat, Meat Fermentation, meat packaging, meat refrigeration, chemical treatment, irradiation and other emerging methods, Developments in Meat Bacterial Starters, problem solving in measuring shelf-life and spoilage of meat and meat
products, Spoilage Detection, Calculation of mycotoxin content in processed meats. Standards, Laws and regulations for meat and meat products, Vegan alternatives for meat.

Unit IV   Fish processing   9

Types of fish, composition, structure and spoilage factors of fish. Post-harvest quality changes and safety hazards in fish. Handling, packaging and transportation of fish. Bacteriology of fish, Chilling of fish, Freezing and Individual quick freezing. Canning and smoking operations, Salting and drying of fish, pickling. Radiation processing of fish and fish products, Advances in fishery by products technology.

UNIT V   Fish products   9

Seaweed products and their economic significance, fish meal and oil, protein concentrates, industrial products, bioactive compounds, value addition of freshwater and aqua cultured fishery products, Seafood quality Assurance, sea food safety – illness associated with consumption -toxins, allergies and intolerances. Applications of seafood byproducts in the food industry and human nutrition

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Lawrie, R.A. "Meat Science", Second Edition. Pergamon Press, Oxford, UK. 1975.
2. Y.H. Hui. "Handbook of Meat and Meat processing", Second Edition. CRC Press, 2012.

References:
1. Joseph Kerry, John Kerry and David Ledwood. "Meat Processing" , Woodhead Publishing Limited, England (CRC Press), 2002.
2. Mead, G. "Poultry Meat Processing and Quality", Woodhead Publishing, England, 2004.

Web References
1. https://www.emsland-group.de/product-solutions/food-innovation/meat-poultry-fish-seafood
2. https://www.health.gov.il/English/Topics/FoodAndNutrition/food/HANDLINGFOOD/Pages/Fresh_meat_ winged.aspx

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

		L	T	P	C
20FTE03	**Poultry and Husbandry Processing Technology**	3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives
The course is intended to
1. Acquire the introduction of Poultry Science.
2. To know the production of Poultry processing.
3. Learn the concept of nutrition and biochemistry behind Poultry.
4. Learn the concepts of prospects and scope of Breeder Flock Management.
5. Introduce the concept of Poultry housing and incubation.

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Apply the idea of Poultry processing and they can start small scale industry of Poultry housing.	Apply
CO2	Understand the morphology and types of cuts in Poultry.	Understand
CO3	Identification of nutrition in Poultry rations.	Remember
CO4	Explain the Breeder Flock Management in Poultry housing.	Understand
CO5	Apply the knowledge of Poultry Incubation and able to develop their own Poultry housing.	Apply

Course contents:
Unit I   An Introduction to Poultry Science   9
Definition of Poultry - Importance of Polutry Farming and Polutry Development in India. Present status & future prospects of Poultry industry. Origin of the chicken and classification of Poultry based on Genetics utility. Classification of chickens as per international standards.
Unit II   Poultry Processing   9
Types and characteristics of poultry products. Unit operation in poultry processing. Pre-slaughter factors affecting poultry meat quality. Factors affecting the shelf-life of poultry meat. Sensory quality of poultry meat- colour, texture and flavour. Preservation techniques: chemical treatments, heating-microwave & IR, freeze drying and irradiation.
Unit III   Poultry Nutrition and Biochemistry   9
Poultry nutrition definition - Importance -objectives - Principles of Poultry Feeding - System of feeding. Factors influencing the protein requirements of Poultry - calorie protein ratio - effects of low and high protein in Poultry rations. Importance of Fat in Polutry - classification - Functions - requirements. Importance of Minerals in Polutry - classification - Functions - requirements.
Unit IV   Breeder Flock Management   9
Principles of Polutry breeding - Inheritance of qualitative and quantitative traits methods and types of breeding - 1,2,3,4. Selection: Aid to selection - mass selection - Family selection - Reciprocal selection. Layer & broiler breeder Flock Management housing & space requirements. Light management during growing and laying period.
UNIT V   Poultry Housing and Incubation   9
Poultry housing - Poultry house equipment - principles of housing - Biological needs of Poultry housing. Poultry housing construction: location - layout - floor - walls - roof. Incubation: natural and artificial incubation - requirements of incubation - selection, handling and care of hatching eggs - types of incubators - incubation period. Fertility and hatchability - Factors affecting fertility and hatchability.
Total: 45 Periods

Text Books:
1. Mac.O north or Donald D Belll, 1990. Commercial production Manual (Fourth edition). Van Nostrand Reinhold - New York.
2. Curtis, S.E. 1983. Environmental management in Animal Agriculture. Lowa state University Press, Ames, IA.

References:
1. P.C. Panda, 1995. Egg and Poultry Technology. Vikas Publishing House.
2. B. Mahaptra ans S.C. Panda, 1989. Poultry production. Indian Council of Agricultural research press.

Web References
1. https://www.nimss.org/projects/view/mrp/outline/18577
2. https://byjus.com/biology/animal-husbandry-poultry-farming/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	**IAE – II (7.5)**	**IAE – III (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

		L	T	P	C
20FTE04	**Cereals and Pulses Processing Technology**	3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Acquire the knowledge on paddy processing
2. Acquaint the idea on wheat processing
3. Analyze the prerequisites for pulses processing
4. Learn the various steps involved in new product development
5. Describe the various laws and rights of cereal processing

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Apply the knowledge on paddy processing	Apply
CO2	Use the techniques in wheat processing	Understand
CO3	Identify the prerequisites and ideas required for pulses processing	Remember
CO4	Explain different techniques and steps involved in developing a new product	Understand
CO5	Apply the different laws in cereal processing	Apply

Course contents:

Unit I   Introduction and Paddy Processing   9

Introduction to cereals and pulses – current scenario in India and worldwide status. Pre cleaning – pre-cleaning machineries Paddy Parboiling Processes - Cold Water and Hot water soaking processes - Paddy Dryer-LSU Dryer. Rice Milling - Paddy dehusking – Hulling –Shelling- Equipments.

Unit II   Wheat Processing   9

Wheat milling process – Flour milling – Cleaning and conditioning. Grinding of wheat – roller mills – components of wheat mill & Wheat mill flow chart. Wheat based products – atta, semolina and maida. Wheat based products – pasta processing. Pulse milling – traditional dry milling, Conditioning – pitting

Unit III   Pulse Processing   9

Milling of Pulses- Traditional milling process, merits and demerits - drying of legumes, Sun drying, Traditional Processing steps – Dehusking and splitting, conditioning-Machinery and equipment for pulse flour products and their applications.

Unit IV   New Product Development   9

Milling and Processing of Maize- Equipments used - Dry and wet milling of maize - Degermination and Dehusking – Products of maize- processing and equipments/ machineries. By product utilization in maize processing- Machineries/ equipments handled during processing. Millets processing

UNIT V   Legal Laws and Rights   9

Production of Flattened and Puffed Rice from Paddy By Products of Paddy Processing - Paddy husk and its uses - as boiler fuel, husk ash, activated carbon, furfural, Sodium silicate, cement and other by-products - Rice bran utilization – rice bran oil – processing and refining.

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Chakraverty, A.: Post Harvest Technology of Cereals, Pulses and Oilseeds. Oxford and IBH Publishing Co, Calcutta (1995)
2. Samuel Matz: The Chemistry and Technology of Cereals as Food and Feed, Chapman & Hall (1992)

References:
1. Sahay, K. M. and K.K.Singh. 1994. Unit operation of Agricultural Processing, Vikas Publishing House Pvt.Ltd., New Delhi.
2. Samuel Matz: The Chemistry and Technology of Cereals as Food and Feed, Chapman & Hall (1992)

Web References
1. https://www.elsevier.com/books/cereals-processing-technology/owens/978-1-85573-561-3
2. http://safeat.ir/wp-content/uploads/2018/05/Gavin_Owens_Cereals_processing_technology.pdf

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2		Medium					Low			

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment			
Bloom's Category	**Internal Assessment Examinations**		**Final Examination (60)**
	IAE – I (7.5)	**IAE – II (7.5)**	**IAE – III (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

20FTE05	Mushroom Processing Technology	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Acquire the morphology and types of Mushrooms.
2. To know the spawn production technique and increase the production and consumption of mushrooms.
3. Learn the concept of identification of edible and poisonous Mushrooms.
4. Learn the concepts of prospects and scope of mushroom cultivation in small scale industry.
5. Introduce the concept of empower rural communities with entrepreneurial skills through the production and sale of mushrooms.

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Apply the idea of mushroom Technology as a startup	Apply
CO2	Understand the morphology and types of Mushrooms.	Remember
CO3	Identification of edible and poisonous Mushrooms.	Understand
CO4	Explain the health benefits of Mushroom used in food industries.	Understand
CO5	Apply the knowledge in mushroom industry	Apply

Course contents:

Unit I   An Introduction to Mushroom   9

Mushroom – Introduction-Taxonomical rank -History and Scope of mushroom cultivation - Edible and Poisonous Mushrooms-Vegetative characters - Structure and key for identification of edible mushrooms- Button mushroom (Agaricus bisporus), Milky mushroom (Calocybe indica), Oyster mushroom (Pleurotus sajorcaju) and paddy straw mushroom (Volvariella volvcea).

Unit II   Techniques in Mushroom Production   9

Principles of mushroom cultivation- Sterilization and disinfections of substrates. -Pasteurization of different substrates –spore printing, pure culture, spawn production and their maintenance.Post-harvest management – Harvest - preservation of mushrooms, storage, methods quality assurance of mushroom.

Unit III   Diseases and Problems of Mushroom Cultivation   9

Factors influence contamination, diseases in mushrooms in mushroom cultivation-Environmental, fungal, bacterial, viral, insect pests, Nematode diseases, and competitor moulds.Insect pests attacking mushroom and mushroom bed – Environmental changes affecting mushroom production

Unit IV   Health Benefits of Mushroom   9

Nutritional values of mushrooms. Value addition and various products of mushrooms soup, cutlet, vegetable curry, samosa, omelette, pickle etc. Medicinal properties and benefits of mushroom.

UNIT V   Entrepreneurship development in Mushroom Cultivation   9

Common Indian mushrooms. Production level - economic return - Foreign exchange from Mushroom cultivating countries and international trade - knowledge of sales tax etc.Production of various mushroom based foods for
marketing - pickles - jams - chips, etc.

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Nita Bhal, "Handbook on Mushrooms" , Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2nd edition, Vol. I and II , 2000.
2. Elangovan, M. "Evaluation of Different Sterilization Techniques for Yield and Biological Efficiency of Milky White Mushroom (C. indica P&C)." International Journal of Agriculture Innovations and Research 9.2 (2020)

References:
1. Pathak, Vishwa Nath, Nagendra Yadav, and Maneesha Gaur. Mushroom production and processing technology. Agrobios, 2000.
2. Khan, Ahmed Abdul Haleem, and M. Aruna. "Department of Botany." University of Karachi (1995): 353-360.

Web References
1. https://www.techno-preneur.net/technology/project-profiles/food/mush-cult.html
2. http://niftem.ac.in/newsite/wp-content/uploads/2021/01/Mushroom-Production-technology.pdf

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE06	**Emerging Technologies in Food Processing**	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. The path ambitions to develop the understanding of college students in the region of emerging or opportunity technology applied to meals processing.
2. This route will enable college students to understand the benefits and drawbacks over present technology.
3. Collect information on pulse light strategies, ohmic heating and microwave processing
4. Apprehend the meals protection techniques
5. Gain ideas related to food irradiation, excessive stress processing and biocatalysts.

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the concepts of hurdle technology	Understand
CO2	Understand the concepts of pulsed electric field processing	Remember
CO3	Understand the concepts of microwave and ohmic heating	Apply
CO4	Understand the concepts of ultrasound and high pressure processing	Analyze
CO5	Understand the concepts of advanced freezing techniques	Understand

Course contents:

Unit I   Hurdle Technology   9

Basics of hurdle technology – Mechanism, Application to foods - Newer Chemical and Biochemical hurdles- organic acids – Plant derived antimicrobials – Antimicrobial enzymes– bacteriocins – chitin / chitosan (only one representative example for each group of chemical and biochemical hurdle).

Unit II   Pulsed Electric Field Processing   9

Mechanism of action, PEF treatment systems; PEF processing of liquid foods and beverages. High intensity electric field pulses on solid foods. Non thermal methods- its applications - Application of light pulses in sterilization of foods and packaging materials

Unit III   Microwave And Ohmic Heating   9

Microwave properties – principle – design aspects of microwave equipment - interaction with food materials, material properties - application of microwave in food processing – merits and demerits – recent advancement in microwave processing - inactivation of microorganisms and enzymes – electrical resistance heating of food - ohmic heating - treatment of products - Elsteril process - influence on microorganisms - food ingredients .

