

HINDUSTHAN
COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)

Coimbatore- 641032

DEPARTMENT OF FOOD TECHNOLOGY
CURRICULUM & I SEMESTER SYLLABUS

Batch: 2022-2026

REGULATIONS 2022





Hindusthan

College of Engineering and Technology
Coimbatore - 641 032

Scheme of Curriculum UNDER GRADUATE PROGRAMME 2022

Under
Choice Based Credit System (CBCS)
Outcomes-Based Education (OBE)
UNDERGRADUATE PROGRAMMES

Programme: B.Tech.

Branch: FOOD TECHNOLOGY

S. No.	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	TOTAL
SEMESTER I											
Theory											
1.	22MA1101	Matrices and Calculus	BSC	3	1	0	4	4	40	60	100
2.	22ME1201	Engineering Drawing	ESC	1	4	0	3	5	40	60	100
Theory with Lab Component											
3.	22PH1151	Physics for Non-Circuit Engineering	BSC	2	0	2	3	4	50	50	100
4.	22HE1151	English for Engineers	HSC	2	0	2	3	4	50	50	100
5.	22IT1151	Python Programming and practices	ESC	2	0	2	3	4	50	50	100
EEC Courses (SE/AE)											
6.	22HE1071	UHV	AEC	2	0	0	2	3	40	60	100
7.	22HE1072	Entrepreneurship & Innovation	AEC	1	0	0	1	1	100	0	100
Mandatory Course											
8.	22MC1091/ 22MC1092	அறிவியல் தமிழ்/ Indian Constitution	MC	2	0	0	0	2	100	0	100
TOTAL				15	5	6	19	27	470	330	800
S. No.	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	TOTAL
SEMESTER II											
Theory											
1.	22MA2106	Statistics and Numerical Methods	BSC	3	1	0	4	4	40	60	100
2.	22CY2101	Environmental Studies	ESC	2	0	0	2	3	40	60	100
3.	22PH2101	Basics of Material Science	BSC	2	0	0	2	3	40	60	100
4.	22EE2231	Basic Electrical, Electronics and Instrumentation Engineering	ESC	3	0	0	3	3	40	60	100



Theory with Lab Component												
5.	22CY2151	Chemistry for Biological Sciences	BSC	2	0	2	3	4	50	50	100	
6.	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100	
Practical												
7.	22ME2001	Engineering Practices	ESC	0	0	4	2	2	60	40	100	
EEC Courses (SE/AE)												
8.	22HE2071	Design Thinking	AEC	1	0	2	2	2	100	0	100	
9.	22HE2072	Soft Skills -1	AEC	1	0	0	1	1	100	0	100	
Mandatory Courses												
10.	22MC2091 22MC2092	தமிழர் மரபு (Heritage of Tamils) / Essence of Indian Traditional Knowledge	MC	2	0	0	0	1	100	0	100	
11.	22MC2093	NCC */NSS / YRC / Sports / Clubs / Society Service - Enrollment (Common)	MC	All students shall enroll, on admission, in anyone of the personality and character development programmes and undergo training for about 80 hours							-	-
TOTAL				18	1	10	22	26	620	380	1000	
S. No.	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	TOTAL	
SEMESTER III												
Theory												
1.	22MA3108	Transforms and Partial Differential Equations	BSC	3	1	0	4	4	40	60	100	
2.	22FT3201	Food Microbiology	PCC	3	0	0	3	3	40	60	100	
3.	22FT3202	Heat and Mass Transfer	PCC	3	1	0	4	3	40	60	100	
4.	22FT3203	Fluid Mechanics	PCC	3	1	0	4	4	40	60	100	
Theory with Lab Component												
5.	22FT3251	Food Chemistry	PCC	2	0	2	3	4	50	50	100	
Practical												
6.	22FT3001	Unit Operations Laboratory	ESC	0	0	4	2	4	60	40	100	
7.	22FT3002	Food Microbiology Laboratory	PCC	0	0	4	2	4	60	40	100	
EEC Courses (SE/AE)												
8.	22HE3071	Soft Skills -2	SEC	1	0	0	1	1	100	0	100	
9.	22HE3072	Ideation Skills	AEC	2	0	0	2	2	40	60	100	
TOTAL				17	3	10	25	29	470	430	900	



S. No.	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	TOTAL
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SEMESTER IV

Theory

1.	22HE4101	IPR and Start-ups	HSC	2	0	0	2	2	40	60	100
2.	22MA4103	Probability and Operations Research	BSC	2	1	0	3	3	40	60	100
3.	22FT4201	Principles of Thermodynamics	PCC	3	1	0	4	3	40	60	100
4.	22FT4202	Refrigeration and Cold Chain Management	PCC	3	1	0	4	4	40	60	100
5.	22FT4203	Unit operations in Food Processing	PCC	3	0	0	3	4	40	60	100
6.	22FT4204	Food Analysis and Quality Control	PCC	3	0	0	3	4	40	60	100

Practical

7.	22FT4001	Food Analysis and Quality Control Laboratory	PCC	0	0	4	2	4	60	40	100
8.	22FT4002	Unit operations in Food Processing	PCC	0	0	4	2	4	60	40	100

EEC Courses (SE/AE)

9.	22HE4071	Soft Skills -III	SEC	1	0	0	1	1	100	0	100
TOTAL				17	3	8	24	29	460	440	900

* Two weeks internship carries 1 credit and it will be done during Semester III summer vacation and same will be evaluated in Semester IV.
If students unable to undergo in semester III, then the Internship I offered in the semester IV can be clubbed with Internship II (Total: 4 weeks-2 credits)

S. No.	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	TOTAL
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SEMESTER V

Theory

1.	22FT5201	Fruits and Vegetable Processing Technology	PCC	3	0	0	3	4	40	60	100
2.	22FT5202	Poultry, Meat and Fish Process Technology	PCC	3	0	0	3	3	40	60	100
3.	22FT53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4.	22FT53XX	Professional Elective-2	PEC	3	0	0	3	3	40	60	100
5.	22FT53XX	Professional Elective-3	PEC	3	0	0	3	3	40	60	100

Theory with Lab Component

6.	22FT5251	Baking and Confectionery Technology	PCC	2	0	2	3	4	50	50	100
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Practical

7.	22FT5001	Fruits and Vegetable Processing Technology Laboratory	PCC	0	0	4	2	4	60	40	100
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EEC Courses (SE/AE)											
8.	22HE5071	Soft Skills -4/Foreign languages	SEC	1	0	0	1	1	100	0	100
TOTAL				18	0	6	21	25	410	390	800
S. No.	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	TOTAL
SEMESTER VI											
Theory											
1.	22FT6201	Dairy Engineering	PCC	3	0	0	3	3	40	60	100
2.	22HS6101	Professional Ethics (Common)	HSC	3	0	0	3	3	40	60	100
3.	22FT63XX	Professional Elective-4	PEC	3	0	0	3	3	40	60	100
4.	22FT63XX	Professional Elective-5	PEC	3	0	0	3	3	40	60	100
5.	22XX64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
6.	22XX64XX	Open Elective – 2*	OEC	3	0	0	3	3	40	60	100
Practical											
7.	22FT6001	Dairy Engineering Laboratory	PCC	0	0	4	2	4	60	40	100
8.	22FT6002	Food Process Equipment Design Laboratory	PCC	0	0	4	2	4	60	40	100
EEC Courses (SE/AE)											
9.	22HE6071	Soft Skills - 5	SEC	2	0	0	2	2	100	0	100
TOTAL				20	0	8	24	28	460	440	900
S. No.	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	TOTAL
SEMESTER VII											
Theory											
1.	22FT7201	Food Packaging	PCC	3	0	0	3	3	40	60	100
2.	22FT7202	Food Plant Layout and Management	PCC	3	1	0	4	4	40	60	100
3.	22FT730X	Professional Elective-6	PEC	3	0	0	3	3	40	60	100
4.	22FT740X	Open Elective – 3*	OEC	3	0	0	3	3	40	60	100
5.	22FT740X	Open Elective – 4*	OEC	3	0	0	3	3	40	60	100
Practical											
6.	22FT7001	Food Packaging Laboratory	PCC	0	0	4	2	4	60	40	100
EEC Courses (SE/AE)											
7.	22FT7701	Internship - II*	SEC	-	-	-	2	1	100	0	100
TOTAL				15	1	4	20	21	360	340	700
* - Two weeks internship carries 1 credit and it will be done during Semester VI summer vacation/placement training and same will be evaluated in Semester VII.											



S. No.	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	TOTAL
SEMESTER VIII											
EEC Courses (SE/AE)											
1.	22FT8901	Project Work/Granted Patent	SEC9	0	0	20	10	20	100	100	200
TOTAL				0	0	20	10	20	100	100	200

Note:

- * 1. As per the AICTE guideline, in Semesters I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Further, the students who enrolled his/her name in HICET NCC and Air Wing are eligible to undergo this subject. The earned extra credits printed in the Consolidated Mark sheet as per the regulation.
2. NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.
3. The above-mentioned NCC Courses will be offered to the Students who are going to be admitted in the Academic Year 2021 – 22.

SEMESTER WISE CREDIT DISTRIBUTION

B.E. / B.TECH. PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSC	3	3	-	2	-	3	-	-	11
2	BSC	7	9	4	3	-	-	-	-	23
3	ESC	6	7	2	-	-	-	-	-	15
4	PCC	-	-	16	18	11	7	9	-	61
5	PEC	-	-	-	-	9	6	3	-	18
6	OEC	-	-	-	-	-	6	6	-	12
7	EEC	3	3	3	1	1	2	2	10	25
8	MC	✓	✓	-	-	-	-	-	-	-
Total		19	22	25	24	21	24	20	10	165



**OPEN ELECTIVE I AND II
(EMERGING TECHNOLOGIES)**

To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AI6451	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2	22CS6451	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6451	Cyber security	OEC	2	0	2	4	3
4	22EC6452	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6451	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6451	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPEN ELECTIVE I AND II

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3
6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3
10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	22EE6401	Digital Marketing	OEC	3	0	0	3	3
13	22EE6402	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3	3
15	22AG6401	Urban Agriculture and Organic Farming	OEC	3	0	0	3	3
16	22CH6401	Biomass and Biorefinery	OEC	3	0	0	3	3

Note: Non Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches



OPEN ELECTIVE III

Students shall choose any one of the open elective courses such that the course content or title not belong to their own programme.

(Note: Each programme in our institution is expected to provide one course only)

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22EE7401	Fundamentals of Solar Energy & its Applications	OEC	3	0	0	3	3

OPEN ELECTIVE IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22LS7401	General studies for competitive examinations	OEC	3	0	0	3	3
2	22LS7402	Human Rights, Women Rights and Gender equity	OEC	3	0	0	3	3
3	22LS7403	Indian ethos and Human values	OEC	3	0	0	3	3
4	22LS7404	Financial independence and management	OEC	3	0	0	3	3
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Processing of Cereals, Pulses and Grain Technology	Vertical II Spices and Plantation Technology	Vertical III Food Safety Management System	Vertical IV Entrepreneurship and Management	Vertical V Food Colors, & Flavors	Vertical VI Novel Technologies
22FT5301 Technology of Fats and Oils	22FT5304 Processing of spices & plantation crops	22FT5307 Introduction to food safety Analysis and Quality Risk Management	22FT5310 Entrepreneurship Opportunities for Food Technologist	22FT5314 Food additives	22FT5317 Principles of Food Processing
22FT5302 Cereal Technology	22FT5305 Blending and Value Addition	22FT5308 HACCP in Food Processing And Preservation	22FT5311 Total Quality Management	22FT5315 Food colors and flavor Technology	22FT5318 Post-Harvest Technology
22FT5303 Processing of Legumes and Oilseeds	22FT5306 Processing of Coffee	22FT5309 FSMS & Food Product and Supply Chain Management	22FT5312 Enterprise for resource planning	22FT5316 Biology and Chemistry of Food Flavors	22FT5319 Cane sugar Technology



22FT6301 Milling Technology for Food Materials	22FT6303 Processing of Tea	22FT6305 Food laws – Indian and International	22FT6307 Consumer acceptance and Market survey in Food Processing	22FT6309 Functional foods and Nutraceuticals	22FT6311 Beverage Technology
22FT6302 Technology of Malting and Brewing	22FT6304 Processing of cocoa And chocolate	22FT6306 Food Safety in Hospitality industry & GLP in Food Industries	22FT6308 Energy audit in food processing industry	22FT6310 Food Toxicology and Allergy	22FT6312 Emerging Non- Thermal Processing of Foods
22FT7301 By Products Management	22FT7302 Packaging of spices. Plantation products	22FT7303 Food Analysis, Testing & Microbial Safety Analysis	22FT7304 Food Process Economics & Industrial Management	22FT7305 Genetically Modified Foods	22FT7306 Emerging Technologies in Food Processing
22FT7307 Quality, Laws And Regulations In grain processing Industries	22FT7308 Spice Processing And products laws, quality standards And regulations	22FT7309 Food quality, Assurance and Quality Control	22FT7310 Supply Chain and Retail Management	22FT7311 Waste Management and By- Product Utilization in Food Industries	22FT7312 Technology of Snack and Extruded Foods

Students are permitted to choose all Professional Electives from a particular vertical or from different verticals.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

**DETAILS OF VERTICAL I: Processing of Cereals,
Pulses and Grain Technology**

SL. NO.	COURS E CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5301	Technology of Fats and Oils	PEC	3	0	0	3	3
2.	22FT5302	Cereal Technology	PEC	3	0	0	3	3
3.	22FT5303	Processing of Legumes and Oilseeds	PEC	3	0	0	3	3
4.	22FT6301	Milling Technology for Food Materials	PEC	3	0	0	3	3
5.	22FT6302	Technology of Malting and Brewing	PEC	3	0	0	3	3
6.	22FT7301	By Products Management	PEC	3	0	0	3	3
7.	22FT7307	Quality, Laws and Regulations in grain processing Industries	PEC	3	0	0	3	3



**DETAILS OF VERTICAL II: Spices and Plantation
Technology**

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5304	Processing of spices & plantation crops	PEC	3	0	0	3	3
2.	22FT5305	Blending and Value Addition	PEC	3	0	0	3	3
3.	22FT5306	Processing of Coffee	PEC	3	0	0	3	3
4.	22FT6303	Processing of Tea	PEC	3	0	0	3	3
5.	22FT6304	Processing of cocoa And chocolate	PEC	3	0	0	3	3
6.	22FT7302	Packaging of spices. Plantation products	PEC	3	0	0	3	3
7.	22FT7308	Spice Processing and products laws, quality standards And regulations	PEC	3	0	0	3	3

DETAILS OF VERTICAL III: Food Safety Management system

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5307	Introduction to food safety Analysis and Quality Risk Management	PEC	3	0	0	3	3
2.	22FT5308	HACCP in Food Processing And Preservation	PEC	3	0	0	3	3
3.	22FT5309	FSMS & Food Product and Supply Chain Management	PEC	3	0	0	3	3
4.	22FT6305	Food laws – Indian and International	PEC	3	0	0	3	3
5.	22FT6306	Food Safety in Hospitality industry & GLP in Food Industries	PEC	3	0	0	3	3
6.	22FT7303	Food Analysis, Testing & Microbial Safety Analysis	PEC	3	0	0	3	3
7.	22FT7309	Food quality, Assurance and Quality Control	PEC	3	0	0	3	3



DETAILS OF VERTICAL IV: Entrepreneurship and Management

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5310	Entrepreneurship Opportunities for Food Technologist	PEC	3	0	0	3	3
2.	22FT5311	Total Quality Management	PEC	3	0	0	3	3
3.	22FT5312	Enterprise for resource planning	PEC	3	0	0	3	3
4.	22FT6307	Consumer acceptance and Market survey in Food Processing	PEC	3	0	0	3	3
5.	22FT6308	Energy audit in food processing industry	PEC	3	0	0	3	3
6.	22FT7304	Food Process Economics & Industrial Management	PEC	3	0	0	3	3
7.	22FT7310	Supply Chain and Retail Management	PEC	3	0	0	3	3

DETAILS OF VERTICAL V: Food Colors & Flavors

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5314	Food additives	PEC	3	0	0	3	3
2.	22FT5315	Food colors and flavor Technology	PEC	3	0	0	3	3
3.	22FT5316	Biology and Chemistry of Food Flavors	PEC	3	0	0	3	3
4.	22FT6309	Functional foods and Nutraceuticals	PEC	3	0	0	3	3
5.	22FT6310	Food Toxicology and Allergy	PEC	3	0	0	3	3
6.	22FT7305	Genetically Modified Foods	PEC	3	0	0	3	3
7.	22FT7311	Waste Management and By-Product Utilization in Food Industries	PEC	3	0	0	3	3

DETAILS OF VERTICAL VI: Novel Technologies

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5317	Principles of Food Processing	PEC	3	0	0	3	3
2.	22FT5318	Post-Harvest Technology	PEC	3	0	0	3	3
3.	22FT5319	Cane sugar Technology	PEC	3	0	0	3	3



4.	22FT6311	Beverage Technology	PEC	3	0	0	3	3
5.	22FT6312	Emerging Non-Thermal Processing of Foods	PEC	3	0	0	3	3
6.	22FT7306	Emerging Technologies in Food Processing	PEC	3	0	0	3	3
7.	22FT7312	Technology of Snack and Extruded Foods	PEC	3	0	0	3	3

Enrollment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree. For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

VERTICALS FOR MINOR DEGREE

- Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

Note: Each programme should provide verticals for minor degree

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5031	Sem 5: Food Analysis and Quality Control	MDC	3	0	0	3	3
2.	22FT6031	Sem 6: Fruits and Vegetable Processing Technology	MDC	3	0	0	3	3
3.	22FT6032	Sem6: Poultry, Meat, and Fish Processing Technology	MDC	3	0	0	3	3
4.	22FT7031	Sem 7: Dairy Engineering	MDC	3	0	0	3	3
5.	22FT7032	Sem 7: Baking and Confectionery Technology	MDC	3	0	0	3	3
6.	22FT8031	Sem 8: Food Packaging	MDC	3	0	0	3	3

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.



Vertical I Fintech and Block Chain	Vertical II Entrepreneurship	Vertical III Environment and Sustainability
Financial Management	Foundations of Entrepreneurship	Sustainable infrastructure Development
Fundamentals of Investment	Team Building & Leadership Management for Business	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	Creativity & Innovation in Entrepreneurship	Sustainable Bio Materials
Introduction to Blockchain and its Applications	Principles of Marketing Management For Business	Materials for Energy Sustainability
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Green Technology
Introduction to Fintech	Financing New Business Ventures	Environmental Quality Monitoring and Analysis

B Tech (Hons) Food Technology with Specialization in Food Technology and Management

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	22FT5203	Transfer Processes in Food Processing	PC	2	0	2	3	4	50	50	100
2.	22FT6202	Food Regulations and Food Safety Management	PC	2	0	2	3	4	50	50	100
3.	22FT6203	Marketing Management	PC	3	1	0	4	3	40	60	100
4.	22FT7203	Food Supply Chain Management	PC	2	0	2	3	4	50	50	100
5.	22FT7204	Inventory Management	PC	2	0	2	3	4	50	50	100
6.	22FT8201	Total Quality Management	PC	0	0	4	2	4	60	40	100

Note: Each programme should provide verticals for Honours degree


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SEMESTER 1

Syllabus



Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22MA1101	MATRICES AND CALCULUS (Common to all Branches)	3	1	0	4
Course Objective	<p>The learner should be able to</p> <ol style="list-style-type: none"> 1. Construct the characteristic polynomial of a matrix and use it to identify eigenvalues and Eigenvectors 2. Impart the knowledge of sequences and series. 3. Analyse and discuss the maxima and minima of the functions of several variables. 4. Evaluate the multiple integrals and apply in solving problems. 5. Apply vector differential operator for vector function and theorems to solve engineering problems. 					
Unit	Description					Instructional Hours
I	Matrices Eigen values and Eigen vectors – Properties of Eigen values and Eigen vectors (without proof) - Cayley - Hamilton Theorem (excluding proof) - Reduction of a quadratic form to canonical form by orthogonal transformation.					12
II	Single Variate Calculus Rolle's Theorem–Lagrange's Mean Value Theorem–Maxima and Minima–Taylor's and Maclaurin's Series.					12
III	Functions of Several Variables Partial derivatives–Total derivative, Jacobian, Maxima, minima and saddle points; Method of Lagrange multipliers.					12
IV	Integral Calculus Double integrals in Cartesian coordinates–Area enclosed by plane curves (excluding surface area)– Triple integrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates.					12
V	Vector Calculus Gradient, divergence and curl; Green's theorem, Stoke's and Gauss divergence theorem (statement only) for cubes only.					12
Total Instructional Hours						60
Course Outcome	<p>At the end of the course, the learner will be able to</p> <p>CO1: Compute Eigen values and Eigen vectors of the given matrix and transform given quadratic form into canonical form.</p> <p>CO2: Apply the concept of differentiation to identify the maximum and minimum values of curve.</p> <p>CO3: Compute partial derivatives of function of several variables and write Taylor's series for functions with two variables.</p> <p>CO4: Evaluate multiple integral and its applications in finding area, volume.</p> <p>CO5: Apply the concept of vector calculus in two and three dimensional spaces.</p>					
TEXTBOOKS:						
T1:G.B.Thomas and R.L.Finney,"Calculus and Analytical Geometry",9 th Edition Addison Wesley Publishing Company, 2016.						
T2:Erwin Kreyszig,"Advanced Engineering Mathematics",John Wiley&Sons,2019.						
T3:K.P.Uma and S.Padma,"Engineering Mathematics I (Matrices and Calculus) ".Pearson Ltd,2022.						
REFERENCEBOOKS:						
R1-Jerrold E.Marsden,Anthony Tromba,"Vector-Calculus",W.H.Freeman,2003						
R2-Strauss M.J,G.L.Bradley and K.J.Smith,"Multivariable calculus",PrenticeHall,2002.						
R3-Veerarajan T,"Engineering Mathematics ".McGraw Hill Education(India)PvtLtd. NewDelhi,2016.						

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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22ME1201	ENGINEERING DRAWING	1	4	0	3
Course Objective	<p>The learner should be able</p> <ol style="list-style-type: none"> To gain the knowledge of Engineer's language of expressing complete details about objects and construction of conics and special curves. To learn about the orthogonal projections of straight lines and planes. To acquire the knowledge of projections of simple solid objects in plan and elevation. To learn about the projection of sections of solids and development of surfaces. To study the isometric projections of different objects. 					
Unit	Description					Instructional Hours
I	PLANE CURVES Importance of engineering drawing; drafting instruments; drawing sheets – layout and folding; Lettering and dimensioning, BIS standards, scales. Geometrical constructions, Engineering Curves Conic sections – Construction of ellipse, parabola and hyperbola by eccentricity method. Construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.					12
II	PROJECTIONS OF POINTS, LINES AND PLANE SURFACES Introduction to Orthographic projections- Projection of points. Projection of straight lines inclined to both the planes, Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).					12
III	PROJECTIONS OF SOLIDS Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane by rotating object method.					12
IV	SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined to 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, cylinder and cone. Development of lateral surfaces of truncated solids.					12
V	ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS Isometric views and projections simple and truncated solids such as - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. Free hand sketching of multiple views from a pictorial drawing. Basics of drafting using AutoCAD software.					12
Total Instructional Hours						60
Course Outcome	At the end of the course, the learner will be able to CO1: Understand and interpret the engineering drawings in order to visualize the objects and draw the conics and special curves. CO2: Draw the orthogonal projections of straight lines and planes. CO3: Interpret the projections of simple solid objects in plan and elevation. CO4: Draw the projections of section of solids and development of surfaces of solids. CO5: Draw the isometric projections and the perspective views of different objects.					
TEXT BOOK:						
T1. K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5th edition New Age International Publishers, New Delhi 2016.						
T2. K.V.Natarajan, "A text book of Engineering Graphics", Dhanlaxmi Publishers, Chennai 2016.						
REFERENCES:						
R1. Basant Agrawal and C.M.Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing company Limited, New Delhi, 2013.						
R2. N.S. Parthasarathy, Vela Murali, "Engineering Drawing", Oxford University PRESS, India 2015.						

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Programme /Sem	Course Code	Name of the Course	L	T	P	C
B.E/B.Tech/ I	22PH1151	PHYSICS FOR NON- CIRCUIT ENGINEERING (Common to Non Circuit branches)	2	0	2	3
Course Objective	<p>The student should be able to</p> <p>1. Gain knowledge about laser, their applications and Conversant with principles of optical fiber, types and applications of optical fiber</p> <p>2. Enhance the fundamental knowledge in properties of matter</p> <p>3. Extend the knowledge about wave optics</p> <p>4. Gain knowledge about magnetic materials.</p> <p>5. Acquire fundamental knowledge of nano materials which is related to the engineering program</p>					
Unit	Description					Instructional Hours
I	LASER AND FIBRE OPTICS Spontaneous emission and stimulated emission –Type of lasers – Nd:YAG laser - Laser Applications – Holography – Construction and reconstruction of images. Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index and modes) – Fiber optical communication link. Determination of Wavelength and particle size using Laser					6+3
II	PROPERTIES OF MATTER Elasticity – Hooke's law –Poisson's ratio – Bending moment – Depression of a cantilever – Derivation of Young's modulus of the material of the beam by Uniform bending theory and experiment. Twisting couple - torsion pendulum: theory and experiment Determination of Young's modulus by uniform bending method Determination of Rigidity modulus – Torsion pendulum					6+3+3
III	WAVE OPTICS Interference of light – air wedge –Thickness of thin paper - Diffraction of light –Fraunhofer diffraction at single slit –Diffraction grating – Rayleigh's criterion of resolution power - resolving power of grating. Determination of wavelength of mercury spectrum – spectrometer grating Defermination of thickness of a thin wire – Air wedge method.					6+3+3
IV	QUANTUM PHYSICS Black body radiation – Compton effect: theory and experimental verification = wave particle duality –concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box .					6
V	THERMAL PHYSICS Transfer of heat energy –thermal conduction, convection and radiation – thermal conductivity - Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – applications: solar water heaters.					6
Total Instructional Hours						45
Course Outcome	After completion of the course the learner will be able to CO1: Understand the advanced technology of LASER and optical communication in the field of Engineering CO2: Illustrate the fundamental properties of matter CO3: Discuss the Oscillatory motions of particles CO4: Understand the advanced technology of magnetic materials in the field of Engineering CO5: Develop the technology of smart materials and Nano materials in engineering field					
TEXT BOOKS:						
T1 - Rajendran V. Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.						
T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8 th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.						
REFERENCE BOOKS:						
R1 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company Ltd., New Delhi 2016						
R2 -Dr. G. Senthikumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2021						

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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22HE1151	ENGLISH FOR ENGINEERS (Common to all Branches)	2	0	2	3
Course Objective	<p>The student should be able</p> <ol style="list-style-type: none"> To improve the communicative proficiency of learners. To help learners use language effectively in professional writing. To advance the skills of maintaining the suitable one of communication. To introduce the professional life skills. To impart official communication etiquette. 					
Unit	Description					Instructional Hours
I	Language Proficiency: Types of Sentences, Functional Units, Framing question. Writing: process description, Writing Checklist. Vocabulary – words on environment. Practical Component: Listening- Watching short videos and answer the questions, Speaking- Self introduction ,formal & semi-formal					7+2
II	Language Proficiency: Tenses, Adjectives and adverbs. Writing: Formal letters (letters conveying positive and negative news), Formal and informal email writing (using emoticons, abbreviations& acronyms), reading comprehension. Vocabulary – words on entertainment. Practical Component: Listening- Comprehensions based on TED talks Speaking- Narrating a short story or an event happened in their life					7+2
III	Language Proficiency: Prepositions, phrasal verbs. Writing: Formal thanks giving, Congratulating, warning and apologizing letters, cloze test. Vocabulary – words on tools. Practical Component: Listening- Listentosongsandanswerthequestions Speaking- Just a minute					5+4
IV	Language Proficiency: Subject verb concord, Prefixes & suffixes. Writing: Preparing agenda & minutes, writing an event report. Vocabulary – words on engineering process. Practical Component: Listening- Comprehensions based on Talk of orators or interview shows Speaking- Presentation on a general topic with ppt.					5+4
V	Language Proficiency: Modal Auxiliaries, Active & passive voice, Writing: Project report (proposal & progress) ,sequencing of sentences Vocabulary –words on engineering material Practical Component: Listening- Listening- Comprehensions based on Nat Geo/Discovery channel-videos Speaking- Preparing posters and presenting as a team.					6+3
Total Instructional Hours						45
Course Outcome	After completion of the course the learner will be able CO1:To communicate in a professional forum CO2:To speak or write a content in the proficient language CO3: To maintain and use appropriate one of the communication. CO4:To read ,write and present in a professional way. CO5:To follow the etiquettes in formal communication.					
TEXTBOOKS:						
T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press,2016.T2- Raymond Murphy, "Essential English Grammar", Cambridge University Press,2019.						
REFERENCEBOOKS:						
R1- Meenakshi Raman and Sangeetha Sharma, "Technical Communication- Principles and Practice", Oxford University Press, 2009. R2-RaymondMurphy, "English GrammarinUse"-4 th editionCambridgeUniversityPress,2004. R3-KamaleshSadanar"AFoundationCoursefortheSpeakersofTamil-Part-I&II",Orient Blackswan,2010.						

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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22IT1151	PYTHON PROGRAMMING AND PRACTICES	2	0	2	3
Course Objective	<p>The learner should be able</p> <ol style="list-style-type: none"> To know the basics of algorithmic problem solving To read and write simple Python programs To develop Python programs with conditionals and loops and to define Python functions and call them To use Python data structures — lists, tuples, dictionaries To do input/output with files in Python 					
Unit	Description					Instructional Hours
I	<p>ALGORITHMIC PROBLEM SOLVING Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: To find the Greatest Common Divisor (GCD) of two numbers, Fahrenheit to Celsius, Perform Matrix addition.</p>					5+4
II	<p>DATA, STATEMENTS, CONTROL FLOW Data Types, Operators and precedence of operators, expressions, statements, comments; Conditionals: Boolean values and operators, conditional (if), alternative (if -else), chained conditional (if -elif-else); Iteration: state, while, for, break, continue, pass; Simple algorithms and programs: Area of the circle, check the given year is Leap year or not, Factorial of a Number.</p>					5+4
III	<p>FUNCTIONS, STRINGS Functions, parameters and arguments; Fruitful functions: return values, local and global scope, function composition, recursive functions. Strings: string slices, immutability, string functions and methods, string module. Illustrative programs: Perform Linear Search, Selection sort, Sum of all elements in a List, Pattern Programs</p>					5+4
IV	<p>LISTS, TUPLES, DICTIONARIES Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension. Illustrative programs: List Manipulation, Finding Maximum in a List, String processing.</p>					5+4
V	<p>FILES, MODULES, PACKAGES Files and exception: text files, reading and writing files, errors and exceptions, handling exceptions, modules, packages Illustrative programs: Reading writing in a file, word count, Handling Exceptions</p>					9
Total Instructional Hours						45
Course Outcome	<p>At the end of the course, the learner will be able to</p> <p>CO1: Develop algorithmic solutions to simple computational problems CO2: Read, write, execute by hand simple Python programs CO3: Structure simple Python programs for solving problems and Decompose a Python program into functions CO4: Represent compound data using Python lists, tuples, dictionaries CO5: Read and write data from/to files in Python Programs.</p>					
TEXT BOOKS:						
T1: Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.6.2. Shroff Publishers, First edition (2017).						
T2: S. Annadurai, S. Shankar, I. Jasmine, M. Revathi, Fundamentals of Python Programming, Mc-Graw Hill Education (India) Private Ltd, 2019						
REFERENCE BOOKS:						
R1: Charles Dierbach. —Introduction to Computer Science using Python: A Computational Problem- Solving Focus, Wiley India Edition, 2013.						
R2: Timothy A. Budd. —Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015						
R3: Robert Sedgewick, Kevin Wayne, Robert Dondero. —Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016						

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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22HE1071	UNIVERSAL HUMAN VALUES (COMMON TO ALL BRANCHES)	2	0	0	2
Course Objectives	<p>The students should be made</p> <ol style="list-style-type: none"> To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature. 					
Unit	Description					Instructional Hours
I	Introduction to Value Education Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)-Understanding Value Education - Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity – the Basic Human Aspirations - Happiness and Prosperity – Current Scenario - Method to Fulfill the Basic Human Aspirations					6
II	Harmony in the Human Being and Harmony in the Family Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body - The Body as an Instrument of the Self - Understanding Harmony in the Self- Harmony of the Self with the Body - Programme to ensure self-regulation and Health					6
III	Harmony in the Family and Society Harmony in the Family – the Basic Unit of Human Interaction. Values in Human to Human Relationship 'Trust' – the Foundational Value in Relationship Values in Human to Human Relationship 'Respect' – as the Right Evaluation Understanding Harmony in the Society					6
IV	Harmony in the Nature / Existence Understanding Harmony in the Nature. Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature- Understanding Existence as Co-existence of mutually interacting units in all pervasivespace Realizing Existence as Co-existence at All Levels The Holistic Perception of Harmony in Existence. Vision for the Universal Human Order					6
V	Implications of the Holistic Understanding – a Look at Professional Ethics Natural Acceptance of Human Values Definitiveness of (Ethical) Human Conduct A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models- Typical Case Studies Strategies for Transition towards Value-based Life and Profession					6
Total Instructional Hours						30
Course Outcome	<p>At the end of the course, the learner will be able</p> <p>CO1: To become more aware of holistic vision of life - themselves and their surroundings.</p> <p>CO2: To become more responsible in life, in the Society and in handling problems with sustainable Solutions.</p> <p>CO3: To sensitive towards their commitment towards what they understood towards environment and Socially responsible behavior.</p> <p>CO4: To able to apply what have learnt to their own self in different day-to-day settings in real life and In handling problems with sustainable solutions.</p> <p>CO5: To develop competence and capabilities for maintaining Health and Hygiene.</p>					
Reference Books:						
R1. A Foundation Course in Human Values and Professional Ethics. R R Gaur, R Asthana, G P Bagaria, 2 nd Revised Edition, Excel Books, New Delhi, 2019, ISBN 978-93-87034-47-1						
R2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2 nd Revised Edition, Excel Books, New Delhi, 2019, ISBN 978-93-87034-53-2						
R3. Jeevan Vidya: EK Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.						
R4. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.						

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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22HE1072	ENTREPRENEURSHIP & INNOVATION	1	0	0	1
Course Objectives	The student should be made					
	<ol style="list-style-type: none"> 1. To acquire the knowledge and skills needed to manage the development of innovation. 2. To recognize and evaluate potential opportunities to monetize these innovations. 3. To plan specific and detailed method to exploit these opportunities. 4. To acquire the resources necessary to implement these plans. 5. To make students understand organizational performance and its importance. 					
Module	Description					
1	Entrepreneurial Thinking					
2	Innovation Management					
3	Design Thinking					
4	Opportunity Spotting/ Opportunity Evaluation					
5	Industry and Market Research					
6	Innovation Strategy and Business Models					
7	Financial Forecasting					
8	Business Plans/ Business Model Canvas					
9	Entrepreneurial Finance					
10	Pitching to Resources Providers/ Pitch Deck					
11	Negotiating Deals					
12	New Venture Creation					
13	Lean Start-ups					
14	Entrepreneurial Ecosystem					
15	Velocity Venture					
TOTAL INSTRUCTIONAL HOURS						15
Course Outcome	<p>At the end of the course, the learner will be able to.</p> <p>CO1: Understand the nature of business opportunities, resources, and industries in critical and creative aspects.</p> <p>CO2: Understand the processes by which innovation is fostered, managed, and commercialized.</p> <p>CO3: Remember effectively and efficiently the potential of new business opportunities.</p> <p>CO4: Assess the market potential for a new venture, including customer need, competitors, and industry attractiveness.</p> <p>CO5: Develop a business model for a new venture, including revenue, Margins, operations, Working capital, and investment</p>					
TEXTBOOKS						
T1: Arya Kumar "Entrepreneurship - Creating and Leading an Entrepreneurial Organization", Pearson, Second Edition (2012).						
T2: Emrah Yayici "Design Thinking Methodology", Artbiztech, First Edition (2016).						
REFERENCE BOOKS						
R1: Christopher Golis "Enterprise & Venture Capital", Allen & Unwin Publication, Fourth Edition (2007).						
R2: Thomas Lock Wood & Edger Papke "Innovation by Design", Career Press.com, Second Edition (2017).						
R3: Jonathan Wilson "Essentials of Business Research", Sage Publication, First Edition (2010).						
WEB RESOURCES						
W1: https://blof.forgeforward.in/tagged/startup-lessons						
W2: https://blof.forgeforward.in/tagged/entrepreneurship						
W3: https://blof.forgeforward.in/tagged/minimum-viable-product						
W4: https://blof.forgeforward.in/tagged/minimum-viable-product						
W5: https://blof.forgeforward.in/tagged/innovation						

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Programme/ Sem	CourseCode	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22MC1091	INDIAN CONSTITUTION	2	0	0	0
Course Objectives	The student should be made to 1. Sensitization towards self, family (relationship), society and nature 2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals 3. Strengthening of self-reflection 4. Development of commitment and courage to act					
Unit	Description	Instructional Hours				
I	BASIC FEATURES AND FUNDAMENTAL PRINCIPLES Meaning of the constitution law and constitutionalism–Historical perspective of the constitution of India– salient features and characteristic of the constitution of India.	6				
II	FUNDAMENTAL RIGHTS Scheme of the fundamental rights–fundamental duties and its legislative status–The directive principles of state policy–its importance and implementation–Federal structure and distribution of legislative and financial powers between the union and states.	6				
III	PARLIAMENTARY FORM OF GOVERNMENT The constitution powers and the status of the president in India.–Amendment of the constitutional Powers and procedures–The historical perspective of the constitutional amendment of India–Emergency provisions: National emergency, President rule, Financial emergency.	6				
IV	LOCAL GOVERNANCE Local self-government-Rural Local Government-Panchayath Raj, Elections of Panchayat-State Election Commission-Urban Local Government-Amendment Act, Urban Local Government Structures in India	6				
V	INDIAN SOCIETY Constitutional Remedies for citizens–Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.	6				
		Total Instructional Hours	30			
Course Outcome	At the end of the course, the learner will be able to CO1:Understand the functions of the Indian government. CO2:Understand and abide the rules of the Indian Constitution					
TEXTBOOKS: T1: Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi, 1997. T2: Agarwal R.C., "Indian Political System", S.Chand and Company, New Delhi, 1997. T3: Maciver and Page, "Society: An Introduction Analysis", Mac Milan India Ltd., New Delhi. T4: Sharma K.L., "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi, 1997.						
REFERENCEBOOKS: R1-Sharma, Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi. R2- Gahai U.R., "Indian Political System", New Academic Publishing House, Jalaendhar. R3-Sharma R.N., "Indian Social Problems", Media Promoters and Publishers Pvt. Ltd.						

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திட்டம்/செம்	பாடநெறி குறியீடு	பாடத்தின் பெயர்	L	T	P	C
பி.இ/ க	22MC1091	அறிவியல் தமிழ் (முதலாம் ஆண்டு பி.இ பொது பாடப்பிரிவு)	2	0	0	0

பாடத்தின் நோக்கம்	<p>கற்றவர் இயல் வேண்டும்</p> <ol style="list-style-type: none"> 1. சங்க காலத்தில் தொழில்துறை பற்றிய அறிவைப் பெறுதல். 2. சங்க காலத்தில் வீட்டின் பொருள் ,சிற்பங்கள் மற்றும் கோவில்கள் வடிவமைப்பு பற்றி கூட்டு கற்றல் 3. வரலாறு மற்றும் தொல்லியல் சான்றுகளின் ஆதாரமாக உலோகவியல் ஆய்வுகளில் அறிவை வளர்த்துக் கொள்ளுங்கள். 4. வேளாண்மை மற்றும் வேளாண் செயலாக்கத்தில் பயன்படுத்தப்படும் பண்டைய நுட்பங்களைப் பற்றிய அறிவைப் பெறுதல். 5. தமிழ் மொழியின் மென்பொருள் பற்றி அறிதல்
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அலகு	விளக்கம்	பயிற்சி நேரம்
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I	<p>நெசவு மற்றும் பானைத் தொழில்நுட்பம்</p> <p>சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம்- கருப்பு சிவப்பு பாண்டங்கள் -பாண்டங்களில் கீறல் குறியீடுகள்</p>	3
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II	<p>வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்</p> <p>சங்க இலக்கியத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் மற்றும் சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு -சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும்- சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிப்பாடுத் தளங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டி நாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோச்செனிக் கட்டிடக் கலை.</p>	3
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III	<p>உற்பத்தி தொழில்நுட்பம்</p> <p>கப்பல் கட்டும் கலை- உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருகுதல் எஃகு - வரலாற்றுசாலை சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள் , கண்ணாடிமணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் -</p>	3
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	தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	
IV	வேளாண்மை மற்றும் நீர்பாசனத் தொழில்நுட்பம் அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குழுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்க பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.	3
V	அறிவியல் தமிழ் மற்றும் கணித்தமிழ் அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணைய கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.	3
மொத்த பயிற்றுவிக்கும் நேரம்		15
பாடத்தின் முடிவு	பாடநெறியின் முடிவில் கற்றவர் கற்றபின் பா மு ₁ : பண்டைய தொழில்நுட்பத்தை அடையாளம் கொள்ள தெரியும் பா மு ₂ : சங்க கால கட்டுமானப் பொருட்கள்- சிற்ப வகைகளை வேறுபடுத்த முடியும் பா மு ₃ : வரலாறு மற்றும் தொல்லியல் சான்றுகளின் ஆதாரமாக உலோகவியல் ஆய்வுகளில் பட்டியலிட்டு அடையாளம் காண முடியும் பா மு ₄ : விவசாயம் மற்றும் வேளாண் செயலாக்கத்தில் பயன்படுத்தப்படும் பழங்கால நுட்பங்களைப் பற்றி விளக்கத்துடன் நிரூபிக்க முடியும் பா மு ₅ : தமிழ் மொழியின் புதிய மென்பொருள் பற்றி உருவாக்கக் கூடிய திறன் மேம்படுத்துதல்.	
உரை புத்தகங்கள்		
உ1- தமிழக வரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)		
உ2- எஸ்.கே. சிங், இடைக்கால இந்தியாவின் வரலாறு. புது தில்லி: ஆக்சிஸ் பக்ஸ் பிரைவேட் லிமிடெட், 2013.		
குறிப்புகள்		
கு1- கணித்தமிழ் -முனைவர் இல. சுந்தரம் .(விகடன் பிரசுரம்)		
கு2- கீழடி வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு.		


ஆய்வு வாரிய தலைவர்


டீன் கல்வியாளர் / முதல்வர்



CURRICULUM R2019



DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. FOOD TECHNOLOGY (UG)

REGULATION-2019

For the students admitted during the academic year 2021-2022 and onwards

The course code 21 indicates that the students joined in the academic year 2021

SEMESTER I

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL	
THEORY											
1.	21HE1101	Technical English	HS	2	1	0	3	40	60	100	
2.	21MA1102	Calculus and Linear Algebra	BS	3	1	0	4	40	60	100	
3.	21ME1101	Basics of Civil and Mechanical Engineering	ES	3	0	0	3	40	60	100	
THEORY & LAB COMPONENT											
4.	21PH1151	Applied Physics	BS	2	0	2	3	50	50	100	
5.	21CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100	
6.	21CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100	
PRACTICAL											
7.	21HE1071	Language Competency Enhancement Course-I	HS	0	0	2	1	100	0	100	
MANDATORY COURSES											
8.	21HE1072	Career Guidance Level – I Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100	
				Total:	16	2	8	20	470	330	800
As Per AICTE Norms 3 Weeks Induction Programme is Added in The First Semester as an Audit Course											

SEMESTER II

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	21HE2101	Business English for Engineers	HS	2	1	0	3	40	60	100
2.	21MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	40	60	100
3.	21FT2105	Principles of Microbiology	ES	3	0	0	3	40	60	100
THEORY & LAB COMPONENT										
4.	21IT2151	Programming in C	ES	2	0	2	3	50	50	100
5.	21PH2151	Material Science	BS	2	0	2	3	50	50	100
6.	21CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
PRACTICALS										
7.	21ME2001	Engineering Practices Lab	ES	0	0	4	2	60	40	100



8.	21HE2071	Language Competency Enhancement Course-II	HS	0	0	2	1	100	0	100
MANDATORY COURSES										
9.	21HE2072	Career Guidance Level – II Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	21HE2073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
Total:				17	2	12	22	630	370	1000

SEMESTER III

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	21MA3102	Fourier Analysis and Transforms	BS	3	1	0	4	25	75	100
2.	21FT3201	Fluid Mechanics	PC	3	1	0	4	25	75	100
3.	21FT3101	Principles of Thermodynamics	PC	3	0	0	3	25	75	100
4.	21FT3202	Food Microbiology	PC	3	0	0	3	25	75	100
THEORY AND LAB COMPONENT										
5.	21FT3251	Bio Chemistry	PC	2	0	2	3	50	50	100
PRACTICALS										
6.	21FT3001	Food Microbiology Laboratory	PC	0	0	3	1.5	50	50	100
7.	21FT3002	Food Production Analysis Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8.	21MC3191	Indian Constitution	MC	2	0	0	0	0	0	0
9.	21HE3072	Career Guidance Level – III Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	21HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
Total				19	2	8	20	450	450	900

SEMESTER IV

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	21FT4201	Fundamentals of Heat and Mass Transfer	PC	3	1	0	4	25	75	100
2.	21FT4203	Engineering properties of food materials	PC	3	0	0	3	25	75	100
3.	21FT4204	Refrigeration and Cold Chain Management	PC	3	1	0	4	25	75	100
THEORY AND LAB COMPONENT										



4.	21FT4251	Food Chemistry	PC	2	0	2	3	50	50	100
5.	21MA4152	Statistics and Numerical Methods	BS	3	0	2	4	50	50	100
PRACTICALS										
6.	21FT4001	Unit Operations Laboratory	PC	0	0	3	1.5	50	50	100
7.	21FT4002	Food Process Equipment Design Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8.	21MC4191	Essence of Indian tradition knowledge/Value Education	MC	2	0	0	0	100	0	100
9.	21HE4072	Career Guidance Level – IV Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	21HE4073	Ideation Skills	EEC	2	0	0	0	100	0	100
Total				20	2	10	21	575	425	1000

SEMESTER V

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
1.	21FT5201	Baking and Confectionery Technology	PC	3	0	0	3	25	75	100
2.	21FT5202	Food Additives	PC	3	0	0	3	25	75	100
3.	21FT5203	Poultry, Meat and Fish Process Technology	PC	3	0	0	3	25	75	100
4.	21FT5204	Principles of Food Processing	PC	3	0	0	3	25	75	100
5.	21FT5205	Unit Operations in Food Processing	PC	3	0	0	3	25	75	100
6.	21FT53XX	Professional Elective -I	PE	3	0	0	3	25	75	100
PRACTICALS										
7.	21FT5001	Baking and Confectionery Technology Laboratory	PC	0	0	4	2	50	50	100
8.	21FT5002	Unit Operations in Food Processing Laboratory	PC	0	0	4	2	50	50	100
MANDATORY COURSES										
9.	21HE5071	Soft Skills - I	EEC	1	0	0	1	25	75	100
10.	21HE5072	Design Thinking	EEC	1	0	0	1	25	75	100
TOTAL				20	0	8	24	300	700	1000

SEMESTER VI

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	21FT6201	Dairy Engineering	PC	3	0	0	3	25	75	100
2.	21FT6202	Plantation crops and Spices Products Technology	PC	3	0	0	3	25	75	100
3.	21FT6203R	Fruits and Vegetable Processing Technology	PC	3	0	0	3	25	75	100
4.	21FT6181	Professional Ethics in Engineering	HS	3	0	0	3	25	75	100



5.	21FT63XX	Professional Elective - II	PE	3	0	0	0	3	25	75	100
6.	21XX64XX	Open Elective- I	OE	3	0	0	0	3	25	75	100
PRACTICALS											
7.	21FT6001	Dairy Engineering Laboratory	PC	0	0	3	1.5	50	50	100	
8.	21FT6002	Fruits and Vegetable Processing Technology Laboratory	PC	0	0	3	1.5	50	50	100	
MANDATORY COURSES											
9.	21FT6701	Industrial Training	EEC	0	0	0	1	0	100	100	
10.	21HE6071	Soft Skills - II	EEC	1	0	0	1	25	75	100	
11.	21HE6072	Intellectual Property Rights(IPR)	EEC	1	0	0	1	25	75	100	
TOTAL				20	0	6	24	300	800	1100	

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL	
PROFESSIONAL ELECTIVE I											
1	21FT5301	Technology of Fats and Oils	PE	3	0	0	3	25	75	100	
2	21FT5302	Food Storage and Infestation Control	PE	3	0	0	3	25	75	100	
3	21FT5303	Food Process Calculations	PE	3	0	0	3	25	75	100	
4	21FT5304	Post-Harvest Technology	PE	3	0	0	3	25	75	100	
5	21FT5305	Cane sugar Technology	PE	3	0	0	3	25	75	100	
6	21FT5306	Milling Technology for Food Materials	PE	3	0	0	3	25	75	100	
PROFESSIONAL ELECTIVE II											
1	21FT6301	Beverage Technology	PE	3	0	0	3	25	75	100	
2	21FT6302 R	Technology of Snack and Extruded Foods	PE	3	0	0	3	25	75	100	
3	21FT6303	Food Biotechnology	PE	3	0	0	3	25	75	100	
4	21FT6304	Bioprocess Engineering	PE	3	0	0	3	25	75	100	
5	21FT6305	Enzyme Technology	PE	3	0	0	3	25	75	100	
6	21FT6306	Crop Process Engineering	PE	3	0	0	3	25	75	100	

OPEN ELECTIVE

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	21FT6401	Traditional Foods	OE	3	0	0	3	25	75	100



SEMESTER VII

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	21FT7201	Food Analysis and Quality Control	PC	3	0	0	3	25	75	100
2.	21FT7202	Food Packaging	PC	3	0	0	3	25	75	100
3.	21FT7203	Food Plant Layout and Management	PC	3	0	0	3	25	75	100
4.	21FT73XX	Professional Elective-III	PE	3	0	0	3	25	75	100
5.	21XX74XX	Open Elective – II	OE	3	0	0	3	25	75	100
PRACTICALS										
6.	21FT7001	Food Packaging Laboratory	PC	0	0	3	1.5	50	50	100
7.	21FT7002	Food Analysis and Quality Control Laboratory	PC	0	0	3	1.5	50	50	100
PROJECT WORK										
8.	21FT7901	Project Phase I	EEC	0	0	4	2	50	50	100
TOTAL				15	0	10	20	275	525	800

SEMESTER VIII

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	21FT83XX	Professional Elective –IV	PE	3	0	0	3	25	75	100
2.	21FT83XX	Professional Elective- V	PE	3	0	0	3	25	75	100
PRACTICAL										
3.	21FT8901	Project Work – Phase II	EEC	0	0	16	8	100	100	200
TOTAL				6	0	16	14	150	250	400

PROFESSIONAL ELECTIVE III

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	21FT7301	Functional foods and Nutraceuticals	PE	3	0	0	3	25	75	100
2.	21FT7302	Biology and Chemistry of Food Flavors	PE	3	0	0	3	25	75	100
3.	21FT7303	Food Toxicology and Allergy	PE	3	0	0	3	25	75	100
4.	21FT7304	Advanced Drying Technology	PE	3	0	0	3	25	75	100
5.	21FT7305	Cereal Technology	PE	3	0	0	3	25	75	100
6.	21FT7306	Processing Technology of Legumes and Oilseeds	PE	3	0	0	3	25	75	100
7.	21FT7307	Emerging Non-Thermal Processing of Foods	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE IV

1.	21FT8301	Food Process Economics and Industrial	PE	0	0	3	25	75	100
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		Management								
2.	21FT8302	Food Laws and Safety	PE	3	0	0	3	25	75	100
3.	21FT8303	Waste Management and By-Product Utilization in Food Industries	PE	3	0	0	3	25	75	100
4.	21FT8304	Instrumentation and Process Control	PE	3	0	0	3	25	75	100
5.	21FT8305	Economics and Management	PE	3	0	0	3	25	75	100
6.	21FT8312	Total Quality Management	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE V

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	21FT8306	Food process plant layout and safety	PE	3	0	0	3	25	75	100
2.	21FT8307	Energy Management in Process Industries	PE	3	0	0	3	25	75	100
3.	21FT8308	Emerging Technologies in Food Processing	PE	3	0	0	3	25	75	100
4.	21FT8309	Separation Techniques in Food Processing	PE	3	0	0	3	25	75	100
5.	21FT8310	Analytical Instruments in Food Industries	PE	3	0	0	3	25	75	100
6.	21FT8311	Entrepreneurship Opportunities for Food Technologists	PE	3	0	0	3	25	75	100
7.	21FT8313	Application of Nanotechnology and Cryogenics	PE	3	0	0	3	25	75	100

LIST OF OPEN ELECTIVES - FOOD TECHNOLOGY

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	21FT7401	Post Harvest Technology of Fruits and Vegetables	OE	3	0	0	3	25	75	100

LIFE SKILL COURSES

1.	21LSZ401	General Studies for Competitive Examinations	OE	3	0	0	3	25	75	100
2.	21LSZ402	Human Rights, Women's Rights and Gender Equality	OE	3	0	0	3	25	75	100
3.	21LSZ403	Indian Ethos and Human Values	OE	3	0	0	3	25	75	100
4.	21LSZ404	Indian Constitution and Political System	OE	3	0	0	3	25	75	100
5.	21LSZ405	Yoga for Human Excellence	OE	3	0	0	3	25	75	100



Enrollment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree. For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

VERTICALS FOR MINOR DEGREE

- Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

Note: Each programme should provide verticals for minor degree

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21FT5031	Sem 5: Food Analysis and Quality Control	MDC	3	0	0	3	3
2.	21FT6031	Sem 6: Fruits and Vegetable Processing Technology	MDC	3	0	0	3	3
3.	21FT6032	Sem6: Poultry, Meat, and Fish Processing Technology	MDC	3	0	0	3	3
4.	21FT7031	Sem 7: Dairy Engineering	MDC	3	0	0	3	3
5.	21FT7032	Sem 7: Baking and Confectionery Technology	*MDC	3	0	0	3	3
6.	21FT8031	Sem 8: Food Packaging	MDC	3	0	0	3	3

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

Vertical I Fintech and Block Chain	Vertical II Entrepreneurship	Vertical III Environment and Sustainability
Financial Management	Foundations of Entrepreneurship	Sustainable infrastructure Development
Fundamentals of Investment	Team Building & Leadership Management for Business	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	Creativity & Innovation in Entrepreneurship	Sustainable Bio Materials
Introduction to Blockchain and its Applications	Principles of Marketing Management for Business	Materials for Energy Sustainability
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Green Technology
Introduction to Fintech	Financing New Business Ventures	Environmental Quality Monitoring and Analysis



B.Tech. (Hons) Food Technology with Specialization in Food Technology and Management

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21FT5XXX	Transfer Processes in Food Processing	PC	2	0	2	3	4	50	50	100
2.	21FT6XXX	Food Regulations and Food Safety Management	PC	2	0	2	3	4	50	50	100
3.	21FT6XXX	Marketing Management	PC	3	1	0	4	3	40	60	100
4.	21FT7XXX	Food Supply Chain Management	PC	2	0	2	3	4	50	50	100
5.	21FT7XXX	Inventory Management	PC	2	0	2	3	4	50	50	100
6.	21FT8XXX	Total Quality Management	PC	0	0	4	2	4	60	40	100

B.Tech. (Hons) Food Technology with Specialization in Entrepreneurship and Management

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21FT5XXX	Entrepreneurship Opportunities for Food Technologist	PC	3	0	0	3	3	40	60	100
2.	21FT6XXX	Enterprise for resource planning	PC	3	0	0	3	3	40	60	100
3.	21FT6XXX	Consumer acceptance and Market survey in Food Processing	PC	3	0	0	3	3	40	60	100
4.	21FT7XXX	Energy audit in food processing industry	PC	3	0	0	3	3	40	60	100
5.	21FT7XXX	Food Process Economics & Industrial Management	PC	3	0	0	3	3	40	60	100
6.	21FT8XXX	Supply Chain and Retail Management	PC	3	0	0	3	3	40	60	100

B.Tech. (Hons) Food Technology with Specialization in Novel Food Technologies

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21FT5XXX	Principles of Food Processing	PC	3	0	0	3	3	40	60	100
2.	21FT6XXX	3D Food Printing and Extrusion	PC	3	0	0	3	3	40	60	100
3.	21FT6XXX	High Pressure Processing	PC	3	0	0	3	3	40	60	100
4.	21FT7XXX	Pulsed Light and UV-C Technology	PC	3	0	0	3	3	40	60	100
5.	21FT7XXX	Emerging Non-Thermal Processing of Foods	PC	3	0	0	3	3	40	60	100
6.	21FT8XXX	Emerging Technologies in Food Processing	PC	3	0	0	3	3	40	60	100

Note: Each programme should provide verticals for Honours degree

SEMESTER-WISE CREDIT DISTRIBUTION



B.E. / B.TECH. PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HS	04	04	-	-	-	03	-	-	11
2	BS	10	10	04	04	-	-	-	-	28
3	ES	06	05	-	-	-	-	-	-	11
4	PC	-	03	16	17	19	12	12		79
5	PE	-	-	-	-	03	03	03	06	15
6	OE	-	-	-	-	-	03	03	-	06
7	EEC	-	-	-	-	02	03	02	08	15
Total		20	22	20	21	24	24	20	14	165

Credit Distribution R2019

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165


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SEMESTER III

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21MA3102	FOURIER ANALYSIS AND TRANSFORMS	3	1	0	4

Course Objectives

- Analyze Fourier series which is central to many applications in engineering.
- Apply the effective tools for the solutions of one-dimensional boundary value problems.
- Apply the effective tools for the solutions of two-dimensional heat equations.
- Apply Fourier transform techniques in various situations.
- Analyze Z transform techniques for discrete time systems.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	FOURIER SERIES Dirichlet's conditions- General Fourier Series – Odd and Even Functions – Half range sine and cosine series – Change of Interval - Parseval's Identity - Harmonic analysis.	12
II	BOUNDARY VALUE PROBLEMS Classification of PDE - Solutions of one-dimensional wave equation - One dimensional equation of heat conduction (excluding insulated edges).	12
III	TWO-DIMENSIONAL HEAT EQUATIONS Steady state solution of two-dimensional equation of heat conduction in infinite plate and semicircular plate.	12
IV	FOURIER TRANSFORMS Fourier Transform Pairs - Fourier sine and cosine transforms – Properties - Transforms of Simple functions – Convolution Theorem (Statement only) – Parseval's identity (Statement only).	12
V	Z - TRANSFORMS AND DIFFERENCE EQUATIONS Z- Transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem (excluding proof)– Solution of difference equations using Z – transform.	12
Total Instructional Hours		60

Course Outcome

- CO1: Understand the principles of Fourier series which helps them to solve physical problems of engineering.
- CO2: Employ Fourier series in solving the boundary value problems.
- CO3: Understand Fourier series in solving the two-dimensional heat equations.
- CO4: Apply Fourier transform techniques which extend its applications.
- CO5: Illustrate the Z- transforms for analyzing discrete-time signals and systems.

TEXT BOOKS:


- T1 - Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.
- T2 - Bali. N.P and Manish Goyal & Watkins, "Advanced Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007

REFERENCE BOOKS :

- R1 - C.Roy Wylie " Advance Engineering Mathematics" Louis C. Barret, 6th Edition, Mc Graw Hill Education India Private Limited, New Delhi 2003.
- R2 - Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics Volume III", S.Chand & Company Ltd., New Delhi, 1996.
- R3 - Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2018.
- R4 - Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2018.


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Programme B.TECH.	Course code 21FT3201	Name of the course FLUID MECHANICS	L 3	T 1	P 0	C 4
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COURSE OBJECTIVES

- Understand the classification of fluids.
- Understand the statements regarding fluid flow.
- Understand the fluid flow through pores.
- Understand the performance of pumps.
- Understand the flow measuring devices and valves.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	Fluid Statics and Dimensional Analysis: Nature of fluids – physical properties of fluids, Compressible and incompressible. Types of fluids – Newtonian and Non – Newtonian fluids. Fluid static: Hydrostatic equilibrium. Application of fluid statics: manometers, continuous gravity decanter. Basics of dimensional analysis: Rayleigh 's method and Buckingham's method.	12
II	Basic Equations of Fluid Flow: Bernoulli equation. Correction of Bernoulli equation for fluid friction. Application of Bernoulli equation for pump work. Shear stress and skin friction in pipes. Laminar and turbulent flow of fluids through closed conduits. Velocity profiles and friction factor for smooth and rough pipes. Friction loss due to sudden enlargement, contraction. Friction loss in fittings valves and coils.	12
III	Flow Past Immersed Bodies: Pressure drop for flow of liquids through porous media. Motion of particles through fluids: Equation for one dimensional motion of spherical particle through fluid, terminal velocity, Hindered settling. Agitation of liquids: Types of impellers, Flow pattern in agitated vessel. Power consumption in agitated vessels, blending and mixing.	12
IV	Transportation of Fluids: Fluid moving machinery. Performance – selection and specification. Positive displacement, centrifugal pump - characteristics. Gear pump, diaphragm pumps, vacuum pump, metering pump, peristaltic pump –working principle and application. Fans, blowers and compressors – Selection, types and applications.	12
V	Metering of Fluids: Variable head meter: Orifice meter, Venturimeter, Pitot tube. Variable area meter: Rota meter. Calibration of flow meters. Principles and applications of Doppler Effect in flow measurement. Principle of Magnetic flow meters, V-Notch, Turbine flow meters, and Thermal flow meters. Valves – Types, applications.	12

TOTAL INSTRUCTIONAL HOURS 60

COURSE OUTCOMES

- CO1 - Classify fluids, apply hydrostatic equilibrium and dimensional analysis in fluid flow behaviour
CO2 - Derive and apply basic equations of fluid flow
CO3 - Analyze fluid flow through porous media and select suitable mixing equipment used in food industries
CO4 - Select and evaluate the performance of pumps
CO5 - Illustrate the principle and application of different flow measuring devices and valves

TEXT BOOKS:

1. McCabe W.L., Smith J.C. and Harriot P., —Unit Operations of Chemical EngineeringI, 7th Edition, McGraw Hill, New York, 2017.
2. Gavhane K.A., —Unit Operations – I, 8th Edition, Nirali Prakashan Publications, Pune, 2017.

REFERENCE BOOKS:

1. Coulson & Richardson's Chemical Engineering. 5th edition, vol. 2. Elsevier, 2006.
2. Mott, Robert L., and Joseph A. Untener. Applied fluid mechanics. Pearson, 2015.
3. Cengel, Yunus and Cimbala John M., —Fluid Mechanics Fundamentals and ApplicationsI, 4th Edition, Tata McGraw Hill Publishing Company, 2017.


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Programme B.TECH.	Course code 21FT3101	Name of the course PRINCIPLES OF THERMODYNAMICS	L 3	T 1	P 0	C 4
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- COURSE OBJECTIVES**
- Understand the basic concepts.
 - Understand the principles of thermodynamics law.
 - Understand the relationship of pure substance.
 - Understand the properties of steam.
 - Understand the mechanism of boiler.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	Basic Concepts and First Law: Fundamental concepts of thermodynamics- microscopic and macroscopic approach – systems, properties, process, functions, units, energy, heat and work, zeroth law. First law - statement of first law for flow and non - flow process, internal energy, enthalpy, heat capacities (CV and CP) – steady state flow processes with reference to various thermal equipments - nozzle, throat, throttling process and compressors.	12
II	Second Law: Second Law of thermodynamics: Kelvin-Planck, Clausius statements and its equivalence, reversible cycle – Carnot cycle and theorem – thermodynamic temperature scale. Entropy, Clausius theorem, Clausius inequality, Entropy changes during processes – available and unavailable energies.	12
III	PVT Behavior of Pure Fluids: PVT surfaces: P-V, P-T, T-S and H-S Diagrams. Equation of state and the concept of ideal gas - Process involving ideal gases: constant volume, constant pressure, constant temperature, adiabatic and polytropic process. Equation of state for real gases – Vander Waals equation, Redlich Kwong equation, Virial equation of state. Principle of corresponding states – generalized compressibility charts.	12
IV	Steam Properties: Properties of steam, usage of steam tables. Determination of dryness fraction of steam. Calorimeters – Tank or barrel type, throttling, separating, separating and throttling. Steam distribution systems. Types of steam traps and their characteristics. Application of steam in food process industries.	12
V	Boilers: Types and classification of boilers - Cochran Boiler, Lancashire boiler, Locomotive Boiler, Fluidized Bed Boiler. Boiler mountings and Accessories. Performance and energy efficiency of boilers.	12
	Simple calculation of Boiler efficiency. Importance of boiler water treatment and blow down.	
	TOTAL INSTRUCTIONAL HOURS	60

- COURSE OUTCOMES**
- CO1 - Outline the basic concepts and apply the first law of thermodynamics in selected processes
 - CO2 - Understand the principle of second law of thermodynamics and concepts of Carnot cycle
 - CO3 - Interpret the second law of thermodynamics and relate the properties of pure substance
 - CO4 - Estimate the properties of steam and measurement of quality of steam using calorimeters
 - CO5 - Integrate the use of simple calculation in gaining the working knowledge of different boilers.

TEXT BOOKS

1. Narayanan K.V., —A Text Book of Chemical Engineering Thermodynamic, 2nd revised edition, Prentice Hall of India, New Delhi, 2013.
2. Reeve Sidney Armor., —"Thermodynamics of Heat Engines", Wentworth press 2019.

REFERENCE BOOKS

1. Smith J.M., Van Ness H.C. and Abbott M.M., —Introduction to Chemical Engineering Thermodynamics, 7th Edition, McGraw Hill, New York, 2005.
2. Rao Y.V.C., —An Introduction to Thermodynamics, Universities Press, 2004.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT3202	FOOD MICROBIOLOGY	3	0	0	3

- COURSE OBJECTIVES**
- Understand the basic concepts.
 - Understand the principles of thermodynamics law.
 - Understand the relationship of pure substance.
 - Understand the properties of steam.
 - Understand the mechanism of boiler.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	Incidence of Microorganisms in Food: Importance of microorganisms in food, primary sources of microorganisms in food, Intrinsic and Extrinsic parameters of food affecting / influencing microbial growth. Types of microorganisms in foods like meats, poultry, seafood, vegetables, dairy products, fruits and vegetables.	9
II	Microbial Load Assessment: Sampling methods, SPC, MPN, spiral platter, DEFT, microcolony HGMF, DMC, Dye reduction, swab/swab-rinse method, impedance, microcalorimetry, flow cytometry, ATP measurement, PCR, Fluorescent antibody, RIA, ELISA.	9
III	Fermented Foods: Fermentation- Introduction, batch, fed batch and continuous fermentation. Fermented foods – Sauerkraut, Cheese, Beer, Vinegar and Tempeh. Single cell protein – Introduction, nutritive value, advantages over plant and animal proteins. Production process – BEL, SYMBA, PEKILLO, BIOPROTEIN, QUORN and PRUTEEN process. Probiotics.	9
IV	Microbial Spoilage: principles and types of spoilage, microbial spoilage of different types of foods—fruits and vegetables, meat, poultry, sea foods, cereals products, bakery products, dairy products, fermented foods and canned foods.	9
V	Food Borne Diseases and Quality Control: Gastroenteritis, Listeriosis, Salmonellosis, Shigellosis, Vibriosis, Campylobacteriosis. Food toxins – Aflatoxin and Botulin. Food sanitation – indicators of food safety, Coliform bacteria. Food processing plant sanitation. Microbiological standards and guidelines –Microbiological criteria for foods, Enforcement and control agencies.	9
TOTAL INSTRUCTIONAL HOURS		45
COURSE OUTCOMES	CO1 - Recognize the sources and factors influencing the microbial growth CO2 - Identify the techniques used to assess the microbial load and CO3 - Apply the knowledge of microorganism in fermentation process CO4 - Interpret microbial spoilage of different foods CO5 - Distinguish food borne diseases and intoxication caused by microorganisms	

TEXT BOOKS

1. Frazier W.C., Westhoff D.C. and Vanitha N.M., —Food Microbiology, 5th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2014.
2. Jay J.M., —Modern Food Microbiology, 6th Edition, Aspen Publications, Maryland, USA, 2000.

REFERENCE BOOKS

1. Adams M.R. and Moss M.O., —Food Microbiology, RSC Publishing, 2008.
2. Ray B. and Bhunia A., —Fundamental Food Microbiology, 5th Edition, CRC Press, 2013.


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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT3251	BIOCHEMISTRY	2	0	2	3

COURSE OBJECTIVES

- To study the structure and properties of carbohydrates
- To understand the structure and properties of lipids
- To know the structural and functional role of proteins
- To have an idea about classification of the enzymes and interpret the enzyme action and their immobilization
- To learn the structure of nucleic acids and illustrate the basics of energy metabolism

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
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I	Carbohydrates: Classification; Simple Sugars: mono and disaccharides, Hygroscopicity and solubility, optical rotation, mutarotation, Sweetness: structure-activity relationship and sweetness index; Dextrose Equivalent, Degree of polymerisation; Sugar alcohols; Oligosaccharides: structure and occurrence. Polysaccharides: Starch-amylose and amylopectin-properties. Cellulose. Pectins, gums and seaweeds – structure & properties. Dietary fibres - Food sources, functional role and uses in foods. Qualitative tests for monosaccharide, disaccharides, polysaccharides. Estimation of reducing sugar by dinitrosalicylic acid method. Estimation of starch by anthrone method	9+6=15
II	Lipids: Structure, classification and composition of fats. Physical properties of fats and oils: crystal formation, polymorphism, melting point, plasticity, radiolysis. Shortening power of fats, emulsification, smoke point and polymerization. Chemical properties of fats – Hydrolysis, saponification, halogenation. Hydrolytic rancidity and oxidative rancidity. Extraction and estimation of oil content	9+2=11
III	Proteins: Amino acids - Definition, structure and classification. Protein - structure and conformation, Food sources and biological role. Properties of proteins in food systems: Dissociation, optical activity, solubility, hydration, swelling, foam formation and stabilization, gel formation, emulsifying effect. Denaturation. Estimation of protein by biuret method, Lowry and Bradford.	9+5=14 *
IV	Enzymes as food processing aids: Introduction, Nature, classification and nomenclature of enzymes. Specificity. Enzyme kinetics – Michelis - Menten equation, Factors affecting enzyme action, mechanism of enzyme action; active site. Immobilization methods. Enzyme activity – phosphatase enzyme.	9+2=11
V	Nucleic Acids: Composition and structure of DNA and RNA. Metabolism: Metabolism - Glycolysis; TCA cycle; substrate level phosphorylation. Protein metabolism – urea cycle. Cellular respiration - electron transport chain. Lipid metabolism – lipases and phospholipases. Fatty acid metabolism – beta oxidation and fatty acid synthesis. Inter relationship of metabolic pathways.	9

TOTAL INSTRUCTIONAL HOURS 45+15=60

COURSE OUTCOMES

- Interpret the structure and properties of carbohydrates
- Recall the structure and properties of lipids
- Recognize the structural and functional role of proteins
- Classify the enzymes and interpret the enzyme action and their immobilization
- Infer the structure of nucleic acids and illustrate the basics of energy metabolism

TEXT BOOKS

1. Belitz H. D., Grosch W., and Schieberle P., —Food Chemistry, 3rd Edition, Springer Verley, Berlin, 2008.
2. Jain J.L., Sunjay Jain and Nitin Jain, —Fundamentals of Biochemistry, S. Chand & Co., New Delhi, 2008.

REFERENCE BOOKS

1. Rastogi S.C., —Biochemistry, 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.
2. Finley, John W., W. Jeffrey Hurst, and Chang Yong Lee. *Principles of food chemistry*. Springer, 2018.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT3001	FOOD MICROBIOLOGY LAB	0	0	3	1.5

COURSE OBJECTIVES

- Expose various microbial aspects of Food Processing
- Impart knowledge on identification of microbes using different technique and its enumeration methods
- Recognize the role of microbes in Food spoilage and preservation

UNIT

LIST OF EXPERIMENTS

- I Introduction, Laboratory Safety, Use of Equipment; Sterilization Techniques; Culture Media-Types and Use; Preparation of Nutrient broth and agar
- II Culture Techniques, Isolation and Preservation of Cultures- Broth: flask, test tubes; Solid: Pour plates, streak plates, slants, stabs
- III Microscopy – Working and care of Microscope; Microscopic Methods in the Study of Microorganisms; Staining Techniques- Simple, Differential- Gram's Staining
- IV Quantification of Microbes: Sampling and Serial Dilution; Bacterial count in food products TVC
- V Microbiological Quality of Water (MPN)
- VI Microbiological quality of milk
- VII Enumeration of Lactic acid bacteria from fermented foods
- VIII Yeast & Mould count from fruits
- IX Enumeration of spores from pepper
- X Inhibitory effect of spices on microbial load in fish & flesh foods
- XI Enumeration & Isolation of *E. coli* from processed meat/chicken
- XII Thermal destruction of microbes: TDT & TDP
- XIII Enumeration & Isolation of Staphylococci from ready to eat street foods
- XIV Effect of cleaning and disinfection on microbial load

TOTAL WORKING HOURS: 45

COURSE OUTCOMES

- CO1 - Complete understanding of isolation, characterization of various microbes associated with foods and food groups.
- CO2 - Familiarize with microbiological techniques for the study of foods.
- CO3 - Better understanding of methods to detect pathogens in foods.
- CO4 - Inoculate, isolate and identify the microorganism from both liquid and solid samples
- CO5 - Select the appropriate equipment for Microbiological works

REFERENCES

1. Yousef A.E. and Carlstrom C., —Food Microbiology: A Laboratory Manual, Wiley Interscience Publications, 2003.
2. McLandsborough L., —Food Microbiology Laboratory, CRC Press, 2004.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT3002	FOOD PRODUCTION ANALYSIS LAB	0	0	4	2

COURSE OBJECTIVES

- Provide knowledge on food quality standards
- Understand role of food additives and their permissible limits
- Know food laws of India for consumer as well as industry

UNIT

LIST OF EXPERIMENTS

- I Studying the expansion characteristics of snack foods on frying.
- II Rancidity test for fried foods to assess primary and secondary oxidative products.
- III Determination of Vitamin C in fruit juices.
- IV Estimation of synthetic Food color in sweets, confectioneries, and beverages.
- V Determination of Iron content in foods.
- VI Determination of Iodine content in iodized salt
- VII Detection of Annatto color in table butter.
- VIII Determination of Lead in spices powder.
- IX Detection of added MSG in foods.
- X Detection of sulphur-di-oxide in foods.
- XI Detection of anti-oxidant in foods.
- XII Detection of certain emulsifiers and stabilizers in foods

CO1 - Analyze the additives present in food

CO2 - Familiarize with the nutrients after processing

COURSE OUTCOMES

CO3 - Better understanding of processed foods with compliance to standards

CO4 - Demonstrate simple detection methods of food adulteration

CO5 - Implement the hygienic practices in food processing industry

REFERENCES

1. Otles, Semih. "Methods of Analysis of Food Components and Additives". CRC Press, 2005.
2. Nollet, Leo M.L. "Hand Book of Food Analysis" 2nd Rev. Edition. Vol. I, II & III, Marcel & Dekker, 2004.
3. Nollet, Leo M.L. " Food Analysis by HPLC". 2nd Rev. Edition, Marcel & Dekker, 2000
4. Otles, Semih. "Handbook of Food Analysis Instruments". CRC Press, 2009.

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Programme	CourseCode	Name of the Course	L	T	P	C
B.TECH.	21MC3191	INDIAN CONSTITUTION	2	0	0	0

The student should be made to

- Course Objectives**
1. Sensitization towards self, family (relationship), society and nature
 2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of
 3. human relationships and resolved individuals
 4. Strengthening of self-reflection
 5. Development of commitment and courage to act

Unit	Description	Instructional Hours
I	BASIC FEATURES AND FUNDAMENTAL PRINCIPLES Meaning of the constitution law and constitutionalism–Historical perspective of the constitution of India– salient features and characteristic of the constitution of India.	6
II	FUNDAMENTAL RIGHTS Scheme of the fundamental rights–fundamental duties and its legislative status–The directive principles of state policy–its importance and implementation-Federal structure and distribution Of legislative and financial powers between the union and states.	6
III	PARLIAMENTARY FORM OF GOVERNMENT The constitution powers and the status of the president in India.–Amendment of the constitutional Powers and procedures–The historical perspective of the constitutional amendment of India–Emergency provisions: National emergency, President rule, Financial emergency.	6
IV	LOCAL GOVERNANCE Local self-government-Rural Local Government-Panchayath Raj, Elections of Panchayat-State Election Commission- Urban Local Government-Amendment Act, Urban Local Government Structures in India	6
V	INDIAN SOCIETY Constitutional Remedies for citizens–Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.	6
Total Instructional Hours		30

Course Outcome
At the end of the course, the learner will be able to
CO1: Understand the functions of the Indian government.
CO2: Understand and abide the rules of the Indian Constitution

TEXTBOOKS:

- T1: Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi, 1997.
T2: Agarwal R C., "Indian Political System", S. Chand and Company, New Delhi, 1997.
T3: Maciver and Page, "Society: An Introduction Analysis", MacMillan India Ltd., New Delhi.
T4: Sharma K L., "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi, 1997.

REFERENCE BOOKS:

- R1-Sharma, Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi.
R2-Gahai UR., "Indian Political System", New Academic Publishing House, Jalaendhar.
R3-Sharma R N., "Indian Social Problems", Media Promoters and Publishers Pvt. Ltd.

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Course code	Course title	L	T	P	C
21HE3072	CAREER GUIDANCE – LEVEL III Personality, Aptitude and Career Development	2	0	0	0
Pre-requisite	None	Syllabus version 1			

Course Objectives:

- Solve Logical Reasoning questions of easy to intermediate level [SLO 6]
- Solve Quantitative Aptitude questions of easy to intermediate level [SLO 7]
- Solve Verbal Ability questions of easy to intermediate level [SLO 8]
- Display good writing skills while dealing with essays [SLO 12]

Expected Course Outcome:

Enable students to solve Aptitude questions of placement level with ease, as well as write effective essays.

Student Learning Outcomes

(SLO): 6, 7, 8, 12

Module:1 Logical Reasoning 6 hours SLO:6

Clocks, calendars, Direction sense and Cubes

- Clocks
- Calendars
- Direction Sense
- Cubes

Data interpretation and Data sufficiency

- Data Interpretation – Tables
- Data Interpretation - Pie Chart
- Data Interpretation - Bar Graph
- Data Sufficiency

Module:2 Quantitative Aptitude 7 hours SLO: 7

Time and work

- Work with different efficiencies
- Pipes and cisterns
- Work equivalence
- Division of wages

Time, Speed and Distance

- Basics of time, speed and distance
- Relative speed
- Problems based on trains
- Problems based on boats and streams
- Problems based on races

Profit and loss, Partnerships and averages

- Basic terminologies in profit and loss
- Partnership
- Averages
- Weighted average

Module:3 Verbal Ability 5 hours SLO: 8

Sentence Correction

- Subject-Verb Agreement
- Modifiers
- Parallelism
- Pronoun-Antecedent Agreement
- Verb Time Sequences
- Comparisons
- Prepositions
- Determiners



Sentence Completion and Para-jumbles

Pro-active thinking

Reactive thinking (signpost words, root words, prefix suffix, sentence structure clues)

Fixed jumbles

Anchored jumbles

Module:4 Writing skills for placements 2 hours SLO: 12

Essay writing

Idea generation for topics


Best practices

Practice and feedback

Total Lecture hours: 20 hours

Mode of Evaluation: Assignments, 3 Assessments with End Semester (Computer Based Test)


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FT - HiCET**


Dean - Academics
**Dean (Academics)
HiCET**



Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21HE3073	LEADERSHIP MANAGEMENT SKILLS	1	0	0	0

Course Objective

1. To know about the leadership skills that is to be acquired for success.
2. To become a teamwork expert, real world problem solver, your views will be challenged
3. To gain global perspective and becoming an effective communicator
4. To understand about learning, negotiation and decision making
- 5: To get first-hand information about the skills we possess and to work on improvement.

Module	Description	Instructional Hours
1.	Strategic thinking skills	
2.	Planning and Delivery skills	
3.	People management skills (Delegation)	
4.	Change management and Innovation skills	
5.	Communication skills	
6.	Persuasion and influencing skills	
7.	Learning Agility	
8.	Motivation	
9.	Personality	
10.	Emotions	
11.	Perception	
12.	Negotiation	
13.	Decision making	
14.	Problem solving	
15.	Building trust	
Total Instructional Hours		15

- Course Outcome**
- CO1: To practice essential leadership skills in day to day operations
 - CO2: To work on leadership skills in the study environment
 - CO3: To understand and develop the skills consciously.
 - CO4: To know about the real worth of all the skills for success
 - CO5: To Analyze the real worth of the person and suggestion for improvement

TEXT BOOKS

- T1 A REVIEW OF LEADERSHIP THEORY AND COMPETENCY FRAMEWORKS, Bolden, R., Gosling, J., Marturano, A. and Dennison, P. June 2003
- T2 LEADING FROM WITHIN: Building Organizational Leadership Capacity-David R. Kolzow, PhD, 2014

REFERENCE BOOKS

- R1 Seven habits of highly effective people – Stephen R.Covey
- R2 The Art of Business Leadership: Indian Experiences – G.Balasubramaniam
- R3 DEVELOPING the LEADER WITHIN YOU-JOHN C. MAXWELL

Jury
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Chairman - BoS
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[Signature]
 Dean - Academics
Dean (Academics)
HiCET

CURRICULUM
R2019

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. FOOD TECHNOLOGY (UG)

REGULATION-2022

For the students admitted during the academic year 2020-2021 and onwards

SEMESTER I

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	19HE1101	Technical English	HS	2	1	0	3	25	75	100
2.	19MA1102	Calculus and Linear Algebra	BS	3	1	0	4	25	75	100
3.	19ME1101	Basics of Civil and Mechanical Engineering	ES	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
4.	19PH1151	Applied Physics	BS	2	0	2	3	50	50	100
5.	19CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
6.	19CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100
PRACTICAL										
7.	19HE1071	Language Competency Enhancement Course-I	HS	0	0	2	1	100	0	100
MANDATORY COURSES										
8.	19HE1072	Career Guidance Level – I Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
Total:				16	2	8	20	425	375	800
As Per AICTE Norms 3 Weeks Induction Programme is Added in The First Semester as an Audit Course										

SEMESTER II

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	19HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100
2.	19MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	25	75	100
3.	19FT2105	Principles of Microbiology	ES	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
4.	19IT2151	Programming in C	ES	2	0	2	3	50	50	100
5.	19PH2151	Material Science	BS	2	0	2	3	50	50	100
6.	19CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
PRACTICALS										
7.	19ME2001	Engineering Practices Laboratory	ES	0	0	4	2	50	50	100
8.	19HE2071	Language Competency Enhancement Course-II	HS	0	0	2	1	100	0	100
MANDATORY COURSES										
9.	19HE2072	Career Guidance Level – II Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	19HE2073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100



Total:	17	2	12	22	575	425	1000
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SEMESTER III

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	19MA3102	Fourier Analysis and Transforms	BS	3	1	0	4	25	75	100
2.	19FT3201	Fluid Mechanics	PC	3	1	0	4	25	75	100
3.	19FT3101	Principles of Thermodynamics	PC	3	0	0	3	25	75	100
4.	19FT3202	Food Microbiology	PC	3	0	0	3	25	75	100
THEORY AND LAB COMPONENT										
5.	19FT3251	Bio Chemistry	PC	2	0	2	3	50	50	100
PRACTICALS										
6.	19FT3001	Food Microbiology Lab	PC	0	0	3	1.5	50	50	100
7.	19FT3002	Food Production Analysis Lab	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8.	19MC3191	Indian Constitution	MC	2	0	0	0	100	0	100
9.	19HE3072	Career Guidance Level – III Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	19HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
Total				19	2	8	20	550	450	1000

SEMESTER IV

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	19FT4201R	Fundamentals of Heat and Mass Transfer	PC	3	1	0	4	25	75	100
2.	19FT4203R	Engineering properties of food materials	PC	3	0	0	3	25	75	100
3.	19FT4204	Refrigeration and Cold Chain Management	PC	3	1	0	4	25	75	100
THEORY AND LAB COMPONENT										
4.	19FT4251	Food Chemistry	PC	2	0	2	3	50	50	100
5.	19MA4152	Statistics and Numerical Methods	BS	3	0	2	4	50	50	100
PRACTICALS										
6.	19FT4001	Unit Operations Laboratory	PC	0	0	3	1.5	50	50	100
7.	19FT4002	Food Process Equipment Design Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8.	19MC4191	Essence of Indian tradition knowledge/Value Education	MC	2	0	0	0	100	0	100
9.	19HE4072	Career Guidance Level – IV Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	19HE4073	Ideation Skills	EEC	1	0	0	0	100	0	100
Total				19	2	10	21	575	425	1000

SEMESTER V

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
1.	19FT5201	Baking and Confectionery Technology	PC	3	0	0	3	25	75	100



2.	19FT5202	Food Additives	PC	3	0	0	3	25	75	100
3.	19FT5203	Poultry, Meat and Fish Process Technology	PC	3	0	0	3	25	75	100
4.	19FT5204	Principles of Food Processing	PC	3	0	0	3	25	75	100
5.	19FT5205	Unit Operations in Food Processing	PC	3	0	0	3	25	75	100
6.	19FT53XX	Professional Elective -I	PE	3	0	0	3	25	75	100
PRACTICALS										
7.	19FT5001	Baking and Confectionery Technology Laboratory	PC	0	0	4	2	50	50	100
8.	19FT5002	Unit Operations in Food Processing Laboratory	PC	0	0	4	2	50	50	100
MANDATORY COURSES										
9.	19HE5071	Soft Skills - I	EEC	1	0	0	1	25	75	100
10.	19HE5072	Design Thinking	EEC	1	0	0	1	25	75	100
TOTAL				20	0	8	24	300	700	1000

SEMESTER VI

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	19FT6201	Dairy Engineering	PC	3	0	0	3	25	75	100
2.	19FT6202	Plantation crops and Spices Products Technology	PC	3	0	0	3	25	75	100
3.	19FT6203R	Fruits and Vegetable Processing Technology	PC	3	0	0	3	25	75	100
4.	19FT6181	Professional Ethics in Engineering	HS	3	0	0	3	25	75	100
5.	19FT63XX	Professional Elective - II	PE	3	0	0	3	25	75	100
6.	19XX64XX	Open Elective- I	OE	3	0	0	3	25	75	100
PRACTICALS										
7.	19FT6001	Dairy Engineering Laboratory	PC	0	0	3	1.5	50	50	100
8.	19FT6002	Fruits and Vegetable Processing Technology Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
9.	19FT6701	Industrial Training	EEC	0	0	0	1	0	100	100
10.	19HE6071	Soft Skills - II	EEC	1	0	0	1	25	75	100
11.	19HE6072	Intellectual Property Rights(IPR)	EEC	1	0	0	1	25	75	100
TOTAL				20	0	6	24	300	800	1100

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1.	19FT5301	Technology of Fats and Oils	PE	3	0	0	3	25	75	100



2.	19FT5302	Food Storage and Infestation Control	PE	3	0	0	3	25	75	100
3.	19FT5303	Food Process Calculations	PE	3	0	0	3	25	75	100
4.	19FT5304	Post-Harvest Technology	PE	3	0	0	3	25	75	100
5.	19FT5305	Cane sugar Technology	PE	3	0	0	3	25	75	100
6.	19FT5306	Milling Technology for Food Materials	PE	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE II										
1.	19FT6301	Beverage Technology	PE	3	0	0	3	25	75	100
2.	19FT6302 R	Technology of Snack and Extruded Foods	PE	3	0	0	3	25	75	100
3.	19FT6303	Food Biotechnology	PE	3	0	0	3	25	75	100
4.	19FT6304	Bioprocess Engineering	PE	3	0	0	3	25	75	100
5.	19FT6305	Enzyme Technology	PE	3	0	0	3	25	75	100
6.	19FT6306	Crop Process Engineering	PE	3	0	0	3	25	75	100

OPEN ELECTIVE

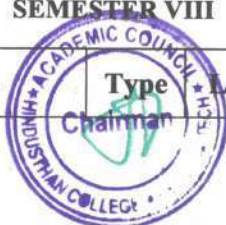
S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	19FT6401	Traditional Foods	OE	3	0	0	3	25	75	100

SEMESTER VII

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	19FT7201	Food Analysis and Quality Control	PC	3	0	0	3	25	75	100
2.	19FT7202	Food Packaging	PC	3	0	0	3	25	75	100
3.	19FT7203	Food Plant Layout and Management	PC	3	0	0	3	25	75	100
4.	19FT73XX	Professional Elective-III	PE	3	0	0	3	25	75	100
5.	19XX74XX	Open Elective – II	OE	3	0	0	3	25	75	100
PRACTICALS										
6.	19FT7001	Food Packaging Laboratory	PC	0	0	3	1.5	50	50	100
7.	19FT7002	Food Analysis and Quality Control Laboratory	PC	0	0	3	1.5	50	50	100
PROJECT WORK										
8.	19FT7901	Project Phase I	EEC	0	0	4	2	50	50	100
TOTAL				15	0	10	20	275	525	800

SEMESTER VIII

S.No	Course Code	Course Title	Type	T	P	C	CIA	ESE	TOTAL
			Chairman						



THEORY										
1.	19FT83XX	Professional Elective –IV	PE	3	0	0	3	25	75	100
2.	19FT83XX	Professional Elective- V	PE	3	0	0	3	25	75	100
PRACTICAL										
3.	19FT8901	Project Work – Phase II	EEC	0	0	16	8	100	100	200
Total				6	0	16	14	150	250	400

PROFESSIONAL ELECTIVE III

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	19FT7301	Functional foods and Nutraceuticals	PE	3	0	0	3	25	75	100
2.	19FT7302	Biology and Chemistry of Food Flavors	PE	3	0	0	3	25	75	100
3.	19FT7303	Food Toxicology and Allergy	PE	3	0	0	3	25	75	100
4.	19FT7304	Advanced Drying Technology	PE	3	0	0	3	25	75	100
5.	19FT7305	Cereal Technology	PE	3	0	0	3	25	75	100
6.	19FT7306	Processing Technology of Legumes and Oilseeds	PE	3	0	0	3	25	75	100
7.	19FT7307	Emerging Non-Thermal Processing of Foods	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE IV

1.	19FT8301	Food Process Economics and Industrial Management	PE	3	0	0	3	25	75	100
2.	19FT8302	Food Laws and Safety	PE	3	0	0	3	25	75	100
3.	19FT8303	Waste Management and By-Product Utilization in Food Industries	PE	3	0	0	3	25	75	100
4.	19FT8304	Instrumentation and Process Control	PE	3	0	0	3	25	75	100
5.	19FT8305	Economics and Management	PE	3	0	0	3	25	75	100
6.	19FT8312	Total Quality Management	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE V

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	19FT8306	Food process plant layout and safety	PE	3	0	0	3	25	75	100
2.	19FT8307	Energy Management in Process Industries	PE	3	0	0	3	25	75	100
3.	19FT8308	Emerging Technologies in Food Processing	PE	3	0	0	3	25	75	100
4.	19FT8309	Separation Techniques in Food Processing	PE	3	0	0	3	25	75	100
5.	19FT8310	Analytical Instruments in Food Industries	PE	3	0	0	3	25	75	100
6.	19FT8311	Entrepreneurship Opportunities for Food	PE	3	0	0	3	25	75	100



		Technologists								
7.	19FT8313	Application of Nanotechnology and Cryogenics	PE	3	0	0	3	25	75	100

LIST OF OPEN ELECTIVES - FOOD TECHNOLOGY

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	19FT7401	Post Harvest Technology of Fruits and Vegetables	OE	3	0	0	3	25	75	100

LIFE SKILL COURSES

1.	19LSZ401	General Studies for Competitive Examinations	OE	3	0	0	3	25	75	100
2.	19LSZ402	Human Rights, Women's Rights and Gender Equality	OE	3	0	0	3	25	75	100
3.	19LSZ403	Indian Ethos and Human Values	OE	3	0	0	3	25	75	100
4.	19LSZ404	Indian Constitution and Political System	OE	3	0	0	3	25	75	100
5.	19LSZ405	Yoga for Human Excellence	OE	3	0	0	3	25	75	100

SEMESTER-WISE CREDIT DISTRIBUTION

B.E. / B.TECH. PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HS	04	04	-	-	-	03	-	-	11
2	BS	10	10	04	04	-	-	-	-	28
3	ES	06	05	-	-	-	-	-	-	11
4	PC	-	03	16	17	19	12	12		79
5	PE	-	-	-	-	03	03	03	06	15
6	OE	-	-	-	-	-	03	03	-	06
7	EEC	-	-	-	-	02	03	02	08	15
Total		20	22	20	21	24	24	20	14	165

Credit Distribution R2019

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165

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Dean (Ac.
HICET

Principal

Principal
Hindustan College of Engineering & Technology
C.No. 1032



SYLLABUS
SEMESTER V

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT5201	BAKING AND CONFECTIONERY TECHNOLOGY	3	0	0	3

Course Objectives

- To understand and remember the technology of baking and confectionery
- To understand the important role of essential ingredients in baking
- To analyze the different uses of bakery equipments
- To understand the production process of bakery products
- To apply and analyze the different methods of confectionery production

UNIT

DESCRIPTION

INSTRUCTIONAL HOURS

I	INTRODUCTION TO BAKING: Classification of bakery products. Bakery ingredients and their functions-Essential ingredients: Flour, yeast and sour dough, water, salt- Other ingredients: Sugar, color, flavor, fat, milk, milk powder and bread improvers. Leaveners and yeast foods. Shortenings, emulsifiers and antioxidants.	9
II	EQUIPMENTS IN BAKERY TECHNOLOGY: Introduction to utensils and equipments used in bakery industry with their purpose. Bulk handling of ingredients- Dough mixing and mixers, Dividing, rounding, sheeting, and laminating-Fermentation enclosures and brew equipment - Ovens and Slicers; Extrusion. Rheology of dough-Farinograph, Amylograph, Alveograph and Extensiograph.	9
III	BAKERY PRODUCT PREPARATION I: The Chemistry of dough Development. Bread making methods- Straight dough/bulk fermentation - Sponge and dough- Activated dough development- Chorley wood bread process- Dough retarding and freezing-emergency No time process. Advantages and disadvantages of various methods of bread-making. Characteristics of good bread: Internal characters; external characters. Bread defects/faults and remedies. Spoilage of bread-Causes, detection and prevention.	9
IV	BAKERY PRODUCT PREPARATION II: Production of cakes and cookies/biscuits. Types of biscuit dough 's –Developed dough, short dough 's, semi-sweet, enzyme modified dough 's and batters. Cake making: Ingredients and their function Structure builders. Tenderizers, moisteners and flavor enhancers. Production process for Wafers- type of flour, raising agents and maturing. Other miscellaneous products- puff pastry, chemically leavened. Problems of baking.	9
V	CONFECTIONERY PRODUCTS: Definition, importance of sugar confectionery. General technical aspects of industrial sugar confectionery manufacture - compositional effects. Manufacture methods of high boiled sweets: - Ingredients - prevention of recrystallization and stickiness Types of confectionery products-Caramel, Toffee and Fudge and other confections-- ingredients - Formulation – Processing method- Quality control- Aerated confectionery-Methods of aeration- Manufacturing process- Chemistry of Hydrocolloids, Hydrocolloid pre treatment Processes -product quality parameters, faults and corrective measures. Spoilage of confectionery products	9

Total Instructional Hours 45

Course Outcomes

Upon completion of the course, students can be able to

- CO1- Apply the principles of baking and analyze the role of ingredients in baking
- CO2- Illustrate and analyze the processing parameters of baking machineries
- CO3- Understand the processing of bread and applying on the production process
- CO4 - Understand the role of ingredients in bakery products
- CO5 - Apply the production process for different types of confectionery products

TEXT BOOKS:

1. Matz, Samuel A., "Bakery Technology and Engineering", III Edition, Chapman & Hall, London.
2. Cauvain, Stanley P, and Young, Linda S., "Technology of Bread Making", II Edition Aspen publication, Maryland, 1999

REFERENCES BOOKS:

1. Edwards W.P. "Science of bakery products", RSC, UK,2007
2. Samuel A. Matz., "Equipment for Bakers", Pan Tech International Publication. 1988.
3. Sugar Confectionery manufacture-(Ed) E.B.Jackson, II edition, Blackie Academic and professional, Glasgow,1995.
4. Bernard. W. Minifie., PhD "Chocolate, Cocoa, and confectionery" (Science and Technology), 3rd edition,CBS publishers and Distributors, New Delhi

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT5202	FOOD ADDITIVES	3	0	0	3

Course Objectives

- To expose the students to the use of different chemical additives in foods during food processing and preservation

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	INTRODUCTION: Definition, role of food additives, classification of food additives based on their role, dual role of certain additives, INS numbering system of food additives, safety requirements of food additives, Acceptable daily intake of food additives, JECFA and Food Chemical Codex standards for food additives, status of food additives with respect to Indian laws, GMP and permissible upper levels of food additives under Indian food laws.	9
II	ACIDITY REGULATORS AND PRESERVATIVES: Acidity Regulators – definition, chemical structure, role and importance, pH modulation and taste, acidity profile, permitted acidity regulators, levels of usage and food applications. Preservatives of chemical and microbial origin; mode of action on spoilage organisms and pathogens, factors affecting the performance of preservatives, active forms of preservatives, necessity in a food and levels of usage; permitted preservatives and food applications. Case studies / illustrations 58	9
III	EMULSIFIERS, STABILIZERS AND THICKENERS: Emulsion, surface tension, oil in water and water in oil emulsion, Hydrophilic and Lipophilic balance (HLB), role of emulsifiers, different classes of emulsifiers and their chemical structure, their HLB values and role in emulsion stabilization; role of different stabilizers and other substances in emulsion stability; emulsion formation process and equipment; measurement of emulsion stability; permitted emulsifiers and stabilizers and food applications. Thickeners – definition, chemical structure, role in food processing and product end characteristics, list of permitted thickeners and food applications	9
IV	ANTIOXIDANTS AND ANTI-CAKING AGENTS: Antioxidants - Chemistry of oxidative deterioration of food and its constituents and its effect on the quality; defining antioxidant; water soluble and oil soluble antioxidants and their chemical structure, permitted antioxidants; mechanism of action, permitted levels and food application. Anti-foaming and propellants, Anti-caking agents – definition, role in preventing spoilage, mode of action, permitted list of anti-caking agents and food application.	9
V	COLOR AND ARTIFICIAL SWEETENERS: Color – Natural and synthetic food colors, their chemical structure, shades imparted, stability, list of colors, usage levels and food application. Artificial Sweeteners – list, structure, taste profile, permitted list, usage levels and food applications.	9
Total Instructional Hours		45

Upon completion of the course, students can be able to

CO1- To understand the principles of chemical preservation of foods

CO2- To understand the role of different food additives in the processing of different foods

Course Outcomes CO3- To know the specific functions of different food additives in improving the shelf life, quality, texture and other physical and sensory characteristics of foods

CO4- To expose the different food additives in improving the physical and sensory characteristics of foods

CO5- To know the regulations and the monitoring agencies involved in controlling the safer use of additives in foods

TEXT BOOKS:

1. Lal and Siddappa., "Fruit and Vegetable preservation", ICMR 1986.

2. Manoranjan Kalia and Sangita, "Food preservation and processing". Kalyani Publishers. Ludhiana 1996.

REFERENCES BOOKS:

1. Fellows, P.J, "Food Processing Technology" 2001.

2. Leninger, H.A. and Beverlod, W.A. "Food Process Engineering", D.Reicle Pub. Corp.

3. Srivastha R.P. and Sanjeev kumar, "Fruit and vegetable Preservation" 1998.

4. Titus A. M. Msagati. "The Chemistry of Food Additives and Preservatives", Wiley-Blackwell, 2013.


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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT5203	POULTRY, MEAT AND FISH PROCESS TECHNOLOGY	3	0	0	3

- Course Objectives**
- Impart the processing technologies and equipment used for meat, fish and Poultry
 - Understand the preservation and value addition of meat, egg and poultry products
 - Assess the quality assurance, sanitation and Packing techniques for meat, fish and Poultry products

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	POULTRY PROCESSING: Types and characteristics of poultry products. Unit operation in poultry processing. Pre-slaughter factors affecting poultry meat quality. Types of poultry cuts. Factors affecting the shelf-life of poultry meat. Sensory quality of poultry meat- color, texture and flavor. Preservation techniques: chemical treatments, heating, drying and irradiation.	9
II	EGG PROCESSING: Structure, composition, nutritive value of egg. Functional properties of eggs, Factors affecting egg quality and measures of egg quality. Preservation of egg by different methods. Egg powder processing-spray drying, Foam mat drying. Packaging of Eggs and Egg Products - Low Cholesterol-cum-Designer Eggs.	9
III	MEAT PROCESSING: Types of Meat and its sources, composition, structure of meat. Ante mortem handling, slaughtering of animals, inspection and grading of meat. Introduction to Halal. Post-mortem changes of meat. Meat -Tenderization, Aging. Meat quality evaluation. Wholesale and retail cuts. Preservation of meat-curing, smoking, drying, freezing. Processed meat products- Hamburgers, sausages and meat balls.	9
IV	FISH PROCESSING: Types of fish, composition and nutritive value of fish. Harvesting of fish. Spoilage factors of fish. Post-mortem changes in fish. Preservation- Freezing and Individual quick freezing, Canning and smoking operations, Salting and drying of fish, pickling.	9
V	HYGIENE AND SANITATION: Handling and maintenance of tools and core equipment. Meat plant layout. Meat processing hygiene. Cleaning and sanitation in meat plants. Food safety measures –GMP and GHP, Safety standards in meat, poultry and egg industry: HACCP/ISO/MFPO/FSSAI/Kosher/Halal.	9
Total Instructional Hours		45


- Course Outcomes**
- Upon completion of the course, students can be able to
- CO1- Understand the process parameters poultry processing
 - CO2- Understand the structure and processing of egg
 - CO3- Understand the processing of meat and meat products
 - CO4- Apply the different processing and preservation operations of fish
 - CO5- Understand and apply safety measures and hygienic conditions

TEXT BOOKS:


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

REFERENCES BOOKS:

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


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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT5204	PRINCIPLES OF FOOD PROCESSING	3	0	0	3

- Course Objectives**
- To understand the principles of food processing and their impact on the shelf life and quality of food materials and products
 - To learn various methods of food processing viz., drying, milling, freezing, thermal treatments etc.
 - To introduce novel food processing techniques

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	HIGH AND LOW TEMPERATURE PROCESSING OF FOODS: Methods of applying heat to food - Blanching, Pasteurization, Sterilization - thermo bacteriology, commercial sterility, calculation of process time - General method- Ball's formula method- methods of sterilization - equipment. Methods of low temperature preservation - Chilling, Freezing, freeze drying and freeze concentration - theory and principles.	12
II	DRYING, DEHYDRATION AND EVAPORATION: Drying - principles, theory of drying, equilibrium moisture content, methods of moisture determination and source of heat. Drying - types of dryers. Dehydration-Osmotic dehydration-theory and principles. Water activity - sorption behaviour of foods - water activity and food stability - Relationship between water activity and moisture - Equilibrium moisture content. Evaporation - definition - single and multiple effect evaporation-types, application and performances of evaporators and boiling point elevation - steam economy, mass and heat balance.	12
III	PROCESSING AND PRESERVATION OF FOODS BY CHEMICALS: Food preservation by sugar, salt, acid - Principles - mechanism- antimicrobial 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 antimicrobial activity of preservatives.	6
IV	NON-THERMAL PROCESSING: Food Irradiation - High Pressure Processing- Pulsed electric field processing, pulsed light treatment and Ultrasound - Theory and Principles - effect on microorganisms- Application in Processing of foods.	9
V	NOVEL METHODS OF FOOD PROCESSING: UV treatment, Ozone treatment, dielectric 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.	9
Total Instructional Hours		45

Course Outcomes

Upon completion of the course, students can be able to

CO1- Apply different methods of high and low temperature processing techniques over raw foods and analyze the process time of that food properties of food

CO2- Understand and apply the suitable dryers to different food to increase the shelf life and analyse the performance of the evaporators and their features.