Unit IV   Ultrasound and High Pressure Processing   9

Ultra sound – introduction – types of pressure waves – generation of ultrasound – mechanism of microbial inactivation – application in food processing – High pressure processing – Principles – concepts – basic laws related to HPP - design of equipment - processing of food using HPP - effect on microorganisms – Application in industry

UNIT V   Innovation In Food Refrigeration   9

Vacuum cooling of foods; High pressure freezing; Freeze drying (lyophilisation) – Theory – Equipment - Effect on foods – Freeze concentration – Theory – Equipment

Total: 45 Periods

Text Books:
1. Nonthermal Preservation of Foods. Gustavo V. Barbosa-Canovas, Usha R. Pothakamury, Enrique Palou and Barry G. Swanson. Published by Marcel Dekker, Inc., 270, Madison Avenue, New Yorkm 10016, 1998.
2. Da-Wen Sun,"Emerging Technologies for Food Processing", Academic press/ Elsiever, London, UK,2005.

References:
1. Trends in Food Engineering, Jorge E. Lozano, Cristina Anon, Efren Parada-Arias, Gustavo V. Barbosa- Canovas, Contributor Jorge E. Lozano, Published by CRC Press, 2000.
2. Gould G.W., "New Methods of Food Preservation", Aspen Publishers, Great Britain, ISBN No. 0834213419, 1999

Web References
1.https://onlinecourses.nptel.ac.in/noc22_ag03/preview
2.https://nptel.ac.in/courses/126/105/126105015/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2		Medium						Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

20FTE07	**Beverage Processing Technology**	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives
The course is intended to
1. Learn the basic knowledge about ingredients used for beverage manufacturing process
2. Understand the processing methods of different kinds of beverages
3. This course is designed to analyze and understand various processing, preservation methods are used for beverages.

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the basic ingredients used for preparation of beverages	Understand
CO2	Understand and demonstrate the different processing techniques	Understand
CO3	Explain the method of processing of carbonated beverage	Remember
CO4	Discuss the processing methods of non-carbonated beverages	Apply
CO5	Explain the quality control measures in food beverage industry	Understand

Course contents:
Unit I   Introduction   9
Beverage-definition-why we drink beverages-ingredients- water, carbon dioxide, bulk and intense sweeteners, water miscible and water dispersible flavouring agents, colours – natural and artificial, Micro and nanoemulsions of flavors and colors in beverages, preservatives, emulsifiers and stabilizers.

Unit II   Alcoholic beverages   9
Background, history and recent trends and developments of alcoholic beverages, alcoholic fermentation, malolactic fermentation, acetic and other fermentations, Preservatives used in the production of alcoholic beverages; Fermented beverages – beer, wine and cidar: ingredients-Malt- hops- adjuncts- water, yeast, processing-distillation, fermentation, malting, preparation of sweet wort, brewing, preservation – pasteurization, packaging. Beer defects and spoilage. Wine-fermentation-types –red and white. Wine defects and spoilage

Unit III   Carbonated beverages   9
History, recent technological development, water treatment, ingredients and formulation of carbonated soft drinks, syrup preparations and syrup room operations, carbon di oxide, carbonation and principles of filling technology, Modern filling systems for carbonated soft drinks

Unit IV   Non-carbonated beverages   9
Fruit juice processing, nectars, cordial, squash, RTS beverages, Manufacturing technology of coffee and tea processing, types of tea - black, green and oolong, Sports beverages, preservation and packaging of beverage products.

UNIT V   Quality control   9
Microbial spoilage of fruit juices and beverages, ensuring safety of juice: strategy and control, Essential Elements of Sanitation and hygiene in the Beverage Industry, Quality of water used in beverages, Effective application of quality controls.

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Deepak Mudgil, Sheweta Barak, "Beverages: Processing and Technology", Scientific Publishers, 2018.
2. Steen, D.P and Ashurst, P.R, "Carbonated soft drinks – Formulation and manufacture", Blackwell Publishing Ltd. 2000.

References:
1. Hui YH. et al 2004. Handbook of Food and Beverage Fermentation Technology. Marcel Dekker.
2. Amalendu Chakraverty et al, "Handbook of Post-Harvest Technology", Ed:.,Marcel Dekker Inc. (Special Indian edition) 2000.

Web References
1. https://www.wiley.com/en-sg/Innovative+Technologies+in+Beverage+Processing-p-9781118929377
2. https://books.google.co.in/books/about/Beverages_Processing_and_Technology.html?id=3Q2NDwAAQBAJ&re dir_esc=y

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3		High			2		Medium					Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE08	**Enzyme Technology**	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Learn the basic knowledge about enzymes and its action
2. Understand the immobilization process
3. Understand the importance of enzyme in food industries

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the basics of enzyme and features	Understand
CO2	Understand the effect of different parameter on enzyme activity	Understand
CO3	Understand the different methods of enzyme immobilization	Remember
CO4	Discuss the importance of enzyme in Food	Apply
CO5	Discuss the application of enzymes in Food Industry	Understand

Course contents:

Unit I   Introduction   **9**

Introduction-Definition-Historical highlights-classification of enzymes-nomenclature- structural features of enzyme- Methods of extraction and purification of enzymes.

Unit II   Mechanism of enzyme action   **9**

Specificity-types of specificity-role of 3D structure -active site-substrate and enzyme concentration relationships- different effects -pH and temperature

Unit III   Enzyme immobilization   **9**

Immobilization-need for immobilization-advantages -disadvantages-immobilization techniques- -effects of pH, temperature, substrate concentration, stability, kinetic properties-role of immobilized enzymes in food processing- commercial food application

Unit IV   Enzymes of Food importance   **9**

Endogeneous enzymes in food quality- color- lipoxynase, chlorophyllase, polyphenol oxidase, texture- Pectic enzymes, Amylases, cellulases, proteases, flavour and aroma-nutritional quality

UNIT V   Application of enzymes in food industries   **9**

Mechanism and application of enzymes in food processing-enzymatic browning. Enzymes used for bread making, Cheese making, meat tenderization, egg, fruit processing, brewing.

                                                                    Total: 45 Periods

Text Books:
1. Price, N. L. and L. Steven. 2000. Fundamentals of Enzymology, Oxford Scientific
2. Robert J.Whitehurst and Barry A.Law Enzymes in food technology Sheffield packaging technology, 2005

References:
1. Marangoni, A.G. 2003. Enzyme Kinetics. A modern approach A John Wiley & Sons. Trevor Palmer. Understanding Enzymes. Fourth Edition.Prentice Hall, London
2. Dr.P.Asokan.2003.Enzymes.chinna publications, Tamil nadu

Web References
1. https://talcottlab.tamu.edu/wp-content/uploads/sites/108/2019/01/Enzymes-and-Processing.pdf
2. https://khni.kerry.com/news/articles/enzymes-in-food-and-nutrition/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment			
Bloom's Category	**Internal Assessment Examinations**		**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE09	Protein Technology	L	T	P	C
		3	0	0	3

Nature of Course	Professional Elective
Pre requisites	Nil

Course Objectives

The course is intended to

1. Cater the students basic knowledge about protein and its quality in food
2. Understand the properties of proteins and their products
3. Explore the students to know about emerging areas of industrial manufacturing of alternative protein products
4. Enable the students to apply knowledge on protein processing technology into various products
5. Able to understand the usage whey and soy protein in food industry

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Analyze the protein quality and quantity in food	Understand
CO2	Identify different properties of protein and its application in food sector	Understand
CO3	Identify modified protein products and its manufacturing technology	Understand
CO4	Applications of protein isolates from different sources in various food processing	Remember
CO5	Analyze the use of whey and soy protein in food industry	Apply

Course contents:

Unit I   Introduction to protein structure and function   9

Role of nitrogenous compounds in food quality – role of proteins in food raw materials, the effect of nitrogenous compounds on the nutritional value and safety of foods, the effect of proteins on the technological value of raw food materials and sensory quality of food materials; protein in food structures – structural value of proteins in food raw materials, interactions with other constituents; Conventional and novel sources of protein.

Unit II   Properties of proteins   9

Chemical and physical properties of food proteins, Factors affecting properties of proteins in food systems, Structure and function of proteins: classification and relationships, Future trends. Functional properties of proteins and their applications; Structure-function relationships of different food proteins.

Unit III   Modified protein products   9

Production of proteins, protein concentrates/isolates from legumes, oilseeds, fish, seafood, leaf, microbes. Textured vegetable proteins and different methods of texturization; High protein food formulations, Modification of proteins by enzymic (manufacture of protein hydrolysates, their characterization and applications), chemical and physical methods. Single cell Protein – spirulina, production, processing and uses

Unit IV   Applications   9

Using proteins as additives in foods, Edible films and coatings from proteins, Protein gels, Proteomics: examining the effects of processing on food proteins

UNIT V   Whey proteins and Soy proteins   9

Manufacturing technologies of whey proteins – whey protein recovery technology, heat / acid precipitation, membrane filtration technology, whey protein fractionation, concentration, drying, whey products processing, Soy protein essentials, liquid soy protein, functional meat protein ingredients,

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Yada R. 2004. *Proteins in Food Processing.* Woodhead
2. Damodaran S & Paraf A. 1997. *Food Proteins and their Applications.* Marcel Dekker.

References:
1. Radomir Lasztity, The Chemistry of Cereal Proteins, CRC Press, Second Edition1995.
2. Shuryo Nakai and H.Wayne Modler, (Editors), Food Proteins: Processing Applications, John Wiley & Sons,1999.

Web References
1. https://nptel.ac.in/content/storage2/courses/122103039/pdf/mod5.pdf
2. https://nptel.ac.in/courses/102/105/102105089/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2		Medium						Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	**IAE – II (7.5)**	**IAE – III (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE10	**Ready to Eat Processing Technology**	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to
1. Acquire the knowledge on Ready to Eat and Ready To Cook foods
2. Acquaint the different RTE products
3. Learn the various equipments and process involved in preparation of RTE food products
4. Identify different packaging materials for RTE and RTC foods
5. Describe the microbial hygiene of RTE foods

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the basics of various Ready to Eat and Ready To Cook foods	Understand
CO2	Understand the different types of RTE foods commercially available	Remember
CO3	Identify the equipments and process of making RTE foods	Understand
CO4	Explain different packaging materials used in RTE foods	Understand
CO5	Illustrate the microbial hygiene of RTE foods	Apply

Course contents:

Unit I   Introduction   9

Basic concepts of RTE,RTC-Categories of RTE- Trends in RTE-Development of food processing and technology- Importance of food processing and preservation-Food as a material-Food product development-Recipe formulation

Unit II   Ready to Eat Foods   9

Snacks- Extruded snack foods: Formulation and processing technology, colouring, flavouring and packaging. Frozen Foods- Food chilling and freezing – Precooling and cold storage; CA and MA; Properties of frozen foods- Cryogenic freezing and IQF; Thermally Processed foods-Instant foods

Unit III   Equipments for RTE   9

Equipments for frying, Baking and drying, toasting, roasting and flaking, popping, blending, Coating, chipping- food freezing equipment such as air blast freezers, plate freezers and immersion freezers. Retort machinery

Unit IV   Packaging of RTE foods   9

Packaging requirements of RTE and RTC-Product characteristics- Factors affecting-Low and high moisture foods- Frozen convenience foods-Ovenable Plastic Based Food Trays and Biodegradable packaging for RTE foods.

UNIT V   Food Hygiene And Toxicology In RTE   9

Factors influencing microbial safety of ready-to-eat foods-Food borne pathogenic bacteria in fresh-cut vegetables and fruits-Safety of fresh-squeezed juices-Risk assessment and HACCP for ready-to-eat foods**.**

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Andy Hwang and Lihan Huang., 2010, "READY-TO-EAT FOODS Microbial Concerns and Control Measures", CRC press.
2. Parthena Kotzekidou, 2016, "Food Hygiene and Toxicology in Ready-to-Eat Foods", Academic Press.

References:
1. Lynn Knipe Robert E. Rust,2010 "Thermal Processing Of Ready-To-Eat Meat Products", Blackwell Publications.

Web References
1. https://ncert.nic.in/textbook/pdf/lehe105.pdf
2. http://niftem.ac.in/newsite/wp-content/themes/niftm/assets/pmfme/processing/rteprocessing.pdf

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	**IAE – II (7.5)**	**IAE – III (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE11	**Food Process Equipment Design**	L	T	P	C
		3	0	0	3

Nature of Course	Professional Elective
Pre requisites	Heat and mass transfer in food processing

Course Objectives
The course is intended to
1. To enable the student to design and develop equipments used in Food Processing operations.
2. To Identify and discuss critical design of typical processing equipment.
3. Understand the relationship between process design and Safety

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Identify the factors that will affect the design of equipments	Understand
CO2	Classify the variables based on various properties	Apply
CO3	Understand about pressure vessel design	Apply
CO4	Select the critical variables for the design of equipments	Remember
CO5	Develop a conceptual design model	Understand

Course contents:

Unit I   Basic Design Considerations and Materials of Construction   9

Basic considerations in process equipment design. Selection and types of Engineering materials, properties - mechanical and chemical. Process flow diagrams (PFD) – symbols used in PFD.

Unit II   Design of Pressure Vessels   9

Basic design of vessel, design of a sell and its components – cylindrical and spherical. Vessels subjected to Optimum proportions of a vessel and vessel size

Unit III   Design of Storage Vessels   9

Storage of fluids – storage of volatile, non-volatile liquids and storage of gases. Design of rectangular tanks and horizontal tanks, Design of tanks – bottom and shell design and self-supporting roof design.