CO3-Analyze the shelf life of foods processed and preserved by natural and chemical agents.

CO4- Understand the operations and features of different non-thermal processing techniques and applying to improve the shelf life of product.

CO5- Apply the principle of advanced novel techniques in food processing industries.

TEXT BOOKS:

- Fellows P.J., —Food processing Technology: Principles and Practicel, 3rd Edition, Woodhead Publishing Ltd., New Delhi, 2009
- Da-Wen Sun, Emerging Technologies for food processing, 2nd Edition, Academic Press, 2014.
- Earle R.L., —Unit Operations in Food ProcessingI, Web Edition, Pergamon Press, UK, 2004.
- G.W. Gould. New methods of Food Preservation, Springer, Boston, MA, 1995.

REFERENCES BOOKS:

- James G Brennan, —Food Processing HandbookI, 2nd Edition, Wiley VCH, Weinheim, 2011.
- Paul Singh R and Dennis R. Heldman, —Introduction to Food Process EngineeringI, 5th Edition, Academic Press, USA, 2014
- Sahay K.M. and Singh K.K., —Unit Operations of Agricultural ProcessingI, 2nd Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2012.
- Albert Ibarz and Gustavo V. Barbosa-Cánovas. Unit Operations in Food Engineering. CRC Press, Boca Raton, FL, USA.2003

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT5205	UNIT OPERATIONS IN FOOD PROCESSING	3	0	0	3

- Course Objectives**
- To understand and remember the concept of food processing and also to know the mechanisms
 - Familiarize with operational skill of equipment and imparting knowledge on entrepreneurship.
 - Impart knowledge on different unit operations and its significance in food Industry.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	SIZE REDUCTION: Fibrous foods, Dry foods and Liquid foods – Energy Used in Grinding. New Surface Formed by Grinding. Grinding and Cutting equipment - Crushers, Hammer mills, Fixed head mills, Ball mills, Plate mills and Roller mills. Cutters - Slicers, Dicers, Shredder and Pulper. Size reduction in liquids	6
II	MECHANICAL SEPARATION: Sedimentation in liquids - Gravitational sedimentation – Floatation - Sedimentation of particles in gas. Centrifugal separation – Velocity of particles – Radius of neutral zone – Equipment. Filtration – Constant rate and Constant pressure filtration - Equipment, Sieving effectiveness and Applications	6
III	CRYSTALLIZATION: Crystallization Equilibrium – Nucleation – Meta stable region – Seed Crystals. Heat of Crystallization - Rate of crystal growth. Stage equilibrium crystallization. Equipment - Types – Applications.	6
IV	MIXING: Characteristics of mixtures. Measurement of mixing - sample size, sample composition. Particle mixing and Liquid Mixing - mixing index. Mixing of different quantities. Rate of Mixing and Energy Input in Mixing. Mixing equipment - Liquid Mixers, Powder and Particle Mixers, Dough and Paste Mixers.	6
V	EXTRUSION: Theory - Rheological properties and Operating Characteristics. Single and Twin-screw extruders - Ancillary Equipment. Applications and Effects on Foods. Material handling: Types of handling and conveying system for food products - Belt conveyor, screw conveyor, bucket elevator and pneumatic conveyor.	6
Total Instructional Hours		45

Upon completion of the course, students can be able to

- Course Outcomes**
- CO1 - Understand and apply the size reduction techniques to convert solids and liquids into uniform particles
 - CO2 - Understand and apply the mechanical separation process like sedimentation, centrifugation, and filtration to separate solids, liquids and gas in food processing
 - CO3 - Understanding the mechanism of crystallization process and applying the principles of crystallization for the production of crystals
 - CO4 - Applying mixing equipment for the uniform mixing of solids, semi solids and liquids
 - CO5- Apply the extrusion process for the preparation of extruded products and its texture analysis and understanding the material handling process with its application.

Total: 45 Hours

TEXT BOOKS:

- Fellows P.J., —Food processing Technology: Principles and Practicel, 3rd Edition, Woodhead Publishing Ltd., New Delhi, 2009
- Earle R.L., —Unit Operations in Food Processingl, Web Edition, Pergamon Press, UK, 2004.

REFERENCES BOOKS:

- James G Brennan, —Food Processing Handbookl, 2nd Edition, Wiley VCH, Weinheim, 2011.
- Paul Singh R and Dennis R. Heldman, —Introduction to Food Process Engineeringl, 5th Edition, Academic Press, USA, 2014
- Sahay K.M. and Singh K.K., —Unit Operations of Agricultural Processingl, 2nd Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2012.
- Albert Ibarz and Gustavo V. Barbosa-Cánovas, —Unit Operations in Food Engineering. CRC Press, Boca Raton, FL, USA.2003

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT5001	BAKING AND CONFECTIONERY TECHNOLOGY LABORATORY	0	0	4	2

Course Objectives

- To understand the practical knowledge about the concepts of baking and confectionery
- To understand the components of bakery flour
- To identify the dough raising capacity
- To develop bakery and confectionery products

S.No.

DESCRIPTION

1. Estimation of wet and dry gluten content of wheat flour
2. Estimation of water absorption power of wheat flour
3. Determination of sedimentation value of wheat flour
4. Determination of dough rising capacity of wet and dry yeast
5. Estimation of quality parameters of bakery ingredients
6. Experiment on leavening power of baking powder, sodium-bicarbonate and ammonium- bicarbonate
7. Preparation and analysis of bread
8. Preparation and analysis of toffee / candy
9. Preparation and analysis of chocolates
10. Preparation and analysis of biscuits / cookies

Total Practical Hours

45

Course Outcomes

Upon completion of the course, students can be able to

- Apply the processing of baking and confectionery products
- Understand the properties of the flour
- Understand the dough raising capacity using leavening agent
- Analyze the quality parameters of the bakery products
- Analyze the quality parameters of the confectionery products

REFERENCE BOOKS:

- R1 1. Duncan Manley,—Biscuit, Cracker and Cookie Recipes for the Food IndustryI, Woodhead Publishing, England, 2001.
- R2 Yogambal Ashokkumar, —Text book of Bakery and ConfectioneryI, 2nd Edition, PHI Learning Pvt. Ltd., New Delhi, 2012.
- R3 Samuel A. Matz, —Bakery Technology and EngineeringII, 3rd Edition, Chapman and Hall, London, 2005.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT5002	UNIT OPERATIONS IN FOOD PROCESSING LABORATORY	0	0	4	2

Course Objectives

- To understand the practical knowledge about the engineering concepts of food materials

S.No.

DESCRIPTION

- Determination of size, roundness, sphericity and 1000 grain weight of food grains
- Determination of bulk density, true density, porosity, angle of repose for grain sample, and coefficient of friction for grain sample
- Determination of separation efficiency of centrifugal separator
- Determination of collection efficiency in cyclone separator
- Determination of efficiency of liquid solid separation by filtration
- Determination of particle size of granular foods by sieve analysis
- Experiment on cold extrusion and quality analysis of extruded products
- Experiment on Crystallization process
- Determination of energy requirement in size reduction using hammer mill/ball mill
- Performance evaluation of a steam distillation process
- Experiment on paddy dehusker to determine the shelling efficiency
- Determination of conveying efficiency and power requirement of screw conveyor
- Determination of conveying efficiency of bucket elevator

Total Practical Hours 30

Course Outcomes

Upon completion of the course, students can be able to

- CO1 - Understand the Engineering mechanisms of equipment and properties of foods
- CO2 - Understand the separation and collection efficiency in different separators.
- CO3 - Apply various mills for the size reduction of food materials into different sizes.
- CO4 - Analyze the performance of different mills and distillation equipment.
- CO5 - Analyze the conveying efficiency of screw conveyors and bucket elevators for designing equipment.

REFERENCES BOOKS:

- R1 1. James G Brennan, —Food Processing HandbookI, 2nd Edition, Wiley VCH, Weinheim, 2011.
- R2 2. Paul Singh R and Dennis R. Heldman, —Introduction to Food Process EngineeringI, 5th Edition, Academic Press, USA, 2014
- R3 3. Sahay K.M. and Singh K.K., —Unit Operations of Agricultural ProcessingI, 2nd Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2012.
- R4 4. Albert Ibarz and Gustavo V. Barbosa-Cánovas. Unit Operations in Food Engineering. CRC Press, Boca Raton, FL, USA.2003

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Programme	Course Code	Course Title	L	T	P	C
B.TECH.	19HE5071	SOFT SKILLS - I	1	0	0	1

Course Objectives:

- 1.To employ soft skills to enhance employability and ensure workplace and career success.
- 2.To enrich students' numerical ability of an individual and is available in technical flavor.
- 3.To interpret things objectively, to be able to perceive and interpret trends to make generalizations and be able to analyze assumptions behind an argument/statement.

Unit	Description	Instructional Hours
I	Introduction to Soft Skills: Introduction- Objective -Hard vs Soft Skills - Measuring Soft Skills- Structure of the Soft Skills -Self Management-Critical Thinking-Reflective thinking and writing- p2p Interaction	3
II	Art of Communication: Verbal Communication - Effective Communication - Active listening -Paraphrasing ; Feedback - Non-Verbal Communication – Roles-Types- How nonverbal communication can go wrong- How to Improve nonverbal Communication - Importance of feelings in communication - dealing with feelings in communication.	4
III	World of Teams: Self Enhancement - importance of developing assertive skills- developing self-confidence – developing emotional intelligence - Importance of Team work – Team vs. Group - Attributes of a successful team – Barriers involved - Working with Groups – Dealing with People- Group Decision Making.	3
IV	Quantitative Aptitude: Averages - Profit and loss - Partnerships - Time and work - Time, Speed and Distance - Problems based on trains - Problems based on boats and streams	3
V	Logical Reasoning: Clocks - Calendars - Direction Sense - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency	2
Course Outcome:	CO1: Students will have clarity on their career exploration process and to match their skills and interests with a chosen career path.	
	CO2: Students will develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others	
	CO3: Students will understand how teamwork can support leadership skills	
	CO4: Students will be able to make sense of problems, develop strategies to find solutions, and persevere in solving them.	
	CO5: Students will demonstrate an enhanced ability to draw logical conclusions and implications to solve logical problems.	

REFERENCE BOOKS:

- R1: Soft Skills Training: A Workbook to Develop Skills for Employment - Frederick H. Wentz
- R2: How to prepare for data interpretation for CAT by Arun Sharma.
- R3: How to Crack TEST OF REASONING in all competitive examinations by Jaikishan and Premkishan.
- R4: New Approach To Reasoning Verbal & Non-Verbal By B.S. Sijwali
- R5: Quantitative Aptitude for Competitive Examinations - Dr. R.S. Aggarwal, S. Chand

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19HE5072	DESIGN THINKING	1	0	0	1

OBJECTIVES:

Course Objective

- To expose students to the design process
- To develop and test innovative ideas through a rapid iteration cycle.
- To provide an authentic opportunity for students to develop teamwork and leadership skills

Unit	Description	Instructional Hours
DESIGN ABILITY		
I	Asking Designers about what they Do – Deconstructing what Designers Do – Watching what Designers Do – Thinking about what Designers Do – The Natural Intelligence of Design Sources	4
DESIGNING TO WIN		
II	Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	4
DESIGN TO PLEASE AND DESIGNING TOGETHER		
III	Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	4
DESIGN EXPERTISE		
IV	Design Process – Creative Design - Design Intelligence – Development of Expertise – Novice to Expert. Critical Thinking – Case studies: Brief history of Albert Einstein, Isaac Newton and Nikola Tesla	3
Total Instructional Hours		15

Course Outcome

Upon completion of the course, students will be able to
 CO1: Develop a strong understanding of the Design Process
 CO2: Learn to develop and test innovative ideas through a rapid iteration cycle.
 CO3: Develop teamwork and leadership skills

TEXT BOOKS:

T1 - 1. Nigel Cross, "Design Thinking", Kindle Edition.

REFERENCE BOOKS:

R1 - Tom Kelley, "Creative Confidence", 2013.

R2 - 3. Tim Brown, "Change by Design", 2009.


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PROFESSIONAL ELECTIVE I

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19FT5301	TECHNOLOGY OF FATS AND OIL	3	0	0	3

Course Objectives

- To study the technology, processing, analysis of fats and oils

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	PROPERTIES OF OILS AND FATS: Oils and fats – sources, composition. Nutritional importance of fats and oils. Physical properties of fats and oils - color, odour, consistency, melting point, flash point, smoke point. Chemical properties of fats and oils - iodine value, saponification value, free fatty acids, peroxide value.	9
II	VEGETABLE OIL AND ANIMAL FAT PRODUCTION: Industrial production of oils- seed handling and storage. Preparation of seed for extraction of oil. Processing- peanut oil, rice bran oil, sunflower oil and soy bean oil. Production of cod liver oil. Method of extraction- cold pressing and hot pressing, Equipments- Filter press, hydraulic press. Production of margarine. Production of Lard.	9
III	SOLVENT EXTRACTION AND REFINING OF OILS: Solvent extraction – prepress and direct extraction, removal and recovery of solvent from miscella and extracted residue. Physical refining, Chemical Refining, Degumming - types, dewaxing/winterization, bleaching – deodorizing, hydrogenation.	9
IV	EDIBLE OIL, FAT PRODUCTS AND MODIFICATION OF OILS: Modification of oils - Refined oil – fractionation- Blending – Interesterification – Types – Chemical and Enzymatic, Applications. Margarines, spreads, mayonnaise. Shortenings in bakery products and confectionery lipids. Fat substitutes and its types.	9
V	PACKAGING AND STORAGE OF OIL: Changes during storage of oil. Role of fat or oil in frying .Selection of frying oil. Applications of frying oil .Rancidity - atmospheric oxidation and enzyme action. Quality standards of oil - Packaging of oils and fats.	9
Total Instructional Hours		45

Upon completion of the course, students can be able to

- Course Outcomes**
- CO1 -Understand the physical and chemical properties of fats and oils
 - CO2- Remember the mechanical methods for oil extraction
 - CO3- Understand the solvent extraction and refining of oils
 - CO4-Understand and develop edible oil, fat products and modified oil
 - CO5- Understand and choose an appropriate package and storage for oils

TEXT BOOKS:


1. Fereidoon Shahidi, —Bailey’s Industrial Oil and Fat ProductsI, 6th Edition, Wiley - Interscience, New Jersey, 2005.
2. Richard D. O'Brien, —Fats and Oils: Formulating and Processing for ApplicationsI, 3rd Edition, CRC Press, London, 2010.

REFERENCES BOOKS:

1. Casimir C. Akoh and David B. Min, —Food Lipids: Chemistry, Nutrition and BiotechnologyI, CRC Press, USA, 2008.
2. Wolf Hamm and Richard J. Hamilton, —Edible Oil ProcessingI, Wiley - Blackwell, UK, 2013.
3. Kanes K. Rajah, —Fats in Food TechnologyI, Sheffield Academic Press, UK, 2002.
4. Gunstone, Frank D. “The Chemistry of Oils and Fats Sources, Composition, Properties and Uses” Blackwell Publishing, 2004.


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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19FT5302	FOOD STORAGE AND INFESTATION CONTROL	3	0	0	3

- To understand the raw material and preserve it by storing in a proper environment

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	FUNDAMENTALS OF STORAGE INFESTATION: Introduction, history of storage entomology, concepts of storage entomology and significance of insect pests. Post-harvest losses - total production of food grains in India. Scientific and socio-economic factors responsible for grain losses. Important pests namely insects, mites, rodents, birds and microorganisms associated with stored grain and field conditions including agricultural products.	9
II	ECOLOGY OF INSECTS AND STORAGE LOSSES: Ecology of insect pests of stored commodities/grains with special emphasis on role of moisture, temperature and humidity in safe storage of food grains and commodities. Stored grain deterioration process, physical and biochemical changes and consequences; traditional storage structures; association of stored grain insects with fungi and mites, their systematic position, identification, distribution, nature and extent of damage, role of field and cross infestations and natural enemies, type of losses in stored grains and their effect on quality including biochemical changes.	9
III	GRAIN STORAGE AND MANAGEMENT: Grain storage types of storage structures - traditional, improved and modern storage structures in current usage. Ideal seeds and commodities storage conditions. Important rodent pests associated with stored grains and their non-chemical and chemical control including fumigation of rat burrows. Pest Birds – role and its management. Control of infestation by insect pests, mites and microorganisms. Preventive measures- Hygiene/sanitation, disinfestations of stores/receptacles, legal methods.	9
IV	PEST CONTROL MEASURES: Non-chemical control measures- ecological, mechanical, physical, cultural, biological and engineering. Chemical control- prophylactic and curative. Pesticides – characteristics, uses and precautions in handling. Integrated approaches to stored grain pest management.	9
V	QUALITY CONTROL IN GRAINS: Detection of insect infestation in stored food grains, losses in stored food grains – weveiled and unweveiled grains, determination of moisture content in stored food grains, Quality control aspects in FCI godowns, central warehouse. Demonstration of preventive and curative measures including fumigation techniques; treatment of packing materials and their effect on seed quality.	9
Total Instructional Hours		45

Course Outcomes

Upon completion of the course, students can be able to

CO1- Remember and identify possible sources of pest infestation in storage

CO2- Understand and interpret ecology of region specific insects and its impact on storage

CO3- Understand and recommend appropriate storage structures and preventive measures for pests

CO4- Understand and elect integrated pest management approach and curative measures in grain storage

CO5- Understand the suitable quality control techniques in grain storage

TEXT BOOKS:

1. Mohan and Awaknavar J.S., —Pest Management in Store Grainsl, Satish Serial Publishing House, New Delhi, 2009.
2. Nair K.R., —Integrated Production and Pest Managementl, DK Publishers and Distributors, Delhi, 2007.

REFERENCES BOOKS:

1. Hagstrum D.W., and Subramanyam B., —Fundamentals of Stored Product Entomologyl American Association of Cereal Chemists Inc., 2006
2. Subramanyam B., —Integrated Management of Insects in Stored Productsl, CRC Press, 1995.
3. Slansky Jr. F., and Rodriguez J.G., —Nutritional Ecology of insects, mites, spiders and related invertebratesl, John Wiley, 1987.
4. Chakravarty et al Handbook of Post-Harvest Technology Marcel Dekker. 2003.

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Programme	Course code	Name of the course	L	T	P	C
BE/B.Tech	19FT5303	FOOD PROCESS CALCULATIONS	3	0	0	3

COURSE OBJECTIVES

- To have an idea about different systems of units and dimensions, estimation compositions of mixtures and solutions
- To understand the material balance for different unit operations
- To apply material balance for recycle operations and perform humidification calculations
- To perform energy balance calculations
- To determine the heat values and composition of fuels

UNIT

DESCRIPTION

INSTRUCTIONAL HOURS

I	Units and Dimensions, Fundamental Calculations: Basic and derived units, unit conversions, use of model units in calculations, methods of expression, compositions of mixture and solutions. Ideal and real gas laws – gas constant - calculations of pressure, volume and temperature using ideal gas law, Use of partial pressure and pure component volume in gas calculations, applications of real gas relationship in gas calculation.	9
II	Material Balance and Stoichiometry: Stoichiometric principles, Importance of material balance and energy balance in a process Industry, material balance with chemical reaction and without chemical reaction- application of material balance to unit operations like distillation, evaporation, crystallization, drying and extraction.	9
III	Recycle Operations: Recycle stream, block diagram, purging operations, purge ratio, recycle ratio and purge stream. Humidity and Saturation: Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity, wet and dry bulb temperature, dew point - Humidity chart usage.	9
IV	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. Standard heat of reaction, heats of formation, combustion, solution, mixing etc., calculation of standard heat of reaction - Effect of pressure and temperature on heat of reaction - Energy balance for systems without chemical reaction.	9
V	Combustion: Combustion of solids, liquid and gas, determination of NHV and GHV. Determination of composition by Orsat analysis - Calculation of excess air, theoretical oxygen requirement.	9

TOTAL INSTRUCTIONAL HOURS 45

COURSE OUTCOMES

- CO1 - Apply different systems of units and dimensions, estimate compositions of mixtures and solutions
- CO2 - Apply material balance for different unit operations
- CO3 - Calculate material balance for recycle operations and perform humidification problems
- CO4 - Examine energy balance calculations
- CO5 - Determine the calorific value and composition of fuels

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19FT5304	POST HARVEST TECHNOLOGY	3	0	0	3
Course Objectives	<ul style="list-style-type: none"> • To understand and identify the specific processing technologies used for different foods and the various products derived from these materials. • To understand the application of scientific principles in the processing technologies specific to the materials. 					

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	CEREALS AND PULSES: Cereal Grains- Basic agricultural aspects, structure and composition; Storage, Insect control, Processing: Wheat - milling, (Atta and maida), quality aspects of flour, wheat proteins and their function; wheat based baked products – Bread, Biscuit, Cakes, Extruded products, malting and malt products; Rice- Milling, Parboiling, Quick cooking rice. Pulses - Basic agricultural aspects, structure, composition, storage, insect control, processing Milling/splitting, dhal milling, products– puffed, flakes, flour, soya milk, soy protein Isolate.	9
II	VEGETABLES AND FRUITS: Climacteric and non-climacteric fruits, ripening process, phytonutrients in fruits and vegetables; Handling, transportation, controlled atmosphere ripening process, grading, cleaning, pre treatments, modified atmosphere packaging, chilling. General pre-processing, different freezing methods and equipment, problems associated with specific fruits and vegetables; Dehydration– General pre processing, different methods of drying, osmotic dehydration and other modern methods. Canning - General pre-processing, specific or salient points in fruits and vegetables like – Blanching, exhausting, processing conditions. Fruit Juice / pulp/ Nectar/Drinks, concentrates Vegetable Purees/pastes.	9
III	OIL SEEDS, NUTS AND SUGARS: Basic agricultural aspects structure, composition, Storage, Insect control; processing: traditional and modern methods of oil extraction, refining, hydrogenation; oil blends. Honey- Composition and Quality aspects; Sugars- Manufacture of table sugar, High Fructose corn syrup and Glucose syrup; Jaggery – sources, manufacture.	9
IV	MILK AND MILK PRODUCTS: Processing of Milk – Pasteurisation, homogenisation, sterilization, HTST and UHT processes; Processing and preservation of milk products - cream, sour cream, butter, ghee, skimmed milk concentrate and skimmed milk powder, whey concentrate and whey powder, yoghurt, cheese and other products.	9
V	MEAT, FISH & POULTRY: Pre and post slaughter handling, meat inspection and grading. Structure and composition of meat, carcass chilling, ageing; storage of fresh meat - Modified atmosphere packaging, packaging of retail cuts; Processing and preservation - artificial tenderizing, chilling, freezing, curing, smoking, ready-to-eat meats and meat products; Marine and fresh water fish, shell fish - composition and nutrition; spoilage factors, ship board operations, storage and transport. Processing and Preservation - chilling, freezing, canning, smoking, curing, salting and drying, fish meal and fish oils. Processing plant operations - slaughter, bleeding, scalding, de-feathering, eviscerating, chilling, packaging; composition and nutrition, poultry meat products Eggs- structure, composition, quality factors, storage, pasteurization, freezing and drying, egg substitutes.	9
Total Instructional Hours		45

Upon completion of the course, students can be able to

- Course Outcomes**
- CO1- Understand the concepts and processing of cereals and pulses
 - CO2- Remember the insight and reduce fruit and vegetable losses during processing after harvesting
 - CO3- Understand the specific processing technologies used especially for oil seeds, nuts and sugars
 - CO4- Understand the post-harvest processing of milk and milk products
 - CO5- Remember the meat, fish and poultry processing technologies

TEXT BOOKS:

1. Hamm, Wolf and Hamilton, R, J. "Edible Oil Processing", Blackwell / Ane Books, 2004.
2. Morris, Peter C and Bryce, J.H. "Cereal Biotechnology", CRC / Wood Head, 2000.

REFERENCES BOOKS:

1. Rajah, Kanes K. "Fats in Food Technology", Blackwell / Ane Books, 2004.
2. Mead G.C., —Poultry Meat Processing and Quality, 1st Edition, CRC Press, London, 2004.
3. Sukumar De, —Outlines of Dairy Technology, Royal Oxford University Press, Delhi, 2010.
4. Alzamora, S.M., Tapia, M.S. and Lopez – Malo, A. "Minimally Processed Fruits and Vegetables: Fundamental Aspects and Applications", Springer, 2005.

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19FT5305	CANE SUGAR TECHNOLOGY	3	0	0	3
Course Objectives	<ul style="list-style-type: none"> To understand the technology of cane sugar 					

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	INTRODUCTION AND PREPROCESSING OPERATION: Brief account of sugar industry- composition of sugar cane, manufacturing process of sugarcane juice, types of cane sugar, terminology. Harvesting indices, Cane cutting – Manual and Mechanical, Transportation, Cane conveyor, Washing, Shredding	9
II	JUICE EXTRACTION AND JUICE CONCENTRATION: Crushing –Types of crushers, crushing efficiency. Extraction of juice – methods. Accumulators – types. Maceration. Theory of cane diffusivity. Types of diffusers. Weighing of juice - Maxwell Boulogne Scale and Magnetic Flow Meters. Concentration - Importance- types of heaters- construction and working of tubular heater, Direct Contact Heater (DCH), Plate Heater (PHE), advantages and disadvantages. Evaporator- types- performance measures.	9
III	CLARIFICATION: Clarification – importance, methods, clarifying agent, bleaching agent. Role of pH, non-sugars, colloids and gums in cane juice clarification. Lime - specification, storage. Preparation of milk of lime, rotary lime slacker, classifier, MOL tanks, lime pumps, use of hydrated lime powder. Sulphur - specification and storage, production of sulphur dioxide gas, construction and working of sulphur burner, film type sulphur burner.	9
IV	CRYSTALLIZATION AND REFINING: Sugar boiling, Nucleation and crystal growth, super saturation and meta stable stage, seeding – shock seeding, true seeding. Crystallizers. Refining - Brown sugar, importance of refining, Affination, clarification, carbonation, sulphitation, phosphitation, decolorization, centrifugation - dewatering of sugar. Drying. Bagging and storage. Factors affecting sugar refining process.	9
V	MANUFACTURING OF JAGGERY/ GUR AND OTHER BY PRODUCTS: Extraction of Juice, Clarification of Gur, Concentration of Juice, Drying and grading of Gur, Storage of Gur. Byproducts - Drying and uses of Bagasse - Back strap Molasses - Characteristics of Molasses. Direct Utilization of Molasses - Distilling Industries - Applications in animal feed – Biogas – Biofertilizers production- Inverted syrup.	9
Total Instructional Hours		45

Course Outcomes

Upon completion of the course, students can be able to

CO1- Remember the sugar cane constituents and apply preprocessing operations

CO2- Understand the suitable cane juice extraction and concentration methods

CO3- Understand the appropriate clarification methods for sugarcane juice

CO4- Remember crystallization and refining techniques

CO5- Understand the knowledge for manufacturing of cane sugar by-products

TEXT BOOKS:

1. Paturau J.M., —By-Products of the Cane Sugar Industry, 2nd Edition, Elsevier Publishing Company, New York, 1989.
2. Baikow V.E., —Manufacturing and Refining of Raw Cane Sugar, 2nd Edition, Volume - I and II, Elsevier Publishing Company, New York, 1967.

REFERENCES BOOKS:

1. Heriot T, H. P., —The Manufacture of Sugar From The Cane and Beet, Read Books, New York, 2007.
2. Ram Behari Lal and Mathur, —Hand Book of Cane Sugar Technology, Oxford and IBH Publishing Company, New Delhi, 1995.
3. Chung Chi Chou, —Handbook of Sugar Refining: A Manual for the Design and Operation of Sugar Refining Facilities, John Wiley and Sons, 2000.
4. Jenkins, George Horner. *Introduction to cane sugar technology*. Elsevier, 2013.

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19FT5306	MILLING TECHNOLOGY FOR FOOD GRAINS	3	0	0	3

Course Objectives

- To understand and remember the milling technology of food materials with by-products

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	STRUCTURE, STORAGE AND PEST MANAGEMENT OF GRAINS: Grains - Definition. Importance. Physical properties of grains. Structure, Composition and Nutritional value – paddy, wheat, maize, oat, sorghum. 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.	9
II	MILLING OF PADDY: Rice milling flow sheet. Cleaning. Parboiling- traditional and improved methods, Physio-chemical changes during parboiling, Effect of parboiling on rice quality. Husking- Methods of husking, Huskers/Shellers – impact type, centrifugal dehusker, under runner disc huller, rubber roll sheller. Separation – indented tray and compartment type separator. Whitening – friction type and abrasive type whiteners. Color sorter. New quality control instruments. Byproducts from rice milling	9
III	MILLING OF WHEAT: Types of wheat. Wheat milling – Simple and detailed flow sheet. Preparation of Wheat for Milling – wheat blending, tempering or conditioning, Roller milling – break rolls and reduction rolls, operation and corrugation specification, Sifting – Plan sifters, Purifying - purifier. Milling performance evaluation. Functional properties of flour. Flour treatment – Enrichment, Enhancement of flour appearance, Improvement of functional properties. By products from wheat milling.	9
IV	MILLING OF CORN AND PULSES: Types of corn. Dry milling – Tempering, dehulling, degermination and milling. Wet milling – Steeping, Germ, fiber, starch and gluten separation, starch refinement. By products from corn milling. Legumes – Structure, Types, Nutritional and Anti-nutritional factors. Pulse Milling – Conditioning, Pitting, Oil/water treatment, drying, dehuskers – Tangential Abrasive Dehulling Device (TADD), Central Institute of Agricultural Engineering (CIAE) design, Schule design, CFTRI mini dhal mill, Husk separation and grading, Splitting – Equipments. Milling - Dry and wet milling, Dehulling efficiency.	9
V	MILLING OF OIL SEEDS: Types of Oil seeds. Oil seed processing - Mechanical extraction – Hydraulic press, Screw press, Filter press. Mechanical extraction of coconut oil and palm oil. Cold pressing and Hot Pressing. Solvent extraction – Flow sheet. Factors influencing extraction. Refining of oil – Degumming, Dewaxing, Neutralization, Bleaching, Filtration and Deodorization. Hydrogenation. Winterization. Oil seed flour concentrates and isolate	9
Total Instructional Hours		45

Upon completion of the course, students can be able to

- Course Outcomes**
- CO1- Understand the structure and storage of grains
 - CO2- Remember the processing of paddy
 - CO3- Remember the processing of wheat
 - CO4- Understand the importance of milling of pulses
 - CO5- Understand the milling process of oil seeds

TEXT BOOKS:

- Chakravarthy A., —Post-Harvest Technology of Cereals, Pulses and Oil Seeds, 3rd Edition, Oxford IBH Publishing Co. Pvt. Ltd., New Delhi, 2008.
- Sahay K.M. and Singh K.K., —Unit Operations of Agricultural Processing, 2nd Edition, Vikas Publishing House, New Delhi, 2008.

REFERENCES BOOKS:

- Chakraverty A., Mujumdar A.S., VijayaRaghavan G.S. and Ramaswamy H.S., —Handbook of Postharvest Technology - Cereals, Fruits, Vegetables, Tea, and Spices, Marcel Dekker, Inc., New York, 2003.
- Kulp K. and Pont J.G., —Handbook of Cereal Science and Technology, 2nd Edition, Marcel Dekker, Inc., New York, 2000.
- Richard D. O'Brien, —Fats and Oils: Formulating and Processing for Applications, 3rd Edition, CRC Press, London, 2008.
- Delcour, Jan A. and R. Carl Hosney. "Principles of Cereal Science and Technology". 3rd Edition. American Association of Cereal Chemists, 2010.

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**CURRICULUM
R2019**

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. FOOD TECHNOLOGY (UG)

REGULATION-2019

For the students admitted during the academic year 2019-2020 and onwards

SEMESTER I

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL	
THEORY											
1.	19HE1101	Technical English	HS	2	1	0	3	25	75	100	
2.	19MA1102	Calculus and Linear Algebra	BS	3	1	0	4	25	75	100	
3.	19ME1101	Basics of Civil and Mechanical Engineering	ES	3	0	0	3	25	75	100	
THEORY & LAB COMPONENT											
4.	19PH1151	Applied Physics	BS	2	0	2	3	50	50	100	
5.	19CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100	
6.	19CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100	
PRACTICAL											
7.	19HE1071	Language Competency Enhancement Course-I	HS	0	0	2	1	100	0	100	
MANDATORY COURSES											
8.	19HE1072	Career Guidance Level – I Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100	
				Total:	16	2	8	20	425	375	800

As Per AICTE Norms 3 Weeks Induction Programme is Added in The First Semester as an Audit Course

SEMESTER II

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL	
THEORY											
1.	19HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100	
2.	19MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	25	75	100	
3.	19FT2105	Principles of Microbiology	ES	3	0	0	3	25	75	100	
THEORY & LAB COMPONENT											
4.	19IT2151	Programming in C	ES	2	0	2	3	50	50	100	
5.	19PH2151	Material Science	BS	2	0	2	3	50	50	100	
6.	19CY2151	Environmental Studies	BS	2	0	2	3	50	50	100	
PRACTICALS											
7.	19ME2001	Engineering Practices Laboratory	ES	0	0	4	2	50	50	100	
8.	19HE2071	Language Competency Enhancement Course-II	HS	0	0	2	1	100	0	100	
MANDATORY COURSES											
9.	19HE2072	Career Guidance Level – II Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100	
10.	19HE2073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100	
				Total:	17	2	12	22	575	425	1000



SEMESTER III

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	19MA3102	Fourier Analysis and Transforms	BS	3	1	0	4	25	75	100
2.	19FT3201	Fluid Mechanics	PC	3	1	0	4	25	75	100
3.	19FT3101	Principles of Thermodynamics	PC	3	0	0	3	25	75	100
4.	19FT3202	Food Microbiology	PC	3	0	0	3	25	75	100
THEORY AND LAB COMPONENT										
5.	19FT3251	Bio Chemistry	PC	2	0	2	3	50	50	100
PRACTICALS										
6.	19FT3001	Food Microbiology Lab	PC	0	0	3	1.5	50	50	100
7.	19FT3002	Food Production Analysis Lab	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8.	19MC3191	Indian Constitution	MC	2	0	0	0	100	0	100
9.	19HE3072	Career Guidance Level – III Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	19HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
Total				19	2	8	20	550	450	1000

SEMESTER IV

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	19FT4201R	Fundamentals of Heat and Mass Transfer	PC	3	1	0	4	25	75	100
2.	19FT4203R	Engineering properties of food materials	PC	3	0	0	3	25	75	100
3.	19FT4204	Refrigeration and Cold Chain Management	PC	3	1	0	4	25	75	100
THEORY AND LAB COMPONENT										
4.	19FT4251	Food Chemistry	PC	2	0	2	3	50	50	100
5.	19MA4152	Statistics and Numerical Methods	BS	3	0	2	4	50	50	100
PRACTICALS										
6.	19FT4001	Unit Operations Laboratory	PC	0	0	3	1.5	50	50	100
7.	19FT4002	Food Process Equipment Design Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8.	19MC4191	Essence of Indian tradition knowledge/Value Education	MC	2	0	0	0	100	0	100
9.	19HE4072	Career Guidance Level – IV Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	19HE4073	Ideation Skills	EEC	1	0	0	0	100	0	100
Total				19	2	10	21	575	425	1000

SEMESTER V

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
1.	19FT5201	Baking and Confectionery Technology	PC	3	0	0	3	25	75	100
2.	19FT5202	Food Additives	PC	3	0	0	3	25	75	100



3.	19FT5203	Poultry, Meat and Fish Process Technology	PC	3	0	0	3	25	75	100
4.	19FT5204	Principles of Food Processing	PC	3	0	0	3	25	75	100
5.	19FT5205	Unit Operations in Food Processing	PC	3	0	0	3	25	75	100
6.	19FT53XX	Professional Elective -I	PE	3	0	0	3	25	75	100
PRACTICALS										
7.	19FT5001	Baking and Confectionery Technology Laboratory	PC	0	0	4	2	50	50	100
8.	19FT5002	Unit Operations in Food Processing Laboratory	PC	0	0	4	2	50	50	100
MANDATORY COURSES										
9.	19HE5071	Soft Skills - I	EEC	1	0	0	1	25	75	100
10.	19HE5072	Design Thinking	EEC	1	0	0	1	25	75	100
TOTAL				20	0	8	24	300	700	1000

SEMESTER VI

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	19FT6201	Dairy Engineering	PC	3	0	0	3	25	75	100
2.	19FT6202	Plantation crops and Spices Products Technology	PC	3	0	0	3	25	75	100
3.	19FT6203	Fruits and Vegetable Processing Technology	PC	3	0	0	3	25	75	100
4.	19FT6181	Professional Ethics in Engineering	HS	3	0	0	3	25	75	100
5.	19FT63XX	Professional Elective - II	PE	3	0	0	3	25	75	100
6.	19XX64XX	Open Elective- I	OE	3	0	0	3	25	75	100
PRACTICALS										
7.	19FT6001	Dairy Engineering Laboratory	PC	0	0	3	1.5	50	50	100
8.	19FT6002	Fruits and Vegetable Processing Technology Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
9.	19FT6701	Industrial Training	EEC	0	0	0	1	0	100	100
10.	19HE6071	Soft Skills - II	EEC	1	0	0	1	25	75	100
11.	19HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	25	75	100
TOTAL				20	0	6	24	300	800	1100

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1.	19FT5301	Technology of Fats and Oils	PE	3	0	0	3	25	75	100
2.	19FT5302	Food Storage and Infestation Control	PE	3	0	0	3	25	75	100
3.	19FT5303	Food Process Calculations	PE	3	0	0	3	25	75	100



4.	19FT5304	Post-Harvest Technology	PE	3	0	0	3	25	75	100
5.	19FT5305	Cane sugar Technology	PE	3	0	0	3	25	75	100
6.	19FT5306	Milling Technology for Food Materials	PE	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE II										
1.	19FT6301	Beverage Technology	PE	3	0	0	3	25	75	100
2.	19FT6302	Technology of Snack and Extruded Foods	PE	3	0	0	3	25	75	100
3.	19FT6303	Food Biotechnology	PE	3	0	0	3	25	75	100
4.	19FT6304	Bioprocess Engineering	PE	3	0	0	3	25	75	100
5.	19FT6305	Enzyme Technology	PE	3	0	0	3	25	75	100
6.	19FT6306	Crop Process Engineering	PE	3	0	0	3	25	75	100

OPEN ELECTIVE I

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	19FT6401	Traditional Foods	OE	3	0	0	3	25	75	100

SEMESTER VII

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	19FT7201	Food Analysis and Quality Control	PC	3	0	0	3	25	75	100
2.	19FT7202	Food Packaging	PC	3	0	0	3	25	75	100
3.	19FT7203	Food Plant Layout and Management	PC	3	0	0	3	25	75	100
4.	19FT73XX	Professional Elective-III	PE	3	0	0	3	25	75	100
5.	19XX74XX	Open Elective – II	OE	3	0	0	3	25	75	100
PRACTICALS										
6.	19FT7001	Food Packaging Laboratory	PC	0	0	3	1.5	50	50	100
7.	19FT7002	Food Analysis and Quality Control Laboratory	PC	0	0	3	1.5	50	50	100
PROJECT WORK										
8.	19FT7901	Project Phase I	EEC	0	0	4	2	50	50	100
TOTAL				15	0	10	20	275	525	800

SEMESTER VIII

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	19FT83XX	Professional Elective –IV	PE	3	0	0	3	25	75	100
2.	19FT83XX	Professional Elective- V	PE	3	0	0	3	25	75	100
PRACTICAL										
3.	19FT8901	Project Work – Phase II	EEC	0	16	8	100	100	200	
Total				6	0	16	14	150	250	400



PROFESSIONAL ELECTIVE III

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	19FT7301	Functional foods and Nutraceuticals	PE	3	0	0	3	25	75	100
2.	19FT7302	Biology and Chemistry of Food Flavors	PE	3	0	0	3	25	75	100
3.	19FT7303	Food Toxicology and Allergy	PE	3	0	0	3	25	75	100
4.	19FT7304	Advanced Drying Technology	PE	3	0	0	3	25	75	100
5.	19FT7305	Cereal Technology	PE	3	0	0	3	25	75	100
6.	19FT7306	Processing Technology of Legumes and Oilseeds	PE	3	0	0	3	25	75	100
7.	19FT7307	Emerging Non-Thermal Processing of Foods	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE IV

1.	19FT8301	Food Process Economics and Industrial Management	PE	3	0	0	3	25	75	100
2.	19FT8302	Food Laws and Safety	PE	3	0	0	3	25	75	100
3.	19FT8303	Waste Management and By-Product Utilization in Food Industries	PE	3	0	0	3	25	75	100
4.	19FT8304	Instrumentation and Process Control	PE	3	0	0	3	25	75	100
5.	19FT8305	Economics and Management	PE	3	0	0	3	25	75	100
6.	19FT8312	Total Quality Management	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE V

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	19FT8306	Food process plant layout and safety	PE	3	0	0	3	25	75	100
2.	19FT8307	Energy Management in Process Industries	PE	3	0	0	3	25	75	100
3.	19FT8308	Emerging Technologies in Food Processing	PE	3	0	0	3	25	75	100
4.	19FT8309	Separation Techniques in Food Processing	PE	3	0	0	3	25	75	100
5.	19FT8310	Analytical Instruments in Food Industries	PE	3	0	0	3	25	75	100
6.	19FT8311	Entrepreneurship Opportunities for Food Technologists	PE	3	0	0	3	25	75	100
7.	19FT8313	Application of Nanotechnology and Cryogenics	PE	3	0	0	3	25	75	100



OPEN ELECTIVES II

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	19FT7401	Post Harvest Technology of Fruits and Vegetables	OE	3	0	0	3	25	75	100
LIFE SKILL COURSES										
1.	19LSZ401	General Studies for Competitive Examinations	OE	3	0	0	3	25	75	100
2.	19LSZ402	Human Rights, Women's Rights and Gender Equality	OE	3	0	0	3	25	75	100
3.	19LSZ403	Indian Ethos and Human Values	OE	3	0	0	3	25	75	100
4.	19LSZ404	Indian Constitution and Political System	OE	3	0	0	3	25	75	100
5.	19LSZ405	Yoga for Human Excellence	OE	3	0	0	3	25	75	100

SEMESTER-WISE CREDIT DISTRIBUTION

B.E. / B.TECH. PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HS	04	04	-	-	-	03	-	-	11
2	BS	10	10	04	04	-	-	-	-	28
3	ES	06	05	-	-	-	-	-	-	11
4	PC	-	03	16	17	19	12	12		79
5	PE	-	-	-	-	03	03	03	06	15
6	OE	-	-	-	-	-	03	03	-	06
7	EEC	-	-	-	-	02	03	02	08	15
Total		20	22	20	21	24	24	20	14	165

Credit Distribution R2019

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165

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Hindusthan College Of Engineering & Technology
COIMBATORE - 641 032.



SYLLABUS
SEMESTER VII

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT7201	FOOD ANALYSIS AND QUALITY CONTROL	3	0	0	3

Course Objectives

- Remember the quality analysis procedures
- Remember the procedure for lipid and protein analysis
- Understand the concepts of food quality standards
- Remember the concepts of food quality assurance in industry
- Remember the regulations for food business operator

UNIT	DESCRIPTION	INSTRUCTIONAL HOUR
1	GENERAL AND CARBOHYDRATE ANALYSIS Proximate analysis of foods- Moisture in foods, Ash content of foods - determination by different methods; Titratable Acidity in foods, Determination of dietary fibre and crude fibre, Carbohydrate analysis- Colorimetric Quantification methods of Mono and Di-Saccharides, HPLC of Mono and Di-Saccharides using refractive index detection; Starch- Enzymatic quantification and Determination of Total amylose content; Cell wall polysaccharides-Determination of uronic acid content and β -Glucan content, Degree of Methylation and Acetylation of pectin.	9
2	LIPIDS AND PROTEINS ANALYSIS Determination of Total fat in foods by different methods; Analysis of oils and fats for physical and chemical parameters, Quality standards, and adulterants. Determination of Proteins Concentration- Colorimetric methods, Determination of Total nitrogen, Spectrophotometric determination; Protein Characterization- Electrophoresis and Isoelectric focussing; Analysis of Protein quality – Protein Efficiency Ratio (PER), Net Protein Utilization (NPU), Biological Value, Protein Digestibility- Corrected Amino acid Score (PDCAAS), <i>In vitro</i> Protein digestibility for C-PER; Measurement of Functional properties of proteins- Protein hydration properties, Surface properties of protein, Protein gel properties. Calculation of proximate and ultimate composition of foods.	9
3	FOOD QUALITY AND STANDARDS: Quality of Foods, Quality Standards - mandatory and optional standards, Food Safety Systems - ISO 9000, ISO 14000, ISO 22000, Mechanism of developing and fixing food standards, Good Manufacturing Practice, HACCP, Standards of Weights and Measures	9
4	QUALITY ASSURANCE IN FOOD INDUSTRY: Objectives, importance and functions of quality control, Concept of Quality Assurance and Quality Control, Quality Control procedures, Quality Assurance procedures, International organizations: ISO, CAC, WTO, USFDA, Codex, EIC. National organizations: BIS, CCFS, Agmark, MMPO and APEDA, Good Laboratory Practices.	9
5	REGULATIONS FOR FOOD BUSINESS OPERATOR: Food adulteration and food safety, Food laws - Food Safety and Standards Act (FSSAI), Prevention of Food Adulteration Act, Packaged Commodities Rules, Functions of Food Business Operator, QA Audit, IPR and Patents, Issues affecting consumers and industry - Genetically Modified Foods, Fortification, Pesticide Residues, Organic Foods, Food Additives	9
TOTAL		45

Course Outcomes

- Upon completion of the course, students can be able to**
- CO1- Summarize the techniques for analyzing specific components in carbohydrates
 - CO2- Outline the various analytical methods and properties of lipids and proteins
 - CO3- Explain the food quality and standards ensuring the quality of food
 - CO4- Discuss the concepts of quality assurance at national and international level
 - CO5- Explain the regulations mandated for food business operators

TEXT BOOKS:

- T1 1.Pomeranz, Yeshajahu. "Food Analysis Theory and Practice". 3rd Edition. Aspen Publishers / Springer, 2000.
- T2 2.Inteaz Alli, —Food Quality Assurance: Principles and Practices, 2nd Edition, Taylor and Francis, UK, 2014.

REFERENCES BOOKS:



- R1 1. David Kilcast, —Sensory Analysis for Food and Beverage Quality Control: A Practical Guide, Woodhead Publishing Ltd, Cambridge, 2010.
- R2 2. Singh, S. P., —Food Safety, Quality Assurance, and Global Trade: Concerns and Strategies, International Book Distributing Company, Lucknow, 2009.
- R3 3. Manuals of Food Quality Control: Quality Assurance in Food Control Chemical Laboratory, FAO, Itlay, 1993.
- R4 4. Ronald E. Wrolstad. "Handbook of Food Analytical Chemistry" Vol I, John Wiley & sons, 2005


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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT7202	FOOD PACKAGING	3	0	0	3
Course Objectives	• To Understand the concepts of packaging for various food products					

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	BASICS IN FOOD PACKAGING: Definitions and basic functions of a food package. Food package design and development. Packaged product quality and shelf life. Current status in food packaging in India. Package standards and regulation. Labelling, Bar coding.	9
II	PAPER AND PAPERBOARD PACKAGING: Properties of paper and paperboard. Paper and paperboard manufacture - SBB, SUB, FBB, WLC. Package types – paper, pouches, sachets, cartons, boxes, tubes, tubs, containers, drums, tapes, cushion, cap liners and diaphragm. Application of paper and paperboards for food packaging.	9
III	PLASTIC PACKAGING: Types of plastics used in packaging – PE, PP, PET, PVC, EVOH, PVA. Secondary conversion techniques – film, extrusion and thermal lamination. Printing of plastic films and rigid plastic containers. Food contact and barrier properties. Seal ability and closure. Application of plastics for food packaging.	9
IV	METAL CANS: Raw materials for can making – steel, aluminum. Can making processes - three-piece welded cans, DWI, DRD cans – end making processes – coating. Film laminates and inks, metal packages – corrosion and Sulphur staining. Application of metal containers in food industries. Glass containers: Definition and composition. Glass container manufacture – melting, forming, surface treatments. Closure selection. Glass bottle design and specification. Application of glass containers in food industries.	9
V	RECENT TRENDS IN FOOD PACKAGING: Active, connected, intelligent and smart packaging and its types – sensors (biosensors and gas sensors), indicators (temperature, freshness), and data carriers (barcode, RFID), modified atmosphere packaging - vacuum and Inert gas Packaging, Biodegradable and edible packaging, Aseptic packaging, Shrink wrapping, Nano packaging, Antimicrobial packaging, self-heating and cooling cans.	9
Total Instructional Hours		45

Course Outcomes

Upon completion of the course, students can be able to

CO1- Understand basic concepts in food packaging
CO2- Understand and choose appropriate metal and glass containers for food packaging
CO3- Understand the classification of plastics and elaborate their properties
CO4- Understand the use of paper and paperboards for various food applications
CO5- Remember the recent trends in food packaging

TEXT BOOKS:

1. Richard Coles and Mark J. Kirwan, -Food and Beverage Packaging Technology, 2nd Edition, Blackwell Publishing Asia Pty Ltd, CRC press, USA, 2011.
2. Robertson Gordon L., -Food Packaging: Principles and Practice, 3rd Edition, Marcel Dekker Inc, USA, 2012.