Unit IV   Design of reaction vessels   9

Classification of reaction vessels, heating system. Design considerations – jacket design, coil and channel design

UNIT V   Design of Heat Exchangers and Dryer   9

Types of heat exchangers – double pipe heat exchangers, shell and tube heat exchangers. Design of shell and tube heat exchanger. Design of single effect evaporator and Design of tray dryer

Total: 45 Periods

Text Books:
1. Mahajani V.V and Umarji S.B. "Joshi's process equipment design". Trinity Press. ISBN: 978-93-5138-091-1, New Delhi, 2014.
2. M.V. Joshi and V.V. Mahajani, Process Equipment Design (3rd edition), New India Publishing Agency, New Delhi, 2004.

References:
1. Rajesh Mehta and J. George "Food Safety Regulation Concerns and Trade- The Developing Country Perspective," Published by Macmillan India Ltd., New Delhi. 2005
2. Miguel A. Galan, Eva Martin Del Valle. "Chemical Engineering: Trends and Developments" John Wiley & Sons, ISBN: 978-0-470-02498-0, 2005

Web References
1. https://nptel.ac.in/courses/103/107/103107207/
2. https://nptel.ac.in/courses/103/103/103103027/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2		Medium						Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE12	**Food Storage Engineering**	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. To develop the knowledge of students in the area of Food storage
2. Students learn the cold storage principles and storage equipments in food process industries.
3. Students learn the food storage freezers and quality losses in frozen foods.
4. Students learn the grain food materials storage and its importance.
5. Students learn the modified food storage as recent advancement techniques.

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Outline factors influencing different types of food storage	Remember
CO2	Understand the application of scientific principles in the cold storage processing technologies	Understand
CO3	Apply the quality techniques by various methods of frozen storage.	Apply
CO4	Understand the grain materials and storage structures, properties and losses during storage.	Understand
CO5	Analyze the benefits of modified food storage.	Analyze

Course contents:

Unit I   Introduction to Food Storage Engineering   9

Introduction-Storage of grains–biochemical changes during storage– production, distribution and storage capacity– ecology, storage factors affecting losses, storage requirements, Bag & bulk storage– pressure distribution– method of stacking– preventive method, Parameters of good storage structure, CAS. Ceiling and Plinth Storage.

Unit II   Cold storage   9

Cold storage- Moist air and applied psychrometry, Estimation of cooling load, Air conditioning systems, Evaporators, Compressors, Condensers, Expansion devices, Cooling towers, Different types of refrigerants, Transmission and distribution system of cool air, Thermal and vapor insulation materials, Design of small capacity cold storage, Instrumentation and climate management in cold storage.

Unit III   Frozen Storage   9

Quality loses in frozen foods- Physical changes, Chemical changes in food components, Nutritional aspects of freezing, Microbiology of frozen products, Glass transitions temperature and stability of frozen foods, Temperature requirements during frozen storage, Shelf-life of frozen foods- shelf-life testing, Modelling loss of quality in frozen foods, Time-Temperature integrators, Packaging of frozen foods, Different types of freezers.

Unit IV   Grain food materials and grain storage   9

Grain Properties: Definition. Importance. Physical properties of grains. Structure, Composition and Nutritional value – paddy, wheat, maize, millet, oat, sorghum. Anti-nutritional factors and its methods of reduction. Grain storage systems - farm level storage, bagged storage, bulk storage, hermetic storage, outdoor storage. Losses during storage, Grain protection methods – physical and chemical methods. Integrated stored grain pest management.

UNIT V   Modified Atmospheric Storage   9

Overview of MAP, Gases & Vapor applied to modified atmosphere processing operations, MAP modelling- Kinetics of food deteriorative reactions, Shelf-life testing, Enzyme kinetics applied to MAP, MAP design with oxygen modeling

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Narayanasamy P., Mohan S and Awaknavar J. S., "Pest Management in Store Grains", 1st Edition, Satish Serial Publishing House, New Delhi, 2009.
2. Chakraverty A., "Post-Harvest Technology of Cereals, Pulses and Oil Seeds", 3rd Edition, Oxford IBH Publishing Co. Pvt. Ltd, New Delhi, 2017.

References:
1. RaijaAhvenainen., "Novel Food Packaging Techniques", 1st Edition, Wood head Publishing, UK, 2003.
2. Jerry Heaps., "Insect Management for Food Storage and Processing", 2nd Edition, Elsevier, USA, 2006.

Web References

1.http://www.cold.org.gr/library/downloads/Docs/Handbook%20of%20Food%20Preservation.PDF
2. https://nptel.ac.in/courses/126/105/126105015/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2		Medium					Low			

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE13	**Design and Formulation of Food**	L	T	P	C
		3	0	0	3

Nature of Course	Professional Elective
Pre requisites	Nil

Course Objectives
The course is intended to
1. Acquire the knowledge on design of foods
2. Acquaint the formulation of infant foods
3. Learn the various balanced and therapeutic diet foods
4. Identify different functional foods
5. Describe the anti-nutritional factors present in food

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the basics of designing food according to its nutritive value	Understand
CO2	Understand the formulation of infant foods	Understand
CO3	Identify the various balanced and therapeutic diet foods	Remember
CO4	Explain different functional foods	Understand
CO5	Illustrate the anti-nutritional factors present in food	Apply

Course contents:
Unit I   Introduction   9

Nutritional Concept in Food Design: Nutritive value and anti-nutritional factors present in cereals, pulses, oil seeds, fruits, vegetables, fish, meat and eggs, effect of processing on nutritive value of foods.

Unit II   Infant Foods   9

Infant Foods: Formulation of weaning foods, Protein energy malnutrition, Formulating diet for preschool going (2-5 years) children. Menu Planning: Explanation of terms, Principles of planning menus, Steps involved in planning menus, Food guide pyramid

Unit III   Diet foods   9

Balanced Diet; Diets during normal life cycle, Nutrition from infancy to adolescence, Nutritional requirements of different age groups, Geriatric nutrition, Nutrition for athletes; Therapeutic Diet: Diet therapy and types of therapeutic diet, Diet for diabetic mellitus, Diet for cardio vascular disease, Diet for gastro intestinal disease.

Unit IV   Functional foods   9

Functional Foods: Concepts for functional foods design, prebiotics & probiotics, nutraceuticals, designer foods; Fermented Foods: Preparation and maintenance of microbial cultures for food fermentation, Nutritional significance of traditional fermented foods.

UNIT V   Anti-Nutritional factors   9

Anti-Nutritional Factors in Foods: Trypsin inhibitors, Phytins, Tannins, Oxalates, Goitrogens, Aflatoxins, Process induced toxins

Total: 45 Periods

Text Books:
1. Nutritive value of Indian Foods by Gopalan C, Ramshastri BV, Balasubramaniam SC. National Institute of Nutrition, Hyderabad.
2. Handbook of Indigenous Fermented Foods' by K.H. Steinkrus, Marcel Dekkar.

References:
1. Proceedings of Technical Session of IFCON-98' AFTS (I), CFTRI, Mysore.
2. Clinical dietetics and nutrition by FP Antia.

Web References
1. http://nutritiondata.self.com/
2. www.nutritionvalue.org/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2		Medium						Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	**IAE – II (7.5)**	**IAE – III (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

		L	T	P	C
20FTE14	**Instrumentation and Process Control in Food Industry**	3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Acquire the knowledge on basics of instrumentation and process control.
2. Acquaint the creativity and innovation to measure instrumentation.
3. Analyze the prerequisites and planning necessary for instrumental analysis.
4. Learn the various steps involved in industrial Instrumentation
5. Describe the various methods in control systems

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Apply the idea of Instrumentation and process control.	Apply
CO2	Create to measure instrumentation techniques.	Understand
CO3	Identify the prerequisites and ideas required for instrumental analysis.	Remember
CO4	Explain different techniques and steps involved in industrial instrumentation.	Understand
CO5	Apply the different methods in control systems.	Apply

Course contents:

Unit I   Introduction   9

Temperature measurement- Measurement methods **-** thermoelectricity, industrial thermocouples, thermocouple lead wires, thermal wells, industrial potentiometers. Resistance thermometers: industrial-resistance-thermometer bulbs, null-bridge resistance thermometers, deflectional resistance thermometer. Radiation temperature measurement: radiation receiving elements, radiation pyrometers, photoelectric pyrometers, optical pyrometers. Pressure measurement – methods - mechanical type measurement devices Electrical pressure transducers.

Unit II   Measurement techniques   9

Force measurement – Torque and load cells instrumentation. Strain gauges – basic and types. Speed measurement & event counting using photo electric & reluctance principles – Proximity sensors. Level measurement- Capacitance method, Conductance method, Hydrostatic method – liquid level measurement. Flow measurement - Positive displacement method, Turbine meters - velocity, magnitude & dire tion measurement. Anemometers – discharge measuring sensors. Indicating & recording devices- basic analogmetrs and digital meters – standards and calibration.

Unit III   Instrumental analysis   9

Spectroscopic analysis, adsorption spectroscopy, emission spectroscopy, mass spectroscopy. Analysis of solids by X-ray diffraction, color measurement by spectrometers, gas analysis by thermal conductivity, psychrometer method for moisture in gases, hygrometer method for moisture in gases, dew-point method, pH ion concentration

Unit IV   Industrial Instrumentation   9

Industrial instrumentation – dielectric heating – Electronic relay circuits – SCR, DIAC and TRIAC- elementary power electronics. Control system, controllers and final control elements, block diagram of a chemical reactor control system, closed-loop transfer functions, transient response of simple control systems, Root locus.

UNIT V   Control systems   9

Control schemes for heat exchangers and chemical reactors. Control of distillation column: control of composition, feed rate, pressure and feed temperature. Microprocessor-based controllers: hardware components, tasks of microprocessor-based controller, implementation of control algorithms. Computerized data acquisition and control in the food industry

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Erika Kress-Rogers and Christopher J. B. B. Instrumentation and sensors for the food Industry. Woodhead Publishing Limited. CRC Press. Cambridge 2001.
2. Doeblin, O.E.1983.Measurment system. McGraw Hill International book., Tokyo

References:
1. Galen W. Ewing, "Instrumental Methods of Chemical Analysis", 5th Ed., McGraw Hill, New York, 1985.
2. Ralph.B and Nathan.W. 1972. Industrial Electronic circuits and applications. Prentice hall India Ltd., New Delhi.

Web References
1. https://nptel.ac.in/courses/103/103/103103037/
2. https://nptel.ac.in/courses/103/101/103101142/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment			
Bloom's Category	**Internal Assessment Examinations**		**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE15	**Food Plant Utilities and Services**	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives
The course is intended to
1. Acquire the knowledge on basics electrical system.
2. Understand the water usage in food industry.
3. Realize the importance of steam usage in Food Industry.
4. Learn the importance of waste disposal and its utilization
5. Describe the various services

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the idea of electrical system in food industry	Understand
CO2	Understand the pumps, water analysis in food industry	Remember
CO3	Identify the importance of steam and its production in food industry	Apply
CO4	Discuss the industrial wastes and its utilization	Understand
CO5	Understand the service facilities needed in food industry	Understand

Course contents:
Unit I   Introduction to Electrical system   9

Classification of various utilities and services in food plant / industry, introduction to electric power supply systems, electrical load management, motor load, power management, distribution losses and trouble shooting of electrical power system

Unit II   Water use in Food processing Industry   9

Water supply system: Pumps types, operational aspects, piping system for fresh water, chilled water, water requirement for cleaning and processing, water quality, water purification and softening. Different types of water requirements in food processing plants – types of water use, water wastage minimization, waste water management, economic use of water and water filtration and recirculation

Unit III   Steam uses in Food Industry   9

Steam generation system – boiler system, fuels used in boilers, energy analysis, heat loss from boiler system. Energy conservation technologies for steam generation system, energy saving through optimal design and operation of boiler and energy recovery.

Unit IV   Waste disposal and its Utilization   9

Industrial waste, sewage, influent, effluent, sludge, dissolved oxygen, biological oxygen demand, chemical oxygen demand

UNIT V   Planning and Design of service facilities in Food Industry   9

Estimation of utilities requirements: Lighting, ventilation, drainage, CIP system, dust removal, fire protection. Maintenance of facilities: Design and installation of piping system, codes for building, electricity, boiler room, plumbing and pipe colouring, service facilities maintenance. Services required in offices, laboratories, locker and toilet facilities, canteen, parking lots and roads, loading docks, garage, repair and maintenance warehouse

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Energy Efficiency and Management in Food Processing Facilities by Lijun Wang published by CRC press, 2008
2. Energy saving Techniques for the Food Industry by M. E. Casper published by Noyes Data Corp., 1977

References:
1. A survey of water use in the food industry by W. E. Whitman, S.D. Holdsworth published by British Food Manufacturing Industries Research Association.
2. Chilton's Food Engineering published by Chilton Co., 1979

Web References
1. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=124499
2. https://pdfcoffee.com/food-plant-utilities-pdf-free.html

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment			
Bloom's Category	**Internal Assessment Examinations**		**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

		L	T	P	C
20FTE16	**Food Packing Technology and Equipment**	3	0	0	3

Nature of Course	Professional Elective
Pre requisites	Nil

Course Objectives

The course is intended to

1. Acquire the knowledge on basics of food packaging.
2. Acquaint the creativity and innovation on packaging methods.
3. Analyze the different types of flexible packaging.
4. Learn the concepts of rigid packaging
5. Learn the different testing methods for packaging materials

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the basics concept of packaging and its classification	Understand
CO2	Discuss the different types of packaging methods	Apply
CO3	Identify the flexible packaging materials suitable for food packing	Remember
CO4	Explain concepts of rigid packing	Understand
CO5	Understand the packing material testing and its impacts	Understand

Course contents:

Unit I   Basics of Packaging   9

History of food packaging technology and methods. Packaging – definition, concepts, significance and classification. Packaging of foods – fresh and processed

Unit II   Packaging systems and methods   9

Vacuum packaging, Gas flush packaging, CAP & MAP, Aseptic and retort packaging, Antimicrobial packaging, Nano packaging, Biodegradable packaging, Edible packaging and smart / intelligent packaging

Unit III   Flexible Food packaging materials   9

Properties of paper and paper board, classification of paper board, manufacturing methods, application of paper and paper board. Plastic packaging – types of plastics: PE, PP, PET, PVC, EVOH and PVA. Polymers – basic concept of polymer, polymerization, plastic versus polymers, lamination and edible coating

Unit IV   Rigid packaging   9

Glass as food packaging materials, advantages and disadvantages. Glass container manufacture – melting, forming, surface treatments, closure selection. Metal containers – steel and aluminium, can making process, can coating and metallic films

UNIT V   Testing of packaging materials and Environmental issues in packaging   9

Testing of packaging materials using universal testing methods – compression, tensile strength tester, bursting strength tester, drop tester, cobb tester, gauge tester, torque tester, tear tester. Packaging laws and regulations, safety aspects of packaging materials, environmental and economic issues – case study, recycling and waste disposal, barrier properties

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Richard Coles, Derek McDowell, Mark J. Kirwan, Food Packing Technology, Blackwell Publishers, 2003
2. Gordon L. Robertson, Food Packaging: Principles and practice, Taylor and Francis, CRC press, 2005

References:
1. L. Yam and D.S. Lee, "Emerging Food Packaging Technologies, Principles and Practice, A volume in Wood head Publishing series in Food Science, Technology and Nutrition," 2012
2. Dong Sun Lee, Kit L. Yam and Luciano Piergiovanni, "Food Packaging Science and Technology", CRC Press, 2008

Web References
1. http://ecoursesonline.iasri.res.in/course/view.php?id=28
2. https://egyankosh.ac.in/bitstream/123456789/12398/1/Unit-16.pdf

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2		Medium						Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	**IAE – II (7.5)**	**IAE – III (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE17	Optimization Techniques in Food Engineering	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to
1. Modelling of heat and mass transfer operations.
2. Learn the factorization of matrices and optimization techniques.
3. Study the physical problems in food process Engineering.
4. Knowledge of Statistical Optimization and Response Surface Methodology
5. Learn the multi optimization techniques

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the fundamentals of modeling in food process	Remember
CO2	Apply the knowledge of factorization of matrices and optimization techniques in clustering and classification of data.	Understand
CO3	Explain the physical problems of food process Engineering.	Apply
CO4	Analyze the parameters optimizing through Statistical Optimization and Response Surface Methodology.	Analyze
CO5	Apply the principles, concepts of multi optimization techniques	Apply

Course contents:

Unit I   Introduction   9
Introduction modeling – General considerations– Kinetic modeling– model parameters; thermo physical properties– Towards food Process Modeling at Different Scales: Multiscale Modeling.

Unit II   Matrix Decomposition And Continuous Optimization   9
Cholesky decomposition – Singular Value Decomposition, Continuous Optimization: Introduction – Unconstrained Optimization – Gradient Descent method – Constrained Optimization – Lagrange Multipliers method – Convex Optimization

Unit III   Physical Problems   9
Forces and Deformation- Heat and Mass Transfer- convection- Heat capacitance and phase change, Fluid flow.

Unit IV   Statistical Optimization and Response Surface Methodology   9
Response Surface Methodology – Response Surface Functions, Design of Experiments, Linear Regression for Building Empirical Models. Analysis of Second-Order Response Surfaces, Adequacy Checking for Regression Models, Optimization on the Response Surfaces.

UNIT V   Multi-Objective Optimization in Food Engineering   9
Evaporator System Design, MOO methods in food processing industries, Heat processing, fermentation, Separation process and MOO Software.

Total: 45 Periods

Text Books:
1. Deisenroth M.P., Faisal A.A. and Ong C.S., "Mathematics for Machine Learning", 1st Edition, Cambridge University Press, 2019 for Units IV, V.

References:
1. FerruhErdogdu., "Optimization in Food Engineering", 1st Edition, CRC Press, USA, 2008.

Web References
1. https://nptel.ac.in/courses/128/106/128106019/
2. https://nptel.ac.in/courses/126/103/126103017/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	**IAE – II (7.5)**	**IAE – III (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

20FTE18	Food Plant Design and Layout	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives
The course is intended to
1. To enable the students understand various concepts of economics of food plant.
2. To understand the processes involved in layout design.
3. To understand the development and design consideration and cost estimation in food industry.

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the various factors involved in setting up a food processing Industry	Remember
CO2	Understand the process of food plant layout design	Apply
CO3	Apply their knowledge to design projects for setting up a Food Processing Industry.	Apply
CO4	Analyze the problems involved in deciding the level of manufacture of a food product	Understand
CO5	Evaluate the options involved and decide on the right choice based on the economics of the system	Understand

Course contents:

Unit I   Food Process Design Development   9
Technical feasibility survey of Food Industry, process development, Food Process flow sheets — Computed-aided process design – Principles of spread-sheet aided process design (Basic concepts only)

Unit II   Plant Layout   9
Marketability of the product, availability of technology, raw materials, equipments, human resources, land and utilities, site characteristics, waste disposal, Government regulations and other legal restrictions, community factors and other factors affecting investment and production costs. Plant Layout based on process and product. Richard Muther's Simple Systematic Plant Layout

Unit III   Overview of Sanitary and Hygienic Design and Layout   9
Hygienic food process design – Principles of Sanitary design - equipment design and specifications- Basic outline on FSMS

Unit IV   Project Evaluation and Cost Estimation   9
Capital investments – fixed capital investments including land, building, equipments and utilities, installation costs (including equipments, instrumentation, piping, electrical installation and other utilities), working capital investments. Methods of Cost estimation – Cost Indices

UNIT V   Product Cost and Plant Overheads   9
Manufacturing costs – Direct production costs(including raw materials, human resources, maintenance and repair, operating supplies, power and other utilities, royalties, etc.). – Process Profitability - Application to a Food Processing plant e.g. Tomato processing - Administration, safety and other auxiliary services, payroll overheads, warehouse and storage facilities etc. Depreciation, Amortization and methods of determining the same

Total: 45 Periods

Text Books:
1. Peters and Timmerhaus, Plant design and Economics for Chemical Engineers, McGraw Hill 5th Edition, ISBN- 007-124044-6, 2004 .
2. Heldman D.R. and Lund D B. Hand Book of Food Engineering, 2nd edition, CRC Press, Taylor and Francis Group, 2007

References:
1. Maroulis Z.B. and Saravacos G.D. Food Process Design, Marcel Dekker Inc. ISBN- 0824743113, 2003.
2. Towler G and Sinnott R.K. Chemical Engineering design principles, practice and Economics of Plant and Process. 2nd Edition. Elsevier, ISBN-9780080966595, 2012

Web References
1. http://bbsbec.edu.in/wp-content/uploads/2020/01/food-plant-design-lecture-ppt-converted-compressed.pdf
2. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=124501

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2		Medium					Low			

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

		L	T	P	C
20FTE19	**Modelling and Simulation of Food Processes**	3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Develop the knowledge of students in concepts of modelling in food processing
2. Modelling concepts in fermentation and MAP
3. Suitable mathematical models in cooling and freezing processes of foods
4. Select the models in thermal processing units.
5. Learn the use of appropriate software for modelling processes.

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Interpret the concepts of modeling in food processing	Understand
CO2	Illustrate the modeling concepts in fermentation and MAP	Remember
CO3	Analyze the mathematical models in cooling and freezing processes of foods	Apply
CO4	Analyze the models to be used in thermal processing of foods	Apply
CO5	Apply the appropriate software for modeling processes	Apply

Course contents:

Unit I Introduction to Modeling 9

Introduction to Modeling: Definition of terms: System, Entity, attributes, activity, state of systems. Physical, Mathematical and Chemical Systems. Modeling - Principles of model formulation, Representation of Model, Fundamental Laws, Types of Modeling Equations, Black Box Principles, Boundary Condition, Validation of model.
Benefits of modeling in food processing.

Unit II Models in Fermentation and Modified Atmospheric Packaging 9

Models in Fermentation: Introduction, Biological models - Genetic models, growth models, killing-off models and productions models. Technological models - heat transfer models, oxygen transfer models and mixing models. Economic models and mixed models. Models in Modified Atmospheric Packaging: Principle and methods, macro, micro and meso level models.

Unit III Modeling of Cooling and Freezing Processes 9

Modeling of Cooling and Freezing Processes: Introduction, modeling product heat load during cooling - single tank model and tank network model. Modeling product heat load during freezing. Numerical solution of heat conduction equation with phase change. Finite different models and element model. Modeling of combined heat and mass transfer - porous, non-porous foods, foods with impermeable skin and frozen foods. .

Unit IV Modeling of Thermal Process 9

Grain Properties: Grains - Definition. Importance. Physical properties of grains. Structure, Composition and Nutritional value – paddy, wheat, maize, millet, oat, sorghum. Anti-nutritional factors and its methods of reduction. Grain storage systems - farm level storage, bagged storage, bulk storage, hermetic storage, outdoor storage. Losses during storage, Grain protection methods – physical and chemical methods. Integrated stored grain pest management.

UNIT V Soft Tools for Modeling of Food Processes 9

Overview of Modified atmospheric storage, Gases and Vapor applied to modified atmosphere processing operations, MAP modelling- Kinetics of food deteriorative reactions, Shelf-life testing, Enzyme kinetics applied to MAP, MAP design with oxygen modeling

Total: 45 Periods

Text Books:
1. Tijskens L.M.M., Hertog T.M. & Nicolai B.M., "Food Process Modeling", 1st Edition, CRC Press, UK, 2001.

References:
1. Babu B.V., "Process Plant Simulation", 1st Edition, Oxford University Press, New Delhi, 2004.
2. Ferruh Erdoˇgdu ., Optimization in Food Engineering., CRC Press., Taylor & Francis Group 6000 Broken Sound Parkway NW, Suite 300 Boca Raton, FL 33487-2742

Web References
1. https://nptel.ac.in/courses/126/103/126103017/
2. https://nptel.ac.in/courses/126/105/126105015/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE20	**Material Science and Technology**	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives
The course is intended to

1. To understand the fundamentals of material science.
2. To impart fundamental understanding at the methods of analysis of substances.
3. To recognize the biocompatible fabric for meals industry.
4. Have a understanding of alloying and its significance in regular existence
5. Recognize the various methods of characterization

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Enumerate the fundamentals of diverse bonds.	Apply
CO2	Understand the importance of strength of material.	Understand
CO3	Understand the knowledge of the imperfections of metals	Remember
CO4	Understand the knowledge of alloying and its importance in everyday life	Understand
CO5	Understand the various methods of characterization.	Understand

Course contents:

Unit I   Introduction to Materials   9

Introduction to materials, bonding between atoms: metallic bonding, ionic bonding, covalent bonding, Van der Waals bond, thermal expansion, elastic modulus and melting point of materials, Role of materials selection in design, structure-property-processing-performance relationships ; Imperfections in solids: vacancies, equilibrium concentration of vacancies, interstitial and substitutional impurities in solids, dislocations, types and characteristics of dislocations, interfacial defects, stacking faults.

Unit II   Strength of Materials   9

Structure of materials and Strength of Materials: Yield strength, tensile strength, Hardness and ductility of materials: stress strain behaviour of metals, ceramics and polymers

Unit III   Fast fracture, Toughness , Fatigue, Creep and Corrosion   9

Micromechanism of fast fracture – Mechanism of crack propogation – Fatigue failure – Fatigue of uncracked and cracked components Creep deformation and creep fracture – Mechanism of creep deformation in metals and designing to lower creep – wet corrosion in materials – Prevention of corrosion

Unit IV   Carbon steels and Alloys   9

Microstructures produced by cooling – Mechanical Properties of normalized carbon steel- Quenched and tempered carbon steels – TTT diagram – Need for alloying – Harden ability and methods – Corrosion resistance – Passivation - Stainless steel and types

UNIT V   Experimental Techniques   9

Introduction to experimental techniques: XRD, NMR, PSA, etc. for material characterization highlighting links between molecular structure and macroscopic properties.