REFERENCES BOOKS:

1. Han Jung H., -Innovations in Food Packaging, 2nd Edition, Academic Press, USA 2013.
2. Dong Sun Lee , Kit L. Yam and Luciano Piergiovanni, -Food Packaging Science and Technology, CRC press, USA, 2008.
3. Otto G. Piringger and A.L. Baner, -Plastic Packaging Materials for Food, 1st Edition, Wiley- VCH, Germany, 2008.
4. Mathlouthi, M. "Food packaging and Preservation". Aspen Publications, 2013

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Programme B.TECH.	Course Code 19FT7203	Name of the Course FOOD PLANT LAYOUT AND MANAGEMENT	L 3	T 0	P 0	C 3
Course Objectives	<ul style="list-style-type: none"> • Impart basic knowledge in selecting a location as well as plant layout with respect to material handling, space utilization, future expansion etc. • Understand the importance of availability of raw material and facilities for production of goods • Integrate man, materials and machinery for optimum production 					

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	PLANT LOCATION AND LAYOUTS: Introduction to food plant design - special features of food and agricultural process industry - plant location - location factors, site selection, location theory and models - layout - objectives, classical and practical layout - preparation of process chart and machinery layout - product layout and process layout - plant layout for size reduction machinery, evaporation plant, drying plant, bake ovens and frying plant, heat exchanger plant, refrigeration and air conditioning plant, boiler, packaging plant and ancillary equipments plant.	9
II	PROJECT PROFILE ANALYSIS: Project profile, key aspects to consider in preparing a project profile and DPR (Detailed Project Report), Describing Project Operations, Categorizing Costs, Environmental Sustainability, completing and interpreting the profile, Project Profile Formats, Preparing model project report on fruit and vegetable processing unit.	9
III	ELECTRICAL AND WATER SUPPLY: Estimation of services - peak and critical load - preparation of electrical layout - selection of fittings and accessories for electrical and water supply - provision of water supply - design of water storage system - selection of pipe, valves and safety devices - drainage - systems, pipeline, traps, safety devices - illumination and ventilation - materials, mounting, operation and maintenance - layout for effluent treatment plant - safe disposal of effluent.	9
IV	PRODUCTION PLANNING AND CONTROL: Production planning and control - continuous and intermittent production - scheduling - routing and dispatching - activity chart and Gantt chart - network planning methods - PERT and CPM - applications - method study - work study - methods - man-machine chart - time study - standard time of a job - inventory control - economic ordering quantity - inventory models.	9
V	REPAIR AND MAINTENANCE OF EQUIPMENT: Repair and maintenance of equipment - preventive maintenance and breakdown maintenance - replacement of equipment - alternative methods and analysis - method of annual equivalence, present worth method and internal rate of returns.	9
Total Instructional Hours		45

Course Outcomes

Upon completion of the course, students can be able to

CO1- Design layout for various types of food processing industries.
CO2- Construct project profile analysis and prepare project report
CO3- Design water storage systems and prepare electrical layout
CO4- Apply different methods for production planning
CO5- Demonstrate the repair and maintenance of equipment

TEXT BOOKS:

1. O.P.Kanna, Industrial Engineering and Management, Dhanpat Rai Publication (P) Ltd., New Delhi, 2003.
2. S.P. Arora and S.P. Bindra, A Text Book of Building Construction, 5th edition, Dhanpat Rai Publications (p) Ltd., New Delhi, 2014.

REFERENCES BOOKS:

1. Zacharias B. Maroulis and George D. Saravacos, Food Process Design, Marcel Dekker, Inc. U.S.A., 2003.
2. Antonio Lopez-Gomez and Gustavo V. Barbosa-Canovas, Food Plant Design, CRC, London, 2005.
3. C.S.Rao, Environmental Pollution Control Engineering, New age International (P) Ltd., New Delhi, 1999.
4. G.K. Agarwal, Plant layout and materials handling, Jain brothers, New Delhi, 2008.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT7001	FOOD PACKAGING LABORATORY	0	0	3	1.5

- Course Objectives**
- Understand the properties and uses of various packaging materials
 - Impart skills related to food packaging technology
 - Become familiar with different forms of packaging box, bottle, tetra, pouch, vacuum, gas, CAP, MAP, aseptic etc.

S.No.	DESCRIPTION
1.	Measuring GSM of various paper and flexible film based packaging materials.
2.	Measuring water absorption by different paper and paper boards using Cobb tester.
3.	Measuring tensile strength of flexible films using UTM.
4.	Measuring compressive strength of carton boxes using UTM.
5.	Measuring drop strength of packaged food material using drop tester
6.	Measuring compressive strength of oil packaged in flexible pouches using Pouch burst tester.
7.	Measuring bursting strength of different paper board-based packaging materials.
8.	Study on estimation of food additives present in the given food sample
9.	Experiment on opening and closing torques of foods packed in bottles/Jars using torque tester.
10.	Isolation and estimation of synthetic food colors

Total Practical Hours **45**

Course Outcomes	Upon completion of the course, students can be able to
	<ul style="list-style-type: none"> • Understand and apply fundamental requirement for packed foods • Select a suitable packaging material for perishable and non-perishable foods • Demonstrate a testing and properties of packaging materials for its regulatory requirements for raw and processed foods • Analyze the textural properties of packaging material and food packed inside the packaging materials • Evaluate the quality of packing materials using latest machineries

REFERENCE BOOKS:

1. "Manual of methods for the Analysis of Foods", Ministry of Health and Family Welfare, Government of India, New Delhi, 2005.
2. NIIR Board, Food Packaging Technology Handbook (2nd Revised Edition), NIIR Project Consultancy Services, 2012.


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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT7002	FOOD ANALYSIS AND QUALITY CONTROL LABORATORY	0	0	3	1.5

The students will able to

Course Objectives

- Understand the method to estimate viscosity, specific gravity and preservatives in food materials
- Determine the amount of fat and analyze the cooking quality parameters
- Select the suitable sensory analysis method to find the quality of food materials
- Examine the level of food additives present in the various food products
- Assess the level of synthetic food colors, total sugars, polyphenols in food commodities

S.No.

DESCRIPTION

1. Estimation of consistency, viscosity and Specific gravity for given food samples
2. Detection and estimation of preservatives in food materials.
3. Extraction and estimation of fat content in fried food samples
4. Measurement and analysis of Cooking Quality Parameters
5. Flavour profile comparison of the given food materials by ranking scale method
6. Sensory analysis of food materials by overall difference test
7. Quality analysis of raw materials used for bakery products
8. Study on estimation of food additives present in the given food sample.
9. Estimation of total Polyphones in tea/coffee extract
10. Isolation and estimation of synthetic food colors
11. Estimation of total sugar content in fruits

Total Practical Hours

45

Upon completion of the course, students can be able to

- Course Outcomes**
- CO1- Estimate and report viscosity, specific gravity and preservatives in the given samples
 - CO2 – Extract and analyze the fat content in fried foods and cooking quality parameters
 - CO3 – Recommend and apply suitable sensory method to analyze the quality attributes of food
 - CO4 – Measure and quantify the food additives present in the various food products
 - CO5 – Identify and test the level of synthetic colors, total sugars and polyphenols in food products

REFERENCE BOOKS:

1. "Manual of methods for the Analysis of Foods", Ministry of Health and Family Welfare, Government of India, New Delhi, 2005.
2. Morris B. Jacobs., "The chemical Analysis of Foods and Food products" Third edition, CBS publishers & distributors, New Delhi, 2005


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PROFESSIONAL ELECTIVE III

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT7301	FUNCTIONAL FOODS AND NUTRACEUTICALS	3	0	0	3
Course Objectives	<ul style="list-style-type: none"> To understand the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction. To understand the role of Nutraceuticals and functional food in health and disease 					
UNIT	DESCRIPTION					INSTRUCTIONAL HOURS
I	INTRODUCTION AND SIGNIFICANCE: Introduction to Nutraceuticals and functional foods; importance, history, definition, classification, list of functional foods and their benefits, Phytochemicals, zoo chemicals and microbes in food, plants, animals and microbes					9
II	ANALYSIS OF PHYTOCHEMICALS: Qualitative and quantitative methods: phytoestrogens in plants; isoflavones; flavonols, polyphenols, tannins, saponins, lignans, Chitin; Carotenoids - Factors affecting bioavailability, chemical and histochemical characterization of cell wall polysaccharides in almond seed in relation to lipid bioavailability.					9
III	ASSESSMENT OF ANTIOXIDANT ACTIVITY: In vitro and In vivo methods for the assessment of antioxidant activity, Comparison of different In Vitro methods to evaluate the antioxidant, Prediction of the antioxidant activity of natural phenolics from electrotopological state indices, Optimising phytochemical release by process technology; Variation of Antioxidant Activity during technological treatments, new food grade peptidases from plant sources					9
IV	ROLE IN HEALTH AND DISEASE: Nutraceuticals and Functional foods in Gastrointestinal disorder, Cancer, CVD, Diabetic Mellitus, HIV and Dental disease; Importance and function of probiotic, prebiotic and symbiotic and their applications, Functional foods and immune competence; role and use in obesity and nervous system disorders.					9
V	SAFETY ISSUES: Health Claims, regulations and safety issues- International and national					9
Total Instructional Hours						45
Course Outcomes	Upon completion of the course, students can be able to CO1- Understand the significance of functional foods and nutraceuticals CO2- Understand the analysis of phytochemicals CO3- Understand the procedures for assessing antioxidant activity CO4- Understand the role of nutraceuticals in health and disease CO5- Understand the safety issues					

TEXT BOOKS:

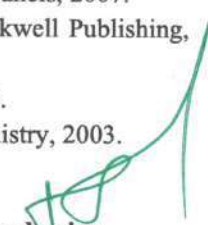
1. Bisset, Normal Grainger and Max Wich H "Herbal Drugs and Phytopharmaceuticals", II Edition, CRC, 2001.
2. Wildman, Robert "Handbook of Nutraceuticals and Functional Foods". CRC, 2006.

REFERENCES BOOKS:

1. Shi, John, Fereidoon Shahidi and Chi-Tang Ho "Asian Functional Foods". CRC/Taylor & Francis, 2007.
2. Watson, Robald Ross "Functional Foods and Nutraceuticals in Cancer Prevention". Blackwell Publishing, 2007.
3. Gibson, G.R. and C.M. Willams. "Functional Foods: Concept to Product". Woodhead, 2000.
4. Hanson, James R. "Natural Products: The Secondary Metabolites", Royal Society of Chemistry, 2003.


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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT7302	BIOLOGY AND CHEMISTRY OF FOOD FLAVOURS	3	0	0	3
Course Objectives	<ul style="list-style-type: none"> • To understand the flavour compounds involved in development of flavor • To understand the analytical techniques involved in flavor analysis 					

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	INTRODUCTION: Problems in flavour research – classification of food flavours; chemical compounds responsible for flavor	9
II	FLAVOUR COMPOUNDS: Chemical compound classes and their flavour responses; flavour development during biogenesis, flavour development during food processing; use of biotechnology to develop flavours.	9
III	THE CHEMICAL SENSES: Anatomy of the chemical senses; neural development of the chemical senses; receptor mechanisms, neural coding; the control of eating.	9
IV	FLAVOUR ANALYSIS: Subjective versus Objective methods of analysis; psychophysics and sensory evaluation and its types, ENOSE, ETONGUE; Instrumental analysis; sample handling and artifacts; data handling	9
V	TEACHING FLAVOUR CONCEPTS: Problem based learning; tongue and nose; Onion-Beverage-Maillard reaction-Thio-stench	9
Total Instructional Hours		45

Course Outcomes

Upon completion of the course, students can be able to

- CO1- Understand the problems in flavor research
- CO2- Understand the compounds responsible for flavours
- CO3- Understand the chemical senses
- CO4- Understand the flavor analysis procedures
- CO5- Understand the flavor concepts and applications

TEXT BOOKS:

1. Fisher, Carolyn and Thomas R. Scott. "Food Flavours: Biology and Chemistry". The Royal Society of Chemistry, 1997.
2. Heath, H.B. and G. Reineccius. "Flavor Chemistry and Technology". CBS Publishers, 1996.

REFERENCES BOOKS:

1. Hofmann, Thomas. "Challenges in Taste Chemistry and Biology". American Chemical Society Publications, 2004.
2. Charalambous, G. "Food Flavors: Generation, Analysis and Process Influence". Elsevier, 1995.
3. Reineccius, Gary. "Flavor Chemistry and Technology". II Edition, Taylor & Francis, 2006.
4. Shahidi, Fereidoon and Chi-Tang Ho. "Flavor Chemistry of Ethnic Foods". Kluwer Academic / Plenum, 1999.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT7303	FOOD TOXICOLOGY AND ALLERGY	3	0	0	3

Course Objectives

- To study various food laws, importance and functions of food safety management systems, to impart knowledge on food laws and safety in food processing.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	INTRODUCTION TO FOOD TOXICOLOGY: Definition and need for understanding food toxicology; Hazards -Microbiological, nutritional and environmental. Basics of immune response - humoral and cell mediated response. Allergen and mechanism of allergic response.	9
II	NATURAL TOXINS, FOOD ALLERGY AND SENSITIVITY: Toxins – Natural toxin and poison, difference between toxin, poison and natural toxin, toxin foods, unsafe food, bio-toxin, toxin characteristics, classification of natural toxin. Chemistry of food allergens, food disorders associated with metabolism, biotransformation and Elimination of Toxicants, lactose intolerance, celiac disease and asthma.	9
III	TOXICANTS FORMED DURING FOOD PROCESSING: Intentional direct additives, preservatives, nitrate, nitrite, and N- nitroso compound flavour enhancers, food colors, indirect additives, residues and contaminants, heavy metals, other organic residues and packaging materials. Toxicity of heated and processed foods, food carcinogens and mutagens - Polycyclic aromatic hydrocarbons, N - nitrosamines, Acrylamide and their mode of action.	9
IV	ASSESSMENT OF TOXICANTS IN FOOD SAMPLING: Quantitative and qualitative analysis of toxicants in foods; Biological determination of toxicants. Assessment of food safety – Risk assessment and risk benefit indices of human exposure, acute toxicity, mutagenicity and carcinogenicity, reproductive and developmental toxicity, neurotoxicity and behavioural effect, immunotoxicity.	9
V	INSTRUMENTATION TECHNIQUES TO DETECT TOXINS: Chromatography, Principles, procedure and applications of Thin layer chromatography, Gas chromatography column chromatography, Ion exchange chromatography and High performance liquid chromatography, PCR Techniques, ELISA. Spectrophotometry, Principles, instrumentation and applications of atomic absorption spectrophotometry (AAS) and atomic emission spectrophotometry (AES), Centrifugation; Principles, instrumentation and applications of preparative and ultracentrifuge.	9
Total Instructional Hours		45

Course Outcomes

Upon completion of the course, students can be able to

- CO1- Understand the concepts of food toxicology
- CO2- Understand the reactions of natural toxins
- CO3- Remember the toxicants during food processing
- CO4- Understand the procedures of sampling
- CO5- Understand the instrumentation techniques to detect toxins

TEXT BOOKS:

- Helferich, William and Carl K.Winter "Food Toxicology" CRC Press, 2001.
- Alluwalla, Vikas "Food Hygiene and Toxicology" Paragon International Publishers, 2007

REFERENCES BOOKS:

- Labbe, Ronald G. and Santos Garcia "Guide to Food Borne Pathogens" John Wiley & Sons, 2001.
- Cliver, Dean O. and Hans P.Riemann "Food Borne Diseases" 2nd Edition., Academic Press / Elsevier, 2002.
- Riemann, Hans P. and Dean O. Cliver "Food Borne Infections and Intoxications" 3rd Edition., Academic Press/Elsevier, 2006.
- Shibamoto, Taka yuki and Leonard F.Bjeldanzes "Introduction to Food Toxicology" 2nd Edition.Academic Press, 2009.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT7304	ADVANCED DRYING TECHNOLOGY	3	0	0	3
Course Objectives	<ul style="list-style-type: none"> To study the advanced drying technologies used for specific food material according to its nature 					

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	Introduction to Drying: Drying and dehydration - principles - Mechanism of drying. Drying curves - Internal and external conditions of drying -Drying rate characteristic curve. Diffusion theories of drying - Effective Fickian diffusivity, Alternative effective diffusion theories. Water activity – Hysteresis, water activity predictive models, Determination of sorption isotherms – Gravimetric method, Manometric method and Hygroscopic methods.	9
II	Spray and Freeze drying: Spray drying – concept, components of spray drier, mechanism of atomization – drop size and drop distribution. Drying of droplets – Fundamentals, drying kinetics, residence time. Heat and mass balance. New developments in Spray drying. Freeze drying- principle - types - heat and mass transfer, design consideration. Freeze drying – Concept. Stages in freeze drying. Industrial freeze dryers. Advances in freeze drying.	9
III	Drying on inert particles: Mechanism and process considerations. Pneumatic and flash drying – principles and its applications. Fluidized bed drying (FBD) - principles of fluidization, Components of fluidized bed system, Classification of fluidized bed dryers – conventional and modified FBD.	9
IV	Superheated steam drying: Principles, classification, selection, applications. Heat pump drying (HPD) – principle, low temperature HPD, chemical HPD, Developments and trends. Contact-Sorption drying- Mechanism, Characteristics of sorbents/carriers. Airless drying. Fry drying. Conveyor dryers.	9
V	Microwave and dielectric drying: basic concept, Generators, applicators and other control devices, industrial applications. Infra red drying – principles, industrial dryers, applications. Sonic drying. Impingement drying. Slush drying. Refractance Window drying.	9
Total Instructional Hours		45

Course Outcomes	Upon completion of the course, students can be able to
	CO1- Understand the mechanism of drying and various dehydration techniques
	CO2- Remember the knowledge on freeze and spray drying
	CO3- Understand the concepts of drying on inert particles, fluidized and pneumatic drying
	CO4- Understand the insight on superheated steam drying, heat pump drying and other novel drying techniques
	CO5- Understand the knowledge on microwave, infra-red and sonic drying techniques

TEXT BOOKS:

1. A.S.Mujumdar. Handbook of Industrial drying – Third edition, CRC press, Taylor and Francis group.UK.2007.
- 2.Potter, N. N. and Hotchkiss, J. H., —Food Science. Fifth Edition, CBS Publishers and Distributors, New Delhi. 1996.

REFERENCES BOOKS:

- 1.Kudra, T and A.S. Mujumdar. Advanced Drying Technologies. Second Edition, CRC press, Taylor and Francis Group. UK. 2009.
- 2.Rao, M. A. and Rizvi, S.S.H., —Engineering Properties of Foods, Marcel Dekker, Inc. New York. 1986.
3. Sahay K.M. and Singh K.K., —Unit Operations of Agricultural Processing, 2nd Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2012.
4. Albert Ibarz and Gustavo V. Barbosa-Cánovas. Unit Operations in Food Engineering. CRC Press, Boca Raton, FL, USA, 2003

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT7305	CEREAL TECHNOLOGY	3	0	0	3
Course Objectives	<ul style="list-style-type: none"> To develop the knowledge of students in the area of Cereal processing and technology. 					

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	PRODUCTION, STRUCTURE AND COMPOSITION: Status, major growing areas and production of cereals and millets in India and the world, structure, Physical properties; Density, Bulk density, Angle of repose, Hardness, asperity, porosity, stack of milling and moisture on physical properties. Chemical composition, Distribution of nutrients and Aroma of cereals and millets; anti-nutritional factors WHEAT AND RICE : Wheat: Morphology, Physicochemical properties, Wheat Quality, Wheat Milling, quality aspects of flour, wheat proteins and their function, rheology of flour; wheat based baked products – Bread, Biscuit, Cakes, Extruded products, Pizza, Chapatis, malting and malt products; Milling of rice: Conventional	9
II	Milling, Modern milling, Advantages and disadvantages of milling machineries, By products of rice milling, Parboiling of rice: Aging of rice: Enrichment: - Need of Enrichment, Methods of enrichment, Enrichment levels, fortification of amino acids. -Processed Foods from rice: Breakfast cereals, flakes, puffing, canning and instant rice.	9
III	OTHER CEREALS: Corn - Morphology, Physico-chemical properties, Corn milling - Wet and dry milling, Milling fractions and modify starches Corn Products – Corn flakes, Corn starch, canned corn products, puffed product; HFCS; Oats-Milling, Oat Products – Steel cut, rolled oats, quick cooking; Rye bread; Traditional and Fermented cereal products	9
IV	MILLETS: Sorghum, Pearl Millet, Finger millet, Foxtail millet, Kodo Millet - storage, insect control; processing - Pearling, Milling, Malting, Malt based foods, flaked and fermented products; Traditional and Nutritional products based on finger millet.	9
V	BAKED AND EXTRUDED PRODUCTS: Baked foods - chemical dough development, mechanical dough development, sheeting extrusion other rapid methods; Bread staling – theory, manifestation, retardation measures; Indian Confectionery. Extrusion processing – methods and products	9
Total Instructional Hours		45

Course Outcomes

Upon completion of the course, students can be able to

CO1- Understand and identify the specific processing technologies used for cereals
CO2- Understand the application of scientific principles in the processing technologies specific to the materials.
CO3 –Understand the processing of millet
CO4 –Understand the importance of baked and extruded product
CO5 – Understand the processing of wheat

TEXT BOOKS:

- 1.Matz, Samuel A. “ The Chemistry and Technology of Cereals as Food and Feed” II Edition, CBS, 1996
2. Delcour, Jan A. and R. Carl Hoskeny. “Principles of Cereal Science and Technology”. III Edition. American Association of Cereal Chemists, 2010.

REFERENCES BOOKS:

- 1.Kulp, Karel “Handbook of Cereal Science and Technology”. IIEdition,CRC Press, 2000.
2. Morris, Peter C. and James H Bryce “Cereal Biotechnology”. CRC / Woodhead, 2000
3. Chakraverty A. Post-harvest Technology of Cereals, Pulses and Oilseeds. Oxford & IBH.2006
- 4.Araullo, E.V., dePadna, D.B. and Graham, Michael. Rice Post Harvest Technology. International Development Res. Centre, Ottawa, Canada. 1976.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT7306	PROCESSING TECHNOLOGY OF LEGUMES AND OILSEEDS	3	0	0	3

Course Objectives

- To develop the knowledge of students in the area of pulse and oil seeds processing and technology.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	COMPOSITION OF LEGUMES: Present status and future prospects of legumes - Morphology of legumes - Classification and types of legumes - Chemical composition, nutritional value and anti-nutritional compounds in legumes - Methods of removal of anti-nutritional compounds – changes during cooking.	9
II	MILLING OF LEGUMES: Pulse milling – unit operations- Home scale, cottage scale and modern milling methods, machines and milling efficiency - factors affecting milling quality and quantity- Problems in dhal milling industry.	9
III	VALUE ADDITION OF LEGUMES: Nutritional changes during soaking and sprouting of pulses- Cooking quality of dhal, methods, factors affecting cooking of dhal - Quick cooking dhal- instant dhal - Fermented products of legumes.	9
IV	COMPOSITION AND EXTRACTION METHODS OF OIL SEEDS: Oil seeds – physical and chemical properties –milling- Ghanis, hydraulic presses, expellers, machines, milling quality- factors affecting milling quality and quantity; Problems in oil milling. industry- solvent extraction - Refining of oils: Degumming, neutralization, bleaching, filtration, deodorization, their principles and process controls- Hydrogenation of oils;	9
V	PROCESSING AND VALUE ADDITION OF OIL SEEDS: Technology Processing for cottonseed, groundnut, rapeseed, mustard and soyabean- linseed, castor -New technologies in oilseed processing; Utilization of oil seed meals for different food uses- High protein products like protein concentrates and isolates- By-products of oil milling and their value addition.	9
Total Instructional Hours		45

Course Outcomes

Upon completion of the course, students can be able to

CO1- Understanding the composition of legumes
CO2- Understand the application of scientific principles in the processing technologies specific to the pulse processing.
CO3 –Understand the value addition of pulses and its products
CO4 –Understand the importance of oilseed extraction
CO5 – Understand the processing of oilseed and value addition

TEXT BOOKS:

1. Chakraverty, A. 2000. Post-Harvest Technology of cereals, pulses and oilseeds. Third Edition. Oxford & IBH publishing & Co. Pvt. Ltd., New Delhi.
2. Sahay, K.M. and K.K. Singh. 1994. Unit operations in Agricultural Processing, Vikas Publishing House Pvt. Ltd., New Delhi

REFERENCES BOOKS:

1. Henderson, S.M. and R.L.Perry. 1995. Agricultural process engineering, John Willey and Sons, New York. p.234.
2. Pande, P.H. 1994. Principles of agricultural processing, Kalyani Publishers, Ludhiana, p.278.
3. Chakraverty A. Post-harvest Technology of Cereals, Pulses and Oilseeds. Oxford & IBH.2006
4. McCabe, W.L. and J.C.Smith. 2001. Unit operations in chemical engineering. McGraw Hill Kogakusha Ltd., Tokyo. p.1028.

Jay
Chairman, Board of Studies
Chairman - BOS
FT - HICET



Dean - Academics
Dean (Academics)
HICET

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT7307	EMERGING NON-THERMAL PROCESSING OF FOOD	3	0	0	3

Course Objectives

- To understand the various emerging non-thermal food processing methods

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	INTRODUCTION: Type and sources of radiation, dosimetry, mode of action of ionizing radiation – direct and indirect effect, radiation effect on food constituents, dose requirement for different products and regulations.	9
II	EMERGING STORAGE AND PACKAGING METHODS: Controlled atmosphere storage- modified atmosphere storage- Diffusion channel - controlled atmosphere packaging, modified atmosphere packaging, vacuum packaging - need of modifying atmospheric gas composition – types of scrubbers	9
III	MINIMAL PROCESSING: Minimal processing – hurdle technology – various parameters which inhibits the growth of microorganism. Ozone – its role in food industry – generation – application. Intermediate moisture foods – formulation – preparation	9
IV	MEMBRANE TECHNOLOGY: Membrane technology – terminologies-types of membrane- types of membrane modules- osmosis- reverse osmosis- ultra filtration- changes during concentration.	9
V	RECENT ADVANCEMENT IN FOOD PRESERVATION: Pulsed electrified sterilization - application. High pressure technology – application, Oscillating magnetic field sterilization, Ultra sound, Ohmic heating – application in food industry.	9
Total Instructional Hours		45

Course Outcomes

Upon completion of the course, students can be able to

CO1- Understand the concepts of non-thermal processing
CO2- Understand the non-thermal packaging techniques
CO3- Understand the minimal processing steps
CO4- Understand the technology of membranes
CO5- Understand the recent advancement in food preservation

TEXT BOOKS:

- Lal and Siddappa., "Fruit and Vegetable preservation", ICMR 1986.
- Manoranjan Kalia and Sangita, "Food preservation and processing". Kalyani Publishers. Ludhiana 1996.

REFERENCES BOOKS:

- Fellows, P.J, "Food Processing Technology" 2001. 154 FP-2013 SRM(E&T)
- Leninger, H.A. and Beverlod, W.A. "Food Process Engineering", D.Reicle Pub. Corp.
- Srivastha R.P. and Sanjeev kumar, "Fruit and vegetable Preservation" 1998.
- Ohlsson, Thomas, and Nils Bengtsson, eds. Minimal processing technologies in the food industries. Elsevier, 2002.

Jay
Chairman, Board of Studies
Chairman - BoS
FT - HiCET

[Signature]
Dean - Academics

Dean (Academic)
HiCET



CO'S, PO'S & PSO'S MAPPING

ACADEMIC YEAR: 2022-2023

SEMESTER I – R 2022

Course Code & Name : 22MA1101/ MATRICES AND CALCULUS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO5	3	3	3	3	3	-	-	-	-	-	-	2	1	2
AVG	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

Course Code & Name : 21ME1152/ ENGINEERING DRAWING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	3	2	-	1	-	1	-	-	1	1	1	1	2
CO2	3	3	2	1	1	-	1	-	-	1	1	1	1	2
CO3	3	3	3	-	1	1	1	-	-	1	1	-	1	1
CO4	3	3	3	1	1	2	1	-	-	1	1	1	1	1
CO5	3	3	3	1	1	3	1	-	-	1	1	1	1	1
Avg	2.8	3	2.6	1	1	2	1	-	-	1	1	1	1	1.4

Course Code & Name : 22PH1151/ PHYSICS FOR NON-CIRCUIT ENGINEERING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	3	2
CO2	3	3	2	2	1	1	1	-	1	-	2	2	3	1
CO3	3	3	2	2	2	1	1	-	1	-	1	2	2	2
CO4	3	2	3	1	3	1	1	-	1	-	1	2	2	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	2	1
Avg	3	2.6	2.6	1.6	2.2	1	1	-	1	-	1.6	2.2	2.4	1.4

Course Code & Name : 22HE1151 / ENGLISH FOR ENGINEERS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2					1	2	2	2	3	1	1	1	2
CO2	2	1			1	1	1	2	2	3		2		2
CO3	2	1			1	1	2	3	3	3		1	1	2
CO4	2	1				1	2	2	2	3	1	1		
CO5	2					1	1	2	3	3		1	1	2
Avg	2	1	-	-	1	1	1.6	2.4	2.4	3	1	1.2	1	2



Course Code & Name : 22CS1151/PYTHON PROGRAMMING PRACTICES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	3	3	-	2	-	-	-	-	-	-	2	2	2
CO2	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO3	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO4	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO5	2	3	3	-	2	-	-	-	2	-	-	2	2	2
Avg	2	3	3	-	2	-	-	-	2	-	-	2	2	2

Semester – II – R2022

Course Code & Name : 22MA2105/ PARTIAL DIFFERENTIAL EQUATION, FOURIER SERIES AND TRANSFORMS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1	2	-	-	-	-	-	-	2	3	2
CO2	3	3	3	2	1	-	-	-	-	-	-	3	2	2
CO3	3	3	3	1	1	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	2
Avg	3	2.8	3	2	2							2.2	2.2	2

Course Code & Name : 22CY2101/ ENVIRONMENTAL STUDIES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	2	1	1	-	-	-	-	1	1	-
CO2	3	2	2	-	2	1	-	-	-	-	-	1	1	-
CO3	3	2	2	-	2	1	1	-	-	-	-	1	-	-
CO4	3	2	2	2	2	1	-	-	-	-	-	1	-	1
CO5	3	2	2	-	2	1	-	-	-	-	-	1	-	1
Avg	3	2	2	2	2	1	1	-	-	-	-	1	1	1

Course Code & Name : 22PH2101/ BASICS OF MATERIAL SCIENCE

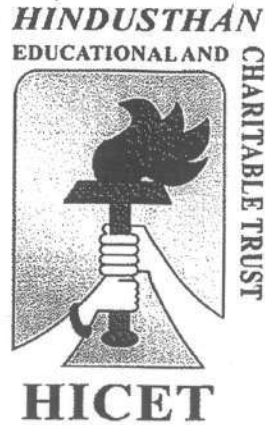
PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	1				1	2		
CO2	3	3	1	1	2						1	2		
CO3	3	2	1	2	2						1	2		
CO4	3	3	1	2	2	1					1	2		
CO5	3	2	2	3	2	1	2				1	2		
Avg	3	2.4	1.2	1.8	1.8	1	1.5				1	2		



(11)

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution Affiliated to Anna University, Chennai)
(Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade)
Coimbatore - 641 032.

B.TECH. FOOD TECHNOLOGY



CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the even semester
Academic year 2022-23
(Academic Council Meeting Held on 03.03.2023)

CURRICULUM

R2022



DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. FOOD TECHNOLOGY (UG)

REGULATION-2022

For the students admitted during the academic year 2022-2023 and onwards

SEMESTER I

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total	
THEORY												
1.	22MA1101	Matrices and Calculus	BSC	3	1	0	4	4	40	60	100	
2.	22ME1201	Engineering Drawing	ESC	1	4	0	3	5	40	60	100	
THEORY WITH LAB COMPONENT												
3.	22PH1151	Physics for Non-Circuit Engineering	BSC	2	0	2	3	4	50	50	100	
4.	22HE1151	English for Engineers	HSC	2	0	2	3	4	50	50	100	
5.	22IT1151	Python Programming and practices	ESC	2	0	2	3	4	50	50	100	
EEC COURSES (SE/AE)												
6.	22HE1071	Entrepreneurship & Innovation	AEC	2	0	0	3	3	40	60	100	
7.	22HE1072	Entrepreneurship & Innovation	AEC	1	0	0	1	1	100	0	100	
MANDATORY COURSE												
8.	22MC1091	Indian Constitution	MC	2	0	0	0	2	0	0	100	
				TOTAL	15	5	6	19	27	370	330	700

SEMESTER II

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22MA2105	Partial differential equations, fourier series and transforms (BME, Civil & FT)	BSC	3	1	0	4	4	40	60	100
2.	22CY2101	Environmental Studies	ESC	2	0	0	2	3	40	60	100
3.	22PH2101	BASICS OF MATERIAL SCIENCE (Common to all branches except Mechatronics)	BSC	2	0	0	2	3	40	60	100
4.	22EE2231	Basics of Electrical Engineering	ESC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
5.	22PH2151	Biochemistry	BSC	2	0	2	3	4	50	50	100



6.	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100
PRACTICAL											
7.	22ME2001	Engineering Practices	ESC	0	0	4	2	2	60	40	100
EEC COURSES (SE/AE)											
8.	22HE2071	Design Thinking	SEC	2	0	0	2	2	100	0	100
9.	22HE2072	Soft Skills -1	AEC	1	0	0	1	1	100	0	100
MANDATORY COURSE											
10.	22MC2091 / 23MC2091	ಕುಟುಂಬ ಪರಂಪರೆ / Heritage of Family	MC	2	0	0	0	1	0	0	0
11.	22MC2099	NCC / NSS / YRC / Sport / Club / Society Service - Enrollment (Common)	MC	All students shall enroll on admission, in any one of the personality and character development programmes and undergo training for about 30 days.							
TOTAL				19	1	8	22	27	520	380	900

SEMESTER III

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total	
THEORY												
1.	22MA3108	Transforms and Partial Differential Equations	BSC	3	1	0	4	4	40	60	100	
2.	22FT3201	Food Microbiology	PCC	3	0	0	3	3	40	60	100	
3.	22FT3202	Heat and Mass Transfer	PCC	3	1	0	4	3	40	60	100	
4.	22FT3203	Fluid Mechanics	PCC	3	1	0	4	4	40	60	100	
THEORY WITH LAB COMPONENT												
5.	22FT3251	Food Chemistry	PCC	2	0	2	3	4	50	50	100	
PRACTICAL												
6.	22FT3001	Unit Operations Laboratory	ESC	0	0	4	2	4	60	40	100	
7.	22FT3002	Food Microbiology Laboratory	PCC	0	0	4	2	4	60	40	100	
EEC COURSES (SE/AE)												
8.	22HE3071	Soft Skills -2	SEC	1	0	0	1	1	100	0	100	
9.	22HE3072	Ideation Skills	AEC	2	0	0	2	2	40	60	100	
TOTAL				17	3	1	0	25	29	470	430	900

SEMESTER IV

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22HE4101	IPR and Start-ups	HSC	2	0	0	2	2	40	60	100
2.	22MA4104	Probability and Operations Research	BSC	3	0	0	3	3	40	60	100



3.	22FT4201	Principles of Thermodynamics	PCC	3	1	0	4	3	40	60	100
4.	22FT4202	Refrigeration and Cold Chain Management	PCC	3	1	0	4	4	40	60	100
5.	22FT4203	Unit operations in Food Processing	PCC	3	0	0	3	4	40	60	100
6.	22FT4204	Food Analysis and Quality Control	PCC	3	0	0	3	4	40	60	100
PRACTICAL											
7.	22FT4001	Food Analysis and Quality Control Laboratory	PCC	0	0	4	2	4	60	40	100
8.	22FT4002	Unit Operations in Food Processing Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9.	22HE4071	Soft Skills -III	SEC	1	0	0	1	1	100	0	100
TOTAL				18	2	8	24	29	460	440	900
<p>* Two weeks internship carries 1 credit and it will be done during Semester III summer vacation and same will be evaluated in Semester IV. If students unable to undergo in semester III, then the Internship I offered in the semester IV can be clubbed with Internship II (Total: 4 weeks-2 credits)</p>											

SEMESTER V

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22FT5201	Fruits and Vegetable Processing Technology	PCC	3	0	0	3	4	40	60	100
2.	22FT5202	Poultry, Meat and Fish Process Technology	PCC	3	0	0	3	3	40	60	100
3.	22FT53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4.	22FT53XX	Professional Elective-2	PEC	3	0	0	3	3	40	60	100
5.	22FT53XX	Professional Elective-3	PEC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
6.	22FT5251	Baking and Confectionery Technology	PCC	2	0	2	3	4	50	50	100
PRACTICAL											
7.	22FT5001	Fruits and Vegetable Processing Technology Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8.	22HE5071	Soft Skills -4/Foreign languages	SEC	1	0	0	1	1	100	0	100
TOTAL				18	0	6	21	25	410	390	800

SEMESTER VI

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22FT6201	Dairy Engineering	PCC	3	0	0	3	3	40	60	100
2.	22HS6101	Professional Ethics (Common)	HSC	3	0	0	3	3	40	60	100
3.	22FT63XX	Professional Elective-4	PEC	3	0	0	3	3	40	60	100



4.	22FT63XX	Professional Elective-5	PEC	3	0	0	3	3	40	60	100
5.	22XX64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
6.	22XX64XX	Open Elective – 2*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
7.	22FT6001	Dairy Engineering Laboratory	PCC	0	0	4	2	4	60	40	100
8.	22FT6002	Food Process Equipment Design Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9.	22HE6071	Soft Skills – 5	SEC	2	0	0	2	2	100	0	100
TOTAL				20	0	8	24	28	460	440	900

SEMESTER VII

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22FT7201	Food Packaging	PCC	3	0	0	3	3	40	60	100
2.	22FT7202	Food Plant Layout and Management	PCC	3	1	0	4	4	40	60	100
3.	22FT730X	Professional Elective-6	PEC	3	0	0	3	3	40	60	100
4.	22FT740X	Open Elective – 3*	OEC	3	0	0	3	3	40	60	100
5.	22FT740X	Open Elective – 4*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
6.	22FT7001	Food Packaging Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
7.	22FT7701	Internship - II*	SEC	-	-	-	2	1	100	0	100
TOTAL				15	1	4	20	21	360	340	700

* - Two weeks internship carries 1 credit and it will be done during Semester VI summer vacation/placement training and same will be evaluated in Semester VII.

SEMESTER VIII

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
EEC COURSES (SE/AE)											
1.	22FT8901	Project Work/Granted Patent	SEC9	0	0	20	10	20	100	100	200
TOTAL				0	0	20	10	20	100	100	200

Note:

- *As per the AICTE guideline, in Semesters I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Further, the students who enrolled his/her name in HICET NCC and Air Wing are eligible to undergo this subject. The earned extra credits printed in the Consolidated Mark sheet as per the regulation.
- NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.
- The above-mentioned NCC Courses will be offered to the students who are going to be admitted in the Academic Year 2021 – 22.



OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES)

To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AI6451	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2	22CS6451	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6451	Cyber security	OEC	2	0	2	4	3
4	22EC6452	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6451	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6451	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPEN ELECTIVE I AND II

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3
6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3
10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	22EE6401	Digital Marketing	OEC	3	0	0	3	3
13	22EE6402	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3	3
15	22AG6401	Urban Agriculture and Organic Farming	OEC	3	0	0	3	3
16	22CH6401	Biomass and Biorefinery	OEC	3	0	0	3	3

Note: Non-Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches

OPEN ELECTIVE III

Students shall choose any one of the open elective courses such that the course content or title not belong to their own programme.

(Note: Each programme in our institution is expected to provide one course only)



S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22EE7401	Fundamentals of Solar Energy & its applications	OEC	3	0	0	3	3

OPEN ELECTIVE IV

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22LS7401	General studies for competitive examinations	OEC	3	0	0	3	3
2	22LS7402	Human Rights, Women Rights and Gender equity	OEC	3	0	0	3	3
3	22LS7403	Indian ethos and Human values	OEC	3	0	0	3	3
4	22LS7404	Financial independence and management	OEC	3	0	0	3	3
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Processing of Cereals, Pulses and Grain Technology	Vertical II Spices and Plantation Technology	Vertical III Food Safety Management System	Vertical IV Entrepreneurship and Management	Vertical V Food Colors, & Flavors	Vertical VI Novel Technologies
22FT5301 Technology of Fats and Oils	22FT5304 Processing of Spices & Plantation Crops	22FT5307 Introduction to food safety Analysis and Quality Risk Management	22FT5310 Entrepreneurship Opportunities for Food Technologist	22FT5314 Food additives	22FT5317 Principles of Food Processing
22FT5302 Cereal Technology	22FT5305 Blending and Value Addition	22FT5308 HACCP in Food Processing and Preservation	22FT5311 Total Quality Management	22FT5315 Food colors and flavor Technology	22FT5318 Post-Harvest Technology
22FT5303 Processing of Legumes and Oilseeds	22FT5306 Processing of Coffee	22FT5309 FSMS & Food Product and Supply Chain Management	22FT5312 Enterprise for resource planning	22FT5316 Biology and Chemistry of Food Flavors	22FT5319 Cane sugar Technology
22FT6301 Milling Technology for Food Materials	22FT6303 Processing of Tea	22FT6305 Food laws – Indian and International	22FT6307 Consumer acceptance and Market survey in Food Processing	22FT6309 Functional Foods and Nutraceuticals	22FT6311 Beverage Technology
22FT6302 Technology of Malting and Brewing	22FT6304 Processing of cocoa and Chocolate	22FT6306 Food Safety in Hospitality Industry & GLP in Food Industries	22FT6308 Energy Audit in Food Processing Industry	22FT6310 Food Toxicology and Allergy	22FT6312 Emerging Non-Thermal Processing of Foods



22FT7301 By Products Management	22FT7302 Packaging of Spices, Plantation products	22FT7303 Food Analysis, Testing & Microbial Safety Analysis	22FT7304 Food Process Economics & Industrial Management	22FT7305 Genetically Modified Foods	22FT7306 Emerging Technologies in Food Processing
22FT7307 Quality, Laws and Regulations in Grain Processing Industries	22FT7308 Spice Processing and Products Laws, Quality Standards and Regulations	22FT7309 Food quality, Assurance and Quality Control	22FT7310 Supply Chain and Retail Management	22FT7311 Waste Management and By- Product Utilization in Food Industries	22FT7312 Technology of Snack and Extruded Foods

Students are permitted to choose all Professional Electives from a particular vertical or from different verticals.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Details of Vertical I: Processing of Cereals, Pulses and Grain Technology

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5301	Technology of Fats and Oils	PEC	3	0	0	3	3
2.	22FT5302	Cereal Technology	PEC	3	0	0	3	3
3.	22FT5303	Processing of Legumes and Oilseeds	PEC	3	0	0	3	3
4.	22FT6301	Milling Technology for Food Materials	PEC	3	0	0	3	3
5.	22FT6302	Technology of Malting and Brewing	PEC	3	0	0	3	3
6.	22FT7301	By Products Management	PEC	3	0	0	3	3
7.	22FT7307	Quality, Laws and Regulations in grain processing Industries	PEC	3	0	0	3	3

Details of Vertical II: Spices and Plantation Technology

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5304	Processing of spices & plantation crops	PEC	3	0	0	3	3
2.	22FT5305	Blending and Value Addition	PEC	3	0	0	3	3
3.	22FT5306	Processing of Coffee	PEC	3	0	0	3	3
4.	22FT6303	Processing of Tea	PEC	3	0	0	3	3
5.	22FT6304	Processing of cocoa and chocolate	PEC	3	0	0	3	3
6.	22FT7302	Packaging of spices and plantation products	PEC	3	0	0	3	3
7.	22FT7308	Spice Processing and products laws, quality standards and regulations	PEC	3	0	0	3	3



Details of Vertical III: Food Safety Management System

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5307	Introduction to food safety analysis and quality Risk management	PEC	3	0	0	3	3
2.	22FT5308	HACCP in Food Processing and Preservation	PEC	3	0	0	3	3
3.	22FT5309	FSMS & Food Product and Supply Chain Management	PEC	3	0	0	3	3
4.	22FT6305	Food laws – Indian and International	PEC	3	0	0	3	3
5.	22FT6306	Food Safety in Hospitality industry & GLP in Food Industries	PEC	3	0	0	3	3
6.	22FT7303	Food Analysis, Testing & Microbial Safety Analysis	PEC	3	0	0	3	3
7.	22FT7309	Food quality, Assurance and Quality Control	PEC	3	0	0	3	3

Details of Vertical IV: Entrepreneurship and Management

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5310	Entrepreneurship Opportunities for Food Technologist	PEC	3	0	0	3	3
2.	22FT5311	Total Quality Management	PEC	3	0	0	3	3
3.	22FT5312	Enterprise for resource planning	PEC	3	0	0	3	3
4.	22FT6307	Consumer acceptance and Market survey in Food Processing	PEC	3	0	0	3	3
5.	22FT6308	Energy audit in food processing industry	PEC	3	0	0	3	3
6.	22FT7304	Food Process Economics & Industrial Management	PEC	3	0	0	3	3
7.	22FT7310	Supply Chain and Retail Management	PEC	3	0	0	3	3

Details of Vertical V: Food Colors & Flavors

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5314	Food additives	PEC	3	0	0	3	3
2.	22FT5315	Food colors and flavor Technology	PEC	3	0	0	3	3
3.	22FT5316	Biology and Chemistry of Food Flavors	PEC	3	0	0	3	3
4.	22FT6309	Functional foods and Nutraceuticals	PEC	3	0	0	3	3
5.	22FT6310	Food Toxicology and Allergy	PEC	3	0	0	3	3



6.	22FT7305	Genetically Modified Foods	PEC	3	0	0	3	3
7.	22FT7311	Waste Management and By-Product Utilization in Food Industries	PEC	3	0	0	3	3

Details of Vertical VI: Novel Technologies

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5317	Principles of Food Processing	PEC	3	0	0	3	3
2.	22FT5318	Post-Harvest Technology	PEC	3	0	0	3	3
3.	22FT5319	Cane sugar Technology	PEC	3	0	0	3	3
4.	22FT6311	Beverage Technology	PEC	3	0	0	3	3
5.	22FT6312	Emerging Non-Thermal Processing of Foods	PEC	3	0	0	3	3
6.	22FT7306	Emerging Technologies in Food Processing	PEC	3	0	0	3	3
7.	22FT7312	Technology of Snack and Extruded Foods	PEC	3	0	0	3	3

Enrollment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree. For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

VERTICALS FOR MINOR DEGREE

- Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

Note: Each programme should provide verticals for minor degree

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5031	Sem 5: Food Analysis and Quality Control	MDC	3	0	0	3	3
2.	22FT6031	Sem 6: Fruits and Vegetable Processing Technology	MDC	3	0	0	3	3
3.	22FT6032	Sem6: Poultry, Meat, and Fish Processing Technology	MDC	3	0	0	3	3
4.	22FT7031	Sem 7: Dairy Engineering	MDC	3	0	0	3	3
5.	22FT7032	Sem 7: Baking and Confectionery Technology	MDC	3	0	0	3	3



6.	22FT8031	Sem 8: Food Packaging	MDC	3	0	0	3	3
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*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

Vertical I Fintech and Block Chain	Vertical II Entrepreneurship	Vertical III Environment and Sustainability
Financial Management	Foundations of Entrepreneurship	Sustainable infrastructure Development
Fundamentals of Investment	Team Building & Leadership Management for Business	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	Creativity & Innovation in Entrepreneurship	Sustainable Bio Materials
Introduction to Blockchain and its Applications	Principles of Marketing Management for Business	Materials for Energy Sustainability
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Green Technology
Introduction to Fintech	Financing New Business Ventures	Environmental Quality Monitoring and Analysis

B Tech (Hons) Food Technology with Specialization in Food Technology and Management

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	22FT5203	Transfer Processes in Food Processing	PC	2	0	2	3	4	50	50	100
2.	22FT6202	Food Regulations and Food Safety Management	PC	2	0	2	3	4	50	50	100
3.	22FT6203	Marketing Management	PC	3	1	0	4	3	40	60	100
4.	22FT7203	Food Supply Chain Management	PC	2	0	2	3	4	50	50	100
5.	22FT7204	Inventory Management	PC	2	0	2	3	4	50	50	100
6.	22FT8201	Total Quality Management	PC	0	0	4	2	4	60	40	100

B Tech (Hons) Food Technology with Specialization in Entrepreneurship and Management

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	22FT5204	Entrepreneurship Opportunities for Food Technologist	PC	3	0	0	3	3	40	60	100
2.	22FT6204	Enterprise for resource planning	PC	3	0	0	3	3	40	60	100
3.	22FT6205	Consumer acceptance and Market survey in Food Processing	PC	3	0	0	3	3	40	60	100
4.	22FT7205	Energy audit in food processing industry	PC	3	0	0	3	3	40	60	100
5.	22FT7206	Food Process Economics & Industrial Management	PC	3	0	0	3	3	40	60	100



6.	22FT8202	Supply Chain and Retail Management	PC	3	0	0	3	3	40	60	100
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B Tech (Hons) Food Technology with Specialization in Novel Food Technologies

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	22FT5205	Principles of Food Processing	PC	3	0	0	3	3	40	60	100
2.	22FT6206	3D Food Printing and Extrusion	PC	3	0	0	3	3	40	60	100
3.	22FT6207	High Pressure Processing	PC	3	0	0	3	3	40	60	100
4.	22FT7207	Pulsed Light and UV-C Technology	PC	3	0	0	3	3	40	60	100
5.	22FT7208	Emerging Non-Thermal Processing of Foods	PC	3	0	0	3	3	40	60	100
6.	22FT8203	Emerging Technologies in Food Processing	PC	3	0	0	3	3	40	60	100

Note: Each programme should provide verticals for Honours degree

SEMESTER-WISE CREDIT DISTRIBUTION


B.E. / B.TECH. PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSC	3	3	-	2	-	3	-	-	11
2	BSC	7	9	4	3	-	-	-	-	23
3	ESC	6	5	2	-	-	-	-	-	15
4	PCC	-	-	16	18	11	7	9	-	61
5	PEC	-	-	-	-	9	6	3	-	18
6	OEC	-	-	-	-	-	6	6	-	12
7	EEC	3	3	3	1	1	2	2	10	25
8	MCC	✓	✓	-	-	-	-	-	-	-
Total		19	22	25	24	21	24	20	10	165

Credit Distribution R2022

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	19	22	25	24	21	24	20	10	165


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SYLLABUS

SEMESTER II

Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22MA2105	PARTIAL DIFFERENTIAL EQUATIONS, FOURIER SERIES AND TRANSFORMS (BME, CIVIL & FT)	3	1	0	4

The student should be able

- | | | |
|-------------------------|---|---|
| Course Objective | 1 | Compute the solution of first order partial differential equations. |
| | 2 | Analyze Fourier series which is central to many applications in engineering. |
| | 3 | Apply the effective tools for the solutions of one-dimensional boundary value problems. |
| | 4 | Apply Fourier transform techniques in various situations. |
| | 5 | Analyze Z transform techniques for discrete time systems. |

Unit	Description	Instructional Hours
	PARTIAL DIFFERENTIAL EQUATIONS	
I	Formation of partial differential equations by eliminating arbitrary constants and functions – Solution of first order partial differential equations of the form $f(p,q)=0$, Clairaut's equation – Lagrange's equation.	12
	FOURIER SERIES	
II	Dirichlet's conditions- General Fourier Series – Odd and Even Functions – Change of Interval - Parseval's Identity - Harmonic analysis.	12
	BOUNDARY VALUE PROBLEMS	
III	Classification of PDE - Solutions of one-dimensional wave equation-One dimensional equation of heat conduction (excluding insulated edges).	12
	FOURIER TRANSFORMS	
IV	Fourier Transform Pair - Fourier sine and cosine transform Pair – Properties- Transforms of Simple functions – Convolution Theorem (Statement only).	12
	Z - TRANSFORMS	
V	Z- Transforms - Elementary properties – Inverse Z - transform (using partial fraction only) –Solution of difference equations using Z – transform.	12

Total Instructional Hours **60**

Course Outcome	CO1	Compute the solution of first order partial differential equations.
	CO2	Understand the principles of Fourier series which helps them to solve physical problems of engineering.
	CO3	Employ Fourier series in solving the boundary value problems
	CO4	Apply Fourier transform techniques which extend its applications
	CO5	Compute the solution of difference equations using Z – transform.