Total: 45 Periods

Text Books:
1. Michael F. Ashby and David R. H. Jones. "Engineering Materials -1. An Introduction to their Properties and Applications", 2002. 2nd Edition. Butterworth-Heinemann. ISBN 0 7506 3081 7.
2. Michael F. Ashby and David R. H. Jones. "Engineering Materials -2. An Introduction to Microstructures, Processing and Design". 2nd Edition. Reprinted 1999. Butterworth-Heinemann. ISBN 0 7506 4019 7.

References:
1. B. S. Mitchell. "An Introduction to Materials Engineering and Science for Chemical and Materials Engineers", 2004. John Wiley & Sons.
2. S. Upadhyaya and A. Upadhyaya, "Material Science and Engineering", 2007.Anshan Publications.

Web References
1. https://nptel.ac.in/courses/113/102/113102080/
2. https://nptel.ac.in/courses/113/107/113107078/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

20FTE21	Applications of Renewable Energy in Food Processing	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives
The course is intended to
1. Enhance energy performance from supply to use
2. Degree and accurate power market failures
3. Facilitate economic integration and cooperation and promote sustainable improvement
4. Ensure that energy manufacturing, conversion and use is value competitive
5. Limit the impact of the energy quarter on the environment from supply to use

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand of renewable and non-renewable sources of energy	Understand
CO2	Gain knowledge about working principle of various solar energy systems	Remember
CO3	Ability to analyze the viability of biomass and alternative energy project	Analyze
CO4	Develop functionality to do fundamental design of bio fuel plant.	Create
CO5	Understand the applications of different renewable energy sources like ocean thermal, hydro, geothermal energy etc	Understand

Course contents:
Unit I   Introduction   **9**
Introduction to energy sources; classification of renewable energy sources, utilization of these sources in food processing sector.

Unit II   Solar Energy   **9**
Solar radiation, measurement of solar radiation, types of solar collectors and their uses; familiarization with solar energy gadgets: solar cooker, solar concentrator, solar dryer, solar steam generator; utilization of solar thermal energy in food processing. Solar photovoltaic cells, modules, arrays, conversion process of solar energy into electricity, applications in food industry

Unit III   Biomass   **9**
Biomass and its characterization; briquetting of biomass. Biomass combustion, pyrolysis, gasification and uses of gasifiers in food industry and biodiesel preparation

Unit IV   Biogas   **9**
Importance of biogas technology, production mechanism, types of biogas plants, uses of biogas, handling & utilization of digested slurry. Use of food waste for biogas generation and its applications.

UNIT V   Other Renewable Energy Resources   **9**
Brief introduction to wind energy, hydroelectric energy, ocean energy, tidal energy, wave energy and hydro- geothermal energy

Total: 45 Periods

Text Books:
1. Rai, G.D. 2013. Non-Conventional Energy Sources, Khanna Publishers, Delhi.
2. Rai, G.D., Solar Energy Utilization, Khanna Publishers, Delh Rai, G.D., Solar Energy Utilization, Khanna Publishers, Delh

References:
1. Tiwari, G.N. and Ghoshal, M.K. 2005. Renewable Energy Resources: Basic Principles and Applications. Narosa Pub. House. Delhi.
2. Rathore N. S., Kurchania A. K., Panwar N. L. 2007. Renewable Energy, Theory and Practice, Himanshu Publications.

Web References
1. https://nptel.ac.in/courses/121/106/121106014/
2. https://nptel.ac.in/courses/103/103/103103206/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment			
Bloom's Category	**Internal Assessment Examinations**		**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

20FTE22	ICT Application in Food Industry	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Trade the subculture of using ICT.
2. Improve self-assurance within the use of ICT for rookies, teachers, school leaders and mother and father.
3. Deepen parental engagement.
4. Reinforce role on hardware and associated infrastructure.
5. Sell new behaviors for teaching.

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the ICT and SCADA.	Understand
CO2	Understand the application of spread sheet in food industries	Remember
CO3	Understand the knowledge about webpage design.	Understand
CO4	Understand the use of MATLAB in food sector.	Understand
CO5	Apply the use of CFD in food industries	Apply

Course contents:

Unit I   Introduction   9

Importance of computerization in food industry, operating environments and information systems for various types of food industries. SCADA systems hardware, firmware, software and protocols, landlines, local area network systems, modems.

Unit II   Spreadsheet   9

Spreadsheet applications: Data interpretation and solving problems, preparation of charts, use of macros to solve engineering problems. Use of add-ins, use of solver

Unit III   Webpage Design   9

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

Unit IV   MATLAB   9

Use of MATLAB in food industry; computing with MATLAB, script files and editor/debugger, MATLAB help system. Problem solving methodologies, numeric, cell, arrays, matrix operations User defined functions, programming using MATLAB; debugging MATLAB programs Applications to simulations; Plotting and model building in MATLAB, X-Y plotting functions, subplots and overlay plots, special plot types, interactive plotting in MATLAB

UNIT V   Computational Fluid Dynamics   9

Introduction to computational fluid dynamics (CFD), governing equations of fluid dynamics; Models of flow, substantial derivative, divergence of velocity, continuity, momentum and energy equations; Physical boundary conditions, discretization; Applications of CFD in food and beverage industry;

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. R. Paul Singh. 2014. Computer Applications in Food Technology: Use of Spreadsheets in Graphical, Statistical and Process Analysis. Academic Press, London.
2. William J. Palm III. 2011. Introduction to MATLAB for Engineers, 3rd Ed. McGraw-Hill Companies, Inc., NY, USA.

References:
1. Nigel Chapman and Jenny Chapman. 2006. Web Design: A Complete Introduction. John Wiley & Sons, USA.
2. David Bailey and Edwin Wright. 2003. Practical SCADA for Industry. Elsevier, Burlington, MA

Web References
1. https://nptel.ac.in/courses/126/104/126104006/
2. https://nptel.ac.in/course.html

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment			
Bloom's Category	**Internal Assessment Examinations**		**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

		L	T	P	C
20FTE23	**Microbial and Food Technology**	3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Understand the microorganisms associated with foods and isolation methods from foods
2. Know the methods of preservation of food products
3. Learn the fermentation process and microorganisms involved in the production of fermented foods

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the microorganisms associated with foods	Understand
CO2	Understand the preservation methods	Understand
CO3	Summarize the microbiology of fermented foods	Understand
CO4	Describe the microbiology of food commodities	Remember
CO5	Evaluate the food borne diseases and intoxication	Apply

Course contents:

 Unit I   Introduction to microorganisms   9

History of microorganisms in food development – microorganisms associated with foods: Bacteria, Molds, Yeast and their importance – Nutritional requirements of bacteria – factors affecting the growth of bacteria in foods – growth curve of bacteria – spoilage and contamination in various food commodities – general microbiological methods of enumeration and isolation of bacteria and fungi – identification of bacteria and fungi by staining methods

 Unit II   Methods of preservation   9

Thermal mode of preservation – pasteurization, sterilization and canning – heat resistance of microorganisms and their spores – spoilage of canned foods and types of spoiled cans – aseptic packaging- low temperature storage

Non-thermal mode of preservation – High pressure processing, microwave, UV and ionizing radiation – use of chemical preservatives, natural food preservatives, applications of probiotics and prebiotics

 Unit III   Microbiology of fermented foods   9

Traditional vegetable fermentation – pickle, sauerkraut, organic acid production – citric acid and Acetic acid, fermentation – alcohol production- beer, wine and fermentation of oriental food products, Introduction and importance of food safety and quality in food industries

 Unit IV   Microbiology of water and food commodities   9

Microbiology of water and their importance in processing of foods in industries, MPN of coliforms, membrane filtration technique. Microbiology of milk, quality testing of milk – phosphate test, methylene blue reduction test, hetero and homo fermentative lactic acid bacteria – yogurt and cheese fermenting organisms

 UNIT V   Food Borne diseases and intoxication   9

Food poisoning and intoxication – food borne diseases – symptoms of disease caused by Bacillus spp., clostridium botulinum, E.coli, salmonella spp, staphylococcus aureus, shigella, hepatitis, gastroenteristis viruses, Entamoeba histolytica, Mycotoxins and Algal toxins

Total: 45 Periods

Text Books:
1. Adams M. R and Moss M.O, Food Microbiology, Panima Publishing corporation,
2nd edition, 2007

References:
1. Sivasankar B, Food Processing and Preservation, 6th edition, Eastern Economy
   Edition, 2009
2. William C Frazier and Dennis C Westoff, Food Microbiology, Springer, 2008

Web References
1. https://wowsooru.wordpress.com/2020/09/29/introduction-to-food-microbiology-presentationppt/
2. https://nptel.ac.in/courses/126/103/126103017/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2		Medium						Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	1
	Attendance	5	5

Summative Assessment			
Bloom's Category	**Internal Assessment Examinations**		**Final Examination (60)**
	IAE – I (7.5)	**IAE – II (7.5)**	**IAE – III (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE24	Application of Nanotechnology and Cryogenic in Food Technology	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Understand the concepts of nanotechnology
2. Know the benefits of nanotechnology in food processing, packaging and food safety
3. Learn the concepts of cryogenic in food industry

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the basics of nanomaterials and its properties	Understand
CO2	Understand the importance of nanotechnology in food processing	Understand
CO3	Understand the importance of nanotechnology in food packaging	Understand
CO4	Understand the concepts of Nano sensors and food safety	Remember
CO5	Discuss the applications of cryogenic in food industry	Apply

Course contents:

Unit I   Introduction to Nanotechnology   9

Introduction – Nanometer scale, Overview of nanomaterial, natural nanomaterial, classification of nanomatrials, history of nanotechnology, basic characterization techniques of nanomaterials, unique properties of nanometrials – mechanical, magnetic, thermal, optical and electrical properties

Unit II   Nanotechnology in Food Processing   9

Nano filtration, Enzyme immobilization, Texture improvement, Color / flavor / aroma enhances, Meat replacers

Unit III   Nanotechnology in Food Packaging   9

Protective packaging – Mechanical and thermal improvement, antimicrobial and antifungal protection, protection from oxygen and other environmental factors, migration potential and biological hazards, health impacts of nano-based biocidal materials

Unit IV   Nanosensors and Food safety   9

Nanosensors – sensor packaging – Sensing biochemical or microbial changes in food, detecting specific gases developing from food spoiling, tracing device for food safety, nanotechnology in quality food assessment, lab-on-chip in food sector, removal of chemicals or pathogens from food

UNIT V   Applications of Cryogenic in Food Industry   9

Introduction to cryogenic, Food processing and preservation, advantages and disadvantages, impact of processing factors on quality of frozen food products

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. M. Rossi, D. Passeri, Nanotechnology for Food Packing and Food Quality Assessment, 2017
2. Alian, An Introduction to Nanoscience and Nanotechnology, Wiley, 2008

References:
1. Dipjyoti Kalita, The Impact of Nanotechnology on Food, 2019
2. Ana C Pinheiro, Advances in Food Nanotechnology

Web References
1. https://www.frontiersin.org/articles/10.3389/fmicb.2017.01501/full
2. https://www.primescholars.com/articles/recent-trends-of-application-of-cryogenics-infood-processing-and- preservation.pdf

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment			
Bloom's Category	**Internal Assessment Examinations**		**Final Examination (60)**
	IAE – I (7.5)	**IAE – II (7.5)**	**IAE – III (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE25	Milling Technology	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives
The course is intended to
1. Enable students to understand different properties of grains
2. Learn milling processes of various cereals
3. Able to understand practical problems and its solutions occurred in milling industries

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Anticipate the different properties of grains	Understand
CO2	Understand the various steps involved in milling process of rice	Understand
CO3	Understand the milling of wheat and corn	Understand
CO4	Understand the process of milling of pulses	Understand
CO5	Understand the importance of oil seeds milling	Understand

Course contents:

Unit I   Introduction To Grain Properties   9

Importance of grains and cereals- definitions, Grain structure, Physicochemical properties of grains and its nutritional value. Storage of cereal grains in relation to maintaining grain quality– types of storage structures.

Unit II   Milling of Rice   9

Rice milling flow sheet. Explanation of steps in milling operations - Cleaning, Parboiling - Physio – chemical changes during Parboiling and effects of qualities of rice. Methods of Parboiling, Milling, Shellers, Paddy Separator, Whitener, Polisher, Grader, and modern rice mill. By products from rice milling and waste utilization.

Unit III   Milling Process of Wheat and Corn   9

Wheat milling flow sheet. Explanation of steps in milling, Cleaning Principles of Parboiling of wheat - Methods of Parboiling, Sifters, De-stoners, Rolle rmilling-Break rolls, and reduction olls, Sifting and purifying, plansifters. Bran separation. Efficiency of milling process. By products from wheat milling and waste utilization. Milling of Corn: Corn– types. Dry and wet milling of corn– flow sheet and explanation, By products from corn milling, cornstarch, corn syrup, cornflakes. Waste utilization.

Unit IV   Milling of Pulses   9

Importance of legumes. Milling and processing of Legumes-Methods of milling of pulses. Processing methods- dehulling losses and effect of dehulling on nutritive value. Grading methods, Cooking quality.

UNIT V   Milling of Oil Seeds   9

Oil seed processing - natural sources of oil. Physio-chemical properties, mechanical extraction - Oil processing machinery, solvent extraction, factor sinfluencing extraction, types of solvents. Refining of oil, hydrogenation, winterization, changes during storage. Oil seed flour concentrates and isolate.

Total: 45 Periods

Text Books:
1. Chakraverty,A.—Post Harvest Technology of Cereals, Pulses and Oil Seeds, Third Edition,
2. Oxford & IBH publishing & Co., NewDelhi, 2000.Sahay,K.M. and Singh.K.K. — Unit operations of Agricultural Processing, Vikas Publishing House, NewDelhi,1996

References:
1. KulpK and PontJG,—Handbook of Cereal Science and Technology, Second Edition, ChipsLtd. USA, 2000.
2. Khader, VijayaandVimala,V., —Grain Quality and Processing, Agrotech Publishing, Udaipur, 2007.

Web References
1. https://nptel.ac.in/content/storage2/courses/112105127/pdf/LM-19.pdf
2. https://nptel.ac.in/content/storage2/courses/112101005/downloads/Module_3_Lecture_5_final.pdf

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE26	**Downstream Processing**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives
The course is intended to
1. Knowledge of students in downstream food processing.
2. Learn the physical methods of separations.
3. Find the suitable isolation methods for food products recovery
4. Learn the safely aspects of product purification process in food industry.
5. Make the product formation and finishing for crystallization and drying operations

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the fundamentals of downstream processing for product recovery	Understand
CO2	Understand the requirements for successful operations of downstream processing	Remember
CO3	Describe the components of downstream equipment and explain the purpose of each	Understand
CO4	Apply principles of various unit operations used in downstream processing and enhance problem solving techniques	Apply
CO5	Apply the principles of product formation and finishing operations	Apply

Course contents:
Unit I   Introduction Downstream Processing   9
Introduction to downstream processing, principles, characteristics of biomolecules and bioprocesses. Cell disruption for product release – mechanical, enzymatic and chemical methods. Pretreatment and stabilization of bio products.

Unit II   Physical Methods of Separation   9
Unit operations for solid-liquid separation - filtration and centrifugation.

Unit III   Isolation of Products   9
Adsorption, liquid-liquid extraction, aqueous two-phase extraction, membrane separation – ultrafiltration and reverse osmosis, dialysis, precipitation of proteins by different methods.

Unit IV   Product Purification   9
Chromatography – principles, instruments and practice, adsorption, reverse phase, ion exchange, size exclusion, hydrophobic interaction, bio-affinity and pseudo affinity chromatographic techniques.

UNIT V   Final Product Formulation and Finishing Operations   9
Crystallization, drying and lyophilization in final product formulation.

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Belter, P.A., E.L. Cussler and Wei-Houhu "Bioseparations – Downstream Processing for Biotechnology", John Wiley, 1988.
2. Sivasankar, B. "Bioseparations: Principles and Techniques". PHI, 2005.

References:
1. Ghosh, Raja "Principles of Bioseparations Engineering". World Scientific, 2006
2. "Product Recovery in Bioprocess Technology". (BIOTOL – Biotechnology by Open Learning

Web References
1. https://nptel.ac.in/courses/102/106/102106022/
2. https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-bt04/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment			
Bloom's Category	**Internal Assessment Examinations**		**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

20FTE27	Creativity, Innovation and New Food Product Development	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Acquire the knowledge on basics of new product development
2. Acquaint the creativity and innovation required to develop a new product
3. Analyze the prerequisites and planning necessary to develop a new product
4. Learn the various steps involved in product development
5. Describe the various laws and IPR needed to develop a new product

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Apply the idea of developing a new product.	Apply
CO2	Create to innovate different food products	Understand
CO3	Identify the prerequisites and ideas required for developing a new product	Remember
CO4	Explain different techniques and steps involved in developing a new product	Understand
CO5	Apply the different laws and IPR's in product development	Apply

Course contents:

Unit I   Introduction   9
Defining and Characterizing New Food Products - New Products - Creative and innovative products - Value added products- Markets and Market places-Product life cycle-opportunities of new product

Unit II   Creativity And Innovation   9
Definition-Research for creativity-Characterizing research-Organizing for Creative Research-Tool for Creativity- Creative products-Definition of innovation- Constraints of innovation-Ideation-Formulation-Communication-Innovative products

Unit III   New Product Planning   9
Design of proto type - testing - quality standards - marketing research - introducing new products- New product ideas-Guidelines of ideas-general techniques-Data mining-Social networking of ideas-internal ideas for product development-Criteria for screening ideas-applying criteria

Unit IV   New Product Development   9
Defining and Characterizing New Food Products- Food receipe formulation- Spoilage and Public Health Concerns - Product preparation-Testing- evaluation of cost estimation--Strategy and Strategists-Bench marking-Market research-Marketing, Case study- Formulation of functional foods

UNIT V   Legal Laws and Rights   9
Research and new product development - Patents - Patent search - Patent laws – International code for patents - Intellectual property rights (IPR).

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Gordon W. Fuller "New Food Product Development-From concept to market place", CRC press.,2011
2. Khandwalla, N. – "Fourth Eye (Excellence through Creativity) - Wheeler Publishing", 1992.

References:
1. Twiss, Brian. "Managing Technological Innovation", Pitman Publishing Ltd., 1992.
2. Watton, Harry B. "New Product Planning", Prentice Hall Inc., 1992.

Web References
1. https://nptel.ac.in/courses/102/106/102106022/
2. https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-bt04/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE28	**Renewable Energy Technology**	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. To encourage the preferential use of renewable energy
2. Facilitate Research and Development in renewable energy and energy efficiency
3. Disseminate information on renewable energy and energy efficiency
4. To behave as a consultative frame on problems related to renewable energy markets.
5. To lobby on the strategic issues affecting the development of a renewable energy sector

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the need of energy conversion and the various methods of energy storage	Understand
CO2	Give an explanation for the sphere applications of solar energy	Understand
CO3	Pick out winds energy as alternate shape of strength and to realize the way it may be tapped	Remember
CO4	Provide an explanation for bio gas generation and its impact on surroundings	Apply
CO5	Understand the Geothermal &Tidal energy, its mechanism of production and its applications	Understand

Course contents:

Unit I   Energy Conservation & Storage   9

Energy- Energy Sources & their Availability - Importance of Renewable Energy Resources - Principles of energy conservation- Energy storage- Necessity of energy storage-Energy storage methods-Mechanical Energy storage - Pumped storage-Compressed air storage Electrical Storage -Lead Acid Battery -Chemical Storage -Energy storage via hydrogen - Electromagnetic energy storage.

Unit II   Solar Energy   9

Solar energy - Introduction-Solar constant- Solar Radiation at the Earth's surface measurements of solar radiation- pyronometer- pyrheliometer- sunshine recorder –Solar collectors-Classification-liquid flat plate collector-construction- effect of various parameter on its performance-Concentrating collector-Focusing and non-focusing type-Applications of Solar Energy - solar water heater- Cooker-Box type-Solar dryer-greenhouse— Summer & winter greenhouse-solar electric power generation- photovoltaic.

Unit III   Wind Energy   9

Introduction- Basic Principles of Wind energy conversion-The nature of wind- The power in the wind (No derivations)- Forces on the Blades (No derivations)-Site Selection considerations-Basic components of a wind energy conversion system (WECS)-Advantages & Limitations of WECS-Wind turbines (Wind mill)-Horizontal Axis wind mill-Vertical Axis wind mill-performance of wind mills-Environmental aspects

Unit IV   Biomass Energy   9

Introduction- Biomass conversion techniques-Biogas Generation-Factors affecting biogas Generation-Types of biogas plants- Advantages & disadvantages of biogas plants-urban waste to energy conversion-MSW plant

UNIT V   Geo Thermal & Tidal Energy.   9

Geothermal Sources-Hydro thermal Sources- a. Vapor dominated systems b. Liquid dominated systems – Prime movers for geothermal energy conversion-Tidal Energy-Basic Principles of Tidal Power-Components of Tidal Power Plants- Schematic Layout of Tidal Power house-Advantages & Limitations of Tidal power

Total: 45 Periods

Passed in Board of studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Grewal B.S, "Higher Engineering Mathematics",Khanna Publishers, 44th Edition,2019
2. Veerarajan.T,"Engineering Mathematics for Semester I and II",Tata McGraw Hill,3rd Edition,2014

References:
1. RamanaB.V,"Higher Engineering Mathematics",TataMcGrawHillCompany, 1st Edition,2018
2. Bali.N.P and ManishGoyal N.P, "A text book of Engineering Mathematics", Laxmi Publications, 6th Edition,2015

Web References
1. https://www.youtube.com/watch?v=r9q80sSHxKM x.
2. https://www.youtube.com/watch?v=GZKKWz_tX1c xi

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium						Low			

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment			
Bloom's Category	**Internal Assessment Examinations**		**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE29	**Functional Foods & Nutraceuticals**	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Food chemistry and nutrition				

Course Objectives

The course is intended to

1. To familiarize the students with the field of functional foods and nutraceuticals.
2. Students will have the knowledge about the functional components of the food and regulatory framework required for regulatory approval of functional foods and Nutraceuticals.
3. This course is designed to evaluate examples of scientific evidence supporting value-added functional foods or nutraceutical supplementation for chronic disease prevention.

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Understand the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction	Understand
CO2	Differentiate between different classes of Nutraceuticals	Understand
CO3	Understand the role of functional properties ot human health	Understand
CO4	Explain regulatory aspects of nutraceuticals and functional foods	Remember
CO5	Apply the knowledge of nutraceuticals and functional foods in food industries.	Apply

Course contents:

Unit I   Introduction and significance of functional foods and nutraceuticals   9

Introduction to Nutraceuticals and functional foods; importance, history, definition, classification, list of functional foods and their benefits; Food and non-food sources of nutraceutical factors

Unit II   Functional properties of Nutraceuticals   9

Properties and functions of various nutraceuticals such as lycopene, isoflavonoids, prebiotics and probiotics, glucosamine, phytosterols, free radicals, mushroom extracts, concept of antioxidants. Quantitative and qualitative analysis methods of phytochemicals

Unit III   Functional foods and health   9

Colonic functional foods, Coronary heart disease, Anti-tumour properties, Functional foods and acute infections: probiotics and gastrointestinal disorders

Unit IV   Developing functional food products   9

Maximising the functional benefits of plant foods, Functional fats and spreads, Functional confectionery, Probiotic functional foods, Dietary fibre functional products

UNIT V   Safety concerns related to nutraceuticals   9

Nutraceuticals stability concerns and shelf life testing; Marketing and regulatory issues for nutraceutical and functional foods : Evolution of a Marketing Environment for Functional Foods and Nutraceuticals, Introduction to Consumer Marketing Issues for Nutraceuticals and Functional Foods, Potential Product Positioning.

Total: 45 Periods

Text Books:
1. Robert EC. 2006. Handbook of Nutraceuticals and Functional Foods. 2nd Ed. Wildman.
2. Gibson GR & William CM. 2000. Functional Foods - Concept to Product.

References:
1. Shi J. (Ed.). 2006. Functional Food Ingredients and Nutraceuticals: Processing Technologies. CRC Press.
2. Webb GP. 2006. Dietary Supplements and Functional Foods. Blackwell Publ

Web References
1. http://biotechjournal.in/images/paper_pdffiles/Fun-5d3196efd9d79.pdf
2. https://faculty.ksu.edu.sa/sites/default/files/lectute_1_457_0.pdf

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2		Medium						Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment			
Bloom's Category	**Internal Assessment Examinations**		**Final Examination (60)**
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTE30	**Instrumental Techniques in Food Analysis**	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Understand the fundamentals of chromatography and spectroscopy principles, instrumentation and advantages and disadvantages of the techniques
2. Perform data acquisition, interpret measurements and perform qualitative and quantitative analysis on selected foods.
3. Understand matrix effects.
4. Evaluate the performance of these techniques for rapid and routine analysis as compared to reference methods.
5. Be capable of designing and conducting experiments and encourage critical thinking.

Course Outcomes

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

Sl. No.	Course Outcome	Bloom's Level
CO1	Apply the idea of theoretical aspects of spectroscopy.	Apply
CO2	Understand the different operations in liquid chromatography.	Understand
CO3	Understand the correct of HPLC & GC	Understand
CO4	Explain an immunochemical analytical work-flow to acquire data and achieve the research objectives of their project.	Remember
CO5	Apply the knowledge and able to Perform experimental innovative analytical technique.	Apply

Course contents:

Unit I   Spectroscopy   9

Fundamental principles, spectral behavior, difference derivative and fluorescence spectroscopy, mass spectroscopy (MS), infrared (IR) spectroscopy, Raman spectroscopy, instrumental parameters.

Unit II   Liquid chromatography   9

Basis of chromatography (mobile and stationary phases, the separation process, resolution, characteristics of the chromatographic peak), size exclusion, ion exchange, basic affinity, and metal chelate affinity chromatography.