TEXT BOOK:

- T1 Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018.
- T2 Bali. N.P and Manish Goyal & Watkins, "Advanced Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007.

REFERENCES:

- R1 Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.
- R2 Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2018.
- R3 Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2018.

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Dean - Academics

Dean (Academics)
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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22CY2101	ENVIRONMENTAL STUDIES (Common to all branches except CSE, IT & AIML)	3	0	0	3

The student should be able

- Course Objective**
- 1 Grasp the importance and issues related to ecosystem and biodiversity and their protection.
 - 2 Acquire knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
 - 3 Identify the various natural resources, exploitation and its conservation
 - 4 Gain knowledge on the scientific, technological, economic and political solutions to environmental problems.
 - 5 Become aware on the national and international concern for environment and its protection

Unit	Description	Instructional Hours
I	ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY Main objectives and scope of environmental studies-Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – food chain, food web and ecological pyramids - energy flow in the ecosystem – ecological succession processes - Introduction, types, characteristic features, structure and function of the forest and ponds ecosystem – Introduction to biodiversity definition: types and value of biodiversity – hot-spots of biodiversity – threats to biodiversity– endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	12
II	NATURAL RESOURCES Renewable and Non-renewable resources - Forest resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forests and tribal people - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – Energy resources: Renewable and non-renewable energy sources – Solar energy and wind energy - role of an individual in conservation of natural resources.	12
III	ENVIRONMENTAL POLLUTION Definition – causes, effects and control measures of: Air pollution- Water pollution – Water quality parameters- Soil pollution - Noise pollution- nuclear hazards – role of an individual in prevention of pollution.	12
IV	SOCIAL ISSUES AND THE ENVIRONMENT From unsustainable to sustainable development – urban problems related to energy- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Municipal solid waste management. Global issues – Climatic change, acid rain, greenhouse effect and ozone layer depletion – Disaster Management – Tsunami and cyclones.	12
V	HUMAN POPULATION AND THE ENVIRONMENT Population growth, variation among nations – population explosion – family welfare programme – environment and human health – effect of heavy metals – human rights – value education – HIV / AIDS – women and child welfare – Environmental impact analysis (EIA)- GIS-remote sensing-role of information technology in environment and human health.	12

Total Instructional Hours 45

Course Outcome	CO	Description
	CO1	Discuss the importance of ecosystem and biodiversity for maintaining ecological balance.
	CO2	Identify the causes of environmental pollution and hazards due to manmade activities
	CO3	Develop an understanding of different natural resources including renewable resources.
	CO4	Demonstrate an appreciation for need for sustainable development and understand the various social issues and solutions to solve the issues.
	CO5	Describe about the importance of women and child education, existing technology to protect environment.

TEXT BOOK:


TI S.Annadurai and P.N. Magudeswaran, "Environmental studies", Cengage Learning India Pvt.Ltd, Delhi, 2020.



T2 Anubha Kaushik and C. P. Kaushik, "Perspectives in Environmental studies", Sixth edition, New Age International Publishers, New Delhi, 2019.

REFERENCES:

- R1 Erach Bharucha, "Textbook of environmental studies" University Press (I) Pvt.ltd, Hyderabad, 2015.
R2 G.Tyler Miller, Jr and Scott E. Spoolman "Environmental Science" Thirteenth Edition, Cengage Learning, 2010.
R3 Gilbert M. Masters and Wendell P. Ela "Introduction to Environmental Engineering and Science", 3rd edition, Pearson Education, 2013.


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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22PH2101	BASICS OF MATERIAL SCIENCE	2	0	0	2

The student should be able

- Course Objective**
- 1 Gain knowledge about Crystal systems and crystal structures
 - 2 Understand the knowledge about electrical properties of materials
 - 3 Enhance the fundamental knowledge in semiconducting materials.
 - 4 Gain knowledge about magnetic materials
 - 5 Acquire fundamental knowledge new engineering materials which is related to the engineering program

Unit	Description	Instructional Hours
	CRYSTAL PHYSICS	
I	Crystal systems - Bravais lattice - Lattice planes - Miller indices - Inter planar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystal structures.	6
	ELECTRICAL PROPERTIES OF MATERIALS	
II	Classical free electron theory - Expression for electrical conductivity - Thermal conductivity, expression - Wiedemann - Franz law - Success and failures - Fermi-Dirac statistics - Density of energy states.	6
	SEMICONDUCTING MATERIALS	
III	Introduction - Compound and elemental semiconductor - direct and indirect band gap of semiconductors. Intrinsic semiconductor - electrical conductivity - band gap determination. Extrinsic semiconductor - n type and p type semiconductor - Light Emitting Diode.	6
	MAGNETIC MATERIALS	
IV	Origin of magnetic moment - Bohr magnetron - comparison of Dia, Para and Ferro magnetism - Domain theory - Hysteresis - soft and hard magnetic materials - anti ferromagnetic materials - Ferrites and its applications.	6
	NEW ENGINEERING MATERIALS	
V	Metallic glasses: melt spinning process, Preparation and applications - shape memory alloys: phases, shape memory effect - Characteristics of SMA: Pseudoelastic effect, Super elasticity and Hysteresis. Applications of SMA. Nanomaterials preparation (bottom up and top-down approaches) - various techniques - pulsed laser deposition - Chemical vapor deposition	6

Total Instructional Hours 30

Course Outcome	CO1	CO2	CO3	CO4	CO5
	Understand the Crystal systems and crystal structures in the field of Engineering.	Illustrate the fundamental of electrical properties of materials	Discuss concept of acceptor or donor levels and the band gap of a semiconducting materials	Develop the technology of the magnetic materials and its applications in engineering field	Understand the advanced technology of new engineering materials in the field of Engineering

TEXT BOOK:

- T1 Rajendran V, "Materials Science", Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
T2 M.N Avadhanulu and P G Kshirsagar "A Text Book of Engineering physics" S. Chand and Company Ltd., New Delhi 2022

REFERENCES:

- R1 Charles Kittel "Introduction to Solid State Physics". Wiley., New Delhi 2017.
R2 Dr. M.Arumugam "Materials Science" Anuradha publications., 2019.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22EE2231	BASICS OF ELECTRICAL ENGINEERING (FT)	3	0	0	3

The student should be able

- | | |
|-------------------------|--|
| Course Objective | 1 Explain the basics of electrical quantities. |
| | 2 Introduce the basics of AC fundamentals and circuits |
| | 3 Describe the Electrical Instrumentation |
| | 4 Elucidate the basics of power supply and wiring. |
| | 5 Explain the basics of safety measures |

Unit	Description	Instructional Hours
I	DC CIRCUITS—Electrical Quantities-Circuit Components-Types of Electrical Networks - Energy Sources-Electrical Power—Energy -Ohm's Law - Kirchoff's Laws - Resistors in Series Parallel Circuit – Star – Delta Transformation – Source Transformation – Active and Passive Element	9
II	AC CIRCUITS – Introduction to AC Circuits- Phasor Representation – Relationship Between Voltage And Current in Resistor - Inductor and Capacitor – Simple AC circuits – Power – Power factor - RLC Series & Parallel Circuit (Quantitative approach only) – Resonance in RLC series Circuits - Band width – Q-Factor.	9
III	BASIC ELECTRICAL INSTRUMENTATION—Introduction - Classification of Instruments - Operating principles - Essential features of measuring Instruments (Elementary Treatment only) - Moving coil - Permanent Magnet (PMMC) Instruments Voltmeter and Ammeter- Moving Iron Ammeters and Voltmeters - Energy meter – Wattmeter.	9
IV	BASICS OF POWER SUPPLY AND ELECTRICAL WIRING Introduction to Power supply circuits: Half wave, Full wave Rectifier – SMPS, UPS (online & offline). Wiring types and applications. - Brief discussion on concealed conduit wiring. One way and two-way control.	9
V	ELECTRICAL SAFETY - Need for Electrical safety - Electric shock - Precautions against shock - Elementary discussion on Circuit protective devices - Fuse and Miniature Circuit Breaker (MCB's) –Earthing – Types –Neutral Earthing - Pipe and plate Earthing - Residual current circuit Breaker.	9

Total Instructional Hours 45

Course Outcome	CO1 Analyze basic DC electric circuits.
	CO2 Classify the AC circuits waveforms and its quantities
	CO3 Familiarize on fundamentals of electrical measurement
	CO4 Ability to analyze basics of power supply and wiring
	CO5 Understand working principles of circuit protective devices and personal safety measures

TEXT BOOK:

- T1 D P Kothari and I J Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
 T2 D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2010.. Wayne Tomasi and Neil Storey, A Textbook On Basic Communication and Information Engineering, Pearson, 2010

REFERENCES:

- R1 Del Toro V, "Electrical Engineering Fundamentals", Pearson Education.
 R2 T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford Higher Education
 R3 A. Bruce Carlson, Paul B. Crilly, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, Tata McGraw Hill, 5th Edition.

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Programme	Course code	Name of the course	L	T	P	C
B-TECH	22ME2151	BIOCHEMISTRY	2	0	2	3

- The student should be able**
- Course Objective**
- To study the structure and properties of carbohydrates
 - To understand the structure and properties of lipids
 - To know the structural and functional role of proteins
 - To have an idea about classification of the enzymes and interpret the enzyme action and their immobilization
 - To learn the structure of nucleic acids and illustrate the basics of energy metabolism

Unit	Description	Instructional Hours
I	Carbohydrates: Classification; Simple Sugars: mono and disaccharides, Hygroscopicity and solubility, optical rotation, mutarotation; Sweetness: structure-activity relationship and sweetness index; Dextrose Equivalent, Degree of polymerisation; Sugar alcohols; Oligosaccharides: structure and occurrence. Polysaccharides: Starch-amylose and amylopectin- properties. Cellulose. Pectins, gums and seaweeds – structure & properties. Dietary fibres - Food sources, functional role and uses in foods. Qualitative tests for reducing sugars and proteins. Estimation of reducing sugar by dinitrosalicylic acid method. Estimation of carbohydrates by anthrone method	9+6=15
II	Lipids: Structure, classification and composition of fats. Physical properties of fats and oils: crystal formation, polymorphism, melting point, plasticity, radiolysis. Shortening power of fats, emulsification, smoke point and polymerization. Chemical properties of fats – Hydrolysis, saponification, halogenation. Hydrolytic rancidity and oxidative rancidity. Determination of oxidative rancidity of oils	9+2=11
III	Proteins: Amino acids - Definition, structure and classification. Protein - structure and conformation, Food sources and biological role. Properties of proteins in food systems: Dissociation, optical activity, solubility, hydration, swelling, foam formation and stabilization, gel formation, emulsifying effect. Denaturation. Estimation of foaming and emulsion properties of proteins. Estimation of protein by biuret method and Lowry's Method.	9+5=14
IV	Enzymes as food processing aids: Introduction, Nature, classification and nomenclature of enzymes. Specificity. Enzyme kinetics – Michelis - Menten equation, Factors affecting enzyme action, mechanism of enzyme action; active site. Immobilization methods. Enzyme activity – Amylase enzyme.	9+2=11
V	Nucleic Acids: Composition and structure of DNA and RNA. Metabolism: Metabolism - Glycolysis; TCA cycle; substrate level phosphorylation. Protein metabolism – urea cycle. Cellular respiration - electron transport chain. Lipid metabolism – lipases and phospholipases. Fatty acid metabolism – beta oxidation and fatty acid synthesis. Inter relationship of metabolic pathways.	9

Total Instructional Hours 45+15=60

Course Outcome	Description
CO1	Interpret the structure and properties of carbohydrates
CO2	Recall the structure and properties of lipids
CO3	Recognize the structural and functional role of proteins
CO4	Classify the enzymes and interpret the enzyme action and their immobilization
CO5	Infer the structure of nucleic acids and illustrate the basics of energy metabolism

TEXT BOOK:

- T1 Belitz H. D., Grosch W., and Schieberle P., —Food Chemistry, 3rd Edition, Springer Verley, Berlin, 2008.
- T2 Jain J.L., Sunjay Jain and Nitin Jain, —Fundamentals of Biochemistry, S. Chand & Co., New Delhi, 2008.

REFERENCES:

- R1 Rastogi S.C., —Biochemistry, 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.
- R2 Finley, John W., W. Jeffrey Hurst, and Chang Yong Lee. Principles of food chemistry. Springer, 2018.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22EE2231	BASICS OF ELECTRICAL ENGINEERING (FT)	3	0	0	3

The student should be able

- Course Objective**
- 1 Explain the basics of electrical quantities.
 - 2 Introduce the basics of AC fundamentals and circuits
 - 3 Describe the Electrical Instrumentation
 - 4 Elucidate the basics of power supply and wiring.
 - 5 Explain the basics of safety measures

Unit	Description	Instructional Hours
I	DC CIRCUITS—Electrical Quantities—Circuit Components—Types of Electrical Networks - Energy Sources—Electrical Power—Energy -Ohm's Law - Kirchhoff's Laws - Resistors in Series Parallel Circuit - Star - Delta Transformation - Source Transformation - Active and Passive Element	9
II	AC CIRCUITS - Introduction to AC Circuits- Phasor Representation - Relationship Between Voltage And Current in Resistor - Inductor and Capacitor - Simple AC circuits - Power - Power factor - RLC Series & Parallel Circuit (Quantitative approach only) - Resonance in RLC series Circuits - Band width - Q-Factor.	9
III	BASIC ELECTRICAL INSTRUMENTATION—Introduction - Classification of Instruments - Operating principles - Essential features of measuring Instruments (Elementary Treatment only) - Moving coil - Permanent Magnet (PMMC) Instruments Voltmeter and Ammeter- Moving Iron Ammeters and Voltmeters - Energy meter - Wattmeter.	9
IV	BASICS OF POWER SUPPLY AND ELECTRICAL WIRING Introduction to Power supply circuits: Half wave, Full wave Rectifier - SMPS, UPS (online & offline). Wiring types and applications. - Brief discussion on concealed conduit wiring. One way and two-way control.	9
V	ELECTRICAL SAFETY - Need for Electrical safety - Electric shock - Precautions against shock - Elementary discussion on Circuit protective devices - Fuse and Miniature Circuit Breaker (MCB's) -Earthing - Types -Neutral Earthing - Pipe and plate Earthing - Residual current circuit Breaker.	9

Total Instructional Hours 45

Course Outcome	Description
CO1	Analyze basic DC electric circuits.
CO2	Classify the AC circuits waveforms and its quantities
CO3	Familiarize on fundamentals of electrical measurement
CO4	Ability to analyze basics of power supply and wiring
CO5	Understand working principles of circuit protective devices and personal safety measures

TEXT BOOK:

- T1 D P Kothari and I J Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
T2 D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2010.. Wayne Tomasi and Neil Storey, A Textbook On Basic Communication and Information Engineering, Pearson, 2010

REFERENCES:

- R1 Del Toro V, "Electrical Engineering Fundamentals", Pearson Education.
R2 T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford Higher Education
R3 A. Bruce Carlson, Paul B. Crilly, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, Tata McGraw Hill, 5th Edition.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22FT2151	BIOCHEMISTRY	2	0	2	3

- The student should be able**
- Course Objective**
- To study the structure and properties of carbohydrates
 - To understand the structure and properties of lipids
 - To know the structural and functional role of proteins
 - To have an idea about classification of the enzymes and interpret the enzyme action and their immobilization
 - To learn the structure of nucleic acids and illustrate the basics of energy metabolism

Unit	Description	Instructional Hours
I	Carbohydrates: Classification; Simple Sugars: mono and disaccharides, Hygroscopicity and solubility, optical rotation, mutarotation; Sweetness: structure-activity relationship and sweetness index; Dextrose Equivalent, Degree of polymerisation; Sugar alcohols; Oligosaccharides: structure and occurrence. Polysaccharides: Starch-amylose and amylopectin- properties. Cellulose. Pectins, gums and seaweeds – structure & properties. Dietary fibres - Food sources, functional role and uses in foods. Qualitative tests for reducing sugars and proteins. Estimation of reducing sugar by dinitrosalicylic acid method. Estimation of carbohydrates by anthrone method	9+6=15
II	Lipids: Structure, classification and composition of fats. Physical properties of fats and oils: crystal formation, polymorphism, melting point, plasticity, radiolysis. Shortening power of fats, emulsification, smoke point and polymerization. Chemical properties of fats – Hydrolysis, saponification, halogenation. Hydrolytic rancidity and oxidative rancidity. Extraction and estimation of oil content	9+2=11
III	Proteins: Amino acids - Definition, structure and classification. Protein - structure and conformation, Food sources and biological role. Properties of proteins in food systems: Dissociation, optical activity, solubility, hydration, swelling, foam formation and stabilization, gel formation, emulsifying effect. Denaturation. Estimation of protein by biuret method, Lowry and Bradford.	9+5=14
IV	Enzymes as food processing aids: Introduction, Nature, classification and nomenclature of enzymes. Specificity. Enzyme kinetics – Michelis - Menten equation, Factors affecting enzyme action, mechanism of enzyme action; active site. Immobilization methods. Enzyme activity – phosphatase enzyme.	9+2=11
V	Nucleic Acids: Composition and structure of DNA and RNA. Metabolism: Metabolism - Glycolysis; TCA cycle; substrate level phosphorylation. Protein metabolism – urea cycle. Cellular respiration - electron transport chain. Lipid metabolism – lipases and phospholipases. Fatty acid metabolism – beta oxidation and fatty acid synthesis. Inter relationship of metabolic pathways.	9
Total Instructional Hours		45+15=60
Course Outcome	CO1 Interpret the structure and properties of carbohydrates CO2 Recall the structure and properties of lipids CO3 Recognize the structural and functional role of proteins CO4 Classify the enzymes and interpret the enzyme action and their immobilization CO5 Infer the structure of nucleic acids and illustrate the basics of energy metabolism	

TEXT BOOK:

- T1 Belitz H. D., Grosch W., and Schieberle P., —Food Chemistry, 3rd Edition, Springer Verley, Berlin, 2008.
- T2 Jain J.L., Sunjay Jain and Nitin Jain, —Fundamentals of Biochemistry, S. Chand & Co., New Delhi, 2008.

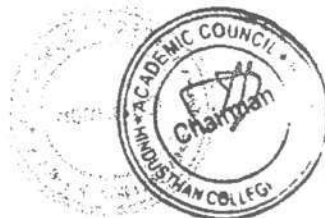
REFERENCES:

- R1 Rastogi S.C., —Biochemistry, 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.
- R2 Finley, John W., W. Jeffrey Hurst, and Chang Yong Lee. Principles of food chemistry. Springer, 2018.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22ME2001	ENGINEERING PRACTICES	0	0	4	2

Course Objective The student should be able
 1 To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical and Electrical Engineering.

Unit

Description

Instructional Hours

1. Preparation of Single pipe line and Double pipe line connection by using valves, taps, couplings, unions, reducers and elbows.
2. Arrangement of bricks using English Bond for one brick thick wall for right angle corner junction and T- junction
3. Arrangement of bricks using English Bond for one and a half brick thick wall for right angle corner and T- junction
4. Preparation of arc welding of Butt joints, Lap joints and Tee joints.
5. Practice on sheet metal Models- Trays and funnels
6. Hands-on-exercise in wood work, joints by sawing, planning and cutting.
7. Practice on simple step turning, taper turning and drilling.
8. Demonstration on Smithy operation.
9. Demonstration on Foundry operation.
10. Demonstration on Power tools.

GROUP B (ELECTRICAL ENGINEERING)

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring.
4. Measurement of Electrical quantities – voltage, current, power & power factor in single phase circuits.
5. Measurement of energy using single phase energy meter.
6. Soldering practice using general purpose PCB.
7. Measurement of Time, Frequency and Peak Value of an Alternating Quantity using CRO and Function Generator.
8. Study of Energy Efficient Equipment's and Measuring Instruments.

Total Instructional Hours 45+15=60

Course Outcome
 CO1 Fabricate wooden components and pipe connections including plumbing works.
 CO2 Fabricate simple weld joints.
 CO3 Fabricate different electrical wiring circuits and understand the AC Circuits.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22HE2151	EFFECTIVE TECHNICAL COMMUNICATION (Common to all Branches)	2	0	2	3

Course Objective	The student should be able
	1 To improve essential business communication skills.
	2 To enrich employability knowledge.
	3 To acquire the crucial organizing ability in official forum.
	4 To impart important business writings.
	5 To make effective presentation with essential etiquette.

Unit	Description	Instructional Hours
I	Language Proficiency: Types of sentences in English according to structure Writing: writing definitions, Describing product, work place and service (purpose, appearance, function) Vocabulary – words on nature Practical Component: Listening- Watching and interpreting advertisements/short films Speaking- Extempore speech	9
II	Language Proficiency: Direct and Indirect speech. Writing: Formal memos, Job application and resume preparation Vocabulary - words on offense and ethics Practical Component: Listening- Comprehensions based on telephonic conversation Speaking- Vote of thanks& welcome address	9
III	Language Proficiency: Homophones and Homonyms, Writing: Preparing a detail plan for an official visit, schedule and Itinerary, reading comprehension, Vocabulary– words on society Practical Component: Listening- Listening- paraphrasing the listened content Speaking- Group Discussion with preparation	9
IV	Language Proficiency: Idioms Writing: Report writing (marketing, investigating) Vocabulary-words involved in business Practical Component: Listening- Watching technical discussions and preparing MoM Speaking- On the spot Group Discussion	9
V	Language Proficiency: spotting errors Writing: making /interpreting chart, sequencing of sentences Vocabulary- words involved in finance Practical Component: Listening- Comprehensions based on announcements Speaking- Presentation on a technical topic with ppt.	9

Total Instructional Hours 45

Course Outcome	CO1	CO2	CO3	CO4	CO5
	Interpret the structure and properties of carbohydrates	Recall the structure and properties of lipids	Recognize the structural and functional role of proteins	Classify the enzymes and interpret the enzyme action and their immobilization	Infer the structure of nucleic acids and illustrate the basics of energy metabolism

TEXT BOOK:

- T1 Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2016.
T2 Ian Wood and Anne Williams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2015.

REFERENCES:

- R1 Michael Mc Carthy, "Grammar for Business", Cambridge University Press, 2009.
R2 Bill Mascull, "Business Vocabulary in use: Advanced 2nd Edition", Cambridge University Press, 2009.
R3 Frederick T. Wood, "Remedial English Grammar For Foreign Students", Macmillan publishers, 2001.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22HE2071	DESIGN THINKING	2	0	0	2

The student should be able

- Course Objective**
- 1 To expose students to the design process
 - 2 To develop and test innovative ideas through a rapid iteration cycle.
 - 3 To provide an authentic opportunity for students to develop teamwork and leadership skills

Unit	Description	Instructional Hours
	DESIGN ABILITY	
I	Asking Designers about what they Do – Deconstructing what Designers Do – Watching what Designers Do – Thinking about what Designers Do – The Natural Intelligence of Design Sources	6
II	DESIGNING TO WIN Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	5
III	DESIGN TO PLEASE AND DESIGNING TOGETHER Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	6
IV	DESIGN EXPERTISE Design Process – Creative Design - Design Intelligence – Development of Expertise – Novice to Expert. Critical Thinking – Case studies: Brief history of Albert Einstein, Isaac Newton and Nikola Tesla	6
V	DESIGN THINKING TOOLS AND METHODS Purposeful Use of Tools and Alignment with Process - Journey Mapping - Value Chain Analysis - Mind Mapping – Brainstorming - Design Thinking Application: Design Thinking Applied to Product Development	7
	Total Instructional Hours	30

- Course Outcome**
- CO1 Interpret the structure and properties of carbohydrates
 - CO2 Recall the structure and properties of lipids.
 - CO3 Recognize the structural and functional role of proteins

TEXT BOOK:

T1 Nigel Cross, "Design Thinking", Kindle Edition.

REFERENCES:

- R1 Tom Kelley, "Creative Confidence", 2013.
- R2 Tim Brown, "Change by Design", 2009.

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Programme	Course code	Name of the course	L	T	P	C
R.TECH.	22HE2072	SOFT SKILLS AND APPTITUDE I	1	0	0	1

The student should be able

- Course Objective**
- To develop and nurture the soft skills of the students through instruction, knowledge acquisition, demonstration and practice.
 - To enhance the student's ability to deal with numerical and quantitative skills.
 - To identify the core skills associated with critical thinking.
 - To develop and integrate the use of English language skills

Unit	Description	Instructional Hours
I	Lessons on excellence Skill introspection, Skill acquisition, consistent practice	2
II	Logical Reasoning Problem Solving - Critical Thinking- Lateral Thinking - Coding and Decoding - Series - Analogy - Odd Man Out - Visual Reasoning - Sudoku puzzles - Attention to detail	11
III	Quantitative Aptitude Addition and Subtraction of bigger numbers - square and square roots - Cubes and cube roots - Vedic maths techniques - Multiplication Shortcuts - Multiplication of 3 and higher digit numbers - Simplifications - Comparing fractions - Shortcuts to find HCF and LCM - Divisibility tests shortcuts - Algebra and functions	11
IV	Recruitment Essentials Resume Building - Impression Management	4
V	Verbal Ability Nouns and Pronouns - Verbs - Subject-Verb Agreement - Pronoun-Antecedent - Agreement - Punctuations	4

Total Instructional Hours 30

- Course Outcome**
- CO1 Students will analyze interpersonal communication skills. public speaking skills.
 - CO2 Students will exemplify tautology, contradiction and contingency by logical thinking.
 - CO3 Students will be able to develop an appropriate integral form to solve all sorts of quantitative problems.
 - CO4 Students can produce a resume that describes their education, skills, experiences and measurable achievements with proper grammar, format and brevity
 - CO5

REFERENCES:

- R1 Quantitative Aptitude - Dr. R S Agarwal
- R2 Speed Mathematics: Secret Skills for Quick Calculation - Bill Handley
- R3 Verbal and Non - Verbal Reasoning - Dr. R S Agarwal
- R4 Objective General English - S.P.Bakshi

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அலகு I மொழி மற்றும் இலக்கியம்:

3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி

இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு-பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை:

3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - சூமரிமுனையில் திருவள்ளூர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதல்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:

3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின்

விளையாட்டுகள்.

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:

3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.



1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருதை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

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HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution Affiliated to Anna University, Chennai)
(Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade)
Coimbatore - 641 032.

B.TECH. FOOD TECHNOLOGY



CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the even semester
Academic year 2022-23
(Academic Council Meeting Held on 03.03.2023)

**CURRICULUM
R2019**



Hindusthan College of Engineering and Technology
 (An Autonomous Institution, Affiliated to Anna University, Chennai
 Approved by AICTE, New Delhi & Accredited by NAAC with 'A' Grade)
 Valley Campus, Pollachi Highway, Coimbatore, Tamil Nadu.



DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. FOOD TECHNOLOGY (UG)

REGULATION-2019

For the students admitted during the academic year 2021-2022 and onwards

The course code 21 indicates that the students joined in the academic year 2021

SEMESTER I

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL	
THEORY											
1.	21HE1101	Technical English	HS	2	1	0	3	40	60	100	
2.	21MA1102	Calculus and Linear Algebra	BS	3	1	0	4	40	60	100	
3.	21ME1101	Basics of Civil and Mechanical Engineering	ES	3	0	0	3	40	60	100	
THEORY & LAB COMPONENT											
4.	21PH1151	Applied Physics	BS	2	0	2	3	50	50	100	
5.	21CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100	
6.	21CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100	
PRACTICAL											
7.	21HE1071	Language Competency Enhancement Course-I	HS	0	0	2	1	100	0	100	
MANDATORY COURSES											
8.	21HE1072	Career Guidance Level - I Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100	
				Total:	16	2	8	20	470	330	800
As Per AICTE Norms 3 Weeks Induction Programme is Added in The First Semester as an Audit Course											

SEMESTER II

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	21HE2101	Business English for Engineers	HS	2	1	0	3	40	60	100
2.	21MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	40	60	100
3.	21FT2105	Principles of Microbiology	ES	3	0	0	3	40	60	100
THEORY & LAB COMPONENT										
4.	21IT2151	Programming in C	ES	2	0	2	3	50	50	100
5.	21PH2151	Material Science	BS	2	0	2	3	50	50	100
6.	21CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
PRACTICALS										
7.	21ME2001	Engineering Practices Lab	ES	0	0	4	2	60	40	100



8.	21HE2071	Language Competency Enhancement Course-II	HS	0	0	2	1	100	0	100
MANDATORY COURSES										
9.	21HE2072	Career Guidance Level – II Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	21HE2073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
Total:				17	2	12	22	630	370	1000

SEMESTER III

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	21MA3102	Fourier Analysis and Transforms	BS	3	1	0	4	25	75	100
2.	21FT3201	Fluid Mechanics	PC	3	1	0	4	25	75	100
3.	21FT3101	Principles of Thermodynamics	PC	3	0	0	3	25	75	100
4.	21FT3202	Food Microbiology	PC	3	0	0	3	25	75	100
THEORY AND LAB COMPONENT										
5.	21FT3251	Bio Chemistry	PC	2	0	2	3	50	50	100
PRACTICALS										
6.	21FT3001	Food Microbiology Laboratory	PC	0	0	3	1.5	50	50	100
7.	21FT3002	Food Production Analysis Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8.	21MC3191	Indian Constitution	MC	2	0	0	0	0	0	0
9.	21HE3072	Career Guidance Level – III Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	21HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
Total				19	2	8	20	450	450	900

SEMESTER IV

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	21FT4201	Fundamentals of Heat and Mass Transfer	PC	3	1	0	4	25	75	100
2.	21FT4203	Engineering properties of food materials	PC	3	0	0	3	25	75	100
3.	21FT4204	Refrigeration and Cold Chain Management	PC	3	1	0	4	25	75	100
THEORY AND LAB COMPONENT										



4.	21FT4251	Food Chemistry									
5.	21MA4152	Statistics and Numerical Methods	BS	3	0	2	4	50	50	100	
PRACTICALS											
6.	21FT4001	Unit Operations Laboratory	PC	0	0	3	1.5	50	50	100	
7.											
MANDATORY COURSES											
8.	21MC4191	Essence of Indian tradition knowledge/Value Education	MC	2	0	0	0	100	0	100	
9.	21HE4072	Career Guidance Level – IV Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100	
10.	21HE4073	Ideation Skills	EEC	2	0	0	0	100	0	100	
Total				20	2	10	21	575	425	1000	

SEMESTER V

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
1.	21FT5201	Baking and Confectionery Technology	PC	3	0	0	3	25	75	100
2.	21FT5202	Food Additives	PC	3	0	0	3	25	75	100
3.	21FT5203	Poultry, Meat and Fish Process Technology	PC	3	0	0	3	25	75	100
4.	21FT5204	Principles of Food Processing	PC	3	0	0	3	25	75	100
5.	21FT5205	Unit Operations in Food Processing	PC	3	0	0	3	25	75	100
6.	21FT53XX	Professional Elective -I	PE	3	0	0	3	25	75	100
PRACTICALS										
7.	21FT5001	Baking and Confectionery Technology Laboratory	PC	0	0	4	2	50	50	100
8.	21FT5002	Unit Operations in Food Processing Laboratory	PC	0	0	4	2	50	50	100
MANDATORY COURSES										
9.	21HE5071	Soft Skills - I	EEC	1	0	0	1	25	75	100
10.	21HE5072	Design Thinking	EEC	1	0	0	1	25	75	100
TOTAL				20	0	8	24	300	700	1000

SEMESTER VI

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	21FT6201	Dairy Engineering	PC	3	0	0	3	25	75	100
2.	21FT6202	Plantation crops and Spices Products Technology	PC	3	0	0	3	25	75	100
4.	21FT6181	Professional Ethics in Engineering	HS	3	0	0	3	25	75	100



5.	21FT63XX	Professional Elective - II	PE	3	0	0	3	25	75	100
6.	21XX64XX	Open Elective-I	OE	3	0	0	3	25	75	100
PRACTICALS										
7.	21FT6001	Dairy Engineering Laboratory	PC	0	0	3	1.5	50	50	100
8.	21FT6002	Fruits and Vegetable Processing Technology Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
9.	21FT6701	Industrial Training	EEC	0	0	0	1	0	100	100
10.	21HE6071	Soft Skills - II	EEC	1	0	0	1	25	75	100
11.	21HE6072	Intellectual Property Rights(IPR)	EEC	1	0	0	1	25	75	100
TOTAL				20	0	6	24	300	800	1100

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1	21FT5301	Technology of Fats and Oils	PE	3	0	0	3	25	75	100
2	21FT5302	Food Storage and Infestation Control	PE	3	0	0	3	25	75	100
3	21FT5303	Food Process Calculations	PE	3	0	0	3	25	75	100
4	21FT5304	Post-Harvest Technology	PE	3	0	0	3	25	75	100
5	21FT5305	Cane sugar Technology	PE	3	0	0	3	25	75	100
6	21FT5306	Milling Technology for Food Materials	PE	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE II										
1	21FT6301	Beverage Technology	PE	3	0	0	3	25	75	100
3	21FT6303	Food Biotechnology	PE	3	0	0	3	25	75	100
4	21FT6304	Bioprocess Engineering	PE	3	0	0	3	25	75	100
5	21FT6305	Enzyme Technology	PE	3	0	0	3	25	75	100
6	21FT6306	Crop Process Engineering	PE	3	0	0	3	25	75	100

OPEN ELECTIVE

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	21FT6401	Traditional Foods	OE	3	0	0	3	25	75	100



SEMESTER VII

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	21FT7201	Food Analysis and Quality Control	PC	3	0	0	3	25	75	100
2.	21FT7202	Food Packaging	PC	3	0	0	3	25	75	100
3.	21FT7203	Food Plant Layout and Management	PC	3	0	0	3	25	75	100
4.	21FT73XX	Professional Elective-III	PE	3	0	0	3	25	75	100
5.	21XX74XX	Open Elective - II	OE	3	0	0	3	25	75	100
PRACTICALS										
6.	21FT7001	Food Packaging Laboratory	PC	0	0	3	1.5	50	50	100
7.	21FT7002	Food Analysis and Quality Control Laboratory	PC	0	0	3	1.5	50	50	100
PROJECT WORK										
8.	21FT7901	Project Phase I	EEC	0	0	4	2	50	50	100
TOTAL				15	0	10	20	275	525	800

SEMESTER VIII

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	21FT83XX	Professional Elective -IV	PE	3	0	0	3	25	75	100
2.	21FT83XX	Professional Elective- V	PE	3	0	0	3	25	75	100
PRACTICAL										
3.	21FT8901	Project Work - Phase II	EEC	0	0	16	8	100	100	200
TOTAL				6	0	16	14	150	250	400

PROFESSIONAL ELECTIVE III

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	21FT7301	Functional foods and Nutraceuticals	PE	3	0	0	3	25	75	100
2.	21FT7302	Biology and Chemistry of Food Flavors	PE	3	0	0	3	25	75	100
3.	21FT7303	Food Toxicology and Allergy	PE	3	0	0	3	25	75	100
4.	21FT7304	Advanced Drying Technology	PE	3	0	0	3	25	75	100
5.	21FT7305	Cereal Technology	PE	3	0	0	3	25	75	100
6.	21FT7306	Processing Technology of Legumes and Oilseeds	PE	3	0	0	3	25	75	100
7.	21FT7307	Emerging Non-Thermal Processing of Foods	PE	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE IV										
1.	21FT8301	Food Process Economics and	PE	3	0	0	3	25	75	100



		Industrial Management								
2.	21FT8302	Food Laws and Safety	PE	3	0	0	3	25	75	100
3.	21FT8303	Waste Management and By-Product Utilization in Food Industries	PE	3	0	0	3	25	75	100
4.	21FT8304	Instrumentation and Process Control	PE	3	0	0	3	25	75	100
5.	21FT8305	Economics and Management	PE	3	0	0	3	25	75	100
6.	21FT8312	Total Quality Management	PE	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE V										
S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	21FT8306	Food process plant layout and safety	PE	3	0	0	3	25	75	100
2.	21FT8307	Energy Management in Process Industries	PE	3	0	0	3	25	75	100
3.	21FT8308	Emerging Technologies in Food Processing	PE	3	0	0	3	25	75	100
4.	21FT8309	Separation Techniques in Food Processing	PE	3	0	0	3	25	75	100
5.	21FT8310	Analytical Instruments in Food Industries	PE	3	0	0	3	25	75	100
6.	21FT8311	Entrepreneurship Opportunities for Food Technologists	PE	3	0	0	3	25	75	100
7.	21FT8313	Application of Nanotechnology and Cryogenics	PE	3	0	0	3	25	75	100

LIST OF OPEN ELECTIVES - FOOD TECHNOLOGY

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	21FT7401	Post Harvest Technology of Fruits and Vegetables	OE	3	0	0	3	25	75	100
LIFE SKILL COURSES										
1.	21LSZ401	General Studies for Competitive Examinations	OE	3	0	0	3	25	75	100
2.	21LSZ402	Human Rights, Women's Rights and Gender Equality	OE	3	0	0	3	25	75	100
3.	21LSZ403	Indian Ethos and Human Values	OE	3	0	0	3	25	75	100
4.	21LSZ404	Indian Constitution and Political System	OE	3	0	0	3	25	75	100
5.	21LSZ405	Yoga for Human Excellence	OE	3	0	0	3	25	75	100



Enrollment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree. For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

VERTICALS FOR MINOR DEGREE

- Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

Note: Each programme should provide verticals for minor degree

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21FT5031	Sem 5: Food Analysis and Quality Control	MDC	3	0	0	3	3
2.	21FT6031	Sem 6: Fruits and Vegetable Processing Technology	MDC	3	0	0	3	3
3.	21FT6032	Sem6: Poultry, Meat, and Fish Processing Technology	MDC	3	0	0	3	3
4.	21FT7031	Sem 7: Dairy Engineering	MDC	3	0	0	3	3
5.	21FT7032	Sem 7: Baking and Confectionery Technology	MDC	3	0	0	3	3
6.	21FT8031	Sem 8: Food Packaging	MDC	3	0	0	3	3

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

Vertical I Fintech and Block Chain	Vertical II Entrepreneurship	Vertical III Environment and Sustainability
Financial Management	Foundations of Entrepreneurship	Sustainable infrastructure Development
Fundamentals of Investment	Team Building & Leadership Management for Business	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	Creativity & Innovation in Entrepreneurship	Sustainable Bio Materials
Introduction to Blockchain and its Applications	Principles of Marketing Management for Business	Materials for Energy Sustainability
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Green Technology
Introduction to Fintech	Financing New Business Ventures	Environmental Quality Monitoring and Analysis



B.Tech. (Hons) Food Technology with Specialization in Food Technology and Management

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21FT5203	Transfer Processes in Food Processing	PC	2	0	2	3	4	50	50	100
2.	21FT6202	Food Regulations and Food Safety Management	PC	2	0	2	3	4	50	50	100
3.	21FT6203	Marketing Management	PC	3	1	0	4	3	40	60	100
4.	21FT7203	Food Supply Chain Management	PC	2	0	2	3	4	50	50	100
5.	21FT7204	Inventory Management	PC	2	0	2	3	4	50	50	100
6.	21FT8201	Total Quality Management	PC	0	0	4	2	4	60	40	100

B.Tech. (Hons) Food Technology with Specialization in Entrepreneurship and Management

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21FT5204	Entrepreneurship Opportunities for Food Technologist	PC	3	0	0	3	3	40	60	100
2.	21FT6204	Enterprise for resource planning	PC	3	0	0	3	3	40	60	100
3.	21FT6205	Consumer acceptance and Market survey in Food Processing	PC	3	0	0	3	3	40	60	100
4.	21FT7205	Energy audit in food processing industry	PC	3	0	0	3	3	40	60	100
5.	21FT7206	Food Process Economics & Industrial Management	PC	3	0	0	3	3	40	60	100
6.	21FT8202	Supply Chain and Retail Management	PC	3	0	0	3	3	40	60	100

B.Tech. (Hons) Food Technology with Specialization in Novel Food Technologies

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21FT5205	Principles of Food Processing	PC	3	0	0	3	3	40	60	100
2.	21FT6206	3D Food Printing and Extrusion	PC	3	0	0	3	3	40	60	100
3.	21FT6207	High Pressure Processing	PC	3	0	0	3	3	40	60	100
4.	21FT7207	Pulsed Light and UV-C Technology	PC	3	0	0	3	3	40	60	100
5.	21FT7208	Emerging Non-Thermal Processing of Foods	PC	3	0	0	3	3	40	60	100
6.	21FT8203	Emerging Technologies in Food Processing	PC	3	0	0	3	3	40	60	100

Note: Each programme should provide verticals for Honours degree



SEMESTER-WISE CREDIT DISTRIBUTION

B.E. / B.TECH. PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HS	04	04	-	-	-	03	-	-	11
2	BS	10	10	04	04	-	-	-	-	28
3	ES	06	05	-	-	-	-	-	-	11
4	PC	-	03	16	17	19	12	12		79
5	PE	-	-	-	-	03	03	03	06	15
6	OE	-	-	-	-	-	03	03	-	06
7	EEC	-	-	-	-	02	03	02	08	15
Total		20	22	20	21	24	24	20	14	165

Credit Distribution R2019

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165


Chairman BoS

**Chairman - BoS
FT - HICET**


Dean Academics

**Dean (Academics)
HICET**


Principal

PRINCIPAL
Hindusthan College Of Engineering & Technology
COIMBATORE - 641 032.



Programme	Course code	Name of the course	L	T	P	C
B.TECH	22MC2093	SOCIAL SERVICES AND COMMUNITY DEVELOPMENT	1	0	0	1

The student should be able

- Course Objective**
1. Acquire the knowledge and active participate in social service and community development activities.
 2. Understand the concept of disaster management and role of NCC cadets in disaster management.
 3. Understand the concept thinking and reasoning process.
 4. Understand about maps and use of bearing and service protector
 5. Know about the principles of flight and Aero foil structure and ATC procedures.

Unit	DESCRIPTION	Instructional Hours
	SOCIAL SERVICES AND COMMUNITY DEVELOPMENT	
I	Basics of social services and its need - Rural development programs - Contribution of youth towards social welfare - NGOs in social services Swach bharrath Abhiyan - Social evils - Mission Indra danush - Beti bacho Beti pado - Digital awareness - Constitution Day.	3
	DISASTER MANAGEMENT	
II	Organization of Disaster management -Types of emergencies - Natural and manmade disasters - fire service and firefighting - prevention of fire.	3
	PERSONALITY DEVELOPMENT	
III	Introduction to personality development - public speaking Intra and Inter personal skills -self-awareness - critical thinking - Decision making and problem solving.	3
	MAP READING	
IV	Types of maps - conventional signs - scales and Grid system - relief and contour gradient - cardinal points - Types of North - types of bearing and use of service protector - Prismatic compass and its uses - setting of maps - finding North and own position.	3
	PRINCIPLES OF FLIGHT AND AIRMANSHIP	
V	Introduction to principle of flight - Forces acting on the aircraft - Angle of attack - Angle of incidence - Newton's - law of motion - Bernauli's theorem and Venturi effect - Aerofoil - Airfield layout - ATC (Air Traffic Control) - circuit procedures - Aviation medicine.	3

Total Instructional Hours 15

Course Outcome	CO1	CO2	CO3	CO4	CO5
	Perform the social services on various occasions for better community and social life.	Appreciate the need and requirement for disaster management and NCC role in disaster management activities.	Define thinking, reasoning, critical thinking and creative thinking.	Use of bearing and service protector and locate the places and objects on the ground.	Understand the principles of flight and Aerofoil structure.

TEXT BOOK:

- T1 NCC cadet Guide (SD/SW) Army.
T2 NCC cadet Guide (SD/SW) Airforce.
T3 ANOs Guide (SD/SW) by DG NCC, Ministry of Defence, New Delhi.
T4 Digital Forum App 1.0 & 2.0, by DG NCC DG NCC, Ministry of Defence, New Delhi.

REFERENCES:

- R1 UGC and AICTE circulated syllabus

Jay
Chairman, Board of Studies

**Chairman - BoS
FT - HiCET**



[Signature]
Dean - Academics

**Dean (Academics)
HiCET**

SYLLABUS

IV SEMESTER

Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT4201	FUNDAMENTALS OF HEAT AND MASS TRANSFER	3	1	0	4
Course Objective	The student should be able					
	1	To understand and apply the principles in heat transfer phenomena				
	2	To understand and apply the principles in mass transfer phenomena				
	3	To design heat and mass transfer equipments.				

Unit	Description	Instructional Hours
I	Heat Transfer - Conduction: Introduction to unsteady state heat transfer by conduction and transient flow. Basic transfer processes - heat, mass and momentum - heat transfer process - conductors and insulators - Steady state - conduction - Fourier's fundamental equation - thermal conductivity and thermal resistance - linear heat flow - heat transfer through homogenous wall, composite walls, radial heat flow through cylinders and sphere - extended surfaces (fins) - solving problems in heat transfer by conduction	12
II	Heat Transfer - Convection: Newton Rikhman's law - film coefficient of heat transfer - convection - free and forced convection - dimensional analysis and its application - factors affecting the heat transfer coefficient in free and forced convection heat transfer - overall heat transfer coefficient - solving problems in heat transfer by convection.	12
III	Heat Transfer - Heat Exchanger: Heat exchangers - parallel, counter and cross flow - evaporator and condensers - Logarithmic Mean Temperature Difference - overall coefficient of heat transfer - tube in tube heat exchanger, shell and tube heat exchanger, plate heat exchanger - applications of heat exchangers - solving problems in heat exchangers.	12
IV	Heat Transfer Radiation: Radiation heat transfer - concept of black and grey body - monochromatic total emissive power - Kirchoff's law - Planck's law - Stefan-Boltzman's law - heat exchange through non-absorbing media - shape factor - solving problems in heat transfer by radiation.	12
V	Mass Transfer: Mass transfer - introduction - Fick's law for molecular diffusion - molecular diffusion in gases - equimolar counters diffusion in gases and diffusion of gas A through non diffusing or stagnant B - diffusion through a varying cross-sectional area and diffusion coefficients for gases - molecular diffusion in liquids, biological solutions and gels. Concept of mass transfer coefficients, Interphase mass transfer and over all mass transfer coefficients in binary systems.	12

Total Instructional Hours 60

Course Outcome	CO1	Understanding the concept of steady state and unsteady state and application of Fourier law of conduction
	CO2	Analyzing the theory of free and forced convection in fluid flow and application of Newton's law of cooling in food processing
	CO3	Applying and analyzing the different types of heat exchangers and its application in food industry
	CO4	Understand and apply the concepts of radiation and Stephan boltzman's law Remembering and applying the mass transfer phenomena using Fick's law of molecular diffusion in food processing
	CO5	Understanding the concept of steady state and unsteady state and application of Fourier law of conduction
		Analyzing the theory of free and forced convection in fluid flow and application of Newton's law of cooling in food processing

TEXT BOOK:

- T1 Bellaney, P.L. "Thermal Engineering". Khanna Publishers, New Delhi, 2001
- T2 Geankoplis C.J. "Transport Process and Unit Operations". Prentice-Hall of India Private

REFERENCES:

- R1 Jacob and Hawkins. "Elements of Heat Transfer". John Willey and Sons Inc. New York, 1983
- R3 EcKert, E.R.G. "Heat and Mass Transfer". McGraw Hill Book Co., New York, 1981

Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT4204	REFRIGERATION AND COLD CHAIN MANAGEMENT	3	0	0	3

Course Objective The student should be able
1. To study the storage systems such as refrigeration and cold storage

Unit	DESCRIPTION	Instructional Hours
I	INTRODUCTION: Introduction to refrigeration, unit of refrigeration capacity. Review of Second law of thermodynamics and interpretation. Production of low temperatures - principles and process. Refrigerants - classification and thermodynamic properties - Eco friendly refrigerants. Ozone depletion potential. Reversed Carnot cycle. Limitations of reversed Carnot systems. Psychrometry-terms-psychrometric chart- sensible heating- sensible cooling process -by-pass factor-	9
II	REFRIGERATION SYSTEMS: Refrigeration cycle - simple vapour compression, vapour 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 Brayton cycle.	9
III	COMPONENTS OF A REFRIGERATION SYSTEM: 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	9
IV	LOW TEMPERATURE STORAGE SYSTEMS: 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.	9
V	COLD CHAIN: Introduction, Components of cold chain. Refrigerated Transport, Handling and Distribution - refrigerated vans (reefer vans), 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.	9

Total Instructional Hours 45

Course Outcome	CO1	CO2	CO3	CO4	CO5
	Understand the basics of refrigeration with thermodynamic principles and Carnot cycle	Understand the concept of refrigeration cycles	Remember the various components of refrigeration system and its types	Understand the concept of low temperature storage systems for foods	Understand and apply cold chain and refrigeration for food products

TEXT BOOK:

- T1 Rajput R.K., —Refrigeration and Air-conditioning, 3rd Edition, S.K. Kataria and Sons (Publishers), Delhi, 2012.
T2 Dellino C.V.J., —Cold and Chilled Storage Technology, 2nd Edition, Springer, US, 2011.

REFERENCES:

- R1 Arora C.P., —Refrigeration and Air Conditioning, 2nd Edition, Tata McGraw-Hill Publishing Company Ltd., Delhi, 2008.
R2 Khurmi R.S. and Gupta J.K., —Textbook of Refrigeration and Air Conditioning, 5th Edition, S. Chand Publishers, New Delhi, 2006.
R3 Narayanan K.V., —A Textbook of Chemical Engineering Thermodynamics, 2nd Edition, PHI Learning Pvt. Ltd., New Delhi, 2013.
R4 Roy J. Dossat, Principles of Refrigeration, Pearson Education Asia, 4th Edition, 2009.
R5 Arora C.P., —Refrigeration and Air Conditioning, 2nd Edition, Tata McGraw-Hill Publishing Company Ltd., Delhi, 2008.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT4251	FOOD CHEMISTRY	2	0	2	3

The student should be able

Course Objective

1. To interpret the nutritional importance of foods and water.
2. To summarize the nutritional importance of vitamins and minerals.
3. To recognize the changes in food components during cooking, processing and storage.
4. To modify the carbohydrates, proteins and fats based on its functional properties.
5. To apply the different methods of food preservation.

Unit	DESCRIPTION	Instructional Hours
I	Food Groups - Definition. Major food groups (basic 4, 5, 7) and their characterization. Food as a source of energy, Energy value of foods, energy requirement of the body - estimation. Water - water activity and food stability, water binding, drinking water - production - classification - quality - structure of water	9
II	Vitamins : Classification: Water and Fat soluble - sources - functional role - general causes of variations and losses of vitamins in food. Minerals : Classification: Major and minor - functions and properties, content of minerals in food and changes during processing Extraction and estimation of polyphenols Extraction and estimation of flavonoids.	9
III	Changes during Cooking : Cooking - objectives, methods - moist heat, dry heat and combination. Loss of nutrients and prevention, biochemical changes in carbohydrates - Gelatinization and retrogradation of starch, proteins and lipids- changes during frying , parboiling of rice; enzymatic browning reactions; nonenzymatic browning reactions - caramelization, Maillard reaction. Estimation of non-enzymatic browning in foods. Isolation of protein from milk and egg.	9
IV	Modification of Biomolecules : Modified starches, resistant starch. Starch hydrolysates - Maltodextrins and dextrans. Modification of proteins - chemical and enzymatic methods. Modification of fats - Hydrogenation - cis and trans isomers, interesterification, winterization. Determination of free fatty acids (FFA) of oil Determination of TBA value of oil.	9
V	Determination of FFA value of lipids and oils Colorants and Flavorants Colorants and flavorants : Technology to preserve degradation of chlorophyll - Color and stability of carotenoids and anthocyanins - microbial colorants - Approved colorants - Natural and synthetic flavorings - Food allergens and antinutrients Extraction and estimation of chlorophyll. Extraction and estimation of carotenoids and lycopene	9
Total Instructional Hours		45

Course Outcome

- CO1 Interpret the nutritional importance of foods and water
- CO2 Summarize the nutritional importance of vitamins and minerals
- CO3 Recognize the changes in food components during cooking, processing and storage
- CO4 Modify the carbohydrates, proteins and fats based on its functional properties
- CO5 Apply the different methods of food preservation

TEXT BOOK:

- T1 Belitz H.D., Grosch W. and Schieberle P., —Food Chemistry, 3rd Edition, Springer-Verley, Berlin, 2004.
- T2 Sivasankar B., —Food Processing and Preservation, Prentice Hall of India, New Delhi, 2005.

REFERENCES:

- R1 Fennema, Owen R., Srinivasan Damodaran, and Kirk L. Parkin. "Introduction to food chemistry."



- In Fennema's Food Chemistry, Fifth Edition, pp. 1-16. CRC Press, 2017.
- R2 Srilakshmi B., —Nutrition Sciencel, 3rd Edition, New Age International Ltd., New Delhi, 2011.
- R3 Damodaran, Srinivasan, and Kirk L. Parkin. Fennema's food chemistry. CRC press, 2017.
- R4 Fennema, Owen R., Srinivasan Damodaran, and Kirk L. Parkin. "Introduction to food chemistry."
In Fennema's Food Chemistry, Fifth Edition, pp. 1-16. CRC Press, 2017.


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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21MA4152	STATISTICS & NUMERICAL METHODS	3	0	2	4

- The student should be able
- To illustrate the relation between two random variables by using correlation concepts along with R studio
 - To employ some basic concepts of statistical methods for testing the hypothesis together with R studio.
 - To analyze the design of experiment techniques to solve various engineering problems accompanying with R studio
 - To apply various methods to find the intermediate values for the given data
 - To explain concepts of numerical differentiation and numerical integration of the unknown functions.

Unit	DESCRIPTION	Instructional Hours
I	CORRELATION AND REGRESSION Correlation – Karl Pearson’s correlation coefficient – Spearman’s Rank Correlation – Regression lines (problems based on Raw data only). Introduction to R programming, Applications of Correlation and Regression	9+3
II	HYPOTHESIS TESTING Tests based on t (for single mean and difference of means) - F distribution – for testing difference of variance, Chi – Square test for Contingency table (Test for Independency) – Goodness of fit Application of F test, Application of Chi – square test	9+6
III	ANALYSIS OF VARIANCE Introduction, analysis of variance, completely randomized design, randomized block design, Latin square design. ANOVA – completely randomized design ANOVA – randomized block design	9+3
IV	INTERPOLATION Interpolation: Newton’s forward and backward difference formulae Lagrangian interpolation for unequal intervals – Divided differences- Newton’s divided difference formula.	9
V	NUMERICAL DIFFERENTIATION AND INTEGRATION Differentiation using interpolation formula – Newton’s forward and backward interpolation formulae for equal intervals – Newton’s divided difference formula for unequal intervals - Numerical integration by Trapezoidal and Simpson’s 1/3 rules.	9

Total Instructional Hours 45+15=60

Course Outcome	CO1	CO2	CO3	CO4	CO5
	Compute correlation and predict unknown values using regression together with R studio.	Understand the concepts of statistical methods for testing the hypothesis along with R studio.	Apply Design of Experiment techniques to solve various engineering problems in addition with R studio.	Understand the concept of interpolation in both cases of equal and unequal intervals.	Identify various methods to perform numerical differentiation and integration.

TEXT BOOK:

- T1 Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018.
T2 Medhi J, "stochastic Processes", New Age International Publishers, New Delhi, 2014

REFERENCES:

- R1 Walpole. R.E., Myers. R.H., Myers. S.T., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.
R2 Grewal B.S. and Grewal J.S. "Numerical Methods in Engineering and Science", 6th Edition, Khanna

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT4001	UNIT OPERATIONS LABORATORY	0	0	3	1.5

EXP.

DESCRIPTION

1. Flow measurement a) Orifice meter b) Venturimeter c) Coils
2. Flow through square duct, annular and circular pipes
3. Pressure drop studies in packed bed
4. Flow through fluidized bed, valves and pipe fittings
5. Calibration of V-notch
6. Solving problems on single and multiple effect evaporator
7. Determination the efficiency of heat transfer in agitated vessel.
8. Determination of efficiency of liquid solid separation by filtration.
9. Determination of absorption efficiency in a packing tower
10. Heat transfer in natural convection/ forced convection
11. Determination of the activity coefficients by vapor liquid equilibrium
12. Determination of vaporization efficiency (Ev) and thermal efficiency (Et) of the given system using steam distillation setup. Also verify with Raleigh's equation
13. Studying the theoretical and actual recovery of solvent using leaching

Total Instructional Hours 45

Course Outcome

- | | |
|-----|--|
| CO1 | Evaluate the process/performance parameters for mass transfer operations (distillation column, leaching) |
| CO2 | Determine diffusivity and Stefan Boltzman constant using fundamental principles |
| CO3 | Calculate the individual and overall heat transfer coefficient of heat exchangers |
| CO4 | Determine the discharge coefficient using variable area flow meters and variable head flow meters |
| CO5 | Assess the flow of fluids through closed conduits, open channels, valves and pipe fitting |

REFERENCES:

- R1 McCabe W.L., Smith J.C. and Harriot P., —Unit Operations of Chemical Engineering, 7th Edition, McGraw Hill, New York, 2005.
- R2 Perry Robert, —Perry's Chemical Engineers Hand Book, 8th Edition, McGraw Hill, New York, 2007.
- R3 Treybal R.E., —Mass Transfer Operations, 3rd Edition, McGraw Hill, New York, 1981.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT4002	FOOD PROCESS EQUIPMENT DESIGN LABORATORY	0	0	3	1.5

The student should be able

- Course objectives**
1. Impart knowledge on basic principles of designing equipment for food processing
 2. Become familiar with design and manufacture of storage tanks, conveyors, heat exchangers, dryers etc.
 3. Provide an idea about devising cold storage units, freezers etc.

EXPERIMENT

DESCRIPTION

1. Studies on basic principles, parameters and symbols used for design and drawing.
2. Studies on Material selection and characteristics
3. Design and drawing of storage tanks
4. Design of an extruder
5. Design and drawing of Milling Equipment
6. Design and drawing of shell and tube heat exchangers
7. Design and drawing of plate heat exchanger
8. Design and drawing of single effect evaporator
9. Design and drawing of tray dryer
10. Design and drawing of Grain dryer
11. Design and drawing of belt conveyor
12. Design of Bucket Elevator

Total Instructional Hours 45

Course Outcome

- CO1 Adapt symbols and materials in plant layout and design
 CO2 Design pipes, storage tanks and supports
 CO3 Design heat transfer equipment and evaporators
 CO4 Design dryers for drying/dehydrating different perishable commodities and analyzing its efficiency
 CO5 Design conveyors and elevators for safe transportation of food material

REFERENCES:

- R1 Joshi M.V. and Mahajan V.V., —Process Equipment Design, 4th Edition, MacMillan India, New Delhi, 2009.
 R2 Dawande S.D., —Process Equipment Design Volume I and 2I, 5th Edition, Denett and Company, India, 2015.
 R3 Perry R.H. and Green D.W., —Chemical Engineers Handbook, 8th Edition, McGraw-Hill, New York, 2007.

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Programme	Course code	Name of the course	L	T	P	C
B.E./B.TEC H.	21MC4191	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	2	0	0	0

The student should be able

Course Objective

1. The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
2. Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view, basic principles of Yoga and holistic health care system, Indian philosophical traditions, Indian linguistic tradition and Indian artistic tradition.
3. The course aims at imparting basic principles of thought process, reasoning and inferencing.

Unit	DESCRIPTION	Instructional Hours
I	Basic Structure of Indian Knowledge System	4
II	Modern Science and Indian Knowledge System	4
III	Yoga and Holistic Health care	4
IV	Philosophical tradition	4
V	Indian linguistic tradition (Phonology, Morphology, Syntax and semantics),	4
Total Instructional Hours		20

Course Outcome	CO1	CO2
	Ability to understand the structure of Indian system of life.	Connect up and explain basics of Indian Traditional knowledge in modern scientific perspective.

REFERENCES:

- R1 Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.
- R2 Swami Jitatanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan R3. Fritzof Capra, Tao of Physics
- R4 Fritzof Capra, The wave of Life.
- R5 V N Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Amaku,am
- R6 Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta.
- R7 GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi, 2016.
- R8 RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016.
- R9 P R Sharma (English translation), Shodashang Hridayam.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21HE4072	CAREER GUIDANCE – LEVEL IV Personality, Aptitude and Career Development	2	0	0	0

- The student should be able**
1. Solve Logical Reasoning questions of easy to intermediate level [SLO 6]
 2. Solve Quantitative Aptitude questions of easy to intermediate level [SLO 7]
 3. Solve Verbal Ability questions of easy to intermediate level [SLO 8]
 4. Crack mock interviews with ease [SLO 13]
 5. Be introduced to problem-solving techniques and algorithms [SLO 14]

Course Objective

Expected Course Outcome:

Enable students to solve Aptitude questions of placement level with ease, as well as write effective essays.

Student Learning Outcomes(SLO): 6, 7, 8, 13, 14

Module	DESCRIPTION	Instructional Hours
I	Logical Reasoning Logical connectives, Syllogism and Venn diagrams <ul style="list-style-type: none"> • Logical Connectives • Syllogisms • Venn Diagrams – Interpretation • Venn Diagrams - Solving 	3
II	Quantitative Aptitude Logarithms, Progressions, Geometry and Quadratic equations <ul style="list-style-type: none"> • Logarithm • Arithmetic Progression • Geometric Progression • Geometry • Mensuration • Coded inequalities • Quadratic Equations Permutation, Combination and Probability <ul style="list-style-type: none"> • Fundamental Counting Principle • Permutation and Combination • Computation of Permutation • Circular Permutations • Computation of Combination • Probability 	6
III	Verbal Ability Critical Reasoning <ul style="list-style-type: none"> • Argument – Identifying the Different Parts (Premise, assumption, conclusion) • Strengthening statement • Weakening statement • Mimic the pattern 	2
IV	Recruitment Essentials Cracking interviews - demonstration through a few mocks Sample mock interviews to demonstrate how to crack the: <ul style="list-style-type: none"> • HR interview • MR interview • Technical interview Cracking other kinds of interviews <ul style="list-style-type: none"> • Skype/ Telephonic interviews • Panel interviews • Stress interviews Resume building – workshop A workshop to make students write an accurate resume	1



Problem solving and Algorithmic skills

V

- Logical methods to solve problem statements in Programming
- Basic algorithms introduced

8

Total Instructional Hours 20

Course Outcome CO1 Enable students to solve Aptitude questions of placement level with ease, as well as write effective essays.

Mode of Evaluation
Assignments, Mock interviews, 3 Assessments with End Semester (Computer Based Test)

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Programme B.TECH.	Course code 21HE4073	Name of the course IDEATION SKILLS	L 2	T 0	P 0	C 0
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The student should be able

- Course Objective**
1. To study the importance of ideation.
 2. To learn about the various tools for Ideation.
 3. To provide an insight in Prototyping and its significance.

Unit	DESCRIPTION	Instructional Hours
I	IDEATION: INTRODUCTION TO DESIGN THINKING METHODOLOGY Design Thinking Methodology and how it can be used as a powerful tool for developing new and innovative solutions - Inspiration - Implementation - Disruptive technology.	4
II	IDEATION: TOOLS FOR IDEATION Various resources to kindle new ideas for innovation. Explore the types of ideas in the past - Effect of the ideas and innovation of past on the world - Innovation Thinking - Case studies	4
III	IDEATION: INTRODUCTION TO CUSTOMER DISCOVERY Intro to Customer Discovery - development of customer discovery plan that can lead to powerful business innovation - Customer Discovery Plan	4
IV	PROTOTYPING AND PRODUCT IDEATION Introduction to Prototyping - minimum viable product - High fidelity prototype vs low fidelity prototype - Prototyping tools	3
Total Instructional Hours		15
Course Outcome	CO1 Develop a strong understanding and importance of ideation	
	CO2 Learn about the different kinds of tools for Ideation.	
	CO3 Learn the need and significance of prototyping and its significance.	

TEXT BOOK:

- T1 Mark Baskinger and William Bardel, "Drawing Ideas: A Hand-Drawn Approach for Better Design", 2013
- T2 Nigel Cross, "Design Thinking", Kindle Edition.

REFERENCES:

- R1 Kurt Hanks and Larry Belliston, "Rapid Viz: A New Method for the Rapid Visualization of Ideas", 2008.
- R2 Kathryn McElroy, "Prototyping for Designers: Developing the Best Digital and Physical Products", 2017.

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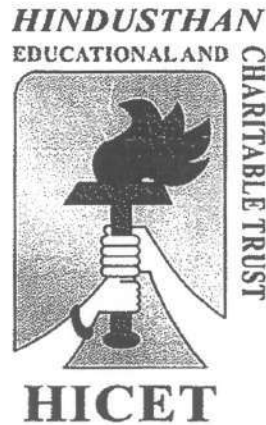
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HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution Affiliated to Anna University, Chennai)
(Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade)
Coimbatore - 641 032.

B.TECH. FOOD TECHNOLOGY



CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the even semester
Academic year 2022-23
(Academic Council Meeting Held on 03.03.2023)

**CURRICULUM
R2019**



DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. FOOD TECHNOLOGY (UG)

REGULATION-20.

For the students admitted during the academic year 2019-2020 and onwards

For the students admitted during the academic year 2020-2021 and onwards

SEMESTER I

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL	
THEORY											
1.	19HE1101	Technical English	HS	2	1	0	3	25	75	100	
2.	19MA1102	Calculus and Linear Algebra	BS	3	1	0	4	25	75	100	
3.	19ME1101	Basics of Civil and Mechanical Engineering	ES	3	0	0	3	25	75	100	
THEORY & LAB COMPONENT											
4.	19PH1151	Applied Physics	BS	2	0	2	3	50	50	100	
5.	19CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100	
6.	19CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100	
PRACTICAL											
7.	19HE1071	Language Competency Enhancement Course-I	HS	0	0	2	1	100	0	100	
MANDATORY COURSES											
8.	19HE1072	Career Guidance Level - I Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100	
				Total:	16	2	8	20	425	375	800
As Per AICTE Norms 3 Weeks Induction Programme is Added in The First Semester as an Audit Course											

SEMESTER II

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	19HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100
2.	19MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	25	75	100
3.	19FT2105	Principles of Microbiology	ES	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
4.	19IT2151	Programming in C	ES	2	0	2	3	50	50	100
5.	19PH2151	Material Science	BS	2	0	2	3	50	50	100
6.	19CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
PRACTICALS										
7.	19ME2001	Engineering Practices Laboratory	ES	0	0	4	2	50	50	100
8.	19HE2071	Language Competency Enhancement Course-II	HS	0	0	2	1	100	0	100
MANDATORY COURSES										



9.	19HE2072	Career Guidance Level – II Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	19HE2073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
Total:				17	2	12	22	575	425	1000

SEMESTER III

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	19MA3102	Fourier Analysis and Transforms	BS	3	1	0	4	25	75	100
2.	19FT3201	Fluid Mechanics	PC	3	1	0	4	25	75	100
3.	19FT3101	Principles of Thermodynamics	PC	3	0	0	3	25	75	100
4.	19FT3202	Food Microbiology	PC	3	0	0	3	25	75	100
THEORY AND LAB COMPONENT										
5.	19FT3251	Bio Chemistry	PC	2	0	2	3	50	50	100
PRACTICALS										
6.	19FT3001	Food Microbiology Lab	PC	0	0	3	1.5	50	50	100
7.	19FT3002	Food Production Analysis Lab	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8.	19MC3191	Indian Constitution	MC	2	0	0	0	100	0	100
9.	19HE3072	Career Guidance Level – III Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	19HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
Total				19	2	8	20	550	450	1000

SEMESTER IV

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	19FT4201R	Fundamentals of Heat and Mass Transfer	PC	3	1	0	4	25	75	100
2.	19FT4203R	Engineering properties of food materials	PC	3	0	0	3	25	75	100
3.	19FT4204	Refrigeration and Cold Chain Management	PC	3	1	0	4	25	75	100
THEORY AND LAB COMPONENT										
4.	19FT4251	Food Chemistry	PC	2	0	2	3	50	50	100
5.	19MA4152	Statistics and Numerical Methods	BS	3	0	2	4	50	50	100
PRACTICALS										
6.	19FT4001	Unit Operations Laboratory	PC	0	0	3	1.5	50	50	100
7.	19FT4002	Food Process Equipment Design Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8.	19MC4191	Essence of Indian tradition knowledge/Value Education	MC	2	0	0	0	100	0	100
9.	19HE4072	Career Guidance Level – IV Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	19HE4073	Ideation Skills	EEC	1	0	0	0	100	0	100
Total				19	2	10	21	575	425	1000



SEMESTER V

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
1.	19FT5201	Baking and Confectionery Technology	PC	3	0	0	3	25	75	100
2.	19FT5202	Food Additives	PC	3	0	0	3	25	75	100
3.	19FT5203	Poultry, Meat and Fish Process Technology	PC	3	0	0	3	25	75	100
4.	19FT5204	Principles of Food Processing	PC	3	0	0	3	25	75	100
5.	19FT5205	Unit Operations in Food Processing	PC	3	0	0	3	25	75	100
6.	19FT53XX	Professional Elective -I	PE	3	0	0	3	25	75	100
PRACTICALS										
7.	19FT5001	Baking and Confectionery Technology Laboratory	PC	0	0	4	2	50	50	100
8.	19FT5002	Unit Operations in Food Processing Laboratory	PC	0	0	4	2	50	50	100
MANDATORY COURSES										
9.	19HE5071	Soft Skills - I	EEC	1	0	0	1	25	75	100
10.	19HE5072	Design Thinking	EEC	1	0	0	1	25	75	100
TOTAL				20	0	8	24	300	700	1000

SEMESTER VI

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	19FT6201	Dairy Engineering	PC	3	0	0	3	25	75	100
2.	19FT6202	Plantation crops and Spices Products Technology	PC	3	0	0	3	25	75	100
3.	19FT6203R	Fruits and Vegetable Processing Technology	PC	3	0	0	3	25	75	100
4.	19FT6181	Professional Ethics in Engineering	HS	3	0	0	3	25	75	100
5.	19FT63XX	Professional Elective - II	PE	3	0	0	3	25	75	100
6.	19XX64XX	Open Elective- I	OE	3	0	0	3	25	75	100
PRACTICALS										
7.	19FT6001	Dairy Engineering Laboratory	PC	0	0	3	1.5	50	50	100
8.	19FT6002	Fruits and Vegetable Processing Technology Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
9.	19FT6701	Industrial Training	EEC	0	0	0	1	0	100	100
10.	19HE6071	Soft Skills - II	EEC	1	0	0	1	25	75	100
11.	19HE6072	Intellectual Property Rights(IPR)	EEC	1	0	0	1	25	75	100
TOTAL				20	0	6	24	300	800	1100



S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1.	19FT5301	Technology of Fats and Oils	PE	3	0	0	3	25	75	100
2.	19FT5302	Food Storage and Infestation Control	PE	3	0	0	3	25	75	100
3.	19FT5303	Food Process Calculations	PE	3	0	0	3	25	75	100
4.	19FT5304	Post-Harvest Technology	PE	3	0	0	3	25	75	100
5.	19FT5305	Cane sugar Technology	PE	3	0	0	3	25	75	100
6.	19FT5306	Milling Technology for Food Materials	PE	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE II										
1.	19FT6301	Beverage Technology	PE	3	0	0	3	25	75	100
3.	19FT6303	Food Biotechnology	PE	3	0	0	3	25	75	100
4.	19FT6304	Bioprocess Engineering	PE	3	0	0	3	25	75	100
5.	19FT6305	Enzyme Technology	PE	3	0	0	3	25	75	100
6.	19FT6306	Crop Process Engineering	PE	3	0	0	3	25	75	100

OPEN ELECTIVE

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	19FT6401	Traditional Foods	OE	3	0	0	3	25	75	100

SEMESTER VII

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	19FT7201	Food Analysis and Quality Control	PC	3	0	0	3	25	75	100
2.	19FT7202	Food Packaging	PC	3	0	0	3	25	75	100
3.	19FT7203	Food Plant Layout and Management	PC	3	0	0	3	25	75	100
4.	19FT73XX	Professional Elective-III	PE	3	0	0	3	25	75	100
5.	19XX74XX	Open Elective - II	OE	3	0	0	3	25	75	100
PRACTICALS										
6.	19FT7001	Food Packaging Laboratory	PC	0	0	3	1.5	50	50	100
7.	19FT7002	Food Analysis and Quality Control Laboratory	PC	0	0	3	1.5	50	50	100
PROJECT WORK										
8.	19FT7901	Project Phase I	EEC	0	0	4	2	50	50	100



TOTAL	15	0	10	20	275	525	800
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SEMESTER VIII

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	19FT83XX	Professional Elective -IV	PE	3	0	0	3	25	75	100
2.	19FT83XX	Professional Elective- V	PE	3	0	0	3	25	75	100
PRACTICAL										
3.	19FT8901	Project Work – Phase II	EEC	0	0	16	8	100	100	200
Total				6	0	16	14	150	250	400

PROFESSIONAL ELECTIVE III

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	19FT7301	Functional foods and Nutraceuticals	PE	3	0	0	3	25	75	100
2.	19FT7302	Biology and Chemistry of Food Flavors	PE	3	0	0	3	25	75	100
3.	19FT7303	Food Toxicology and Allergy	PE	3	0	0	3	25	75	100
4.	19FT7304	Advanced Drying Technology	PE	3	0	0	3	25	75	100
5.	19FT7305	Cereal Technology	PE	3	0	0	3	25	75	100
6.	19FT7306	Processing Technology of Legumes and Oilseeds	PE	3	0	0	3	25	75	100
7.	19FT7307	Emerging Non-Thermal Processing of Foods	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE IV

1.	19FT8301	Food Process Economics and Industrial Management	PE	3	0	0	3	25	75	100
2.	19FT8302	Food Laws and Safety	PE	3	0	0	3	25	75	100
3.	19FT8303	Waste Management and By-Product Utilization in Food Industries	PE	3	0	0	3	25	75	100
4.	19FT8304	Instrumentation and Process Control	PE	3	0	0	3	25	75	100
5.	19FT8305	Economics and Management	PE	3	0	0	3	25	75	100
6.	19FT8312	Total Quality Management	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE V

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	19FT8306	Food process plant layout and safety	PE	3	0	0	3	25	75	100
2.	19FT8307	Energy Management in Process Industries	PE	3	0	0	3	25	75	100



3.	19FT8308	Emerging Technologies in Food Processing	PE	3	0	0	3	25	75	100
4.	19FT8309	Separation Techniques in Food Processing	PE	3	0	0	3	25	75	100
5.	19FT8310	Analytical Instruments in Food Industries	PE	3	0	0	3	25	75	100
6.	19FT8311	Entrepreneurship Opportunities for Food Technologists	PE	3	0	0	3	25	75	100
7.	19FT8313	Application of Nanotechnology and Cryogenics	PE	3	0	0	3	25	75	100

LIST OF OPEN ELECTIVES - FOOD TECHNOLOGY

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	19FT7401	Post Harvest Technology of Fruits and Vegetables	OE	3	0	0	3	25	75	100
LIFE SKILL COURSES										
1.	19LSZ401	General Studies for Competitive Examinations	OE	3	0	0	3	25	75	100
2.	19LSZ402	Human Rights, Women's Rights and Gender Equality	OE	3	0	0	3	25	75	100
3.	19LSZ403	Indian Ethos and Human Values	OE	3	0	0	3	25	75	100
4.	19LSZ404	Indian Constitution and Political System	OE	3	0	0	3	25	75	100
5.	19LSZ405	Yoga for Human Excellence	OE	3	0	0	3	25	75	100

SEMESTER-WISE CREDIT DISTRIBUTION

B.E. / B.TECH. PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HS	04	04	-	-	-	03	-	-	11
2	BS	10	10	04	04	-	-	-	-	28
3	ES	06	05	-	-	-	-	-	-	11
4	PC	-	03	16	17	19	12	12		79
5	PE	-	-	-	-	03	03	03	06	15
6	OE	-	-	-	-	-	03	03	-	06
7	EEC	-	-	-	-	02	03	02	08	15
Total		20	22	20	21	24	24	20	14	165

Credit Distribution R2019

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165

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VI SEMESTER

Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT6201	DAIRY ENGINEERING	3	0	0	3

- Course Objective**
- The student should be able**
1. To retrieve the scenarios and status of dairy industry
 2. To understand the processing of milk and milk products
 3. To apply the concepts and different unit operations for the conversion of different products and value-added products
 4. Gain knowledge on designing and usage of equipment's for different milk processing.

Unit	Description	Instructional Hours
I	PROPERTIES OF Milk: Indian Dairy industry, Milk - Definition, types of market milk, Composition of milk, Factors affecting composition of milk, System of pricing of milk, Nutritive value of milk, Physico-chemical properties of milk: Color, Flavour, Specific Gravity, Boiling point, Freezing point, Refractive Index, Acidity and pH, Viscosity, Surface Tension.	9
II	Raw Milk Collection, Transportation and Reception: Raw milk collection system, Cooling and Transportation of milk, Platform tests of milk: Smell, Appearance, Temperature, Sediment, Acidity, Lactometer Reading, Fat, Solids-Not-Fat, Dye Reduction Test: MBRT test, Resazurin tests, Mastitis test; Filtration/Clarification of raw milk, Bactofugation of milk, Cooling and storage of raw milk, Bulk transportation technologies – carbon dioxide impregnation.	9
III	Design of Equipment: Selection of Accessories - Pipes, Aseptic valves, Filters, Pumps, Blenders, Storage Tank. Design of dairy equipment – Heat exchangers, Homogenizer, Spray dryer, Bulk coolers, Evaporators, Butter churner, Separators. Calculation of Refrigeration Load. Process Automation.	9
IV	Fluid Milk Processing: Milk Standardization, Cream separation, Homogenization, Milk Pasteurization: HTST and Batch Pasteurization, Milk Sterilization, Bottling/Packaging of milk, Liquid milk filling, Aseptic filling of milk. Milk Products: Manufacture of cheese, ice-cream, yoghurt, condensed milk, milk powder using drum and spray dryer, probiotics.	9
V	Cleaning and Sanitization of Dairy Equipment: Basic principles, Cleaning and Sanitizing – agents and methods. Can washer - Rotary type and straight through type. Selection and maintenance of can washers, CIP - Types of CIP system, Design of CIP system, CIP of dairy equipment. Applications of Non thermal processing in dairy industry.	9

Total Instructional Hours 45

Course Outcome	CO1	Recall the current Dairy sector status, constituents, and physico-chemical properties of milk
	CO2	Reproduce the pre-handling operations and analyze the quality of raw milk using different tests
	CO3	Experiment the concepts of designing the equipment's for processing of milk
	CO4	Show the different unit operations involved in processing of milk using flow diagrams
	CO5	Implement the cleaning and sanitation procedures in the dairy plant

TEXT BOOK:

- T1 Recall the current Dairy sector status, constituents, and physico-chemical properties of milk
- T2 Reproduce the pre-handling operations and analyze the quality of raw milk using different tests

REFERENCES:

- R1 Jane Selia dos Reis Coimbra, Jose A. Teixeira, —Engineering Aspects of Milk and Dairy Products, CRC Press, New York, 2010.
- R2 Robinson R.K., —Modern Dairy Technology: Advances in Milk Products, Volume 2, Springer London Ltd., 2012.
- R3 Hui, Y.H., —Dairy Science and Technology Handbook: Applications Science, Technology and Engineering, Volume 3, Wiley, New Delhi, 2014.
- R4 Selia, Jane dos Reis Coimbra and Jose A. Teixer "Engineering Aspects of Milk and Dairy Products". Jane Selia dos Reis Coimbra & Jose A. Teixer, CRC Press, 2009.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT6202	PLANTATION CROPS AND SPICES PRODUCTS TECHNOLOGY	3	0	0	3

The student should be able to

- Course Objective**
1. Understand the importance and scope of plantation of major spices.
 2. Remember the appropriate techniques for processing of minor spices.
 3. Study the processing of tea, coffee and Cocoa.
 4. Study the processing of coconut, oil palm, arecanut and cashew.
 5. Analyze various method of analysis of quality of spices, uses of packaging and grading system.

Unit	Description	Instructional Hours
I	PROCESSING OF MAJOR SPICES Spices – production and importance – stage of harvesting and harvesting methods - processing of major spices – pepper, cardamom, chilli, turmeric, ginger, garlic and onion. - Unit operations involved – equipment – principle and construction.	9
II	PROCESSING OF MINOR SPICES: Production and importance – stage of harvesting and harvesting methods - processing of minor spices –Herbs, leaves, spartan, clove, coriander, cumin, nutmeg, curry leaves vanilla annatto– seed spices– unit operations, involved – cryogenic grinding – equipment – principle and construction.	9
III	PROCESSING OF COFFEE, TEA AND COCOA: Coffee- Chemical constituents - harvesting - fermentation of coffee beans. Processing of coffee, - wet and dry method –equipment used. Process flow sheet for the manufacture of coffee powder- Instant coffee, technology-Chicory chemistry- Quality grading of coffee. Processing of tea- types – green, oolong, CTC- methods and equipment - grading of tea – methods – instant tea processing - grades of tea- packaging of tea - Cocoa - Chemistry of the cocoa bean - changes taking place during fermentation of cocoa bean - Processing of cocoa bean - cocoa powder - cocoa liquor manufacture- Chocolate - Types - Chemistry and technology of chocolate manufacture - Quality control of chocolates.	9
IV	PROCESSING OF COCONUT, OILPALM, ARECANUT, CASHEW: Processing of plantation crops – production and importance – Coconut-harvesting - Processing technology of Virgin Coconut oil- Coconut SAP and sugar-Desiccated Coconut, Milk Cream, Nata-de-Coco, Packed Tender Coconut Water- Vinegar and Activated Carbon. Processing of oil palm, arecanut – harvesting and stages of harvest – drying, cleaning and grading – production of value-added products – packaging and storage of produces. Cashew-harvesting- products - uses of cashew & CSNL- cashew nut processing -methods of roasting - shelling - grading-packaging- infestation- Hygiene and safety.	9
V	PACKAGING, GRADING AND QUALITY ANALYSIS OF SPICES & PLANTATATION: Cleaning and grading - packaging and storage of spices & plantation crops – quality specifications -processes involved in the manufacture of oleoresins and essential oils – quality analysis of spices & plantation crops and their derivatives – flavor extraction techniques and standard specifications. Functional packaging of spices & plantation crops and its products & By-products.	9
Total Instructional Hours		45

Course Outcome	CO1	CO2	CO3	CO4	CO5
	Build the steps involved in processing of plantation of major spices.	Select the appropriate techniques for processing of minor spices.	Identify the technology for processing of tea, coffee and Cocoa based on their chemical composition.	Utilize food processing operations to produce byproducts of plantation crops such as coconut, oil palm, arecanut and cashew.	Discuss the standards of packaging, grading and analyze the quality of spices and condiments.


TEXT BOOK:

- T1 Pandey P.H., —Post-Harvest Engineering of Horticultural Crops through ObjectivesI, Saroj Prakasam, Allahabad, 2003.
- T2 Kumar K., Md Abdul Kadar JBM., Rangaswamyi P. and Irulappan I., "Introduction to Spices, Plantation Crops, Medicinal and Aromatic PlantsI, Oxford and IBH Publishing, 2006.



REFERENCES:

- R1 Minifie Bernard W., —Chocolate, Cocoa and Confectionery Technology, 3rd Edition, Springer Netherlands, 2012.
- R2 Shanmugavelu K.G., Kumar N. and Peter K.V., —Production Technology of Spices and Plantation Crops, Jodhpur Agrobios (India) Agro House, 2005
- R3 National Institute of Industrial Research (NIIR) Board, —Handbook on Spices, Asia Pacific Business Press Inc., New Delhi, 2004.
- R4 Pruthi, J.S. Spices and Condiments Chemistry, Microbiology and Technology. 1st Edition. Academic Press Inc., New York, USA. 2011.


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Programme	Course code	Name of the course	L	T	P	C
B.TECH	19FT6203R	FRUITS AND VEGETABLE PROCESSING TECHNOLOGY	3	0	0	3

- The student should be able to
1. To understand the maturity standards of fruits and vegetables.
 2. To learn post-harvest handling of fruits and vegetables.
 3. To understand the technology of processing fruits and vegetable products.

Unit	Description	Instructional Hours
I	PHYSIOLOGY AND HARVESTING OF FRESH FRUITS AND VEGETABLES: <u>Scope of Fruits and Vegetables Processing Industry in India and World-present status.</u> Physical, Textural characteristics, structure and composition. Harvesting of important fruits and vegetables. Maturity standards; Importance, methods of Maturity determinations maturity indices for selected fruits and vegetables. Fruit ripening- physiological changes, regulations, methods. <u>Factors leading to deterioration of fruits and vegetables. Methods to reduce post-harvest losses.</u>	9
II	POST-HARVEST STORAGE AND PRE- PROCESSING OF FRUITS & VEGETABLES: Storage practices: Control atmospheric, hypobaric storage, cool store, zero emerge cool chamber. <u>Pre-processing of fruits and vegetables: Precooling, Cleaning, washing, sorting, grading, peeling, blanching.</u> Freezing- General preprocessing. Dehydration – General preprocessing; problems associated with specific fruits and vegetables. Indian Food Regulation and Quality assurance.	9
III	MINIMAL PROCESSING AND CANNING: Primary processing: Peeling, slicing, cubing, cutting and other size reduction operations for fruits and vegetables. Minimal Processing of Fruits and Vegetables. Canning - principles, types of cans - preparation of canned products - packing of canned products - spoilage of canned foods. Bottling of fruit and vegetable. Precautions in canning operations. General considerations in establishing a commercial fruit and vegetable cannery, machineries involved in canning and bottling unit.	9
IV	FRUIT AND VEGETABLE PRODUCTS I: Fruit Juice / pulp/ Nectar/Drinks, concentrates – General and specific processing, packaging. Vegetable Purees/ pastes - General and specific processing, packaging. Ready to eat fruit and vegetable products, Jams/Marmalades, Squashes/cordials, Ketchup/sauces, Chutneys, Fruit Bar, Soup powders, Candied Fruits- General and specific processing, packaging. Indian Food Regulation and Quality assurance.	9
V	FRUIT AND VEGETABLE PRODUCTS II: Natural colors, Fruit and Vegetable Fibres- General and specific processing, packaging. Onion: Dried, Powder. Garlic: Dried Garlic, Powder, Oil. Potato: Wafer; starch, Papad, Carrot: Preserve, candy, Pickle, Jam. Cauliflower and cabbage: Dried cauliflower and cabbage, Sauerkraut, Pickle Leafy vegetables; Dried Leafy Vegetables. (Spinach, Fenugreek, Coriander leaves, Curry leaves). Bitter gourd: Pickle, Dried bitter gourd. Indian Food Regulation and Quality assurance.	9

Total Instructional Hours 45

Course Outcome	Description
CO1	Remember and understand the physiological aspects of fruits and vegetables and analyze the physical and chemical components
CO2	Understand the basic pre- processing operations and its applications for fresh fruits and vegetables
CO3	Apply the pre-treatments and canning principle to process fruit and vegetable products
CO4	Understand the Indian standards and apply the techniques for preparation of different products and value addition
CO5	Apply different processing methods to prepare fruits and vegetable products as per regulations and standards

TEXT BOOK:

- T1 Fellows, P J. "Food Processing Technology: Principles and Practice". 2nd-Edition, CRC/ Woodhead, 1997
- T2 Salunke, D. K and S. S Kadam "Hand Book of Fruit Science and Technology: Production, Composition, Storage and Processing". Marcel Dekker, 1995.



REFERENCES:

- R1 "Food Processing & Preservation", Prentice Hall of India, 2002.
R2 Wim Jongen, -Fruit and Vegetable Processing: Improving Quality, Wood Head Publishing Ltd, England, 2002
R3 Thompson A.K., -Fruits and Vegetable - Harvesting, Handling and Storage, Blackwell Publishing, USA, 2003.
R4 Lal G., Siddappa G. and Tondon G.L., -Preservation of Fruits and Vegetables, Indian Council of Agricultural Research, New Delhi, 1986.


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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT6181	PROFESSIONAL ETHICS IN ENGINEERING	3	0	0	3

Course Objective The student should be able to
 To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

Unit	Description	Instructional Hours
I	HUMAN VALUES: Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.	9
II	ENGINEERING ETHICS: Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.	9
III	ENGINEERING AS SOCIAL EXPERIMENTATION: Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.	9
IV	SAFETY, RESPONSIBILITIES AND RIGHTS: Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.	9
V	GLOBAL ISSUES: Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.	9
Total Instructional Hours		45

Course Outcome	CO1	Infer human values
	CO2	Rephrase Engineering Ethics
	CO3	Relate engineering and social experimentation
	CO4	Recall the responsibilities
	CO5	Illustrate ethical global issues

TEXT BOOK:

- T1 Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
 T2 Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

- R1 Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
 R2 Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
 R3 John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
 R4 Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT6001	DAIRY ENGINEERING LABORATORY	0	0	3	1.5

Course Objective
The student should be able to
 To understand the practical knowledge about the processing of dairy products
 To analyze the chemical composition of dairy products


Unit	Description
1.	Studies on milk sampling, judging and grading of milk.
2.	Determination of acidity, specific gravity and clot-on-boil test of milk.
3.	Determination of fat, SNF and total solids content in milk.
4.	Determination of MBRT and alcohol index test of milk.
5.	Determination of pasteurization efficiency of milk.
6.	Estimation of homogenization efficiency of homogenizer.
7.	Estimation of surface tension of milk.
8.	Design of dairy equipment – homogenizer/spray dryer.
9.	Determination of churning efficiency of butter churner.
10.	Determination of efficiency of spray dryer.
11.	Experiment on preparation of different dairy products (ice cream, milk powder etc.) and sensory analysis using 9-point hedonic scale.
	Experiment on construction and working of cream separator.

Total Instructional Hours 45


Course Outcome	CO1 Familiarization with sampling techniques
	CO2 Perform quality analysis of milk
	CO3 Standardize the milk containing different fat percentages
	CO4 Demonstrate the manufacturing process associated with dairy products
	CO5 Find the performance evaluation associated with dairy processing equipment

REFERENCES:

- R1 Jane Selia dos Reis Coimbra, Jose A. Teixeira, —Engineering Aspects of Milk and Dairy Products, CRC Press, New York, 2010.
- R2 Robinson R.K., —Modern Dairy Technology: Advances in Milk Products, Volume 2, Springer London Ltd., 2012.
- R3 Hui, Y.H., —Dairy Science and Technology Handbook: Applications Science, Technology and Engineering, Volume 3, Wiley, New Delhi, 2014.


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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT6002	FRUITS & VEGETABLE PROCESSING LABORATORY	0	0	3	1.5

The student should be able to

- Course Objective**
1. Understand the knowledge on extraction, pulping, dehydration, and preparing fruit/vegetable-based products
 2. Understand different methods of fruits and vegetable processing
 3. Understand quality evaluation of fruit and vegetable products

Unit	Description
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1. Estimate the maximum % yield efficiency of the prepared fruit pulp
2. Experiment on osmotic dehydration of fruits and vegetables and also calculate its effect on drying kinetics
3. Demonstration on minimal processing of fruits and vegetables viz. blanching, CAS, MAP, and vacuum packaging
4. Experiment on preparation of jam/jelly (Plain or mixed fruits), sauce and its estimation of total soluble solids (TSS)
Experiment on preparation of squash and its estimation of total soluble solids (TSS) with sensory analysis of the prepared sample
5. Experiment on Ready to Serve (RTS) beverages preparation and its sensory analysis
6. Experiment on canning of fruits and vegetables and its analysis on shelf life of the end product
7. Experiment on preparation of fruit preserve, marmalade and candy and its sensory analysis
8. Experiment on tomato puree and ketchup preparation and its sensory analysis
9. Determination of pectin content from fruit and vegetable waste and its estimation of active compounds
10. Estimation of ascorbic acid content in the given fruit samples using quantitative analysis
11. Experiment on drying characteristics of curry leaves using Fluidized bed dryer and quality analysis of the end product
12. Determination of drying rate of fruits and vegetables using Tray dryer
13. Estimate the maximum % yield efficiency of the prepared fruit pulp

Total Instructional Hours 45

- | Course Outcome | Description |
|----------------|---|
| CO1 | Understand the knowledge on extraction, pulping, dehydration and prepare fruit/vegetable-based products |
| CO2 | Impart knowledge on value addition of food products
Demonstrate methods to prevent or reduce deterioration and loss of nutritional quality of vegetables and fruits |
| CO3 | Implement dehydration methods to produce dehydrated fruits and vegetables
Demonstrate the production of fermented products like pickles, sauerkraut from fruits and vegetables |
| CO4 | Understand the knowledge on extraction, pulping, dehydration and prepare fruit/vegetable-based products |
| CO5 | Impart knowledge on value addition of food products |

REFERENCES:

- R1 Ranganna S., —Handbook of Analysis and Quality Control for Fruit and Vegetable, Tata McGraw-Hill, 2001.
- R2 Gordon L. Robertson, —Food Packaging and Shelf Life: A Practical Guide, CRC Press, USA, 2009.

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Programme B.TECH.	Course code 19HE6071	Name of the course SOFT SKILL-II	L 1	T 0	P 0	C 1
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The student should be able to

- Course Objective**
1. To make the students aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice.
 2. To learn everything from equations to probability with a completely different approach.
 3. To make the students learn on an increased ability to explain the problem comprehensively.

Unit	Description	Instructional Hours
I	Group Discussion & Presentation Skills: GD skills – Understanding the objective and skills tested in a GD – General types of GDs – Roles in a GD – Do's & Don'ts – Mock GD & Feedback. - Presentation Skills – Stages involved in an effective presentation – selection of topic, content, aids – Engaging the audience – Time management – Mock Presentations & Feedback	9
II	Interview Skills and Personality Skills: Interview handling Skills – Self preparation checklist – Grooming tips: do's & don'ts – mock interview & feedback - Interpersonal skills-creative thinking-problem solving-analytical skills	9
III	Business Etiquette & Ethics: Etiquette – Telephonic & E-mail etiquette – Dining etiquette – do's & Don'ts in a formal setting – how to impress. Ethics – Importance of Ethics and Values – Choices and Dilemmas faced – Discussions from news headlines.	9
IV	Quantitative Aptitude: Permutation, Combination - Probability - Logarithm - Quadratic Equations - Algebra - Progression - Geometry - Mensuration.	9
V	Logical Reasoning: Logical Connectives - Syllogisms - Venn Diagrams – Cubes - Coded inequalities - Conditions and Grouping	9

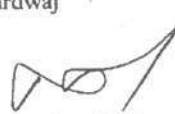
Total Instructional Hours 45

- Course Outcome**
- CO 1 Students will have learnt to keep going according to plan, coping with the unfamiliar, managing disappointment and dealing with conflict.
 - CO 2 Students will Actively participate meetings, Group Discussions / interviews and prepare & deliver presentations
 - CO 3 Students will define professional behavior and suggest standards for appearance, actions and attitude in a business environment
 - CO 4 Students will be able to apply quantitative reasoning and mathematical analysis methodologies to understand and solve problems.
 - CO 5 Students will excel in complex reasoning.

REFERENCES:

- R1 Bridging the Soft Skills Gap: How to Teach the Missing Basics to Today's Young Talent- Bruce Tulgan
- R2 Quantitative Aptitude for Competitive Examinations (5th Edition) - Abhjit Guha
- R3 How to crack test of Reasoning - Jaikishan and Premkishan
- R4 The hand on guide to Analytical Reasoning and Logical Reasoning - Peeyush Bhardwaj


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Programme B.TECH.	Course code 19HE6072	Name of the course INTELLECTUAL PROPERTY RIGHTS (IPR)	L 1	T 0	P 0	C 1
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The student should be able to

- Course Objective**
- To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.
 - To disseminate knowledge on patents, patent regime in India and abroad and registration aspects.
 - To disseminate knowledge on copyrights and its related rights and registration aspects.
 - To disseminate knowledge on trademarks and registration aspects.
 - To disseminate knowledge on Design, Geographical Indication (GI) and their registration aspects.

Unit	Description	Instructional Hours
I	INTRODUCTION TO INTELLECTUAL PROPERTY Introduction, Types of Intellectual Property, International Organizations, Agencies and Treaties, Importance of Intellectual Property Rights.	9
II	PATENTS Patents -Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application -Non -Patentable Subject Matter -Registration Procedure, Rights and Duties of Patentee, Assignment and license.	9
III	COPYRIGHTS Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.	9
IV	TRADEMARKS Concept of Trademarks -Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) -Non-Registrable Trademarks -Registration of Trademarks.	9
V	DESIGN AND GEOGRAPHICAL INDICATION Design: meaning and concept of novel and original -Procedure for registration. Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration.	9

Total Instructional Hours 45

Course Outcome	CO	Description
	1	Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.
	2	Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.
	3	Identify, apply and assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing.
	4	Identify different types of trademarks and procedure for registration
	5	Recognize the concept of design, geographical indication and procedure for registration

TEXT BOOK:

- T1 Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, TN: PHI Learning Private Limited.
- T2 V. Scoble Vinod, Managing Intellectual Property, Prentice Hall of India pvt. Ltd, 2012.

REFERENCES:

- R1 Ahuja, V.K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.
- R2 Edited by Derek Bosworth and Elizabeth Webster. The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

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PROFESSIONAL ELECTIVE

Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT6301	BEVERAGE TECHNOLOGY	3	0	0	3

Course Objective **The student should be able to**

1 To gain knowledge on machinery and process involved in beverage technology and fermentation process involved in making beverage process.

Unit	Description	Instructional Hours
I	BASIC INGREDIENTS IN BEVERAGES: 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.	9
II	BEER AND WINE MANUFACTURE: 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	9
III	CARBONATED BEVERAGES: Procedures- carbonation equipment-ingredients- preparation of syrups-Filling system-packaging containers and closures	9
IV	NON-CARBONATED BEVERAGE: Coffee bean preparation-processing- brewing-decaffeination- instant coffee-Tea types- black, green and oolong- fruit juices, nectars, quash, RTS beverages, isotonic Beverages. Flash pasteurization, Canning and Aseptic Packaging of beverages	9
V	QUALITY CONTROL: 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.	9
	Total Instructional Hours	45
Course Outcome	CO1 Understand the role of ingredients used in beverage processing	
	CO2 Understand the processing of beer and wine processing	
	CO3 Understand the procedure of carbonated beverages	
	CO4 Understand the procedure of non-carbonated beverages	
	CO5 Understand the steps for quality control	

TEXT BOOK:

- T1 Ashurst, P.R, "Chemistry and technology of Soft drink and fruit juices", 2nd edition, Blackwell Publishing Ltd. 2005.
- T2 Steen, D.P and Ashurst, P.R, "Carbonated soft drinks – Formulation and manufacture", Blackwell Publishing Ltd. 2000.

REFERENCES:

- R1 Amalendu Chakraverty et al, "Handbook of Post Harvest Technology", Ed., Marcel Dekker Inc. (Special Indian edition) 2000.
- R2 Robert.W.Hutkins, "Microbiology and Technology of Fermented foods", IFT Press, Blackwell Publishing Ltd. 2006.
- R3 Shankunthala Manay, N. and Shadakdharaswamy, M, "Foods – Facts and Principles", New Age International Pvt. Ltd, 3rd revised edition 2000.
- R4 Charles, W.Bamforth, "Food, fermentation and microorganisms", Blackwell Science Publishing Ltd. 2005

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Programme	Course code	Name of the course	L	T	P	C
B.TECH	19FT6302R	TECHNOLOGY OF SNACKS AND EXTRUDED FOODS	3	0	0	3

The student should be able to

Course Objective

1. Outline the types, processes and ingredients involved in snacks preparation
2. Simplify the sequential steps involved in the processing and preparation of snacks from potatoes and rice
3. Explain the production processes of tortilla chip, popcorn and mechanism of extrusion
4. Discuss the preparation and types of pasta and pretzel manufacturing
5. Summarize the concepts of snacks packaging, filling and quality control

Unit	Description	Instructional Hours
I	INTRODUCTION: Current status of snack food industry in India. Types of snack food – Raw Vegetable Snack, Formed dough products from potato and maize derivatives, Half Products, Directly expanded extruded snack, Puffed Snacks and other. Types and Functions of ingredients – structure forming materials, dispersed phase/filling materials, plasticizers/lubricants, soluble solids, nucleating substances, coloring and flavouring substances.	9
II	POTATO AND RICE BASED SNACKS: Potato Chip - Pre cleaning and peeling, slicing, drying/frying, salting and seasoning, quality control. Fabricated potato snacks – potato flakes, potato granules, potato starch, ground and crushed dehydrated potato. Rice based Snacks – Products using whole grains – Gun puffed rice. Products using flours	9
III	CORN AND EXTRUSION BASED SNACKS: Tortilla chip – Corn soaking and smoking, Grinding, Masa flour, Sheeting and Cutting, Baking and Frying. Popcorn – Popping methods, oil popping and dry popping. Commercial and industrial popcorn process. Flavorings and Applicators. Extruder components – Single and Twin screw, Single and Multiple die extruders. Second generation and Third generation snacks, Co extruded snacks, Masa based snacks, Flat bread, Crisp bread.	9
IV	PASTA PRODUCTS: Raw materials. Preparation of raw materials for extrusion. Spaghetti, noodles, macaroni and similar products. Dry and frozen pasta products. Pretzel – Types – Formulation and Processing - mixing, extrusion, proofing, cooking, surface salting, baking and drying. Problems in pretzel manufacture.	9
V	SNACKS PACKAGING AND QUALITY ASSURANCE Snacks filling and packaging – package styles – case filling – cartoning – Trouble shooting – problems and suggested solutions – Processes for healthy foods and reduction in unhealthy items – Quality programs – evaluation methods – quality control and quality assurance	9
Total Instructional Hours		45

Course Outcome

- CO1 Classify the types of snacks and ingredients used in snack preparation
- CO2 Propose and develop an innovative potato and rice-based snacks
- CO3 Understand the preparation process of tortilla chip, popcorn and mechanism of extrusion
- CO4 Remember the methods involved in pasta and pretzel preparation
- CO5 Choose the appropriate snacks filling and packaging systems and quality control techniques

TEXT BOOK:

- T1 Edmund W. Lusas and Lloyd W. Rooney, —Snack Food ProcessingI, 1st Edition, CRC Press, Florida, 2001.
- T2 Robin Guy, —Extrusion cooking: Technologies and ApplicationsI, 1st Edition, CRC Press, Florida, 2001.

REFERENCES:

- R1 Panda H., —The Complete Technology Book on Snack FoodsI, National Institute of Industrial Research, New Delhi, 2003.
- R2 Sergio O. Serna-Saldivar, —Industrial Manufacture of Snack FoodI, Woodhead Publishing, New Delhi, 2008.
- R3 Mian N. Riaz., —Extruders in Food ApplicationI, CRC Press, Florida, 2000.
- R4 Davidar, Ruth N. "Indian Food Science A Health and Nutrition Guide to Traditional Recipes, East West Books, 2001.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT6303	FOOD BIOTECHNOLOGY	3	0	0	3

Course Objective The student should be able to

- To understand application of biotechnology in food processing industries, understand downstream processing concepts, process involving production of enzymes

Unit	DESCRIPTION	Instructional Hours
I	INTRODUCTION TO BIOTECHNOLOGY Introduction -Biotechnology relating to the food industry – application of genetics to food production – role of bio process engineering in biotechnology industry. Regulatory and Social aspects of biotechnology of foods.	9
II	MICROBIALGENETICS Microbial genetics – mutation – induction of mutation – conjugation, transformation, transduction – heterokaryoses – parasexuality – General mechanism of gene transfer techniques in genetic engineering. Principles of immunology – Antigen and antibody reaction – Development of vaccines – Microbial products and industrial application of microorganisms in foods.	9
III	PRODUCTION OF PRIMARY AND SECONDARY METABOLITE The process of production of some commercially important organic acids – citric acid, lactic acid, gluconic acid, amino acids and alcohol– Bio products for food industries – Natural bio-preservatives – Nisin.	9
IV	DOWNSTREAM PROCESSING Principle of downstream processing –stages in downstream processing- solid liquid separation flotation-flocculation-filtration-types-centrifugation-cell disruption-concentration-evaporation liquid - liquid extraction-membrane filtration- precipitation-adsorption-purification by chromatography.	9
V	APPLICATION OF BIOTECHNOLOGY TO TRADITIONAL FERMENTED FOODS Milk derivatives- fermented milks-past, present and future-plant derivatives-biotechnology application in cassava processing-animal derivatives-fish meat sausage-human health safety and nutrition considerations-future directions.	9
Total Instructional Hours		45

Course Outcome	CO1 Understand the introduction to biotechnology
	CO2 Remember the concepts of microbial genetics
	CO3 Understand the production of primary and secondary metabolites
	CO4 Remember the operations behind downstream processing
	CO5 Understand the application of biotechnology to traditional fermented foods

TEXT BOOK:

- T1 Rita Singh, "Food Biotechnology". Global vision publication house, Delhi 2004.
 T2 Sarah Elderidge, "Food Biotechnology; Current issues and perspectives". Nova science pub. Inc. 2003.

REFERENCES:

- R1 Kalaichelvan, P.T, "Bioprocess technology", MJP publishers, Chennai 2007.
 R2 Sathnarayana U, "Biotechnology", Arunavhazan publishers, kolkatta 2006.
 R3 National Research Council, "Application of biotechnology to traditional fermented foods", National academy press, Washington 1992.
 R4 Najafpour, D. Ghasem. "Biochemical Engineering & Biotechnology". Elsevier, 2007

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Programme **B.TECH.** Course code **19FT6304** Name of the course **BIOPROCESS ENGINEERING** L **3** T **0** P **0** C **3**

Course Objective **The student should be able to**
 I To study the immobilization, inhibition process of microbes

Unit	DESCRIPTION	Instructional Hours
I	ENZYME: Introduction, Single and Multi-substrate reactions - mechanisms and kinetics; turnover number; Enzyme Inhibition and Kinetics- competitive, non-competitive and uncompetitive; Enzyme Immobilization – Physical and chemical methods	9
II	MICROBIAL STRAIN IMPROVEMENT: Media – composition, design, formulation and optimization. Microbial Strains: Isolation, cultivation and preservation techniques; strain selection and improvement - Recombinant DNA Techniques and Cloning Strategies	9
III	STOICHIOMETRY OF CELL GROWTH AND PRODUCT FORMATION: Elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients, energetic analysis of microbial growth and product formation.	9
IV	FERMENTATION AND STERILIZATION: Batch, fed batch and continuous fermentation. Main parameters to be monitored and controlled in fermentation processes. Microbial growth kinetics model - Simple unstructured and Monod model. Sterilization methods, Thermal death kinetics of microorganisms, batch and continuous heat sterilization, filter sterilization.	9
V	REACTOR TYPES & MODES OF OPERATION Batch, fed batch and continuous cultivation. Simple unstructured kinetic models for microbial growth, Monod model, growth of filamentous organisms, product formation kinetics - leudeking- piret models. Types of reactor- Air Lift Reactor, Bubble Column Reactor, Immobilized enzyme reactors- packed bed, fluidized bed, membrane reactors.	9
Total Instructional Hours		45

Course Outcome	CO1	CO2	CO3	CO4	CO5
	Understand the enzymes concept	Understand the microbial stains	Understand the stoichiometry of cell growth	Understand the process of fermentation	Understand the knowledge for reactor

TEXT BOOK:

- T1 Shuler, M.L. and Kargi, F. "Bioprocess Engineering Basic Concepts", 3rd Edition, PHI, 2017
- T2 Palmer, Trevor "Enzymes Biochemistry, Biotechnology, Clinical Chemistry", Affiliated East- West Press Pvt. Ltd., 2004.

REFERENCES:

- R1 Stanbury, P.F., A. Whitaker and S.J. Hall "Principles of Fermentation Technology", 3rd Edition, Butterworth – Heinemann (an imprint of Elsevier), 2016.
- R2 Doran, P.M. "Bioprocess Engineering Principles", 2nd Edition Academic Press, 2013.
- R3 Najafpour, D. Ghasem. "Biochemical Engineering & Biotechnology". Elsevier, 2007.
- R4 Bryce, C.F.A and EL. Mansi. "Fermentation Microbiology & Biotechnology, 1999.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT6305	ENZYME TECHNOLOGY	3	0	0	3

Course Objective The student should be able to

1 To know about Isolation and Purification of enzymes, understand the concept of enzyme immobilization techniques and the application of enzymes in food industries.

Unit	DESCRIPTION	Instructional Hours
I	INTRODUCTION Introduction-Definition-Historical highlights-classification of enzymes nomenclature-structural features of enzyme-Methods of extraction and purification of enzymes.	9
II	MECHANISM OF ENZYME ACTION Specificity-types of specificity-role of 3D structure -active site-substrate and enzyme concentration relationships-different effects -pH and temperature.	9
III	ENZYME KINETICS MM equation, Lineweaver Plot, - kinetics. 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	9
IV	ENZYMES OF FOOD IMPORTANCE Endogeneous enzymes in food quality-color- lipoxynase, chlorophyllase, polyphenol oxidase, texture- Pectic enzymes, Amylases, cellulases, proteases, flavour and aroma-nutritional quality	9
V	APPLICATION OF ENZYMES IN FOOD INDUSTRIES Mechanism and application of enzymes in food processing-enzymatic browning. Application of enzyme in meat industry, fruit and vegetable industry, dairy industry- bakery industry.	9
Total Instructional Hours		45

Course Outcome	CO1	Understand the enzyme structure and nomenclature
	CO2	Remember the importance of enzyme in foods
	CO3	Understand the application of enzyme in food industries
	CO4	Understand the appropriate staining techniques
	CO5	Understand the cell production mechanism

TEXT BOOK:

- T1 Price, N. L. and Steven L., "Fundamentals of Enzymology", Oxford Scientific 2000.
T2 Godfrey T. West S (Eds), "Industrial Enzymology" 2nd Edition Mac Millan Press, London 1996

REFERENCES:

- R1 Colowick, S.P and Kalpan, N.O.(Eds), "Methods of enzymology" Academic press 1977.
R2 Tauber ph.D and Hentry, "Enzyme technology" 2000
R3 Marañoni, A.G, "Enzyme Kinetics". A modern approach A John Wiley & Sons 2003.
R4 Trevor Palmer. Understanding Enzymes. Fourth Edition. Prentice Hall, London Robert L. Ory, Allen J. St. Angelo, "Enzymes in food and beverage processing" American chemical society 1977

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Programme **B.TECH.** Course code **19FT6306** Name of the course **CROP PROCESS ENGINEERING** L **3** T **0** P **0** C **3**

The student should be able to

- Course Objective
- To Study the storage and handling techniques of cereals
 - To Gain knowledge on processing and milling of pulses
 - To Understand the post-harvest processing on application oriented

Unit	DESCRIPTION	Instructional Hours
I	ENGINEERING PROPERTIES AND MOISTURE CONTENT Post harvest losses in field crops - optimum stage of harvest, properties of grains - physical, thermal, electrical and aerodynamic properties, moisture content - measurement - direct and indirect methods - moisture meters, equilibrium moisture content - equilibrium relative humidity, relationship and isotherm models, methods of determination.	9
II	THRESHING, SHELLING, CLEANING, GRADING AND DRYING Threshing - threshers, types, cleaning and grading- principles, types, efficiency of separation, performance index, shelling and decortication - principles, maize sheller, husker sheller, groundnut decorticator and castor sheller, psychrometry - properties of air - water vapour mixture, grain drying - principles, types, heat sources, performance of dryers.	9
III	RICE AND PULSES PROCESSING Rice processing - parboiling, drying, dehusking, polishing, modern rice mill machineries - construction details and adjustments, layout of modern rice mills, manufacture of beaten rice, expanded rice and puffed rice, traditional and improved methods, processes and equipments, material handling equipment - types, construction and working - pulse milling - wet and dry method.	9
IV	STORAGE Storage of food grains - factors affecting storage, traditional methods, types - bag and bulk storage, storage structure, storage losses - estimation, storage of grains in large bins, modified atmosphere storage of grains - facilities, construction, operation and maintenance.	9
V	WASTE UTILIZATION Waste materials, sources and classification - crop residues, farm and industrial wastes and by-products, utilization - production of paper and paperboards, particle board, fuel briquettes - production of fibre, activated carbon, furfural and adhesive from tamarind kernel powder.	9

Total Instructional Hours 45

Course Outcome	CO1	CO2	CO3	CO4	CO5
	Demonstrate different engineering properties of grains and the method to determine moisture content	Select suitable equipment for threshing, cleaning and drying of grains and oilseeds	Summarize the operations involved in rice and pulse processing	Apply the knowledge on the various storage methods to minimize the loss and extend the shelf life of the grains	Use different ways to utilize the waste into useful by products and value-added products

TEXT BOOK:

- T1 Chakraverty, A., Post-Harvest Technology of cereals, pulses and oilseeds, Third Edition, Oxford & IBH publishing & Co: Pvt. Ltd., New Delhi, 2000
- T2 Sahay, K.M. and K.K. Singh. Unit operations in Agricultural Processing, Vikas Publishing House Pvt. Ltd., New Delhi, 1994
- T3 Henderson, S.M. and R.L.Perry, Agricultural process engineering, John Willey and Sons, New York, 1995.

REFERENCES:

- R1 Pande, P.H., Principles of agricultural processing, Kalyani Publishers, Ludhiana, 1994.
- R2 McCabe, W.L. and J.C.Smith, Unit operations in chemical engineering, McGraw Hill Kogakusha Ltd., Tokyo, 2001.
- R3 Mohsenin, N.N., Physical properties of plant and animal materials, Gordon and Breach publishers, New York, 1986

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OPEN ELECTIVE

Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT6401	TRADITIONAL FOODS	3	0	0	3

The student should be able to

- Course Objective**
1. Understand the importance of traditional foods and food habits
 2. Know the traditional processing of snack, sweet and dairy food products
 3. Infer the wide diversity and common features of traditional Indian foods and meal patterns.

Unit	DESCRIPTION	Instructional Hours
I	TRADITIONAL METHODS OF FOOD PROCESSING: Introduction - food culture -geographical features and food. Traditional methods of milling grains - rice, wheat and corn - equipments and processes as compared to modern methods. Equipments and processes for edible oil extraction- comparison of traditional and modern methods. Energy costs, efficiency, yield, shelf life and nutrient content comparisons. Traditional methods of food preservation - sun-drying, osmotic drying, brining, pickling and smoking.	9
II	SWEETS, SNACKS AND DAIRY PRODUCTS: Production, formulation, preparation and processing of Indian traditional sweet and snack food products: - Rasgolla, Gulabjamun; formulation and preparation of namkeen, papads, vada, potato chips, banana chips, samosa etc. Acid coagulated and fermented dairy products- paneer, dahi, shrikhand, lassi - processing conditions, defects etc. Fat rich products- Butter, ghee and its processing; milk-based puddings/ desserts	9
III	FERMENTED FOOD PRODUCTS: Idli, Tempe, Soya sauce, fish pickle, dry fish, meat and vegetable fermented products. Various alcohol-based products. Ways to increase nutritional quality of food such as enrichment, fortification, fermentation and mutual supplementation. Best cooking and processing procedures to reduce loses of nutrients	9
IV	COMMERCIAL PRODUCTION: Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozen foods &-types marketed, turnover; role of SHGs, SMES industries, national and multinational companies; commercial production and packaging of traditional beverages such as tender coconut water, neera, lassi, buttermilk, dahi. Commercial production of intermediate foods - ginger and garlic pastes, tamarind pastes, masalas (spice mixes), idli and dosa batters	9
V	HEALTH ASPECTS: Comparison of traditional foods with typical fast foods / junk foods - cost, food safety, nutrient composition, bioactive components; energy and environmental costs of traditional foods; traditional foods used for specific ailments /illnesses.	9
Total Instructional Hours		45

- Course Outcome**
- CO1 Justify the processing methods of traditional foods in terms of its health benefits
 - CO2 Assess the production methods of traditional sweets, snacks and dairy products
 - CO3 Differentiate Traditional fermented foods products based on its raw material
 - CO4 Implement a large-scale production of tradition foods for its increased consumption
 - CO5 Compare the health aspects of traditional foods with modern foods

TEXT BOOK:

- T1 Sen and Colleen Taylor, Food Culture in India, Greenwood Press, 2005.
- T2 Davidar, Ruth N. "Indian Food Science: A Health and Nutrition Guide to Traditional Recipes:" East West Books, 2001.

REFERENCES:

- R1 Steinkrus.K.H. Handbook of Indigenous Fermented Foods, CRC press, 1995.
- R2 Aneja. R.P, Mathur.BN, R.C. Chandan, and Banerjee.A.K. Technology of Indian Milk Products. Dairy India Year Book, 2009.

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CURRICULUM

R2019



DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. FOOD TECHNOLOGY (UG)

REGULATION-2019

For the students admitted during the academic year 2019-2020 and onwards

SEMESTER I

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	19HE1101	Technical English	HS	2	1	0	3	25	75	100
2.	19MA1102	Calculus and Linear Algebra	BS	3	1	0	4	25	75	100
3.	19ME1101	Basics of Civil and Mechanical Engineering	ES	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
4.	19PH1151	Applied Physics	BS	2	0	2	3	50	50	100
5.	19CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
6.	19CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100
PRACTICAL										
7.	19HE1071	Language Competency Enhancement Course-I	HS	0	0	2	1	100	0	100
MANDATORY COURSES										
8.	19HE1072	Career Guidance Level – I Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
Total:				16	2	8	20	425	375	800
As Per AICTE Norms 3 Weeks Induction Programme is Added in The First Semester as an Audit Course										

SEMESTER II

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	19HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100
2.	19MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	25	75	100
3.	19FT2105	Principles of Microbiology	ES	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
4.	19IT2151	Programming in C	ES	2	0	2	3	50	50	100
5.	19PH2151	Material Science	BS	2	0	2	3	50	50	100
6.	19CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
PRACTICALS										
7.	19ME2001	Engineering Practices Laboratory	ES	0	0	4	2	50	50	100
8.	19HE2071	Language Competency Enhancement Course-II	HS	0	0	2	1	100	0	100
MANDATORY COURSES										
9.	19HE2072	Career Guidance Level – II	EEC	2	0	0	0	100	0	100



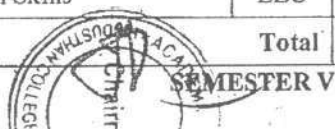
		Personality, Aptitude and Career Development								
10.	19HE2073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
			Total:	17	2	12	22	575	425	1000

SEMESTER III

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	19MA3102	Fourier Analysis and Transforms	BS	3	1	0	4	25	75	100
2.	19FT3201	Fluid Mechanics	PC	3	1	0	4	25	75	100
3.	19FT3101	Principles of Thermodynamics	PC	3	0	0	3	25	75	100
4.	19FT3202	Food Microbiology	PC	3	0	0	3	25	75	100
THEORY AND LAB COMPONENT										
5.	19FT3251	Bio Chemistry	PC	2	0	2	3	50	50	100
PRACTICALS										
6.	19FT3001	Food Microbiology Lab	PC	0	0	3	1.5	50	50	100
7.	19FT3002	Food Production Analysis Lab	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8.	19MC3191	Indian Constitution	MC	2	0	0	0	100	0	100
9.	19HE3072	Career Guidance Level – III Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	19HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
			Total	19	2	8	20	550	450	1000

SEMESTER IV

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	19FT4201R	Fundamentals of Heat and Mass Transfer	PC	3	1	0	4	25	75	100
2.	19FT4203R	Engineering properties of food materials	PC	3	0	0	3	25	75	100
3.	19FT4204	Refrigeration and Cold Chain Management	PC	3	1	0	4	25	75	100
THEORY AND LAB COMPONENT										
4.	19FT4251	Food Chemistry	PC	2	0	2	3	50	50	100
5.	19MA4152	Statistics and Numerical Methods	BS	3	0	2	4	50	50	100
PRACTICALS										
6.	19FT4001	Unit Operations Laboratory	PC	0	0	3	1.5	50	50	100
7.	19FT4002	Food Process Equipment Design Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8.	19MC4191	Essence of Indian tradition knowledge/Value Education	MC	2	0	0	0	100	0	100
9.	19HE4072	Career Guidance Level – IV Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	19HE4073	Ideation Skills	EEC	1	0	0	0	100	0	100
			Total	19	2	10	21	575	425	1000



S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
1.	19FT5201	Baking and Confectionery Technology	PC	3	0	0	3	25	75	100
2.	19FT5202	Food Additives	PC	3	0	0	3	25	75	100
3.	19FT5203	Poultry, Meat and Fish Process Technology	PC	3	0	0	3	25	75	100
4.	19FT5204	Principles of Food Processing	PC	3	0	0	3	25	75	100
5.	19FT5205	Unit Operations in Food Processing	PC	3	0	0	3	25	75	100
6.	19FT53XX	Professional Elective -I	PE	3	0	0	3	25	75	100
PRACTICALS										
7.	19FT5001	Baking and Confectionery Technology Laboratory	PC	0	0	4	2	50	50	100
8.	19FT5002	Unit Operations in Food Processing Laboratory	PC	0	0	4	2	50	50	100
MANDATORY COURSES										
9.	19HE5071	Soft Skills - I	EEC	1	0	0	1	25	75	100
10.	19HE5072	Design Thinking	EEC	1	0	0	1	25	75	100
TOTAL				20	0	8	24	300	700	1000

SEMESTER VI

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	19FT6201	Dairy Engineering	PC	3	0	0	3	25	75	100
2.	19FT6202	Plantation crops and Spices Products Technology	PC	3	0	0	3	25	75	100
3.	19FT6203	Fruits and Vegetable Processing Technology	PC	3	0	0	3	25	75	100
4.	19FT6181	Professional Ethics in Engineering	HS	3	0	0	3	25	75	100
5.	19FT63XX	Professional Elective - II	PE	3	0	0	3	25	75	100
6.	19XX64XX	Open Elective- I	OE	3	0	0	3	25	75	100
PRACTICALS										
7.	19FT6001	Dairy Engineering Laboratory	PC	0	0	3	1.5	50	50	100
8.	19FT6002	Fruits and Vegetable Processing Technology Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
9.	19FT6701	Industrial Training	EEC	0	0	0	1	0	100	100
10.	19HE6071	Soft Skills - II	EEC	1	0	0	1	25	75	100
11.	19HE6072	Intellectual Property Rights(IPR)	EEC	1	0	0	1	25	75	100
TOTAL				20	0	6	24	300	800	1100

S.No.	Course Code	Course Title	T	P	C	CIA	ESE	TOTAL
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PROFESSIONAL ELECTIVE I										
1.	19FT5301	Technology of Fats and Oils	PE	3	0	0	3	25	75	100
2.	19FT5302	Food Storage and Infestation Control	PE	3	0	0	3	25	75	100
3.	19FT5303	Food Process Calculations	PE	3	0	0	3	25	75	100
4.	19FT5304	Post-Harvest Technology	PE	3	0	0	3	25	75	100
5.	19FT5305	Cane sugar Technology	PE	3	0	0	3	25	75	100
6.	19FT5306	Milling Technology for Food Materials	PE	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE II										
1.	19FT6301	Beverage Technology	PE	3	0	0	3	25	75	100
2.	19FT6302	Technology of Snack and Extruded Foods	PE	3	0	0	3	25	75	100
3.	19FT6303	Food Biotechnology	PE	3	0	0	3	25	75	100
4.	19FT6304	Bioprocess Engineering	PE	3	0	0	3	25	75	100
5.	19FT6305	Enzyme Technology	PE	3	0	0	3	25	75	100
6.	19FT6306	Crop Process Engineering	PE	3	0	0	3	25	75	100

OPEN ELECTIVE

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	19FT6401	Traditional Foods	OE	3	0	0	3	25	75	100

SEMESTER VII

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	19FT7201	Food Analysis and Quality Control	PC	3	0	0	3	25	75	100
2.	19FT7202	Food Packaging	PC	3	0	0	3	25	75	100
3.	19FT7203	Food Plant Layout and Management	PC	3	0	0	3	25	75	100
4.	19FT73XX	Professional Elective-III	PE	3	0	0	3	25	75	100
5.	19XX74XX	Open Elective – II	OE	3	0	0	3	25	75	100
PRACTICALS										
6.	19FT7001	Food Packaging Laboratory	PC	0	0	3	1.5	50	50	100
7.	19FT7002	Food Analysis and Quality Control Laboratory	PC	0	0	3	1.5	50	50	100
PROJECT WORK										
8.	19FT7901	Project Phase I	EEC	0	0	4	2	50	50	100
TOTAL				15	0	10	20	275	525	800



SEMESTER VIII

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	19FT83XX	Professional Elective -IV	PE	3	0	0	3	25	75	100
2.	19FT83XX	Professional Elective- V	PE	3	0	0	3	25	75	100
PRACTICAL										
3.	19FT8901	Project Work – Phase II	EEC	0	0	16	8	100	100	200
Total				6	0	16	14	150	250	400

PROFESSIONAL ELECTIVE III

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	19FT7301	Functional foods and Nutraceuticals	PE	3	0	0	3	25	75	100
2.	19FT7302	Biology and Chemistry of Food Flavors	PE	3	0	0	3	25	75	100
3.	19FT7303	Food Toxicology and Allergy	PE	3	0	0	3	25	75	100
4.	19FT7304	Advanced Drying Technology	PE	3	0	0	3	25	75	100
5.	19FT7305	Cereal Technology	PE	3	0	0	3	25	75	100
6.	19FT7306	Processing Technology of Legumes and Oilseeds	PE	3	0	0	3	25	75	100
7.	19FT7307	Emerging Non-Thermal Processing of Foods	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE IV

1.	19FT8301	Food Process Economics and Industrial Management	PE	3	0	0	3	25	75	100
2.	19FT8302	Food Laws and Safety	PE	3	0	0	3	25	75	100
3.	19FT8303	Waste Management and By-Product Utilization in Food Industries	PE	3	0	0	3	25	75	100
4.	19FT8304	Instrumentation and Process Control	PE	3	0	0	3	25	75	100
5.	19FT8305	Economics and Management	PE	3	0	0	3	25	75	100
6.	19FT8312	Total Quality Management	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE V

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	19FT8306	Food process plant layout and safety	PE	3	0	0	3	25	75	100
2.	19FT8307	Energy Management in Process Industries	PE	3	0	0	3	25	75	100
3.	19FT8308	Emerging Technologies in Food Processing	PE	3	0	0	3	25	75	100



4.	19FT8309	Separation Techniques in Food Processing	PE	3	0	0	3	25	75	100
5.	19FT8310	Analytical Instruments in Food Industries	PE	3	0	0	3	25	75	100
6.	19FT8311	Entrepreneurship Opportunities for Food Technologists	PE	3	0	0	3	25	75	100
7.	19FT8313	Application of Nanotechnology and Cryogenics	PE	3	0	0	3	25	75	100

LIST OF OPEN ELECTIVES - FOOD TECHNOLOGY

S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	19FT7401	Post Harvest Technology of Fruits and Vegetables	OE	3	0	0	3	25	75	100

LIFE SKILL COURSES

1.	19LSZ401	General Studies for Competitive Examinations	OE	3	0	0	3	25	75	100
2.	19LSZ402	Human Rights, Women's Rights and Gender Equality	OE	3	0	0	3	25	75	100
3.	19LSZ403	Indian Ethos and Human Values	OE	3	0	0	3	25	75	100
4.	19LSZ404	Indian Constitution and Political System	OE	3	0	0	3	25	75	100
5.	19LSZ405	Yoga for Human Excellence	OE	3	0	0	3	25	75	100

SEMESTER-WISE CREDIT DISTRIBUTION

B.E. / B.TECH. PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HS	04	04	-	-	-	03	-	-	11
2	BS	10	10	04	04	-	-	-	-	28
3	ES	06	05	-	-	-	-	-	-	11
4	PC	-	03	16	17	19	12	12		79
5	PE	-	-	-	-	03	03	03	06	15
6	OE	-	-	-	-	-	03	03	-	06
7	EEC	-	-	-	-	02	03	02	08	15
Total		20	22	20	21	24	24	20	14	165

Credit Distribution R2019

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165

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SEMESTER VIII
PROFESSIONAL ELECTIVE IV

Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT8301	FOOD PROCESS ECONOMICS AND INDUSTRIAL MANAGEMENT	3	0	0	3

The student should be able to

- Course Objective**
- To introduce the students about the process economics and industrial management principles
 - To improve the management and planning skills in students thus enabling them for functional role in industries

Unit	DESCRIPTION	Instructional Hours
I	PRODUCTION MANAGEMENT AND ORGANISATION 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.	9
II	ENGINEERING ECONOMICS FOR PROCESS ENGINEERS- INTEREST, INVESTMENT COSTS AND COST ESTIMATION Time Value of money; capital costs and depreciation, estimation of capital cost, manufacturing costs and working capital, invested capital and profitability.	9
III	PROFITABILITY, INVESTMENT REPLACEMENT Estimation of project profitability, sensitivity analysis; investment alternatives; replacement policy; forecasting sales; inflation and its impact.	9
IV	ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE Principles of accounting; balance sheet; income statement; financial ratios; analysis of performance and growth.	9
V	ECONOMIC BALANCE AND QUALITY CONTROL 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.	9
	Total Instructional Hours	45

Course Outcome	CO1 Understand the concept of production management and organization
	CO2 Understand the Engineering Economics for process Engineers
	CO3 Understand the profitability, investment replacement concepts.
	CO4 Understand the principles of accounting and analysis of performance growth
	CO5 Understand the concepts of economic balance and quality control

TEXT BOOK:

- T1 Peters, M. S. and Timmerhaus, C. D., "Plant Design and Economics for Chemical Engineers", 5th Edition., McGraw Hill, 2002.
- T2 Holand, F.A., Watson, F.A. and Wilkinson, J.K., " Introduction to process Economics ", 2nd Edition., John Wiley, 1983.

REFERENCES:

- R1 Allen, L.A., "Management and Organization", McGraw Hill, 1958.
- R2 Perry, R. H. and Green, D., "Chemical Engineer's Handbook ", 9th Edition., McGraw Hill, 2018.
- R3 Narang, G.B.S. and Kumar, V., "Production and Costing", Khanna Publishers, New Delhi, 1988.
- R4 Bourlakis, Michael A., and Paul WH Weightman, eds. Food supply chain management. Blackwell Pub., 2004.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT8302	FOOD LAWS AND SAFETY	3	0	0	3

Course Objective The student should be able to

1 To study various food laws, importance and functions of food safety management systems, to impart knowledge on food laws and safety in food processing

Unit	DESCRIPTION	Instructional Hours
I	HISTORICAL PERSPECTIVES INCLUDING NECESSITY OF FOOD LAWS: Establishment of US Pure Food Law in early 1900s and of Food & Drug Administration to enforce safety of food products; Urbanisation of population and necessity of processed and preserved foods and the necessity of ensuring quality of food to prevent adulteration. Prevention of Food Adulteration Act 1954 & Rules 1955 established in India to enforce safety and purity of food products; Various aspects of defining adulteration, taking samples of food for analysis by public analyst, prosecution for adulteration and punishment; Standards of various food products; FPO; Infant Milk Substitute Act; Laws relating to vegetable oils; Use of permitted additives like colours, preservatives, emulsifiers, stabilisers, antioxidants etc. Food Safety & Standards Act 2006 and the provisions therein; Integrated Food Law - Multi departmental multilevel to single window control system, consumer protection Act.	9
II	FOOD SAFETY IN PROCESSING: Building and equipment design; microbiological quality of water, air; Safety in food procurement, storage, handling and manufacture; Food safety in retail food businesses; international food service operators, institutional food service operators; application of the principals of modern hygiene; Food handlers, habits, clothes, illness	9
III	KEY SAFETY PRINCIPLES: Training & Education for safe methods of handling food; cleaning and sanitization of processing plants; principles of cleaning and sterilization; sterilization & disinfection different methods used-detergents, heat, chemicals; selecting and installing equipment; Cleaning of equipment and premises. Safety limits of sanitizers; pest control; management and disposal of waste	9
IV	FOOD SAFETY MANAGEMENT SYSTEM: Food safety and quality management systems- Physical, chemical and Microbial hazards and their control in food industry; Good laboratory practice (GLP); Quality systems standards including ISO; - ISO 9000; total quality management (TQM); hazard analysis of critical control points (HACCP); good manufacturing practices (GMP)	9
V	MANAGEMENT: Good Manufacturing Practice and HACCP; Surveillance networks, Consumer and food service operator education; GM Foods, safety and labeling; International Food Standards ISO 9000 and related standards; Impact of food safety on global trade.	9
	Total Instructional Hours	45
Course Outcome	CO1 Understand the safety during processing	
	CO2 Understand the key safety principles	
	CO3 Understand the manufacturing practices	
	CO4 Understand the need of food laws	
	CO5 Understand the management systems	

TEXT BOOK:

- T1 Rees, Naomi and David Watson —International Standards for Food Safety, Aspen Publication, 2000.
 T2 Schmidt, Ronald H. and Rodrick, G.E. —Food Safety Handbook, Wiley Interscience, UK, 2005.

REFERENCES:

- R1 Mehta, Rajesh and J. George —Food Safety Regulations, Concerns and Trade :The Developing Country Perspective, Macmillan, 2005.
 R2 The Prevention of Food Adulteration Act, 1954, Commercial Law Publishers India) Pvt. Ltd.,
 R3 Oyarzabal, Omar A., and Steffen Backert, eds. Microbial Food Safety: An Introduction. Springer Science & Business Media, 2011.
 R4 Dreyer, Marion, and Ortwin Renn. Food safety governance. Berlin: Springer, 2009.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT8303	WASTE MANAGEMENT AND BY-PRODUCT UTILIZATION IN FOOD INDUSTRIES	3	0	0	3

Course Objective The student should be able to

1 To understand the concepts of waste management and its utilization in food industries

Unit	DESCRIPTION	Instructional Hours
I	IMPORTANCE AND CHARACTERISTICS OF INDUSTRIAL WASTE: Classification of waste, characterization of waste, magnitude of waste generation in different food processing industries, importance of waste management, Economical aspects of waste treatment and disposal, Strategies for minimizing waste, Application of 3R's and life cycle assessment (LCA).	9
II	WASTE TREATMENT METHODS: Membrane separation, advanced oxidation/reduction, electrolytic methods, up-flow anaerobic sludge blanket (UASB), aerobic and anaerobic methods, activated sludge treatment, sludge thickening, sludge conditioning, sludge dewatering, composting and incineration, land filling, vermicomposting.	9
III	BY PRODUCTS FROM OIL SEED AND TUBER PROCESSING INDUSTRIES: Oil processing industries – Introduction, De-oiled cake, animal feed, fertilizer, bio sorbents, waxes, soap stock, cocoa butter replacer. Tuber processing industries- Introduction, enzyme production, biogas, bakers yeast, bio-ethanol, animal feed, corn syrup, organic acids, nutraceuticals.	9
IV	BY PRODUCTS FROM ANIMAL PRODUCT BASED INDUSTRIES: Dairy industry - Introduction- opportunities – whey, bio surfactants, bacteriocin. Meat, fish, poultry processing industries- bio active peptide, protein extract, gelatin, heparin, pepsin, bio molecule from bone and blood, keratin from animal hair, bone meal, meat meal, chondroitin sulfate, squalene, fish oil, micro nutrients- vitamins and minerals, pigments.	9
V	BY PRODUCTS FROM MILLING, FRUITS AND VEGETABLES PROCESSING INDUSTRIES: Milling industries- introduction, bran utilization- dietary fibre, substrate for mushroom cultivation and enzyme production, briquettes, edible oils. Fruits and vegetable processing industries- current scenario in waste generation- anti oxidants, natural colorants and flavors, pectin and other poly saccharides, organic acids, adsorbent, phyto chemicals.	9
Total Instructional Hours		45

Course Outcome	CO1	Understand the classification of food waste and recommend the strategies for waste minimization
	CO2	Understand and identify the method for treatment of liquid and solid waste
	CO3	Understand and utilize residues from oil seed and tuber processing industries
	CO4	Understand the by-product production from animal product-based industries
	CO5	Understand and develop by-products from grain, fruits and vegetables processing

TEXT BOOK:

- T1 Chandrasekaran M., —Valorization of Food Processing By-Products, CRC Press, 2013.
- T2 VassoOreopoulou and Winfried Russ, —Utilization of By-Products and Treatment of Waste in the Food Industry, Springer Science Business Media, USA, 2007.

REFERENCES:

- R1 Keith Waldron, —Handbook of waste management and co-product recovery in food processing, Wood head Publishing Ltd., England, 2007.
- R2 Green J.H. and Kramer A., —Food Processing Waste Management, AVI Publishing Company, Malaysia, 1981.
- R3 Nelson L. Nemerow and Franklin J. Agardy, —Strategies of Industrial and Hazardous Waste Management, John Wiley and Sons, 1998.
- R4 Anal, Anil, ed. *Food processing by-products and their utilization*. John Wiley & Sons, Incorporated, 2018.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT8304	INSTRUMENTATION AND PROCESS CONTROL	3	0	0	3

Course Objective The student should be able to
1 To learn about the process control methods and systems

Unit	DESCRIPTION	Instructional Hours
I	LAPLACE TRANSFORM AND FIRST ORDER SYSTEM: Laplace transformation, transform of standard functions, derivatives and integrals, inversion, theorems in Laplace transformation, application. Open-loop systems, first order systems and their transient response for standard input functions, Linearization and its application in process control.	9
II	SECOND ORDER SYSTEM: Second order systems - Interacting system and non-interacting system, manometer, damped oscillator, dynamic response of second order system, Closed loop control systems, development of block diagram for feedback control systems, servo and regulator problems.	9
III	CONTROLLERS AND DYNAMIC RESPONSE: Controllers - Proportional, Proportional Integral, Proportional Derivative and Proportional Integral Derivative (PID). Dynamic behavior of feedback controlled processes. Effect of proportional, Integral, Derivative and composite control actions on the response of controlled processes. Automation: Control components of SCADA, working of SCADA, comparison of SCADA with DCS, comparison of PLC with RTU.	9
IV	STABILITY ANALYSIS AND FREQUENCY RESPONSE: Stability for linear systems, Routh stability criterion and its limitations. Introduction to frequency response of closed-loop systems, control system design by frequency, Bode diagram, Bode stability criterion, phase and gain margin, Ziegler- Nichols optimum controller settings and its limitations.	9
V	PROCESS INSTRUMENTS: Principles of measurements - Static and dynamic response of instruments, Temperature measurements - Expansion Thermometer, filled system thermometers, thermocouple, thermistors, optical pyrometers, radiation pyrometers. Pressure measurements - Manometers, bourdon gauge and bellow gauge, pressure transducers, pressure measurement by vacuum. Level measurement - sight glass level indicator, float and tape liquid level gauge.	9
	Total Instructional Hours	45
Course Outcome	CO1 Understand the use of Laplace transformation for first order control systems	
	CO2 Understand the Laplace transformation for second order control systems and determine its dynamic response	
	CO3 Understand the concepts of feedback controller, its dynamic response and automation	
	CO4 Understand the stability criteria for various controllers	
	CO5 Understand the temperature and pressure measuring instruments	

TEXT BOOK:

- T1 Vyas R.P., —Process Control and Instrumentation, 6th Edition, Central Techno Publications, Nagpur, 2011.
T2 Eckman D.P., —Industrial Instrumentation, Wiley Eastern Ltd, New Delhi, 2004.

REFERENCES:

- R1 Stephanopoulos S.G., —Chemical Process Control: An introduction to Theory and Practice, Prentice Hall of India, New Delhi, 1997.
R2 Coughanowr Donald R., —Process Systems Analysis and Control, 3rd Edition, McGraw Hill, New York, 2009.
R3 Singh S.K., —Industrial Instrumentation and Control, 2nd Edition, Tata McGraw-Hill, New Delhi, 2006.
R4 Johnson, Curtis D. *Process control instrumentation technology*. Prentice Hall PTR, 1999.

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Programme **B.TECH.** Course code **19FT8305** Name of the course **ECONOMICS AND MANAGEMENT** L **3** T **0** P **0** C **3**

Course Objective **The student should be able to**
 1 To enable the students to understand the various concepts of economics, process development, design consideration and cost estimation in chemical industry.

Unit	DESCRIPTION	Instructional Hours
I	INTEREST AND PLANT COST: Time value of money - equivalence, Depreciation, Depletion, estimation of capital cost, Capital requirement for complete plant, cost indices, capital recovery.	9
II	PROJECT PROFITABILITY AND FINANCIAL RATIOS: Estimation of project profitability, Investment alternatives, income statement and financial ratios, balance sheet preparation- problems.	9
III	ECONOMIC BALANCE IN EQUIPMENTS: Essentials of economic balance, economic balance in batch operations, cyclic operations, economic balance for insulation, evaporation, heat transfer equipment	9
IV	PRINCIPLES OF MANAGEMENT: Principles of management, planning, organizing, staffing, coordinating, directing, controlling and communicating. Types of organizations, Management information systems (MIS).	9
V	PRODUCTION PLANNING CONTROL: Work measurement techniques, motion study, principles of time study, elements of production control, forecasting, planning, routing, scheduling, dispatching, inventory and control, role of control charts in production and quality control.	9

Total Instructional Hours 45

Course Outcome
 CO1 Understand the capital cost and the value of money for the complete plant
 CO2 Understand the profitability of the project and balance sheet preparation
 CO3 Understand the economic operation of the equipment
 CO4 Understand the planning and management
 CO5 Understand the production planning, control chart preparation and quality control

TEXT BOOK:

- T1 Peters and Timmerhaus, Plant design and Economics for Chemical Engineers, McGraw Hill 5th Edition, 2004.
 T2 Schweyer. H.E, "Process Engineering Economics", Mc Graw Hill, 1969.

REFERENCES:

- R1 F.C. Jelen and J.H. Black, "Cost and Optimization Engineering", McGraw Hill, 3rd Edn., 1992
 R2 Ahuja K.K, Industrial management, Khanna publishers, New Delhi, 1985.
 R3 Zimmer and Scarborough, —Essentials of Entrepreneurship and Small Business Management, 5th Edition, PHI Learning Pvt. Ltd., 2009.
 R4 Supply Chain Management, Chopra and peter, Pearson, 5th edition, 2013

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Programme B.TECH.	Course code 19FT8312	Name of the course TOTAL QUALITY MANAGEMENT	L 3	T 0	P 0	C 3
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The student should be able to

- Course Objective**
- To make the students understand the basic concepts of total quality management and appreciate its importance in today's business environment
 - To enable them to acquire required diagnostic skills and use various quality tools
 - To familiarize the students about the Quality Management System

Unit	DESCRIPTION	Instructional Hours
I	INTRODUCTION Introduction - Definition of quality - Quality control tools - Quality control chart - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Quality Gurus - Barriers to TQM - Cost of Quality.	9
II	TQM PRINCIPLES Quality statements - Customer focus -Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Continuous process improvement - PDCA cycle, 5s, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.	9
III	TQM TOOLS The seven traditional tools of quality - New management tools - Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA -Stages, Types.	9
IV	TQM TOOLS Quality circles - Quality Function Deployment (QFD) -Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures - BPR.	9
V	QUALITY SYSTEMS Need for ISO 9000- ISO 9600-2000 Quality System - Elements, Documentation, Quality auditing- QS 9000 -ISO 14000- ISO 22000 - Concepts, Requirements and Benefits -Quality Council - Leadership, Employee involvement -Motivation, Empowerment, Team and Teamwork, Recognition and Reward.	9
Total Instructional Hours		45
Course Outcome	CO1 Apply TQM concepts for improving the quality of products and services	
	CO2 Implement the basic principles of TQM in manufacturing and service based organization	
	CO3 Apply the tools and techniques of quality management to manufacturing and service processes	
	CO4 Predict the improvement necessary for the better performance	
	CO5 Implement Quality Management System.	

REFERENCES:

- R1 Evans, James R. and William M. Lindsay, "The Management and Control of Quality".6th Edition South-Western (Thomson Learning), 2005.
- R2 Oakland, J.S. "TQM - Text with Cases", 3rd Edition. Butterworth - Heinemann, 2003.
- R3 Suganthi,L and Anand Samuel, "Total Quality Management", PHI, 2006 .
- R4 Janakiraman,B and Gopal, R.K, "Total Quality Management - Text and Cases". PHI, 2006. Besterfiled, Dale H. et al., "Total Quality Management", 4th Edition, Pearson Education. Asia 2006.

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PROFESSIONAL ELECTIVE V

Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT8306	FOOD PROCESS PLANT LAYOUT AND SAFETY	3	0	0	3

Course Objective The student should be able to
 1 To understand and design with the safety measures for processing industry

Unit	DESCRIPTION	Instructional Hours
I	SELECTION OF PLANT LAYOUT: Introduction and classification of food plants, Site selection of plant. Plant location factors plant lay out advantages types of layout-characteristics of an efficient layout. Techniques of plant layout. General requirements and considerations for construction, materials and floors. Drains and drain layout. Ventilation, fly control, mould prevention, illumination in food plants.	9
II	INDUSTRIAL SAFETY: Process industries, potential hazards, toxic chemicals and physical safety analysis, high pressure, high temperature operation, radioactive materials, safe handling and operation of machineries.	9
III	SAFETY PERFORMANCE: Safety Appraisal, effective steps to implement safety procedures, periodic inspection and safety procedures; proper selection and replacement of handling equipment, personal protective equipment	9
IV	ACCIDENTS: Industrial accidents – accident costs – identification of accident spots, remedial measures, identification and analysis of causes of injury to men and machines – accident prevention – accident proneness – vocational guidance, fault free analysis. Fire prevention and fire protection.	9
V	HEALTH HAZARDS AND LEGAL ASPECTS: Health hazards – occupational – industrial health hazards – health standards, and rules – safe working environments – parliamentary legislations – factories act – labour welfare act – ESI Act – Workmen Compensation Act.	9
Total Instructional Hours		45

Course Outcome	CO1	Understand and design the plant layout
	CO2	Understand the different industrial hazards
	CO3	Remember the industrial safety performance and safety procedures
	CO4	Remember the acquired knowledge for prevention of industrial accidents
	CO5	Understand the health hazards and legal aspects in industries

TEXT BOOK:

- T1 Handley William, —Industrial Safety Hand Book1, 2nd Edition, McGraw Hill, New York, 1969.
- T2 Fawatt H.H. and Wood W.S., —Safety and Accident Prevention in Chemical Operation1, 2nd Edition, Inter-science, New York, 1984.

REFERENCES:

- R1 Heinrich H.W., Dan Peterson P.E. and Nester Rood, —Industrial Accident Prevention1, 2nd Edition, McGraw-Hill Book Co., 1980.
- R2 Blake R.P., —Industrial Safety1, 3rd Edition, Prentice Hall Inc., New Jersey, 1993.
- R3 Amit Gupta, _Industrial Safety and Environment1, 2nd Edition, Laxmi Publications Pvt. Ltd., New Delhi, 2006.
- R4 "Food plant engineering system" by Theunis C. Robberts, II Edition, CRC Press, Washington,2013.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT8307	ENERGY MANAGEMENT IN PROCESS INDUSTRIES	3	0	0	3

Course Objective The student should be able to

1 To understand the concepts of energy management in process industries

Unit	DESCRIPTION	Instructional Hours
I	Energy and Energy Analysis: Energy, unit of energy, energy consumption and GDP, energy and environment – carbon dioxide emission, depletion of ozone layer. Energy supply: Primary energy, delivered energy, electricity supply, natural gas, fuel oils, renewable energy. Energy analysis – Annual Energy Consumption, Normalized Performance Indicators, Time-Dependent Energy Analysis. Energy Management - Organizational Structure, Energy Policy and Planning.	9
II	Energy Audits and Surveys: Energy Audit - types, Preliminary Energy Audits, Comprehensive, Energy Surveys and Audit report. Energy Monitoring, Targeting and Waste Avoidance - Concept of monitoring and targeting, Computer-Based M and T, Monitoring and Data Collection, Energy Targets, reporting techniques, Diagnosing Changes in Energy Performance, waste avoidance, Prioritizing.	9
III	Energy Conservation in Thermal Systems: Energy conservation in steam generation –energy analysis, energy recovery - through optimal design, from flue gas, from blow down water. Steam distribution system – heat loss, energy efficiency and energy conservation. Waste heat recovery – heat pumps, heat exchangers. Thermal energy storage- storage systems, storage materials, hot thermal energy and cooling energy storage.	9
IV	Energy Conservation in Power, Electrical and Mechanical Systems: Sources of energy loss – low power factor, improper motor load, poor control. Energy conservation - Power Factor Improvement, Replacement with High-Efficiency Motors and electronic adjustable speed motors. Energy Conservation in Mechanical systems: Compressed air system – sources of energy losses. Energy conservation – high efficiency motor, repairing of air leaks, reduced air pressure and air inlet temperature. Localized air delivery system.	9
V	Energy Conservation in Food Processing Units: Dairy Processing - Potential Energy Conservation measures in pasteurization, cooling, concentration and drying. Fruit and Vegetable Processing – energy flow in canned products, energy conservation measures in blanching, pasteurization, sterilization. Energy conservation in Baking and confectionery units. Thermochemical Conversion of Food Processing Wastes for Energy Utilization – pyrolysis, gasification and liquefaction.	9
Total Instructional Hours		45

Course Outcome	CO1	CO2	CO3	CO4	CO5
	Understand the procedure for analyzing energy	Understand the role of energy conservation in thermal system	Understand the role of energy in power, electrical and mechanical systems	Understand the energy conservation in food processing unit	Understand the procedures for energy audits and surveys

TEXT BOOK:

- T1 Beggs Clive, —Energy: Management Supply and ConservationI, 2Nd Edition, Butterworth Heinemann, USA, 2002.
T2 Lijun Wang, —Energy Efficiency and Management in Food Processing FacilitiesI, CRC Press, 2008.

REFERENCES:

- R1 Wayne C. Turner, —Energy Management HandbookI, 4Th Edition, The Fairmont Press, Inc, 2001.
R2 Klemes J, R. Smith, Santa Barbara, J-K Kim, —Handbook of Water and Energy Management in Food ProcessingI, 1st Edition, Woodhead Publishing, 2008.
R3 Chakrabarti Allan, —Energy Engineering and ManagementI, PHI Learning Pvt. Ltd., 2011.
R4 Caffall, Clive. *Learning from experiences with Energy Management in Industry*. No. BOOK. Centre for the analysis and dissemination of demonstrated energy technologies, 1995.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT8308	EMERGING TECHNOLOGIES IN FOOD PROCESSING	3	0	0	3

Course Objective The student should be able to
1 To study the various emerging techniques in food processing

Unit	DESCRIPTION	Instructional Hours
I	HIGH PRESSURE PROCESSING OF FOODS: High Pressure Processing – Principle - Description, Packaging requirements, Uses and Effects on food quality. High Pressure Regulations. Other applications of high pressure - High pressure freezing, High Pressure thawing, High Pressure non-frozen storage. Pulsed Electric Field Processing: Principle - Mechanism of action. PEF treatment systems - processing parameters. Applications. Safety aspects, Problems and challenges in PEF.	9
II	HIGH INTENSITY PULSED LIGHT TECHNOLOGY: Principles of Pulsed Light Technology, Effect of Pulsed Light Technology on food products, enzymes and food properties. Systems for Pulsed Light Technology. Irradiation of Foods: Fundamentals of food irradiation - Definition, Doses of Irradiation: Biological effects of irradiation – effect on micro-organisms, parasites and insects, viruses, ripening and sprouting inhibition	9
III	ULTRASOUND: Fundamentals of ultrasound, ultrasonic processing equipment, Inactivation of micro-organisms and enzymes. Application- mixing and homogenization, foam formation and destruction, precipitation of airborne powders, filtration and drying, extraction. Ozonation: Solubility, stability and reactivity of ozone. Antimicrobial properties of ozone. Ozone Treatment System. Food applications.	9
IV	OHMIC HEATING: Ohmic Heating - fundamentals, electrical conductivity. Generic Configurations - Batch Configuration, Transverse Ohmic heating and Collinear Ohmic heating. Product suitability for thermal treatments. Di-electrical Heating: Dielectric properties of foods. Dielectric heating, difference between MW and RF. Microwave heating – working principle. Microwave processing of foods – baking, thawing, drying, pasteurization and sterilization. Radio-frequency heating – material properties, adopting RF technology, heating and drying application.	9
V	NOVEL HYBRID DRYING TECHNOLOGIES: Need for hybrid drying systems. Hybrid systems - Heat pump drying, fluidized bed drying, combined microwave and vacuum drying, infra-red drying, superheated steam drying, pressure regulating drying, rotating jet spouted bed drying. Automation: Automation process control for food industry – introduction. Recent trends in tools of automation – Computer vision systems, On-line sensors, Expert systems, Robot Technology, Computer Integrated manufacturing	9
Total Instructional Hours		45

Course Outcome	CO1	Understand the concepts of high-pressure processing and pulsed electric field and identify their applications in food industry
	CO2	Demonstrate and utilize the concepts of pulsed light technology and irradiation in applications
	CO3	Understand and adapt ultrasound and ozone techniques for foods
	CO4	Illustrate and make use of the concepts of ohmic and dielectric heating in food applications
	CO5	Explain the novel drying techniques and automation in food processing

TEXT BOOK:

- T1 Da-Wen Sun, —Emerging Technologies for Food ProcessingI, 2nd Edition, Elsevier Academic Press, London, 2014.
Howard Q. Zhang, Gustavo V. Barbosa-Canovas, Balasubramaniam V.M., Dunne C. P., Farkas D.F. and Yuan J.T.C., —Non-thermal Processing Technologies for FoodI, 1st Edition, John Wiley and Sons Ltd., UK, 2011.

REFERENCES:

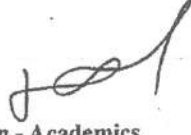
- R1 Han, Jung H., —Packaging for Non-thermal Processing of FoodI, Wiley-Blackwell, Oxford, 2007.



- R2 Mujumdar A.S., —Handbook of Industrial dryingl, 4th Edition, CRC Press, UK, 2014.
R3 Lelieveld H.L.M., —Food Preservation by pulsed electric fields: From research to applicationl, Wood
Head Publishing Ltd., England, 2007.
R4 Yam, Kit L., and Dong Sun Lee, eds. Emerging food packaging technologies: Principles and practice.
Elsevier, 2012.


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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT8309	SEPARATION TECHNIQUES IN FOOD PROCESSING	3	0	0	3

Course Objective The student should be able to
 1 To study the separation techniques in food processing

Unit	DESCRIPTION	Instructional Hours
I	Mechanism of Separation and Filtration Processes: Review of conventional processes. Recent advances in separation techniques based on size, surface properties, ionic properties and other special characteristics of substances. Process concept, theory and equipment used in cross flow filtration, cross flow electro filtration, dual functional filter, Surface based solid - liquid separations involving a second liquid, Sirofloc filter.	9
II	Membrane Separation: Types and choice of membranes, membrane module- Plate and frame, tubular, spiral wound and hollow fibre. Membrane processes - dialysis, reverse osmosis, Nanofiltration, ultrafiltration, Microfiltration and Donnan dialysis. Membrane fouling - cleaning techniques.	9
III	Adsorption and Chromatography: Mechanism, Types and choice of adsorbents, adsorption techniques - pressure swing and temperature swing cycles. Affinity and Immuno-chromatography. Large scale chromatography - theory and general system.	9
IV	Ionic Separation and Permeation: Controlling factors, Applications, Types of equipment employed for electrophoresis, Dielectrophoresis, ion exchange chromatography and electro dialysis. Separations involving pervaporation and permeation techniques for solids, liquids and gases.	9
V	Other Separation Processes: Zone melting, Adductive crystallization, Supercritical fluid extraction, Oil spill Management, Industrial effluent treatment by modern techniques.	9
Total Instructional Hours		45

Course Outcome	CO1 Understand the concepts of separation and filtration techniques
	CO2 Understand and select the suitable membrane process and cleaning techniques
	CO3 Understand the classification of adsorption techniques
	CO4 Understand the concepts of ionic separation and permeation
	CO5 Understand and elaborate other separation processes and effluent treatment

TEXT BOOK:

- T1 Seader J.D., Ernest J. Henley and Keith Roper D., -Separation Process Principles, 3rd Edition, John Wiley and Sons Inc., New York, 2011.
 T2 Roussel Ronald W., -Handbook of Separation Process Technology, John Wiley, New York, 2008

REFERENCES:

- R1 Scott K. and Hughe R., - Industrial Membrane Separation Technology, Blackie Academic and Professional Publications, Glasgow, 1996.
 R2 Schoen H.M., -New Chemical Engineering Separation Techniques, Inter-science Publishers, New York, 1972.
 R3 Humphrey Jimmy L., George E. Keller II., -Separation Process Technology, McGraw-Hill Publishing Company Ltd., USA; 1997.
 R4 Grandison, Alistair S. Separation processes in the food and biotechnology industries. CRC Press, 1996.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT8310	ANALYTICAL INSTRUMENTS IN FOOD INDUSTRIES	3	0	0	3

Course Objective The student should be able to
 1 To learn about the various analytical instruments used for food analysis

Unit	DESCRIPTION	Instructional Hours
I	SPECTROMETRY: Classification of Instrumental methods- Electromagnetic radiation – electromagnetic spectrum, Interaction of electromagnetic radiation with matter. Visible spectrometry and Colorimetry – Theory, Instrumentation (Line diagram alone) and applications. Ultra violet spectroscopy – Theory, instrumentation - Single and Double beam, applications. Infra-red spectroscopy – Theory, Fundamental Vibrations, Instrumentation, Applications.	9
II	ATOMIC ABSORPTION AND NMR SPECTROSCOPY: AAS - Principle, Instrumentation and applications. NMR spectroscopy – Principle, Instrumentation, Chemical shift and applications. Thermal methods: Thermogravimetry, Differential thermal analysis, Differential Scanning Calorimetry – Principle, Instrumentation and Applications	9
III	X-RAY AND FLAME PHOTOMETER: X-ray diffraction - Principle, instrumentation, detectors and applications. Flame photometer - Theory, Instrumentation and applications. Polarimetry- specific rotation, optical activity, Principle and instrumentation. Saccharimetry- Analysis of Sugar.	9
IV	CONDUCTANCE AND POTENTIAL MEASUREMENTS: Definitions, conductance measurements, applications, Types, advantages and disadvantages of Conductometric titrations. Potential measurements, pH determination, Potentiometric Titrations. Basic principles of electrophoresis, theory and application of paper and gel.	9
V	CHROMATOGRAPHIC TECHNIQUES: Introduction, Paper chromatography, Thin Layer Chromatography, Column Chromatography - Gas chromatography, HPLC – reverse phase and normal phase - Principle, Instrumentation and Applications.	9
Total Instructional Hours		45

Course Outcome	CO1	CO2	CO3	CO4	CO5
	CO1- Understand the application of UV-Visible and IR spectroscopy in food analysis	CO2- Understand and make use of AAS, NMR and thermal methods to analyze different food materials	CO3- Understand and apply X- ray diffraction, flame photometers and Polarimetry in food analysis	CO4- Remember and recognize the usage of conductance and potential measurements for analysis of components	CO5- Understand and infer the chromatographic principles to separate and analyze materials

TEXT BOOK:

- T1 1.Chatwal, Gurdeep R., and Anand, Sham K., —Instrumentation Methods of Chemical AnalysisI, 2nd Edition, Himalaya Publications, Bombay, 2003.
 T2 2.Willard H.H, Merritt L.L, Dean J.A, and Settle F.A., —Instrumental Methods of AnalysisI, 7th Edition, CBS Publishers and Distributors, New Delhi, 1988.

REFERENCES:

- R1 1.Skoog Douglas A., West Donald M., Holler F James, and Crouch Stanley R., —Analytical Chemistry: An IntroductionI, 7th Edition, South-Western, Australia, 2000.
 R2 2.Rouessac F., —Chemical Analysis: Modern International Method and TechniquesI, 3rd Edition, Wiley, New Delhi, 1999.
 R3 3.Banwell G.C., —Fundamentals of Molecular SpectroscopyI, 2nd Edition, Tata McGraw-Hill, New Delhi, 1992.
 R4 4. Kress-Rogers, Erika, and Christopher JB Brimelow, eds. Instrumentation and sensors for the food industry. Vol. 65. Woodhead Publishing, 2001.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT8311	ENTREPRENEURSHIP OPPORTUNITIES FOR FOOD TECHNOLOGIST	3	0	0	3

Course Objective **The student should be able to**

1 To Develop the Entrepreneurial skills for Food Technologists
 To Acquire basic knowledge in Trade license and registration marks, Sources of finance,
 Selection of land and factory sheds
 To Impart knowledge on Preparation of project report, Market feasibility reports ,
 Techno-economic feasibility report

Unit	DESCRIPTION	Instructional Hours
I	ENTREPRENEURIAL COMPETENCE: Entrepreneurship concept- Entrepreneurship as a Career- Entrepreneur Personality Characteristics- Knowledge- Skills- Attitude Requirement	9
II	ENTREPRENEURIAL ENVIRONMENT: Business Environment- Role of Family and Society- Entrepreneurship Development Training and Other Support Organizational Services- Central and State Government Industrial Policies and Regulations- International Business	9
III	BUSINESS PLAN PREPARATION: Sources of Product for Business- Prefeasibility Study- Criteria for Selection of Product- Ownership- Capital- Budgeting Project Profile Preparation- Matching Entrepreneur with the Project- Feasibility Report Preparation and Evaluation Criteria	9
IV	LAUNCHING OF SMALL BUSINESS: Finance and Human Resource Mobilization Operations Planning- Market and Channel Selection- Growth Strategies- Product Launching	9
V	MANAGEMENT OF SMALL BUSINESS: Monitoring and Evaluation of Business- Preventing Sickness and Rehabilitation of Business Units- Effective Management of small Business	9
Total Instructional Hours		45

Course Outcome	CO1 Describe the meaning and role of an entrepreneur and the functions
	CO2 Check the policies and regulations for entrepreneurship
	CO3 Generate the business plan and evaluate the feasibility
	CO4 Generate and launch small business plan
	CO5 Apply the guidelines of developed business plan to manage small business

REFERENCES:

- R1 Hisrich, "Entrepreneurship", Tata McGraw Hill, New Delhi, 2005.
- R2 Saravanavel, P., 'Entrepreneurial Development', Ess Pee kay Publishing House, Chennai, 2005
- R3 Khanka, S S., "Entrepreneurial Development", S.Chand and Co Limited, New Delhi, 2001.
- R4 Jain, P C., "Handbook for New Entrepreneurs", Second Edition, Oxford University Press, New Delhi, 2002.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT8313	APPLICATION OF NANOTECHNOLOGY AND CRYOGENICS IN FOOD PROCESSING	3	0	0	3

The student should be able to

Course Objective		involved in
1. Understand the concept of Nanotechnology and nano material synthesis		
2. Impart knowledge on synthesis and characterization techniques involved in Nanotechnology		
3. Learn the principle and application of cryogenics in food processing		

Unit	DESCRIPTION	Instructional Hours
I	BASICS OF NANOTECHNOLOGY AND NANOSTRUCTURES IN FOOD Background- Evolution of new technologies in the food sector- Public perception of nanotechnology food products-Properties of nanomaterials - Nanomaterial for food applications-Nano-sized food ingredients and additives in relation to digestion of food-Natural nanostructures in food-Naturally occurring food nano substances and nanostructure-Designing food nanostructures.	9
II	NANOMATERIALS AND SYNTHESIS METHOD Nanomaterials- Physical properties -mechanical and optical properties- Magnetic and size dependent properties of nanomaterials- Electrical conductivity and photoluminescence properties of nanomaterials- Method of nanomaterials synthesis-mechanical, gas phase and physical vapor deposition-Chemical Synthesis-Nanoparticle size determination by X-ray diffraction technique and dynamic light scattering method for colloidal nanoparticle- Manipulation of nanomaterials by transmission electron microscopy (TEM) and scanning electron microscopy (SEM). Use of Infra-red and magnetic resonance spectroscopy in nanoscience.	9
III	APPLICATIONS OF NANOTECHNOLOGY IN FOOD PROCESSING Nanotechnology in Food Preservation-Nanoemulsion - Nanodispersions-Nanocapsules -Association colloids - Nanocoatings. Nanostructure multilayer emulsions - Biopolymeric nanoparticles - Nano packaging -Nanoplastic - Nanocomposites - Active packaging - Intelligent packaging - Biodegradable Nano packaging - Nanofibers - Nanosensors. Ethical issues in nanotechnology - socio-economic issues - Benefits, challenges and future of nanotechnology.	9
IV	INTRODUCTION TO CRYOGENICS Cryogenics and its applications- Properties of cryogenic fluids- Properties of materials at cryogenic temperature- Gas-Liquefaction and Refrigeration Systems- Gas Separation- Cryocoolers- Cryogenic Insulations- Vacuum Technology- Instrumentation in Cryogenics- Liquid storage and transfer systems- Cryostat design- Dilution Refrigerator and Adiabatic Demagnetization.	9
V	APPLICATIONS OF CRYOGENICS IN INDUSTRIES Advances in Cryogenics- Vortex tube and applications- Pulse tube refrigerator- Cryogenic Engine for space vehicles- Cryogenic Applications- gas industry- cryogenic fluids-space research- Cryobiology- food processing- chemical processing- cryogenic power generation, medicine, analytical physics and chemistry.	9
Total Instructional Hours		45

Course Outcome	
CO1	Acquire knowledge about current trends and future aspects in the field of Nanotechnology
CO2	Identify the synthesis methods to produce nano materials
CO3	Apply the function of Nanotechnology in Food processing and assess its socio-economic issue
CO4	Differentiate the types of cryogenics based on its applications
CO5	Apply and analyze the necessitate of cryogenics in food industries

REFERENCES:

- R1 Kenneth David & Paul Thompson. What Can Nanotechnology Learn From Biotechnology, ISBN, 2008
Qasim chaudhry, Laurence castle and Richard Watkins.. Text book on Nanotechnologies in food, RSC
- R2 Nano science and Nano technology, published by the Royal society of chemistry, ISBN 978-0-85404-169-5, 2010
- R3 RE hester and R.M Harrison.. Nanotechnology, Consequences for Human Health and the Environment,



ISBN: 978-0-85404-216-6, 2007

- R4 Peter JM Bartos, John J Hughes, Pavel Trtik.: Nanotechnology in construction, ISBN: 978-0-85404-623-2, 2004
- R5 Randall F. Barron, Cryogenics Systems, Second Edition Oxford Univesity Press New York, Clarendon Press, Oxford, 1985.
- R6 Timmerhaus, Flynn, Cryogenics Process Engineering , Plenum Press, New York.

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Course Code & Name : 22EE2231/BASICS OF ELECTRICAL ENGINEERING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	3	2
CO2	3	3	2	2	1	1	1	-	1	-	2	2	3	1
CO3	3	3	2	2	2	1	1	-	1	-	1	2	2	2
CO4	3	2	3	1	3	1	1	-	1	-	1	2	2	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	2	1
Avg	3	2.6	2.6	1.6	2.2	1	1	-	1	-	1.6	2.2	2.4	1.4

Course Code & Name: 22FT2151/BIO CHEMISTRY

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2			3	2	3				3		2	3	2
CO2	3	2		2	3		2							3	2
CO3	2	1	3	2			2						1	3	1
CO4	3	2	1	2									1	3	1
CO5	2	3	3				1							2	2
Avg	2.5	2	2.3	2	3	2	2				3		1.3	2.8	1.6

Course Code & Name : 22HE2151/ EFFECTIVE TECHNICAL COMMUNICATION

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1		2			1		1	3		1		2	1
CO2	2	1				2	2	2	3		2		1	1
CO3	2		1			2		1	3		2		1	1
CO4	1	2				1		1	3		1		1	1
CO5	1			2		1		1	3		2		1	1
Avg	1.4	1.5	1.5	2		1.4	2		3		1.6		1.2	1

Semester – III R 2019

Course Code & Name: 21MA3102 Fourier Analysis and Transforms

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	1	2	-	-	-	-	-	-	2	3	1
CO2	3	3	3	2	1	-	-	-	-	-	-	3	2	3
CO3	3	3	3	1	1	-	-	-	-	-	-	2	2	2
CO4	3	3	3	1	2	2	-	-	-	-	-	2	2	2
CO5	3	3	3	2	1	1	-	-	-	-	-	2	2	3
Avg	3	2.8	3	1.4	1.4	2	-	-	-	-	-	2.2	2.2	2.2



PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	1	2	-	-	-	-	-	-	2	3	1
CO2	3	3	3	2	1	-	-	-	-	-	-	3	2	3
CO3	3	3	3	1	1	-	-	-	-	-	-	2	2	2
CO4	3	3	3	1	2	2	-	-	-	-	-	2	2	2
CO5	3	3	3	2	1	1	-	-	-	-	-	2	2	3
Avg	3	2.8	3	1.4	1.4	2	-	-	-	-	-	2.2	2.2	2.2

Course Code & Name: 21FT3201 Fluid Mechanics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1										1	1	1
CO2	2	2	1									1	1	1
CO3	3	2	1	1		1						1	1	1
CO4	3	2	1	2		1						1	1	1
CO5	3	2	1	1		1						1	1	1
Avg	2.8	1.8	1	1.3		1						1	1	1

Course Code & Name: 21FT3101 Principles of Thermodynamics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2										2	1	1
CO2	2	2	1									2	2	1
CO3	3	2	3	1		1						1	2	1
CO4	3	2	2	2		1						1	1	1
CO5	3	2	1	1		1						1	1	1
Avg	2.8	1.8	1	1.3		1						1	1	1

Course Code & Name: 21FT3202 Food Microbiology

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2												1	1
CO2		2											1	1
CO3		2	2	2	2								1	1
CO4			2	2									1	1
CO5		2	2	2	2								1	1
Avg	2.8	1.8	1	1.3		1						1	1	1



Course Code & Name: 21FT3251 Bio Chemistry

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		2			3	2	3				3		2	3
CO2	3	2		2	3		2							3
CO3	2	1	3	2			2						1	3
CO4	3	2	1	2									1	3
CO5	2	3	3				1							2
Avg	2.5	2	2.3	2	3	2	2				3		1.3	2.8

Course Code & Name: 21FT3001/Food Microbiology Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	2		2					2	2	2
CO2	2	2	2	2	2		2					2	2	2
CO3	2	1	2	2	2		2					2	2	2
Avg	2	1.7	1.7	2	2		2					2	2	2

Course Code & Name: 21FT3002/Food Production Analysis Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	1	1	2	2	2	-	1	1	-	2	3	1
CO2	2	1	1	1	2	2	2	-	1	1	-	2	2	1
CO3	2	2	1	1	2	2	2	-	1	1	-	2	1	-
Avg	2	1	1	1	2	2	2	-	1	1	-	2	1.2	0.4

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Course Code & Name: 21FT4201/Fundamentals of Heat and Mass Transfer

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1		1	1	1				1			2	1	2
CO2	1	2	2	1	1							1		2
CO3	1	1		1	1							2		3
CO4	1	1	1	1	1							1		2
CO5	1	1	3	1								2		3
Avg	1	1.25	1.75	1	4				1			1.6	1	2.4

Course Code & Name: 21FT4204/REFRIGERATION AND COLD CHAIN MANGEMENT

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2



CO1	1		1	1	1				2			2	3	2
CO2	1	2	2	2	1							3		3
CO3	1	1		2	3							3		3
CO4	1	1	2	2	1							1		2
CO5	1	1	3	1								2		3
Avg	1	1.25	2	1.6	1.5				2			2.2	3	2.6

Course Code & Name: 21FT4203/ENGINEERING PROPERTIES OF FOOD MATERIALS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2										3	2
CO2	3		2			2							3	2
CO3		1	2	2										3
CO4	3		2									2		3
CO5	1	3	3	3								2		3
Avg	2	1.2	2.2	2.5		2						2	3	2.6

Course Code & Name: 21FT4251/FOOD CHEMISTRY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	1	1		1	1	2				1	1	2
CO2	2	1	2	2		1	1					2	1	2
CO3	3	3	2	3		1	1	1				2	1	2
CO4	2	3	2	1		1	1					2	1	2
CO5	2	1	2	3		1	1	3			1	3	1	2
Avg	2.8	1.8	1	1.3		1						1	1	1

Course Code & Name: 21MA4152 STATISTICS AND NUMERICAL METHODS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	1	2	-	-	-	-	-	-	2	3	2
CO2	3	3	3	2	1	-	-	-	-	-	-	3	2	2
CO3	3	3	3	1	1	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	2



Avg	3	2.8	3	2	2								2.2	2.2	2
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Course Code & Name: 21FT4001/UNIT OPERATIONS LABORATORY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2		1					3			2		
CO2	1		2						3			2		
CO3	1		3	2	2				2			2		
CO4	2				2				2			3	2	
CO5	2	1		2					3			3	2	
Avg	1.6	1.5	2.5	1.7	2				2.6			2.4	2	

Course Code & Name: 21FT4002 /FOOD PROCESS EQUIPMENT DESIGN LABORATORY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3							3			3		3
CO2	2		2						3			2		3
CO3	2		2						3			2		3
Avg	2.33	3	2						3			2.3		3

Course Code & Name: 19FT5202/FOOD ADDITIVES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1			3			2	1	1				1	3	1
CO2	1		2			2		1				1	2	1
CO3	1		3			2		1				1	2	1
CO4			3			2	1	1				1	2	1
CO5	1		3			2	1	1				1	2	1
Avg	1		2.8			2	1	1				1	2.2	1

Course Code & Name: 19FT5203/POULTRY, MEAT AND FISH PROCESS TECHNOLOGY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO	PSO



													1	2
CO1		2			3	2	3				3		2	3
CO2	2	3	3	2	3		2							3
CO3	2	3	3	1			2						1	3
CO4	3	2	1	2									1	3
CO5	2	3	3				1							2
Avg	2.25	2.75	2.5	1.66	3		1.6						1	2.75

Course Code & Name: 19FT5204 PRINCIPLES OF FOOD PROCESSING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2										3	2
CO2	3	1	2			2							3	2
CO3		1	2	2									3	1
CO4	3		2									1	3	2
CO5	1	3	3	3								1	3	2
Avg	2.5	1.75	2.2	2.5	0	2						1	3	1.8

Course Code & Name: 19FT5205/UNIT OPERATIONS IN FOOD PROCESSING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1		1	1	1				1			2	1	2
CO2	1	2	2	1	1							1	1	2
CO3	1	1		1	1							2		3
CO4	1	1	1	1	1							1		2
CO5	1	1	3	1								2		3
Avg	1	1.25	1.75	1	1				1			1.6	1	2.4

Course Code & Name: 19FT5301 TECHNOLOGY OF FATS AND OILS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1	-	-	-	-	-	-	-	-	1	2	-
CO2	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO3	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO4	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO5	1	2	2	-	-	-	2	-	-	1	-	1	3	-
Avg	1	2	1.2				1.25			1		1	1.6	

Course Code & Name: 19FT5302/FOOD STORAGE AND INFESTATION CONTROL

PO&	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO	PO	PO		



PSO										10	11	12	PSO 1	PSO 2
CO1	1	2	1	-	-	-	-	-	-	-	-	1	2	-
CO2	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO3	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO4	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO5	1	2	2	-	-	-	2	-	-	1	-	1	3	-
Avg	1	2	1.2				1.25			1		1	1.6	

Course Code & Name: 19FT5303/FOOD PROCESS CALCULATIONS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1	-	-	-	-	-	-	-	-	1	2	-
CO2	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO3	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO4	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO5	1	2	2	-	-	-	2	-	-	1	-	1	3	-
Avg	1	2	1.2				1.25			1		1	1.6	

Course Code & Name: 19FT5304/POST-HARVEST TECHNOLOGY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1	-	-	-	-	-	-	-	-	1	2	-
CO2	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO3	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO4	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO5	1	2	2	-	-	-	2	-	-	1	-	1	3	-
Avg	1	2	1.2				1.25			1		1	1.6	

Course Code & Name: 19FT5305/CANE SUGAR TECHNOLOGY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1	-	-	-	-	-	-	-	-	1	2	-
CO2	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO3	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO4	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO5	1	2	2	-	-	-	2	-	-	1	-	1	3	-
Avg	1	2	1.2				1.25			1		1	1.6	

Course Code & Name: 19FT5306/MILLING TECHNOLOGY FOR FOOD MATERIALS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
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CO1	1	2	1	-	-	-	-	-	-	-	-	1	2	-
CO2	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO3	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO4	1	2	1	-	-	-	1	-	-	1	-	1	1	-
CO5	1	2	2	-	-	-	2	-	-	1	-	1	3	-
Avg	1	2	1.2				1.25			1		1	1.6	

**Course Code & Name: 19FT5001/BAKING AND CONFECTIONERY TECHNOLOGY
LABORATORY**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	1	1		1	1	2				1	1	1
CO2	2	1	2	2		1	1					2	1	2
CO3	3	3	2	3		1	1	1				2	1	2
CO4	2	3	2	1		1	1					2	1	2
CO5	2	1	2	3		1	1	3			1	3	3	3
Avg	2.25	2	2	2.25		1	1	2			1	2.25 5	1.5	2.25

Course Code & Name: 19FT5002/UNIT OPERATIONS IN FOOD PROCESSING LABORATORY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2										3	2
CO2	3	1	2										3	2
CO3		1	2	2									3	1
CO4	3		2									1	3	2
CO5	1	3	3	3								1	3	2
Avg	2.5	1.75	2.2	2.5								1	3	1.8

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Course Code & Name: 19FT6201/ DAIRY ENGINEERING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	1	2	2	-			-	1	1	1	2
CO2	3	2	3	1	2	2	1				2	1	1	2
CO3	3	2	3	1	2	2	1				1	1	1	2
CO4	3	2	3	1	2	2	1				2	1	1	2
CO5	3	2	3	1	2	2	2				2	1	1	2
Avg	3	2	3	1	2	2	1.25				1.7 5	1	1	2

**Course Code & Name: 19FT6202/PLANTATION CROPS AND SPICES PRODUCTS
TECHNOLOGY**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO	PSO



													1	2
CO1	3	2	2										3	2
CO2	3		2			2							3	2
CO3		1	2	2										3
CO4	3		2									2		3
CO5	1	3	3	3								2		3
Avg	3	1	2	2		2						2	3	2.6

Course Code & Name: 19FT6203/FRUITS AND VEGETABLE PROCESSING TECHNOLOGY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2										3	2
CO2	3	1	2			2							3	2
CO3		1	2	2									3	1
CO4	3		2									1	3	2
CO5	1	3	3	3								1	3	2
Avg	2.5	1.75	2.2	2.5		2						1	3	1.8

Course Code & Name: 19FT6181/PROFESSIONAL ETHICS IN ENGINEERING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2										3	2
CO2	3		2			2							3	2
CO3		1	2	2										3
CO4	3		2									2		3
CO5	1	3	3	3								2		3
Avg	2.3	2	2.25	2.5		2						2	3	2.75

Course Code & Name: 19FT6301/BEVERAGE TECHNOLOGY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1									1	1	
CO2	1	2	1				1			1		2	1	
CO3	1	2	1				1			1		1	1	
CO4	1	2	1				1			1		1	1	
CO5	1	2	2				2			1		1	3	
Avg	1	2	1.2				1.25			1		1	1.4	

Course Code & Name: 19FT6302 R/TECHNOLOGY OF SNACK AND EXTRUDED FOODS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1									1	1	



CO2	1	2	1				1			1		2	1	
CO3	1	2	1				1			1		1	1	
CO4	1	2	1				1			1		1	1	
CO5	1	2	2				2			1		1	3	
Avg	1	2	1.2				1.25			1		1	1.4	

Course Code & Name: 19FT6303/FOOD BIOTECHNOLOGY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1									1	1	
CO2	1	2	1				1			1		2	1	
CO3	1	2	1				1			1		1	1	
CO4	1	2	1				1			1		1	1	
CO5	1	2	2				2			1		1	3	
Avg	1	2	1.2				1.25			1		1	1.4	

Course Code & Name: 19FT6304/BIOPROCESS ENGINEERING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1									1	1	
CO2	1	2	1				1			1		2	1	
CO3	1	2	1				1			1		1	1	
CO4	1	2	1				1			1		1	1	
CO5	1	2	2				2			1		1	3	
Avg	1	2	1.2				1.25			1		1	1.4	

Course Code & Name: 19FT6305/ENZYME TECHNOLOGY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1									1	1	
CO2	1	2	1				1			1		2	1	
CO3	1	2	1				1			1		1	1	
CO4	1	2	1				1			1		1	1	
CO5	1	2	2				2			1		1	3	
Avg	1	2	1.2				1.25			1		1	1.4	

Course Code & Name: 19FT6306/CROP PROCESS ENGINEERING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1									1	1	
CO2	1	2	1							1		2	1	



CO3	1	2	1				1			1		1	1	
CO4	1	2	1				1			1		1	1	
CO5	1	2	2				2			1		1	3	
Avg	1	2	1.2				1.25			1		1	1.4	

Course Code & Name: 19FT6401/TRADITIONAL FOODS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	1	1	2	-	-	-	1	1	2
CO2	2	1	2	2	-	1	1		-	-	-	2	1	2
CO3	3	3	2	3	-	1	1	1	-	-	-	2	1	2
CO4	2	3	2	1	-	1	1		-	-	-	2	1	2
CO5	2	1	2	3	-	1	1	3	-	-	1	3	3	2
Avg	2.2	2.0	1.8	2	-	1	1	2	-	-	1	2	1.4	3

Course Code & Name: 19FT6001/DAIRY ENGINEERING LABORATORY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	-	-	1	1	-	1	1	-	1	2	-
CO2	1	1	1	-	1	1	1	-	1	1	-	1	2	-
CO3	1	2	1	-	-	1	1	-	1	1	-	1	1	-
CO4	2	2	2	1	1	1	1	-	1	1	-	1	1	2
CO5	2	2	3	1	1	1	1	-	1	1	-	1	1	-
Avg	1.5	1.75	1.75	1	1	1	1		1	1		1	1.25	2

Course Code & Name: 19FT6002/FRUITS AND VEGETABLE PROCESSING TECHNOLOGY LABORATORY

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	2		2					2	2	2
CO2	2	1	2	2	2		2					2	3	2
CO3	2	2	2	2	2		2					2	2	2
Avg	2	1.5	2	2	2		2					2	2.5	2

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Course Code & Name: 19FT7201/Food Analysis and Quality Control

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2



CO1	3	3	2	3	3	2	2		2	1		3	3	1
CO2	3	3	2	3	3	2	2		2	1		3	3	1
CO3	2	3	2	2	1	3	1		2	3	1	3	3	3
CO4	1	3	1	2		3	1		2	3	1	3	3	2
CO5	2	2	1	1	1	3	1		2	1	1	3	3	2
Avg	2.2	2.8	1.6	2.2	2	2.6	1.4		2	1.8	1	3	3	1.8

Course Code & Name: 19FT7202/Food Packaging

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	-	2	3	1	2	2	-	-	-	-	1	1	1
CO2	1	-	2	2	2	2	2	-	-	-	-	1	2	1
CO3	1	-	2	1	1	2	2	-	-	-	-	1	2	1
CO4	1	-	2	2	2	2	2	-	-	-	-	1	1	1
CO5	1	-	3	2	2	2	2	-	-	-	-	1	2	1
Avg	1	-	2.2	2	1.6	2	2	-	-	-	-	1	1.6	1

Course Code & Name: 19FT7203 Food Plant Layout and Management

PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O 2	
CO1	3	2	3	2	1	1	-	1	1	-	1	1	1	2	3
CO2	3	2	3	2	1	1	1	1	3	1	2	1	1	2	3
CO3	3	2	3	2	1	1	1	1	1	1	1	1	1	2	3
CO4	3	2	3	2	1	1	1	1	1	1	2	1	1	2	2
CO5	3	2	3	2	1	1	2	1	1	1	2	1	1	2	2
Avg	3	2	3	2	1	1	1.25	1	1.5	1	1.75	1	1	2	3

Course Code & Name: 19FT7301/FUNCTIONAL FOODS AND NUTRACEUTICALS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2			2							3	2
CO2	3	1	2										3	2
CO3		1	2	2									3	1
CO4	3		2										3	2
CO5	1	3	3	3									3	2
Avg	2.5	1.75	2.4	2.5		2							3	1.8

Course Code & Name: 19FT7302/BIOLOGY AND CHEMISTRY OF FOOD FLAVORS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2			2							3	2
CO2	3	1	2										3	2
CO3		1	2	2									3	1



CO4	3		2										3	2
CO5	1	3	3	3									3	2
Avg	2.5	1.75	2.4	2.5		2							3	1.8

Course Code & Name: 19FT7303/FOOD TOXICOLOGY AND ALLERGY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2			2							3	2
CO2	3	1	2										3	2
CO3		1	2	2									3	1
CO4	3		2										3	2
CO5	1	3	3	3									3	2
Avg	2.5	1.75	2.4	2.5		2							3	1.8

Course Code & Name: 19FT7304/ADVANCED DRYING TECHNOLOGY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2			2							3	2
CO2	3	1	2										3	2
CO3		1	2	2									3	1
CO4	3		2										3	2
CO5	1	3	3	3									3	2
Avg	2.5	1.75	2.4	2.5		2							3	1.8

Course Code & Name: 19FT7305/CEREAL TECHNOLOGY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2			2							3	2
CO2	3	1	2										3	2
CO3		1	2	2									3	1
CO4	3		2										3	2
CO5	1	3	3	3									3	2
Avg	2.5	1.75	2.4	2.5		2							3	1.8

Course Code & Name: 19FT7306/PROCESSING TECHNOLOGY OF LEGUMES AND OILSEEDS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2			2							3	2
CO2	3	1	2										3	2
CO3		1	2	2									3	1



CO4	3		2										3	2
CO5	1	3	3	3									3	2
Avg	2.5	1.75	2.4	2.5		2							3	1.8

Course Code & Name: 19FT7307/EMERGING NON-THERMAL PROCESSING OF FOODS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2			2							3	2
CO2	3	1	2										3	2
CO3		1	2	2									3	1
CO4	3		2										3	2
CO5	1	3	3	3									3	2
Avg	2.5	1.75	2.4	2.5		2							3	1.8

Course Code & Name: 19FT7001/FOOD PACKAGING LABORATORY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	-	1	-	-	-	-	3	-	-	2	-	1
CO2	1	-	2	-	-	-	-	-	3	-	-	2	-	2
CO3	1	-	3	2	2	-	-	-	2	-	-	2	-	-
CO4	2	-	-	-	2	-	-	-	2	-	-	3	2	2
CO5	2	1	-	2	-	-	-	-	3	-	-	3	2	3
Avg	1.6	1.5	2.5	1.7	2	-	-	-	2.6	-	-	2.4	2	2

Course Code & Name: 19FT7002/FOOD ANALYSIS AND QUALITY CONTROL LABORATORY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	1	1						2	3	3
CO2	3	3	2	2	1	1						2	3	3
CO3	3	3	2	2	1	1						2	3	3
CO4	3	3	2	2	1	1						2	3	3
CO5	3	3	2	2	1	1						2	3	3
Avg	3	3	2	2	1	1						2	3	3

Course Code & Name: 19FT7401/POST-HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	2	2	2		2			3	3	3
CO2	3	2	2	2	1	2	2		2	1		3	3	1
CO3	3	2	2	2	2	2	1		2	1		3	3	2
CO4	2	2	1	1	1	2	1		2	1		3	3	2
CO5	3	2	2	2	1				2	1		3	3	2



Avg	2.8	2.2	1.8	1.8	1.4	2.2	1.4		2	1		3	3	2
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SEMESTER VIII R2019

Course Code & Name: 19FT8301/FOOD PROCESS ECONOMICS AND INDUSTRIAL MANAGEMENT

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	1	1
CO2	3	3	2	2	1	1	1	-	1	-	2	2	1	1
CO3	3	3	2	-	2	1	1	-	1	-	1	2	1	1
CO4	3	2	-	1	3	1	1	-	1	-	1	2	1	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	1	1
Avg	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1

Course Code & Name: 19FT8302/FOOD LAWS AND SAFETY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	1	1
CO2	3	3	2	2	1	1	1	-	1	-	2	2	1	1
CO3	3	3	2	-	2	1	1	-	1	-	1	2	1	1
CO4	3	2	-	1	3	1	1	-	1	-	1	2	1	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	1	1
Avg	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1

Course Code & Name: 19FT8303/WASTE MANAGEMENT AND BY-PRODUCT UTILIZATION IN FOOD INDUSTRIES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	1	1
CO2	3	3	2	2	1	1	1	-	1	-	2	2	1	1
CO3	3	3	2	-	2	1	1	-	1	-	1	2	1	1
CO4	3	2	-	1	3	1	1	-	1	-	1	2	1	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	1	1
Avg	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1

Course Code & Name: 19FT8304/INSTRUMENTATION AND PROCESS CONTROL

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	1	1
CO2	3	3	2	2	1	1	1	-	1	-	2	2	1	1
CO3	3	3	2	-	2	1	1	-	1	-	1	2	1	1



CO4	3	2	-	1	3	1	1	-	1	-	1	2	1	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	1	1
Avg	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1

Course Code & Name: 19FT8305/ECONOMICS AND MANAGEMENT

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	1	1
CO2	3	3	2	2	1	1	1	-	1	-	2	2	1	1
CO3	3	3	2	-	2	1	1	-	1	-	1	2	1	1
CO4	3	2	-	1	3	1	1	-	1	-	1	2	1	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	1	1
Avg	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1

Course Code & Name: 19FT8312/TOTAL QUALITY MANAGEMENT

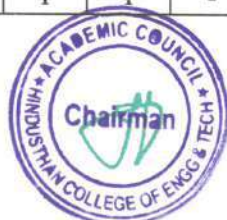
PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	1	1
CO2	3	3	2	2	1	1	1	-	1	-	2	2	1	1
CO3	3	3	2	-	2	1	1	-	1	-	1	2	1	1
CO4	3	2	-	1	3	1	1	-	1	-	1	2	1	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	1	1
Avg	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1

Course Code & Name: 19FT8306/Food process plant layout and safety

PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	1	1
CO2	3	3	2	2	1	1	1	-	1	-	2	2	1	1
CO3	3	3	2	-	2	1	1	-	1	-	1	2	1	1
CO4	3	2	-	1	3	1	1	-	1	-	1	2	1	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	1	1
Avg	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1

Course Code & Name: 19FT8307/Energy Management in Process Industries

PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	1	1
CO2	3	3	2	2	1	1	1	-	1	-	2	2	1	1



CO3	3	3	2	-	2	1	1	-	1	-	1	2	1	1
CO4	3	2	-	1	3	1	1	-	1	-	1	2	1	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	1	1
Avg	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1

Course Code & Name: 19FT8308/Emerging Technologies in Food Processing

PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	1	1
CO2	3	3	2	2	1	1	1	-	1	-	2	2	1	1
CO3	3	3	2	-	2	1	1	-	1	-	1	2	1	1
CO4	3	2	-	1	3	1	1	-	1	-	1	2	1	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	1	1
Avg	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1

Course Code & Name: 19FT8309/Separation Techniques in Food Processing

PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	1	1
CO2	3	3	2	2	1	1	1	-	1	-	2	2	1	1
CO3	3	3	2	-	2	1	1	-	1	-	1	2	1	1
CO4	3	2	-	1	3	1	1	-	1	-	1	2	1	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	1	1
Avg	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1

Course Code & Name: 19FT8310/Analytical Instruments in Food Industries

PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	1	1
CO2	3	3	2	2	1	1	1	-	1	-	2	2	1	1
CO3	3	3	2	-	2	1	1	-	1	-	1	2	1	1
CO4	3	2	-	1	3	1	1	-	1	-	1	2	1	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	1	1
Avg	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1

Course Code & Name: 19FT8313/Application of Nanotechnology and Cryogenics

PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO	PSO



													1	2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	1	1
CO2	3	3	2	2	1	1	1	-	1	-	2	2	1	1
CO3	3	3	2	-	2	1	1	-	1	-	1	2	1	1
CO4	3	2	-	1	3	1	1	-	1	-	1	2	1	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	1	1
Avg	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1

Course Code & Name: 19FT8311/Entrepreneurship Opportunities for Food Technologists

PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	1	1
CO2	3	3	2	2	1	1	1	-	1	-	2	2	1	1
CO3	3	3	2	-	2	1	1	-	1	-	1	2	1	1
CO4	3	2	-	1	3	1	1	-	1	-	1	2	1	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	1	1
Avg	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1

Mapping of Course Outcome and Programme Outcome:

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	
I	I	22MA1101/ MATRICES AND CALCULUS	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2	
		22ME1152/ ENGINEERING DRAWING	3	2.6	1	1	2	1	-	-	1	1	1	1	1	1.4	3
		22PH1151/ PHYSICS FOR NON-CIRCUIT ENGINEERS	2.6	2.6	1.6	2.2	1	1	-	1	-	1.6	2.2	2.4	1.4	2.6	
		22HE1151 / ENGLISH FOR ENGINEERS	1	-	-	1	1	1.6	2.2	2.4	3	1	1.2	1	2	1	
		22CS1151/ PYTHON PROGRAMMING PRACTICES	3	3	-	2	-	-	-	2	-	-	2	2	2	2	3
Year	Se m	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO 9	PO 10	PO 11	PO 12			
I	II	22MA2105/ PARTIAL DIFFERENTIAL EQUATION, FOURIER SERIES AND TRANSFORMS	2.8	3	2	2							2.2	2.2	2	2.8	
		22CY2101/ ENVIRONMENTAL STUDIES	2	2	2	2	1	1	-	-	-	-	1	1	1	2	
		22PH2101/ 	2.4	1.2	1.8				1.5				1	2			2.4



		BASICS OF MATERIAL SCIENCE															
		22EE2231/BASICS OF ELECTRICAL ENGINEERING	2.6	2.6	1.6	2.2	1	1	-	1	-	1.6	2.2	2.4	1.4	2.6	
		22FT2151/BIO CHEMISTRY	2.5	2	2.3	2	3	2	2				3		1.3	2.8	
		22HE2151/EFFECTIVE TECHNICAL COMMUNICATION	1.4	1.5	1.5	2		1.4	2		3		1.6		1.2	1	
		ENGINEERING PRACTICES	3		3		3					1					
Year	Sem	Course Code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
II	III	21MA3102 FOURIER ANALYSIS AND TRANSFORMS	3	2.8	3	1.4	1.4	2	-	-	-	-	-	2.2	2.2	2.2	
		21FT3201 FLUID MECHANICS	2.8	1.8	1	1.3		1							1	1	1
		21FT3101 PRINCIPLES OF THERMODYNAMICS	2.8	1.8	1	1.3		1							1	1	1
		21FT3202 FOOD MICROBIOLOGY	2.8	1.8	1	1.3		1							1	1	1
		21FT3251 BIO CHEMISTRY	2.5	2	2.3	2	3	2	2	2				3		1.3	2.8
		21FT3001 FOOD MICROBIOLOGY LABORATORY	2	1.7	1.7	2	2		2						2	2	2
		21FT3002 FOOD PRODUCTION ANALYSIS LABORATORY	2	1	1	1	2	2	2	2	-	1	1	-	2	1.2	0.4
Year	Sem	COURSE CODE & NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
II	IV	21FT4201 FUNDAMENTALS OF HEAT AND MASS TRANSFER	1	1.25	1.75	1	4				1				1.6	1	2.4
		21FT4204 REFRIGERATION AND COLD CHAIN MANAGEMENT	1	1.25	2	1.6	1.5					2			2.2	3	2.6
		21FT4203 ENGINEERING PROPERTIES OF FOOD MATERIALS	2	1.2	2.2	2.5		2							2	3	2.6
		21FT4251 FOOD	2.8	1.8	1	1.3		1							1	1	1



Year	Sem	COURSE CODE & NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
		CHEMISTRY															
		21MA4152 STATISTICS AND NUMERICAL METHOD	3	2.8	3	2	2								2.2	2.2	2
		21FT4001 UNIT OPERATIONS LABORATORY	1.6	1.5	2.5	1.7	2				2.6				2.4	2	
		21FT4002 FOOD PROCESS EQUIPMENT DESIGN LABORATORY	2.3 3	3	2						3				2. 3		3
Year	Sem	COURSE CODE & NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
II	V	19FT5201 BAKING AND CONFECTIONERY TECHNOLOGY	3	2	3	1	2	2	1.25				1.75	1	1	2	
		19FT5202 FOOD ADDITIVES	1		2.8			2	1	1				1	2.2	1	
		19FT5203 POULTRY, MEAT AND FISH PROCESS TECHNOLOGY	2.25	2.75	2.5	1.66	3		1.6						1	2.75	
		19FT5204 PRINCIPLES OF FOOD PROCESSING	2.5	1.75	2.2	2.5	0	2						1	3	1.8	
		19FT5205 UNIT OPERATIONS IN FOOD PROCESSING	1	1.25	1.75	1	1				1			1.6	1	2.4	
		19FT530 TECHNOLOGY OF FATS AND OILS	1	2	1.2				1.25			1		1	1.6		
		19FT5302/FOOD STORAGE AND INFESTATION CONTROL	1	2	1.2				1.25			1		1	1.6		
		19FT5303/FOOD PROCESS CALCULATIONS	1	2	1.2				1.25			1		1	1.6		
		19FT5304/POST-HARVEST TECHNOLOGY	1	2	1.2				1.25			1		1	1.6		
		19FT5305/CANE SUGAR TECHNOLOGY	1	2	1.2				1.25			1		1	1.6		
		19FT5306 MILLING TECHNOLOGY FOR FOOD MATERIALS	1	2	1.2				1.25			1		1	1.6		
		19FT5001 BAKING AND CONFECTIONERY TECHNOLOGY LABORATORY	2.25	2	2	2.25		1	1	2			1	2.25	1.5	2.25	
		19FT5002 UNIT OPERATIONS IN	2.5	1.75	2.2	2.5								1	3	1.8	



Year	Sem	COURSE CODE & NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		FOOD PROCESSING LABORATORY														
		19FT6201 DAIRY ENGINEERING	3	2	3	1	2	2	1.25				1.75	1	1	2
		19FT6202 PLANTATION CROPS AND SPICES PRODUCTS TECHNOLOGY	3	1	2	2		2						2	3	2.6
		19FT6203 FRUITS AND VEGETABLE PROCESSING TECHNOLOGY	2.5	1.75	2.2	2.5		2						1	3	1.8
		19FT6181 PROFESSIONAL ETHICS IN ENGINEERING	2.3	2	2.25	2.5		2						2	3	2.75
		19FT6301 BEVERAGE TECHNOLOGY	1	2	1.2				1.25			1		1	1.4	
		19FT6302R/ TECHNOLOGY OF SNACK AND EXTRUDED FOODS	1	2	1.2				1.25			1		1	1.4	
		19FT6303/FOOD BIOTECHNOLOGY	1	2	1.2				1.25			1		1	1.4	
		19FT6304/ BIOPROCESS ENGINEERING	1	2	1.2				1.25			1		1	1.4	
		19FT6305 /ENZYME TECHNOLOGY	1	2	1.2				1.25			1		1	1.4	
		19FT6306/CROP PROCESS ENGINEERING	1	2	1.2				1.25			1		1	1.4	
		19FT6401 TRADITIONAL FOODS	2.2	2.0	1.8	2	-	1	1	2	-	-	1	2	1.4	3
		19FT6001 DAIRY ENGINEERING LABORATORY	1.5	1.75	1.75	1	1	1	1		1	1		1	1.25	2
		19FT6002 FRUITS AND VEGETABLE PROCESSING TECHNOLOGY LABORATORY	2	1.5	2	2	2		2					2	2.5	2
Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
IV	VI I	19FT7201 Food Analysis and Quality Control	2.2	2.8	1.6	2.2	2	2.6	1.4		2	1.8	1	3	3	1.8



		19FT7202 Food Packaging	2.2	2.8	1.6	2.2	2	2.6	1.4		2	1.8	1	3	3	
		19FT7203 Food Plant Layout and Management	3	2	3	2	1	1	1.25	1	1.5	1	1.75	1	1	2
		19FT7301/FUN CTIONAL FOODS AND NUTRACEUTI CALS	3	2	3	2	1	1	1.25	1	1.5	1	1.75	1	1	2
		19FT7302/BIO LOGY AND CHEMISTRY OF FOOD FLAVORS	3	2	3	2	1	1	1.25	1	1.5	1	1.75	1	1	2
		19FT7303/FOO D TOXICOLOG Y AND ALLERGY	3	2	3	2	1	1	1.25	1	1.5	1	1.75	1	1	2
		19FT7304/AD VANCED DRYING TECHNOLOG Y	3	2	3	2	1	1	1.25	1	1.5	1	1.75	1	1	2
		19FT7305/CER EAL TECHNOLOG Y	3	2	3	2	1	1	1.25	1	1.5	1	1.75	1	1	2
		19FT7307 Emerging Non- Thermal Processing of Foods	2.5	1.75	2.4	2.5		2							3	1.8
		19XX7401 Open Elective – II	2.8	2.2	1.8	1.8	1.4	2.2	1.4		2	1*		3	3	2
		19FT7001 Food Packaging Laboratory	1.6	1.5	2.5	1.7	2	-	-	-	2.6	-	-	2.4	2	2
		19FT7002 Food Analysis and Quality Control Laboratory	3	3	2	2	1	1						2	3	3
Year	Se m	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P O 10	P O 11	P O 12	PSO 1	PSO2
IV		19FT8301/FOO D PROCESS ECONOMICS AND INDUSTRIAL MANAGEME NT	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1
		19FT8302/FOO D LAWS AND SAFETY	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1
	VI II	19FT8303/WA STE MANAGEME NT AND BY- PRODUCT UTILIZATION IN FOOD	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1



MANAGEMENT															
19FT8312 Total Quality Management	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1	
19FT8306/Food process plant layout and safety	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1	
19FT8307/Energy Management in Process Industries	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1	
19FT8308 Emerging Technologies in Food Processing	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1	
19FT8309/Separation Techniques in Food Processing	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1	
19FT8310/Analytical Instruments in Food Industries	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1	
19FT8313/ Application of Nanotechnology and Cryogenics	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1	
19FT8311/ Entrepreneurship Opportunities for Food Technologists	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1	

[Signature]
**Chairman - BoS
 FT - HiCET**



[Signature]
**Dean (Academics)
 HiCET**