Unit III   High performance liquid chromatography (HPLC) and gas chromatography (GC) 9

Concepts and principles, methodology, instrumentation and applications; HPLC-UV/diode array detector, HPLC-MS, HPLC-MS/MS, GC-flame ionization detector, GC-MS, GC-olfactometry, GC-IR.

Unit IV   Immunochemical techniques   9

Definitions and basic immunological principles, polyclonal and monoclonal antibodies, precipitation techniques, radioimmunoassays and enzyme immunoassays, antigen-antibody interactions, enzymatic labels, amplification systems, applications.

UNIT V   Innovative analytical tools   9

Microfluidic "lab-on-a-chip", nanotechnology and biosensor, colorimetric sensor, quantum dot, advanced materials (graphene, metal-organic framework, molecularly imprinted polymers).

Total: 45 Periods

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Text Books:
1. Frazier, R. A., Ames, J.M. and Nursten, H.E. (Eds.). 2000. Capillary electrophoresis for food analysis: method development. Cambridge: The Royal Society of Chemistry. 127 p.UBC Woodward Library
2. Horwitz, W. and Latimer, G.W. (Eds.). 1998. Official methods of analysis of AOAC International. 16th ed. Gaithersburg: AOAC International.UBC Woodward Library

References:
1. MacRae, R. (Ed.). 1988. HPLC in food analysis. London: Academic Press.UBC Woodward Library (TX541.H25.1988)
2. Nielsen, S.S. (Ed.). 2003. Food analysis. 3rd ed. Gaithersburg: Aspen Publishers Inc.UBC Woodward Library (TX545.F54 2003), 2003.

Web References
1. https://egyankosh.ac.in/bitstream/123456789/12395/1/Unit-13.pdf
2. https://link.springer.com/referenceworkentry/10.1007/978-3-642-41609-5_18-1

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		1	2	1						1		
CO2	2	2	2	2									2		
CO3	2	2	2		2	1	2						1		
CO4	2	2	2	1	1	1	2						2		
CO5	1	2	2	2	1		2						1		
	3	High			2	Medium							Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20FTA05	Health Fitness	L	T	P	C
		1	0	0	1
Nature of Course	Physical fitness and wellbeing				
Pre requisites	Nil				

Course Objectives

The course is intended to
1. To introduce the fundamental concepts of physical fitness, health and wellness.
2. To provide a general understanding on nutrition, yoga and stress management.

Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO1	Create consciousness among students towards health, fitness and maintaining healthy lifestyle.	Understanding
CO2	Familiarize students about lifestyle diseases and its management through health and yoga.	Apply

Course Contents:

Unit –I   Introduction to Health and Fitness   8

Definition, Objectives, Importance and scope of Health Fitness. Modern concept of Health, Physical Fitness and Wellness. Physical Fitness components: Speed, Strength, Endurance, Flexibility and Coordinative abilities. Types of Health Fitness: Health related physical Fitness; performance related physical Fitness, Cosmetic Fitness.

Unit –II   Exercise, Yoga , Stress and Lifestyle disease managements   7

Activities for learning physical fitness components, Nutritional balance. Yoga Asana's and its effects. Stress management and relaxation techniques. Lifestyle diseases and its management; Health related physical fitness tests and assessments. BMI, BMR, Pulse rate and Blood pressure.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme SpecificOutcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3		2	3							2	1	3	
CO2	2	3		2	3							2	1	3	
	3	High			2		Medium				1		Low		

Summative assessment (Internal Mode)		
Bloom's Level	Assessment 1	Assessment 2
Remember	10	10
Understand	10	10
Apply	30	30
Analyse		
Evaluate		
Create		

20FTA06	Social Psychology	L	T	P	C
		1	0	0	1
Nature of Course	Social facilitation				
Pre requisites	Nil				

Course Objectives

The course is intended to
1. Develop an understanding of the nuances of the social world as well as different perspectives on relations between individual and society.
2. Introduce students to the realm of social influence and behaviour, as to how individuals think, feel and behave in social situations.

Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO1	Understand the various causes for social behavior and thoughts.	Understanding
CO2	Gives understanding about responding to social perception, cognition, attitudes, aggression and personal behavior.	Understanding

Course Contents:

Unit –I   Psychology of the Social, Interaction and Influence   8

The meaning of 'social'; Key assumptions and approaches to social psychology; Overview of the history of social psychology (including India); Relationship with sociology and anthropology; Areas of application: Health, Law, and Workplace. Social psychology and sustainable future. Interpersonal attraction, Pro-Social Behaviour, Aggression, Social influence.

Unit –II   Understanding and evaluating the social world, Group Dynamics   7

Self and its processes: Self-concept, Self-esteem, and self-presentation; Social identity and its functions. Social Cognition, Social perception, Attitudes, Attitude-behaviour link; Strategies for attitude change. Aggressions, Nature of groups, Consequences of belonging - performance, decision making, cooperation and conflict. Nature of intergroup relations- prejudice, inter-group conflict, Intervention techniques.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme SpecificOutcomes (PSOs)															
	Pos												**PSOs**		
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3		2	3							2	1	3	
CO2	2	3		2	3							2	1	3	
	3	High			2		Medium				1		Low		

Summative assessment (Internal Mode)		
Bloom's Level	**Assessment 1**	**Assessment 2**
Remember	10	10
Understand	10	10
Apply	30	30
Analyse		
Evaluate		
Create		

Passed in Board of studies Meeting
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting
CHAIRMAN - ACADEMIC COUNCIL

Equipment Needed for 30 Students

Refrigerator	2
Sedimentation cylinder	1
Deck oven	1
Dough mixer	3
Fermentation cabinet	1
Humidity chamber	1
Hunter calorimeter	1
Cake & candy moulds	10
Farinograph	1
Extensograph	1
Egg beater	3
Texture analyzer	1
Weighing balance	1

REFERENCES / MANUALS/SOFTWARE:

- Sugar Confectionery manufacture-(Ed) E.B.Jackson, II edition. Blackie Academic and professional, Glasgow(1995).

FD8701   **DAIRY PROCESS TECHNOLOGY**   **L T P C**
                                                                        3 0 0 3

OBJECTIVE:

- To introduce the students to dairy industry, properties and processing of milk, manufacture of dairy products, sanitation and effluent treatment in dairy industry

UNIT I   PROPERTIES OF MILK   7
Milk-Types-Composition-Physical-Chemical and Thermal Properties-Heat Capacity, Density-Freezing-Boiling point-Expansion-Agitation-Viscosity-Classification of milk Market and Special Milk Handling-effects of Merits on Milk-toxicity of metals.

UNIT II   PROCESSING AND QUALITY PARAMETERS OF MILK   10
Processing of Milk- Pasteurization-HTST, UHT, sterilization, Homogenization, Filtering and Clarification of Milk-cream separation-Methods and Equipment's-Emulsification – Fortification, packaging of milk and milk products, judging and grading of milk, national and international standards of milk and milk products.

UNIT III   MILK PRODUCTS   12
Traditional dairy products, Manufacturing of Yogurt, Cheese, Butter, Ghee, Ice-cream, malted products, evaporated milk products - properties, Classification-processing Methods, Equipment used, standards and quality parameters.

UNIT IV   MILK POWDER PROCESSING AND MILK SUBSTITUTES   9
Processing of Milk Powder- Composition - Properties- methods of drying, substitutes for milk and milk products – casein, lactose and other by-products, weaning foods, therapeutic foods, fortification and enrichment.

UNIT V   STORAGE SANITATION AND EFFLUENT TREATMENT   7

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

TOTAL: 45 PERIODS

OUTCOME:

- The students will gain knowledge about dairy processing and understand the manufacturing processes of various dairy products

TEXT BOOKS:

1. Ananthakrishnan, C.P., and Sinha, N.N., "Technology and Engineering of Dairy Plant Operations, Laxmi Publications, New Delhi, 1984.
2. Warner, J.N., "Principles of Dairy Processing", Wiley Eastern Pub. Co., New York, 1975.
3. Walstra, P., "Diary Technology: Principles of Milk Properties and Processes". Marcel Dekker, 1999
4. Spreer, Edgar "Milk and Diary Product Technology". Marcel Dekker, 2005.

REFERENCES:

1. Tufail Ahmed., "Dairy Plant Engineering and Management", KitabMahal Publishers, Allahabad, 1997.
2. Lampert, Lincoln M. "Modern Dairy Products: Composition, Food Value, Processing, Chemistry, Bacteriology, Testing, Imitation Dairy Products". Chemical Publishing Company, 1998.
3. Selia, Jane dos Reis Coimbra and Jose A. Teixeir "Engineering Aspects of Milk and Dairy Products". Jane Selia dos Reis Coimbra & Jose A. Teixeir, CRC Press, 2009

FD8702	FOOD SAFETY, QUALITY AND REGULATION	L T P C
		3 0 0 3

OBJECTIVES:

- To characterize different type of food hazards, physical, chemical and biological in the industry and food service establishments
- To help become skilled in systems for food safety surveillance
- To be aware of the regulatory and statutory bodies in India and the world
- To ensure processed food meets global standards

UNIT I 10

Introduction to food safety and security: Hygienic design of food plants and equipments, Food Contaminants (Microbial, Chemical, Physical), Food Adulteration (Common adulterants), Food Additives (functional role, safety issues), Food Packaging & labeling. Sanitation in warehousing, storage, shipping, receiving, containers and packaging materials. Control of rats, rodents, mice, birds, insects and microbes. Cleaning and Disinfection, ISO 22000 – Importance and Implementation

UNIT II 8

Food quality: Various Quality attributes of food, Instrumental, chemical and microbial Quality control. Sensory evaluation of food and statistical analysis. Water quality and other utilities.

UNIT III 9

Critical Quality control point in different stages of production including raw materials and processing materials. Food Quality and Quality control including the HACCP system. Food inspection and Food Law, Risk assessment – microbial risk assessment, dose response and exposure response modelling, risk management, implementation of food surveillance system to monitor food safety, risk communication

UNIT IV 9

Indian and global regulations: FAO in India, Technical Cooperation programmes, Bio-security in Food and Agriculture, World Health Organization (WHO), World Animal Health Organization (OIE), International Plant Protection Convention (IPPC)

UNIT V 9

Codex Alimentarius Commission - Codex India – Role of Codex Contact point, National Codex contact point (NCCP), National Codex Committee of India – ToR, Functions, Shadow Committees etc.

TOTAL: 45 PERIODS

OUTCOMES:
- Thorough Knowledge of food hazards, physical, chemical and biological in the industry and food service establishments
- Awareness on regulatory and statutory bodies in India and the world

REFERENCES:
1. Handbook of food toxicology by S. S. Deshpande, 2002
2. The food safety information handbook by Cynthia A. Robert, 2009
3. Nutritional and safety aspects of food processing by Tannenbaum SR, Marcel Dekker Inc., New York 1979
4. Microbiological safety of Food by Hobbs BC, 1973
5. Food Safety Handbook by Ronald H. Schmidt, Gary E. Rodrick, A John Wiley & Sons Publication, 2003

FD8703 **FOOD PACKAGING TECHNOLOGY** **L T P C**
3 0 0 3

OBJECTIVE:
- The course aims to develop the knowledge of students in the area of packaging of foods and the related technology used. This course will enable students to appreciate the application of scientific principles in the packaging of foods.

UNIT I **BASICS OF PACKAGING** 6
Packaging –Concepts, definition, Significance, classification. Packaging – Development, Retail/Unit; Packaging of foods –fresh and processed

UNIT II **PACKAGING MEDIA & MATERIALS** 12
Primary packaging media – Properties and application, Paper boards, metals, plastics, wood and plywood, glass, flexible materials Labels, caps and closures and adhesives, inks and lacquers, cushioning materials, reinforcements; Testing & evaluation of packaging media – retail packs & transport packages

UNIT III **PACKAGING SYSTEMS AND METHODS** 12

Vacuum packaging, gas flush packaging, CAP & MAP, aseptic & retort packaging, box in box. Food products-General classification and packaging types, varieties and trends Storage handling and distribution of packages-including pallets & containers; Modern methods of packaging.

UNIT IV   PACKAGING DESIGN   7
Food marketing and role of packaging; Packaging aesthetic and graphic design; Packaging – Laws and regulations

UNIT V   ENVIRONMENTAL ISSUES IN PACKAGING   8
Coding and marking including bar coding and Environmental, ecological & Economic issues, recycling and waste disposal.

TOTAL: 45 PERIODS

OUTCOMES:

To gain knowledge on
- The different types of materials and media used for packaging foods.
- Hazards and toxicity associated with packaging materials and laws, regulations and the monitoring agencies involved food safety, labelling of foods
- Methods of packaging, shelf life and food factors affecting packaging

TEXT BOOKS:
1. Robertson, G.L. "Food Packaging: Principles and Practice". 2nd Edition. Taylor & Francis, 2006.
2. Han, Jung H. "Innovations in Food Packaging". Elsevier, 2005.
3. Ahvenainen, Raija. "Novel Food Packaging Techniques". Wood Head Publishing, 2003.
4. Mathlouthi, M. "Food packaging and Preservation". Aspen Publications, 1999.

FD8711	TESTING OF PACKAGING MATERIALS	L T P C
	LABORATORY	0 0 4 2

OBJECTIVES:

To develop skills related to
- Testing methods for packaging materials to assure quality
- Use of various techniques to check the barrier properties of packaging materials to avoid contamination

EXPERIMENTS:
1. Testing of physical/mechanical properties of food packaging material .
2. Testing of thermal shock resistance of glass .
3. Gas/Vacuum packaging of foods and shelf life studies.
4. Determination of Water Vapor Transmission rate of Packaging Material.
5. Determination of grease resistance of papers used in food industry – butter paper& toffee wraps.
6. Determination of adhesive test of tapes
7. Determination of drop test using food packets
8. Estimation of water absorption test in paper based materials
9. Experiment on sealing of plastic cups
10. Experiment on retort packing
11. Edible packaging of Food Samples.

12. Study of Sorption Isotherm for Food Package Design.
13. Packaged food cut-out analysis.

. **TOTAL: 60 PERIODS**

Equipment Needed for 30 Students

Tensile testing machine digital	1
Wall thickness gauge	1
Friction tester	1
Puncture resistance tester	1
Modified Atmospheric cum Vacuum Packaging machine	1
Moisture meter	1
Drop tester	1
Pouches	1
Heat sealer	1
Freshness tester	1
Retort processor	1

OUTCOME:

- On the completion of the course, the students will able to get experience on testing food packaging materials to assure quality of foods.

TEXT BOOKS:

1. Robertson,G.L. "Food Packaging: Principles and Practice (2nd Edn). Taylor &Francis.2006.

REFERENCES:

1. Han,J.H. " Innovations in Food Packaging". Elsevier Academic Press,2005.
2. Ahvenainen,R. " Novel Food Packaging Techniques". CRC Press. 2003.
3. Coles,R., McDowell,D. and Kirwan,M.J. " Food Packaging Technology". CRC Press.2003.

FD8712   DAIRY PROCESS TECHNOLOGY LABORATORY   L T P C
**   0 0 4 2**

OBJECTIVES:

To develop skills related to

- Preservation and analytical techniques in milk and milk products
- Use of various techniques and additives for milk product processing and quality analysis

EXPERIMENTS:

Properties of milk

1. Analysis of milk
2. Platform test - Methylene Blue Reduction Test, clot on boiling test
3. Determination of protein in milk by formol titration (pynes method)
4. Determination of lactose content of milk by polarimeter
5. Estimation of milk fat by Gerber method or Milko tester
6. Phosphatase test
7. Determination of adulterant and preservatives of milk
8. Efficiency of sterilization in preparation of sterilized milk by turbidity test.
9. Determination of redox potential, acidity and pH of milk
10. Determination of viscosity, density and specific gravity of milk

Milk products and Quality Analysis

11. Preparation and analysis of Yoghurt
12. Preparation and analysis of Cottage cheese
13. Preparation and analysis of Ice-cream/ Cream
14. Preparation and analysis of Butter/ Ghee

TOTAL: 60 PERIODS

Equipment Needed for 30 Students

Gerber centrifuge	1
Butyrometer	15
Lactometer	4
Water bath	4
Refractometer	3
Polarimeter	1
Milko tester	1
pH meter	3
Deep freezer	1
Heating mantle	5
Thermometer	3
Weighing balance	2
Kjeldhal apparatus	1
Lovi bond comparator disc	1
Laminar air flow chamber	1
Incubator	1
Blast freezer	1
Homogeniser	1

OUTCOME:

- On the completion of the course, the students will able to get experience on dairy process technology.

REFERENCES:

1. Ralph Early, "Technology of Dairy Products" Springer Science & Business Media, 1998
2. Edgar R. Ling, "Textbook of Dairy Chemistry", Vol II, London, 1945

UNIT IV   SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT   9

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - **Sustenance -**Maintenance and Repair – Enhancements - **Product EoL -** Obsolescence Management – Configuration Management - EoL Disposal

UNIT V   BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY   9

The Industry - Engineering Services Industry - Product Development in Industry versus Academia –**The IPD Essentials -** Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

TEXTBOOKS:
1. Book specially prepared by NASSCOM as per the MoU.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.

REFERENCES:
1. Hiriyappa B, "Corporate Strategy – Managing the Business", Author House, 2013.
2. Peter F Drucker, "People and Performance", Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, "Enterprise Resource Planning – Concepts", Second Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013

FD8018	MANAGEMENT OF FOOD WASTE	L T P C
		3 0 0 3

OBJECTIVES:
- Importance of treating waste product from food industry.
- Treatment methods and recycling of waste product from food industry.

UNIT I   CLASSIFICATION & CHARACTERIZATION OF FOOD INDUSTRY WASTE   8

Classification and characterization of waste from various food industries; Need for treating waste from various food industries.

UNIT II   WASTE FROM MEAT, DAIRY AND VEGETABLE PROCESSING INDUSTRY   9

Classification, analysis and disposal of waste from meat; Bioremediation and utilization of dairy waste. Treatment of water from fruit and vegetable processing industry

UNIT III TREATMENT METHODS OF WASTE FROM FOOD INDUSTRY 9

Treatment methods for liquid waste from food industry; Design of activated sludge process, bioremediation, trickling filter process and Anaerobic Digestion Treatment methods for solid waste from food industry-drying, incineration and Design of solid waste management.

UNIT IV RECYCLING AND UTILIZATION OF WASTE PRODUCT FROM FOOD INDUSTRY 10

Treatment of water from food industry -BOD, COD, RO. Recovery of protein from potato starch plant, utilization of molasses, utilization of waste from meat and fish for live stock and poultry.

UNIT V REGULATORY ISSUES WITH FOOD INDUSTRY WASTE 9

International and national scenario on disposal of waste from food industries; Regulatory issues with food industry waste

TOTAL: 45 PERIODS

OUTCOMES:

- Awareness of Importance in treating waste product from food industry.
- Knowledge of Treatment methods and recycling of waste product from food industry

TEXT BOOKS:

1. Herzka, A. and Booth, R.G. "Food Industry and Trade: Recycling Waste". Applied Science Publishers, 1981.
2. Tegge, G., Green, J. H., and A. Kramer. "Food Processing Waste Management;: AVI Publishing, 1979 .

REFERENCES:

1. VassoOreopoulou and Winfried Russ. "Utilization of by-products and Treatment of Waste in the Food Industry". Springer, 2007.
2. Ioannis S. Arvanitoyannis. "Waste Management for the Food Industries". Academic Press, 2008.

FD8019	FOOD SAFETY MANAGEMENTSYSTEMS	L T P C
		3 0 0 3

OBJECTIVE:

To enable the students to

- To understand the rules and regulations given by different food authority around the world to maintain food quality and safety.

UNIT I 10

Introductiontofoodsafetyandsecurity:Hygienicdesignoffoodplantsandequipments,FoodContaminants(Microbial, Chemical, Physical), Food Adulteration(Common adulterants),Food Additives(functional role, safety issues), Food Packaging & labeling. Sanitation in warehousing, storage, shipping, receiving, containers and packaging materials. Controlofrats, rodents, mice, birds, insects and microbes. Cleaning and Disinfection, ISO22000–Importance and Implementation

UNIT II 8

Food quality: Various Quality attributes of food, Instrumental, chemical and microbial Quality control. Sensory evaluation of food and statistical analysis. Water quality and other utilities.

TEXT BOOK:

1. Yanyun Zhao "Specialty Foods: Processing Technology, Quality, and Safety", CRC Press, 2012

REFERENCES:

1. Steve Taylor, "Advances in Food and Nutrition Research", Volume 49, Elsevier Inc. ,2005
2. Parvinder S. Bali, "Food Production Operation", Oxford University, 2014

FD8013	ENTREPRENEURSHIP	L T P C
		3 0 0 3

UNIT I 9
• Should You Become an Entrepreneur?
• What Skills Do Entrepreneurs Need?
• Identify and Meet a Market Need
• Entrepreneurs in a Market Economy
• Select a Type of Ownership

UNIT II 9
• Develop a Business Plan

UNIT III 9
• Choose Your Location and Set Up for Business
• Market Your Business
• Hire and Manage a Staff

UNIT IV 9
• Finance, Protect and Insure Your Business
• Record Keeping and Accounting
• Financial Management

UNIT V 9
• Meet Your Legal, Ethical, Social Obligations
• Growth in Today's Marketplace

TOTAL: 45 PERIODS

TEXT BOOK

1. Entrepreneurship Ideas in Action—South-Western, 2000.

FD8014	BEVERAGE TECHNOLOGY	L T P C
		3 0 0 3

OBJECTIVE:

• The course aims to gain knowledge on machinery and process involved in beverage technology and fermentation process involved in making beverage process

UNIT I   BASIC INGREDIENTS IN BEVERAGES 9

Beverage-definition-why we drink beverages-ingredients- water, carbon dioxide, bulk and intense sweeteners, water miscible and water dispersible flavouring agents, colours – natural and artificial,

Micro and nanoemulsions of flavors and colors in beverages, preservatives, emulsifiers and stabilizers.

UNIT II   BEER AND WINE MANUFACTURE   9
Ingredients- Malt- hops- adjuncts- water, yeast. Beer manufacturing process, distillation, malting, preparation of sweet wort, brewing, fermentation, pasteurization and packaging. Beer defects and Spoilage.Wine-fermentation-types –red and white. Wine defects and spoilage

UNIT III   CARBONATEDBEVERAGES   9
Procedures- carbonation equipments-ingredients-preparation of syrups-Filling system-packaging-containers and closures

UNIT IV   NON CARBONATED BEVERAGE   9
Coffee bean preparation-processing-brewing-decaffeination- instant coffee-Teatypes- black, green and oolong- fruit juices, nectars, quash, RTS beverages, isotonic Beverages. Flash pasteurization, Canning and Aseptic Packaging of beverages

UNIT V   QUALITYCONTROL   9
Effective application of quality controls, brix, acidity to brix ratio, single strength of juice- sanitation and hygiene in beverage industry-Quality of water used in beverages - threshold limits of various ingredients according to PFA, EFSA and FDA – Absolute requirements of Soluble solids and titrable acidity in beverages.

OUTCOMES:
  On completion of the course the students are expected to
   • Be able to understand various concepts, principles and procedures involved in processing of beverages.
   • Demonstrate various unit operations involved in the food beverage manufacturing.
   • List the quality control steps in beverage preparation.

TEXT BOOKS:
   1. Ashurst, P.R, "Chemistry and technology of Soft drink and fruit juices", 2nd edition, Blackwell Publishing Ltd. 2005.
   2. Steen, D.P and Ashurst, P.R, "Carbonated soft drinks – Formulation and manufacture", Blackwell Publishing Ltd. 2000.
   3. Shankunthala Manay, N. and Shadakdharaswamy, M, "Foods – Facts and Principles", New Age International Pvt. Ltd, 3rd revised edition 2000.
   4. Charles, W.Bamforth, "Food, fermentation and microorganisms", Blackwell Science Publishing Ltd. 2005.

REFERENCES:
   1. Amalendu Chakraverty et al, "Handbook of Post Harvest Technology", Ed:.,Marcel Dekker Inc. (Special Indian edition) 2000.
   2. Robert.W.Hutkins, "Microbiology and Technology of Fermented foods", IFT Press, Blackwell Publishing Ltd. 2006.
   3. "Brewing yeast and fermentation Chris Boulton and David Quain", Blackwell Science Ltd
   4. "Prevention of Food Adulteration Acts and Rules Manual"

OBJECTIVE:
* To objective of the project is to make use of the knowledge gained by the student at various stages of the degree programme.

The students are assigned project work related to product / process development, solution to the technical problems in industry and current research at national and international level. The student is required to submit a report at the end of semester based on the findings. The evaluation is made as per the Regulations of University.

FD8001   **BIOLOGY AND CHEMISTRY OF FOOD FLAVOURS**   **L T P C**
3 0 0 3

OBJECTIVES:
* To understand the flavour compounds involved in development of flavor
* To understand the analytical techniques involved in flavor analysis

UNIT I   INTRODUCTION   9
Problems in flavour research – classification of food flavours; chemical compounds responsible for flavour.

UNIT II   FLAVOUR COMPOUNDS   9
Chemical compound classes and their flavour responses; flavour development during biogenesis, flavour development during food processing; use of biotechnology to develop flavours.

UNIT III   THE CHEMICAL SENSES   9
Anatomy of the chemical senses; neural development of the chemical senses; receptor mechanisms, neural coding; the control of eating.

UNIT IV   FLAVOUR ANALYSIS   9
Subjective versus Objective methods of analysis; psychophysics and sensory evaluationand its types, ENOSE, ETONGUE; Instrumental analysis; sample handling and artifacts; data handling

UNIT V   TEACHING FLAVOUR CONCEPTS   9
Problem based learning; tongue and nose; Onion-Beverage-Maillard reaction-Thio-stench
TOTAL: 45 PERIODS

OUTCOMES:
* Better understanding and knowledge of contribution of different compounds for the development of flavor and Analytical techniques involved in flavor analysis.

TEXT BOOKS: