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

HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST
HICET

CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the Odd semester

Semester I

Academic year 2023-24

Batch 2023-2027

Academic council Meeting Held on 19.06.2023

CURRICULUM
R2022

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. FOOD TECHNOLOGY (UG)

FIRST YEAR

REGULATION-2022

For the students admitted during the academic year 2023-2024 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.	22HE1072	Entrepreneurship & Innovation	AEC	1	0	0	1	1	100	0	100
7.	22HE1073	Introduction to Soft Skills	SEC	1	0	0	1	1	100	0	100
MANDATORY COURSE											
8.	22MC1093/ 22MC1091	தமிழர்மரபு /Heritage of Tamil	MC	2	0	0	0	1	100	0	100
9.	22MC1095	Universal Human values	AEC	2	0	0	0	1	100	0	100
			TOTAL	**16**	**5**	**6**	**18**	**25**	**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

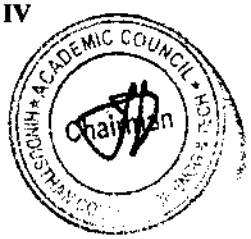
HINDUSTHAN ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF

THEORY WITH LAB COMPONENT											
5.	**22FT2151**	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	AEC	2	0	0	1	2	100	0	100
9.	**22HE2073**	Soft Skills and Aptitude - I	SEC	1	0	0	1	1	100	0	100
MANDATORY COURSE											
10.	**22MC2094/ 22MC2095**	தமிழரும் தொழில்நுட்பமும்/ Tamil and Technology	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							
				19	**1**	**8**	**21**	**27**	**520**	**380**	**900**

SEMESTER III

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	**22MA3107**	Numerical Methods	BSC	3	1	0	4	4	40	60	100
2.	**22FT3201**	Food Microbiology	PCC	3	0	0	3	3	40	60	100
3.	**22FT3202**	Fundamentals of 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	3	60	40	100
7.	**22FT3002**	Food Microbiology Laboratory	PCC	0	0	4	2	3	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
MANDATORY COURSE											
10.	**22MC3191**	Essence of Indian tradition knowledge/Value Education	MC	2	0	0	0	2	100	0	100
			TOTAL	**19**	**3**	**10**	**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**

* 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)

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

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.

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	CATEGORY	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	CATEGORY	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

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.	22FT5601	Sem 5: Food Quality Analysis	MDC	3	0	0	3	3
2.	22FT6601	Sem 6: Technology of Fruits and Vegetable Processing	MDC	3	0	0	3	3
3.	22FT6602	Sem6: Meat Processing Technology	MDC	3	0	0	3	3
4.	22FT7601	Sem 7: Processing of milk and milk products	MDC	3	0	0	3	3
5.	22FT7602	Sem 7: Technology of Baking and Confectionery	MDC	3	0	0	3	3
6.	22FT8601	Sem 8: Food Packaging Technology	MDC	3	0	0	3	3

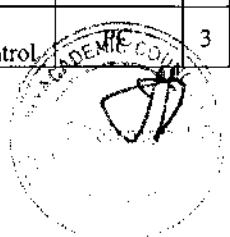
*MDC – Minor Degree Course

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	22BA5601 Foundation of Entrepreneurship	Sustainable infrastructure Development
Fundamentals of Investment	22BA6601 Introduction to Business Venture	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	22BA6602 Team Building & 22BA7601 Leadership Management for Business	Sustainable Bio Materials
Introduction to Blockchain and its Applications	22BA7602 Creativity & Innovation in Entrepreneurship	Materials for Energy Sustainability
Fintech Personal Finance and Payments	22BA8601 Principles of Marketing Management for Business	Green Technology
Introduction to Fintech	22BA8602 Human Resource Management for Entrepreneurs	Environmental Quality Monitoring and Analysis

B Tech (Hons) Food Technology with Specialization in Machine Learning Applications

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	22FT5XXX	Basics of AI in Food	PC	3	0	0	3	3	40	60	100
2.	22FT6XXX	Computer Applications in Food Processing	PC	3	0	0	3	3	40	60	100
3.	22FT6XXX	IoT Applications in Food Industry	PC	3	0	0	3	3	40	60	100
4.	22FT7XXX	Computer simulation and modelling in food processing	PC	3	0	0	3	3	40	60	100
5.	22FT7XXX	Instrumentation and process control	PC	3	0	0	3	3	40	60	100



		in food processing									
6.	22FT8XXX	Image Processing for the Food Industry	PC	3	0	0	3	3	40	60	100

B Tech (Hons) Food Technology with Specialization in Processing and Value Addition

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	22FT5XXX	Technology of milk and milk products	PC	3	0	0	3	3	40	60	100
2.	22FT6XXX	Ready to Eat foods	PC	3	0	0	3	3	40	60	100
3.	22FT6XXX	Cane sugar Technology	PC	3	0	0	3	3	40	60	100
4.	22FT7XXX	Beverage Technology	PC	3	0	0	3	3	40	60	100
5.	22FT7XXX	Technology of snack and extruded foods	PC	3	0	0	3	3	40	60	100
6.	22FT8XXX	Mushroom Processing Technology	PC	3	0	0	3	3	40	60	100

B Tech (Hons) Food Technology with Specialization in Food Science and Biotechnology

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	22FT5XXX	Food nutrition and dietics	PC	3	0	0	3	3	40	60	100
2.	22FT6XXX	Food Biotechnology	PC	3	0	0	3	3	40	60	100
3.	22FT6XXX	Downstream Process Engineering	PC	3	0	0	3	3	40	60	100
4.	22FT7XXX	Chemical reaction Engineering	PC	3	0	0	3	3	40	60	100
5.	22FT7XXX	Fermentation Technology	PC	3	0	0	3	3	40	60	100
6.	22FT8XXX	Enzymes in Food Processing	PC	3	0	0	3	3	40	60	100

Note: Each programme should provide verticals for Honours degree

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 I

Programme/Sem	Course Code	Name of the Course	L	T	P	C
B.Tech/I	22MA1101	MATRICES AND CALCULUS (Common to all Branches)	3	1	0	4

Course Objective

The learner should be able to

1. Construct the characteristic polynomial of a matrix and use it to identify eigen values and Eigenvectors.
2. Impart the knowledge of sequences and series.
3. Analyseanddiscussthemaximaandminimaofthefunctionsofseveralvariables.
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

At the end of the course, the learner will be able to

- CO1 Compute Eigen values and Eigen vectors of the given matrix and transform given quadratic form into canonical form.
- CO2 Apply the concept of differentiation to identify the maximum and minimum values of curve.
- CO3 Compute partial derivatives of function of several variables and write Taylor's series for functions with two variables.
- CO4 Evaluate multiple integral and its applications in finding area, volume.
- CO5 Apply the concept of vector calculus in two- and three-dimensional spaces.

TEXTBOOKS

T1 G.B. Thomas and R. L. Finney, "Calculus and Analytical Geometry", 9th Edition Addison Wesley Publishing Company,2016.

T2 Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2019.

T3 K. P. Umaand S. Padma, "Engineering Mathematics I(Matrices and Calculus), "Pearson Ltd, 2022.

REFERENCEBOOKS

R1 JerroldE. Marsden, Anthony Tromba, "Vector Calculus", W. H. Freeman, 2003.

R2 Strauss M. J, G. L. Bradley and K. J. Smith, "Multi variable calculus", Prentice Hall, 2002.

R3 Veerarajan T, "Engineering Mathematics", Mc Graw Hill Education (India) Pvt Ltd, New Delhi, 2016.

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Programme/Sem	Course Code	Name of the Course	L	T	P	C
B.Tech/I	22ME1201	ENGINEERING DRAWING	1	4	0	3

Course Objective

The learner should be able

1. To gain the knowledge of Engineer's language of expressing complete details about objects and construction of conics and special curves.
2. To learn about the orthogonal projections of straight lines and planes.
3. To acquire the knowledge of projections of simple solid objects in plan and elevation.
4. To learn about the projection of sections of solids and development of surfaces.
5. To study the isometric projections of different objects.

Unit	Description	Instructional Hours
I	**PLANE CURVES** Importance of engineering drawing; drafting instruments; drawing sheets – layout andfolding; Lettering and dimensioning, BIS standards, scales.Geometrical constructions, Engineering Curves Conic sections –Construction of ellipse, parabolaand 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 inclinedto 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 toone 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", 5thedition New Age International Publishers, New Delhi 2016.

T2 K.V.Natarajan, "A textbook of Engineering Graphics", Dhanlaksmi Publishers, Chennai 2016.

REFERENCES

R1 BasantAgrawal 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.Tech/I	22PH1151	PHYSICS FOR NON- CIRCUIT ENGINEERING	2	0	2	3

Course Objective

The student should be able to

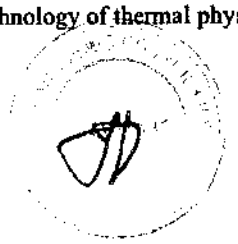
1. Gain knowledge about laser, their applications, become Conversant with principles of optical fiber, types and applications of optical fiber.
2. Enhance his fundamental knowledge about properties of matter.
3. Understand the concept of Wave optics.
4. Gain knowledge about Quantum Physics.
5. Acquire fundamental knowledge of thermal physics which is related to the engineering program.

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
II	**PROPERTIES OF MATTER** Elasticity – Hooke's law – Poisson's ratio – Bending moment – Depression of a cantilever – Deteremination 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
III	**WAVE OPTICS** Interference of light – air wedge –Thickness of thin paper -Testing of thickness of surface- Michelson interferometer. 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** **Determination of thickness of a thin wire – Air wedge method**	6
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	30
	Total Lab Instructional Hours	30

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 Quantum Physics in the field of Engineering.
CO5	Develop the technology of thermal physics 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, 8th 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. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2021.

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Programme/Sem	Course Code	Course Name	L	T	P	C
B.Tech/I	22HE1151	ENGLISH FOR ENGINEERS (Common to all Branches)	2	0	2	3

Course Objective

The student should be able

1. To improve the communicative proficiency of learners.
2. To help learners use language effectively in professional writing.
3. To advance the skills of maintaining the suitable one of communication.
4. To introduce the professional life skills.
5. 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, **Reading**- Purpose of Reading - Churning & Assimilation, Interpreting Ideas - Interpreting Graphs in Technical Writing.	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 **Reading** - Skimming – Scanning – Reading: Scientific Texts – Literary Texts .	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**- Listen to songs and answer the questions **Speaking**-Just a minute **Reading**- Reading feature articles (from newspapers and magazines) -Reading to identify point of view and perspective (opinion pieces, editorials etc.)	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. **Reading**- Reading Comprehension - Techniques for Good Comprehension - - Sequencing of Sentences.	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. **Reading**- Biographies, travelogues, technical blogs.	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 communications.
CO4	To read, write and present in a professional way.
CO5	To follow the etiquettes in formal communication.

TEXT BOOKS

T1 Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press,2016.

T2 Raymond Murphy, "Essential English Grammar", Cambridge UniversityPress,2019.

REFERENCE BOOKS

R1 Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", Oxford University Press, 2009.

R2 Raymond Murphy, "English GrammarinUse"-4th editionCambridgeUniversityPress,2004.

R3 Kamalesh Sadanan, "A Foundation Course for the Speakers of Tamil – Part – I & II", Orient Blackswan,2010

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Programme/Sem	Course Code	Name of the Course	L	T	P	C
B.Tech/I	22IT1151	PYTHON PROGRAMMING AND PRACTICES	2	0	2	3

Course Objective

The learner should be able

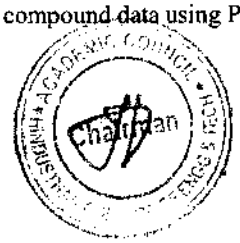
1. To know the basics of algorithmic problem solving.
2. To read and write simple Python programs.
3. To develop Python programs with conditionals and loops and to define Python functions and call them.
4. To use Python data structures – lists, tuples, dictionaries.
5. To do input/output with files in Python.

Unit	Description	Instructional Hours
I	**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)oftwo numbers, Fahrenheit to Celsius, Perform Matrix addition.**	5+4
II	**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.**	5+4
III	**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**	5+4
IV	**LISTS, TUPLES, DICTIONARIES** Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, listparameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations andmethods; advanced list processing - list comprehension. **Illustrative programs: List Manipulation, Finding Maximum in a List, String processing.**	5+4
V	**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**	9
	Total Instructional Hours	45

Course Outcome

At the end of the course, the learner will be able to

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.

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 Pythonl, 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

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Programme/Sem	Course Code	Name of the Course	L	T	P	C
B.TECH/I	22HE1072	ENTREPRENUERSHIP AND INNOVATION	1	0	0	1

Course Objectives

The student should be made

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**

At the end of the course, the learner will be able to

Course Outcome	**CO1**	Understand the nature of business opportunities, resources, and industries in critical and creative aspects.
	CO2	Understand the processes by which innovation is fostered, managed, and commercialized.
	CO3	Remember effectively and efficiently the potential of new business opportunities.
	CO4	Assess the market potential for a new venture, including customer need, competitors, and industry attractiveness.
	CO5	Develop a business model for a new venture, including revenue. Margins, operations, Working capital, and investment.

TEXTBOOKS

T1 Arya Kumar "Entrepreneurship–CreatingandleadinganEntrepreneurialOrganization", 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/entrepreurship

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	Course Code	Course Title	L	T	P	C
BE/BTECH	22HE1073	INTRODUCTION TO SOFT SKILLS	0	0	0	1

Course Objectives:

1. To develop and nurture the soft skills of the students through instruction, knowledge acquisition, demonstration and practice.
2. To enhance the students ability to deal with numerical and quantitative skills.
3. To identify the core skills associated with critical thinking.
4. 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	2
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: Students will be developed to acquire the ability to use English language with an error while making optimum use of grammar.

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SUBJECT CODE – 22MC1093

GE3152	தமிழர் மரபு	L T P C 1 0 0 1

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 – பானற 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 – குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III **நாட்டுப்பறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:** 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், 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, கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரவாறு.

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. பொருநை – 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 ofArchaeology & 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) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech	22MC1094	HERITAGE OF TAMIL	2	0	0	0

The learner should be able to

Course Objective

1. Introduce students to the great History of Tamil literature.
2. Establish the heritage of various forms of Rock art and Sculpture art.
3. To study and understand the various folk and Martial arts of Tamil culture
4. Introduce students to Ancient Tamil concepts to understand the richness of Tamil literature.
5. To learn about the various influences or impacts of Tamil language in Indian culture.

Unit	Description	Instructional Hours
I	**Language and Literature** Language families in India – Dravidian Languages – Tamil as a classical language – Classical Literature in Tamil- Secular nature of Sangam Literature – Distributive justice in Sangam Literature – Management principles in Thirukural – Tamil epics and impacts of Buddhism & Jainism in Tamil and Bakthi literature of Azhwars and Nayanmars – Forms of minor poetry _ Development of Modern literature in Tamil – Contribution of Bharathiyar and Bharathidasan.	6
II	**Heritage _ Rock Art Paintings to Modern Art – Sculpture** Hero Stone to Modern Sculpture – Bronze icons – Tribes and their handcrafts - Art of temple car making – Massive Terracotta sculptures, Village deities, Thiruvalluvar statue at Kanyakumari, Making of musical instruments – Mridangam, Parai, Yazh and Nadhaswaram - Role of Temples in social and economic life of Tamils.	6
III	**Folk and Martial Arts** Therukoothu, Karagattem, Villupattu, Kaniyan koothu, Oyilattam, Leather puppertry, Silambattam., Valari Tiger dance – Sports and Games of Tamils.	6
IV	**Thinai Concept of Tamils** Flora and Fauna of Tamils – Aham and Puram Concept from Tholkappiyam and Sangam Literature – Aram concept of Tamils – Education and Literacy during Sangam Age - Ancient cities and ports of Sangam age – Exporot and Import during Sangam age – Overseas conquest of Cholas.	6
V	**Contribution of Tamils to Indian National Movement and Indian Culture** Contribution of Tamils to Indian freedom struggle – The cultural influence of Tamils over the other parts of India – Self respect movement – Role of Siddha Medicine in indigenous systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil books.	6
	Total Instructional Hours	**30**

At the end of the course, the learner will be able to

Course Outcome

CO1: Learn about the works pertaining to Sangam age
CO2: Aware of our Heritage in art from Stone sculpture to Modern Sculpture.
CO3Appreciate the role of Folk arts in preserving, sustaining and evolution of Tamil culture.
CO4: Appreciate the intricacies of Tamil literature that had existed in the past.
CO5: Understand the contribution of Tamil Literature to Indian Culture

TEXTBOOKS:

T1: Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
T2: Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
T3: Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).

REFERENCEBOOKS:

R1-The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)
R2- Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
R3-Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

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Chairman

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Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/	**22HE1095**	**UNIVERSAL HUMAN VALUES** (COMMON TO ALL BRANCHES)	2	0	0	0

Course Objectives

Thestudentshould bemade

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. TofacilitatethedevelopmentofaHolisticperspectiveamongstudentstowardslifeandprofession 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.
3. To highlight plausible implication sofsuchaHolisticunderstanding Interms ofethicalhumanconduct, 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 RightEvaluation 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 CaseStudiesStrategies for Transition towards Value-based Life and Profession	6
	Total Instructional Hours	**30**

Course Outcome

At the end of the course, the learner will be able

CO1: To become more aware of holistic vision of life - themselves and their surroundings.

CO2: To become more responsible in life, in the Society and in handling problems with sustainable Solutions.

CO3: To sensitive towards their commitment towards what they understood towards environment and Socially responsible behavior.

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.

CO5: To develop competence and capabilities for maintaining Health and Hygiene.

Reference Books:

R1.A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

R2.Teachers'ManualforAFoundationCourseinHumanValuesandProfessionalEthics,RRGaur, R Asthana,G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-53-2

R3.JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak,1999.

R4.Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

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SYLLABUS REVISION DETAILS FOR THE *REGULATION 22* – ACADEMIC YEAR *2023-24 ODD* SEMESTER

S.NO	COURSE CODE/COURSE NAME	SUGGESTION BY EXPERTS	EXISTING CONTENT (IN THE AY2022-23 ODD)	REVISED CONTENT(FOR AY 2023-24 ODD)	TYPE OF REVISION DELETION/ INSERTION/ MODIFICATION	PERCENTAGE OF REVISION
1	**22PH1151** PHYSICS FOR NON CIRCUIT ENGINEERING AGRI, CHEM , FT, AERO, AUTO, CIVIL ,MECH, MECT)	The topic - Testing of thickness of surface- Michelson interferometer may be included in the third unit Wave Optics.	**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 Determination of thickness of a thin wire – Air wedge method.**	Interference of light – air wedge – Thickness of thin paper -**Testing of thickness of surface- Michelson interferometer. 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 Determination of thickness of a thin wire – Air wedge method**	A topic inserted	5%
2	**22HE1151 ENGLISH FOR ENGINEERS**	All units for odd sem and even sem syllabi must include reading parts.	**UNIT –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	**UNIT –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,**Reading-** Purpose of Reading -	Reading components added in each unit.	20%

SYLLABUS REVISION DETAILS FOR THE *REGULATION 22* – ACADEMIC YEAR *2023-24 ODD* SEMESTER

				Churning & Assimilation, Interpreting Ideas - Interpreting Graphs in *Technical* Writing.		
			UNIT –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	**UNIT –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 **Reading -** Skimming – Scanning – Reading: Scientific Texts – Literary Texts .		
			UNIT –III **Language Proficiency:** Prepositions, phrasal verbs. **Writing:** Formal thanks giving, Congratulating, warning and apologizing letters, cloze test. **Vocabulary** – words on tools.**PracticalComponent:Listening** - Listentosongsandanswerthequestions**Speaking**-Justaminute	**UNIT –III** **Language Proficiency:** Prepositions, phrasal verbs. **Writing:** Formal thanks giving, Congratulating, warning and apologizing letters, cloze test. **Vocabulary** – words on tools.**PracticalComponent:Listening**-Listen to songs and answer the questions**Speaking-** Justaminute**Reading-** Reading feature articles (from newspapers		

SYLLABUS REVISION DETAILS FOR THE *REGULATION 22* – ACADEMIC YEAR *2023-24 ODD* SEMESTER

				presenting as a team.**Reading-** Biographies, travelogues, technical blogs.		

III SEMESTER MATHEMATICS

R 2019		R 2022	
COURSE CODE	**COURSE NAME**	**COURSE CODE**	**COURSE NAME**
21MA3101	FOURIER SERIES AND STATISTICS **(AERO/AUTO/MECH/MCTS)**	**22MA3101**	APPLIED STATISTICS AND QUEUING THEORY **(IT)**
21MA3102	FOURIER ANALYSIS AND TRANSFORMS **(AGRI/BM/FT/EEE/ ECE/ EIE)**	**22MA3102**	COMPLEX ANALYSIS AND TRANSFORMS **(ECE,EEE,EIE)**
21MA3103	FOURIER ANALYSIS AND NUMERICAL METHODS **(CIVIL & CHEMICAL)**	**22MA3103**	DISCRETE MATHEMATICS AND GRAPH THEORY**(CSE)**
21MA3104	DISCRETE MATHEMATICS AND GRAPH THEORY **(CSE)**	**22MA3104**	FOURIER ANALYSIS AND NUMERICAL TECHNIQUES **(AUTO, AERO)**
21MA3151	**STATISTICS AND QUEUEING THEORY (IT)**	**22MA3105**	FOURIER SERIES AND TRANSFORMS**(MECT, MECH)**
21MA3152	**PROBABILITY AND APPLIED STATISTICS (AI&ML)**	**22MA3106**	DISCRETE MATHEMATICS**(AIML)**
		22MA3107	NUMERICAL METHODS **(CHEM & FT)**
		22MA3108	STATISTICS & NUMERICAL METHODS **(CIVIL)**
		22MA3109	TRANSFORMS AND APPLICATIONS **(AGRI)**
		22MA3151	**STATISTICS AND NUMERICAL METHODS WITH R PROGRAM (BME)**

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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

HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST
HICET

CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the Odd semester

For

SEMESTER III

Academic year 2023-24

Batch 2022-2026

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	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	தமிழரும் தொழில் நுட்பமும் / Indian Constitution	MC	2	0	0	0	2	0	0	0
			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.	22FT2151	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	AEC	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/ 22MC2092	தமிழர் மரபு/ Heritage of Tamils	MC	2	0	0	0	1	0	0	0
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							-
				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.	22MA3107	Numerical Methods	BSC	3	1	0	4	4	40	60	100
2.	22FT3201	Food Microbiology	PCC	3	0	0	3	3	40	60	100
3.	22FT3202	Fundamentals of 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
MANDATORY COURSE											
10.	22MC3191	Essence of Indian tradition knowledge/Value Education	MC	2	0	0	0	2	100	0	100
			TOTAL	**17**	**3**	**10**	**25**	**29**	**470**	**430**	**900**

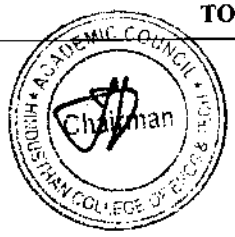
SEMESTER IV

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**

* 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)

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**

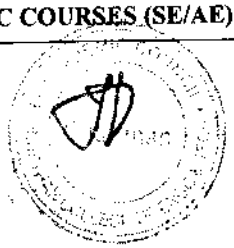
SEMESTER VII

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:

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.

OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES)

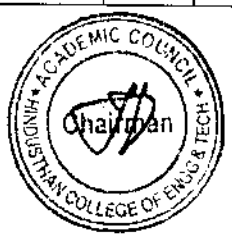
To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

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	CATEGORY	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	CATEGORY	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	CATEGORY	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

ACADEMIC COUNCIL
Chairman

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	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5601	Sem 5: Food Quality Analysis	MDC	3	0	0	3	3
2.	22FT6601	Sem 6: Technology of Fruits and Vegetable Processing	MDC	3	0	0	3	3
3.	22FT6602	Sem6: Meat Processing Technology	MDC	3	0	0	3	3
4.	22FT7601	Sem 7: Processing of milk and milk products	MDC	3	0	0	3	3
5.	22FT7602	Sem 7: Technology of Baking and Confectionery	MDC	3	0	0	3	3
6.	22FT8601	Sem 8: Food Packaging Technology	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.

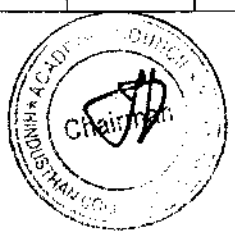
Vertical I Fintech and Block Chain	Vertical II Entrepreneurship	Vertical III Environment and Sustainability
21CS5601-Financial Management	22BA5601 - Foundation of Entrepreneurship	Sustainable infrastructure Development
Fundamentals of Investment	22BA6601- Introduction to Business Venture	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	22BA6602 - Team Building & Leadership Management for Business	Sustainable Bio Materials
Introduction to Blockchain and its Applications	22BA7601 - Creativity & Innovation in Entrepreneurship	Materials for Energy Sustainability
Fintech Personal Finance and Payments	22BA7602 - Principles of Marketing Management for Business	Green Technology
Introduction to Fintech	2BA8601 -Human Resource Management for Entrepreneurs	Environmental Quality Monitoring and Analysis
	22BA8602 Financing New Business Ventures	

B Tech (Hons) Food Technology with Specialization in Machine Learning Applications

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	22FT5XXX	Basics of AI in Food	PC	3	0	0	3	3	40	60	100
2.	22FT6XXX	Computer Applications in Food Processing	PC	3	0	0	3	3	40	60	100
3.	22FT6XXX	IoT Applications in Food Industry	PC	3	0	0	3	3	40	60	100
4.	22FT7XXX	Computer simulation and modelling in food processing	PC	3	0	0	3	3	40	60	100
5.	22FT7XXX	Instrumentation and process control in food processing	PC	3	0	0	3	3	40	60	100
6.	22FT8XXX	Image Processing for the Food Industry	PC	3	0	0	3	3	40	60	100

B Tech (Hons) Food Technology with Specialization in Processing and Value Addition

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	22FT5XXX	Technology of milk and milk products	PC	3	0	0	3	3	40	60	100
2.	22FT6XXX	Ready to Eat foods	PC	3	0	0	3	3	40	60	100
3.	22FT6XXX	Cane sugar Technology	PC	3	0	0	3	3	40	60	100



4.	22FT7XXX	Beverage Technology	PC	3	0	0	3	3	40	60	100
5.	22FT7XXX	Technology of snack and extruded foods	PC	3	0	0	3	3	40	60	100
6.	22FT8XXX	Mushroom Processing Technology	PC	3	0	0	3	3	40	60	100

B Tech (Hons) Food Technology with Specialization in Food Science and Biotechnology

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	22FT5XXX	Food nutrition and dietics	PC	3	0	0	3	3	40	60	100
2.	22FT6XXX	Food Biotechnology	PC	3	0	0	3	3	40	60	100
3.	22FT6XXX	Downstream Process Engineering	PC	3	0	0	3	3	40	60	100
4.	22FT7XXX	Chemical reaction Engineering	PC	3	0	0	3	3	40	60	100
5.	22FT7XXX	Fermentation Technology	PC	3	0	0	3	3	40	60	100
6.	22FT8XXX	Enzymes 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

Chairman BoS

Chairman - BoS
FT - HiCET

Dean Academics

Dean (Academics)
HiCET

Principal

PRINCIPAL
Hindusthan College Of Engineering &
COIMBATORE - 641

SYLLABUS

III SEMESTER

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH	22MA3107	NUMERICAL METHODS (CHEM, FT)	3	1	0	4

Course Objective

The learner should be able to

1. Solve algebraic, transcendental and system of linear equations by using various techniques.
2. Analyze various methods to find the intermediate values for the given data.
3. Explain concepts of numerical differentiation and numerical integration of the unknown functions.
4. Explain single and multi-step methods to solve Ordinary differential equations
5. Describe various methods to solve ordinary differential equations and partial differential equations.

Unit	Description	Instructional Hours
I	**SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS** Solution of Algebraic and Transcendental equations: Newton Raphsonmethod . Solution of linear system: Gauss Elimination - Gauss Jordan method -Gauss Seidel method. Matrix inversion by Gauss Jordan method.	12
II	**INTERPOLATION** Interpolation - Newton's forward and backward difference formulae – Newton's divided difference formula and Lagrangian interpolation for unequal intervals.	12
III	**NUMERICAL DIFFERENTIATION AND INTEGRATION** Numerical Differentiation: Newton's forward and backward interpolation formulae for equal intervals –Newton's divided difference formula for unequal intervals. Numerical integration: Trapezoidal and Simpson's 1/3 rule	12
IV	**INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS** Single step methods for solving first order equations: Taylor's series method – Euler and Modified Euler methods – Fourth order Runge-kutta method -Multi step method: Milne's predictor and corrector method.	12
V	**BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS** Solution of second order ordinary differential equation by Finite difference method – Solution of partial differential equation: one dimensional heat equation by Bender schmidt method – One dimensional Wave equation by Explicit method– Two dimensional heat equation - Laplace Equation and Poisson Equations	12
	Total Instructional Hours	60

Course Outcome

At the end of the course, the learner will be able to

CO1: Solve the system of linear algebraic equations which extends its applications in the field of engineering

CO2: Apply various methods to find the intermediate values for the given data.

CO3: Identify various methods to perfrom numerical differentiation and integration

CO4: Classify and solve ordinary differential equations by using single and multi step methods.

CO5: Illustrate various methods to find the solution of ordinary and partial differential equations.

TEXT BOOKS:

T1 - Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018.

T2 - Grewal.B.S. " Higher Engineering Mathematics", 44th Edition, Khanna Publications, New Delhi, 2012.

REFERENCE BOOKS :

R1 - M.K.Jain,S.R.K.Iyengar, R.K.Jain "Numerical methods for Scientific and Engineering Computation", Fifth Edition, New Age International publishers 2010.

R2 - Grewal B.S. and Grewal J.S. " Numerical Methods in Engineering and Science ", 6th Edition , Khanna publishers, New Delhi 2015.

R3 - S.K.Gupta, Numerical Methods for Engineers" , New Age International Pvt.Ltd Publishers,2015.

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.	22FT3202	FUNDAMENTALS OF HEAT AND MASS TRANSFER	3	1	0	4

COURSE OBJECTIVES

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 equipment.

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 in drying.	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 – 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 in baking, freezing.	12
V	**Mass Transfer:** Mass transfer – introduction – principles and theory of diffusion - Fick's law for molecular diffusion –convective mass transfer – theories of mass transfer - determination of mass transfer rate - molecular diffusion in gases – equimolar counters diffusion in gases – diffusion of gases through solids.	12
	TOTAL INSTRUCTIONAL HOURS	**60**

COURSE OUTCOMES

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

CO5 - Remembering and applying the mass transfer phenomena using Fick's law of molecular diffusion in food processing

TEXT BOOKS:

1. Bellaney, P.L. "Thermal Engineering". Khanna Publishers, New Delhi, 2001
2. Geankoplis C.J. "Transport Process and Unit Operations". Prentice-Hall of India Private Limited, New Delhi, 1999
3. D.G. Rao. Fundamentals of Food Engineering, PHI Learning Private limited, New Delhi

REFERENCES:

1. R. Paul Singh and Dennis R Heldman. Introduction to food engineering. Academic Press Inc New York
2. Jacob and Hawkins. "Elements of Heat Transfer".John Willey and Sons Inc. New York, 1983
3. EcKert, E.R.G. "Heat and Mass Transfer". McGraw Hill Book Co., New York, 1981
4. Holman, E.P. "Heat Transfer". McGraw-Hill Publishing Co. New Delhi, 2001
5. Coulson, J.M. and etal. "Coulson & Richardson's Chemical Engineering", 6th Edition, Vol. I & II, Butterworth – Heinman (an imprint of Elsevier), 2004
6. McCabe, W.L., J.C. Smith and P.Harriot "Unit Operations of Chemical Engineering", 6th Edition, McGraw Hill, 2003.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22FT3203	FLUID MECHANICS	3	1	0	4

COURSE OBJECTIVES

1. Understand the classification of fluids.
2. Understand the statements regarding fluid flow.
3. Understand the fluid flow through pores.
4. Understand the performance of pumps.
5. 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 Engineeringl, 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.

Coulson & Richardson's Chemical Engineering. 5th edition, vol. 2. Elsevier, 2006.

3. Cengel, Yunus and Cimbala John M., —Fluid Mechanics Fundamentals and Applicationsl, 4th Edition, Tata McGraw Hill Publishing Company, 2017.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22FT3251	FOOD CHEMISTRY	2	0	2	3

Course Objective

The student should be able

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 dextrins. 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	**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 Chemistryll, 3rd Edition, Springer-Verley, Berlin, 2004.

T2 Sivasankar B., —Food Processing and Preservationl, 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.	22FT3001	UNIT OPERATIONS LABORATORY	0	0	4	2

Course Objectives

- To impart the knowledge on heat and mass transfer phenomena
- To provide the knowledge on performance of pipes, valves and other accessories
- To demonstrate the principles of free and forced convection

Experiments:

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

COURSE OUTCOMES

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 Engineeringl, 7th Edition, McGraw Hill, New York, 2005.

R2 Perry Robert, —Perry's Chemical Engineers Hand Bookl, 8th Edition, McGraw Hill, New York, 2007.

Treybal R.E., —Mass Transfer Operationsl, 3rd Edition, McGraw Hill, New York, 1981.

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Programme	Course code	Name of the course	L	T	P	C
B.Tech	22FT3002	FOOD MICROBIOLOGY LABORATORY	0	0	3	1.5

COURSE OBJECTIVES

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

EXPERIMENTS

I Introduction, Laboratory Safety, Use of Equipment; Sterilization Techniques; Culture Media-Types and Use; Preparation of Nutrient broth and agar

II Plating Techniques: Pour plate, Spread plate and Streak plate methods for the Isolation and Counting of Viable Microorganisms in Food samples

III Microscopy – Working and Care of Microscope; Microscopic Methods in the Study of Microorganisms;

IV Staining Techniques - Simple, Differential- Gram's Staining methods

V Determination and Enumeration of Pathogenic and Indicator Organisms in Foods (MPN Method)

VI Experiment on Microbial Quality of Milk

VII Enumeration of Lactic acid bacteria from Fermented Foods

VIII Microbial examination of Fruits and Vegetable products for Yeasts and Molds

IX Microbial Examination of Spices for Spores

X Inhibitory effect of Spices on microbial load in Fish & Flesh foods

XI Enumeration & Isolation of *E. coli* from Processed Chicken Meat

XII Determination of Thermal Death Time

XIII Detection of *Staphylococcus aureus* from food sample

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

R1 Yousef A.E. and Carlstrom C., —Food Microbiology: A Laboratory Manuall, Wiley Interscience Publications, 2003.

R2 McLandsborough L., —Food Microbiology Laboratoryl, CRC Press, 2004.

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Programme	Course Code	Course Title	L	T	P	C
B. TECH	22HE3071	Soft Skills and Aptitude - II	0	0	0	1

Course Objectives:

1. Solve Logical Reasoning questions of easy to intermediate level
2. Solve Quantitative Aptitude questions of easy to intermediate level
3. Solve Verbal Ability questions of easy to intermediate level
4. Display good writing skills while dealing with essays

Unit	Description	Instructional Hours
I	**Logical Reasoning** Clocks - Calendars - Direction Sense - Cubes - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency **Quantitative Aptitude**	9
II	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, - Profit and loss, Basic terminologies in profit and loss - Averages - Weighted average	12
III	**Verbal Ability** 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.	7
IV	**Writing skills for placements** Essay writing: Idea generation for topics, Best practices, Practice and feedback	2
	Total Instructional Hours	**30**

Course Outcome

CO1	Students will avoid the various fallacies that can arise through the misuse of logic.
CO2	Students would opt for alternate methods to solve the problems rather than conventional methods.
CO3	Students will heighten their awareness of correct usage of English grammar in writing and speaking
CO4	Students will be concise and clear, using professional language for placements.

REFERENCE BOOKS

R1 A New Approach To Reasoning Verbal & Non-Verbal By B.S. Sijwali

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 Quantitative Aptitude for Competitive Examinations - Dr. R.S. Aggarwal, S. Chand

R5 Word Power Made Easy by Norman Lewis

R6 Six weeks to words of power by Wilfred Funk

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22HE3072	IDEATION SKILLS	2	0	0	0

Course Objective

The student should be able

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 Visualitzation of Ideas", 2008.

R2 Kathryn McElroy, "Prototyping for Designers: Developing the Best Digital and Physical Products", 2017.

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22MC3191	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	2	0	0	0

The student should be able

Course Objective

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
2. To make the students understand the traditional knowledge and analyze it and apply it to their day-to-day life.
3. To impart basic principles of thought process, Itihas and Dharma Shastra and connecting society and nature.
4. To understand the concept of Intellectual and intellectual property rights with special reference.
5. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and Indian philosophy.

Unit	Description	Instructional Hours
I	**Introduction to traditional knowledge:** Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vs indigenous knowledge, traditional knowledge vs western knowledge	6
II	**Protection of traditional knowledge:** The need for protecting traditional knowledge, Significance of TK Protection, value of TK in global economy, Role of Government to harness TK	6
III	**Itihas and Dharma-Shastra** Itihas: The Mahabharata - The Puranas - The Ramayana Dharma-Shastra: Manu Needhi - The Tirukkural – Thiru Arutpa	6
IV	**Traditional knowledge and intellectual property:** Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge	6
V	**Indian philosophy** Jain – Buddhist – Charvaka – Samkhya - Yoga - Nyaya - Vaisheshika - Saiva *Siddhanta*	6
	Total Instructional Hours	30

Course Outcome

CO1	Identify the concept of Traditional knowledge and its importance.
CO2	Explain the need and importance of protecting traditional knowledge.
CO3	Explain the need and importance of Itihas and Dharma Shastra.
CO4	Interpret the concepts of Intellectual property to protect the traditional knowledge.
CO5	Interpret the concepts of Indian philosophy to protect the traditional knowledge.

REFERENCES:

R1 Traditional Knowledge System in India, by Amit Jha, 2009.

R2 Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.

R3 "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2.

R4 V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.

R5 V N Jha (Eng. Trans,), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation, Velliamad, Amakuam.

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SYLLABUS REVISION DETAILS FOR THE REGULATION 2022 – SEMESTER III

S.NO	COURSE CODE/COURSE NAME	SUGGESTION BY EXPERTS	EXISTING CONTENT (IN THE AY 2022-23 ODD)	REVISED CONTENT(FOR AY 2023-24 ODD)	TYPE OF REVISION DELETION/ INSERTION/ MODIFICATION	PERCENTAGE OF REVISION
1	**22FT3202** Fundamentals of Heat and Mass Transfer	Inclusion of topics (in unit II, IV, V & Deletion of topics in unit V	**UNIT 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.	**UNIT 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 in drying	A topic included	12%
			UNIT 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 in baking, freezing.	**UNIT IV** **Heat Transfer Radiation** Radiation heat transfer – concept of black and grey body - 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 in baking, freezing.	Deletion and inclusion of a topic	

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			UNIT V **Mass Transfer** Mass transfer – introduction - Fick's law for molecular diffusion - equimolar counters diffusion in 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.	**UNIT V** **Mass Transfer** Mass transfer – introduction – principles and theory of diffusion - Fick's law for molecular diffusion –convective mass transfer – theories of mass transfer - determination of mass transfer rate - molecular diffusion in gases – equimolar counters diffusion in gases – diffusion of gases through solids	Deletion and inclusion of topics	
2	**22FT3002** Food Microbiology Laboratory	Changes in experiment II, V, IX, XII, XIII were suggested	Exp II: Culture Techniques, Isolation and Preservation of Cultures- Broth: flask, test tubes; Solid: Pour plates, streak plates, slants, stabs	Plating Techniques: Pour plate, Spread plate and Streak plate methods for the Isolation and Counting of Viable Microorganisms in Food samples	New experiments added instead of the existing experiments	53.8 %
			EXP V: Microbiological Quality of Water (MPN)	Determination and Enumeration of Pathogenic and Indicator Organisms in Foods (MPN Method)		
			EXP IX: Enumeration of spores from pepper	Microbial Examination of Spices for Spores		
			EXP XII: Thermal destruction of microbes: TDT & TDP	Determination of Thermal Death Time		
			EXP XIII: Enumeration & Isolation of Staphylococci from ready to eat street foods	Detection of *Staphylococcus aureus* from food sample		

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Coimbatore - 641 032.

B.TECH. FOOD TECHNOLOGY

HINDUSTHAN EDUCATIONAL AND CHARITABLE TRUST

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CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the Odd Semester

For

Semester V

Academic year 2023-24

Batch 2021-2025

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 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										

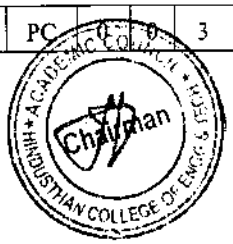
9.	21HE2072	**Career Guidance Level – II** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	21HE2073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
			Total:	**17**	**2**	**12**	**22**	**630**	**370**	**1000**

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	40	60	100
2.	21FT3201	Fluid Mechanics	PC	3	1	0	4	40	60	100
3.	21FT3101	Principles of Thermodynamics	PC	3	0	0	3	40	60	100
4.	21FT3202	Food Microbiology	PC	3	0	0	3	40	60	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	60	40	100
7.	21FT3002	Food Production Analysis Laboratory	PC	0	0	3	1.5	60	40	100
MANDATORY COURSES										
8.	21MC3191	Indian Constitution	MC	2	0	0	0	100	0	0
9.	21HE3072	**Career Guidance Level – III** Personality, Aptitude and CareerDevelopment	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**	**630**	**370**	**1000**

SEMESTER IV

S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	21FT4201	Fundamentals of Heat and MassTransfer	PC	3	1	0	4	40	60	100
2.	21FT4203	Engineering properties of food materials	PC	3	0	0	3	40	60	100
3.	21FT4204	Refrigeration and Cold ChainManagement	PC	3	1	0	4	40	60	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	60	40	100



7.	21FT4002	Food Process Equipment Design Laboratory	PC	0	0	3	1.5	60	40	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**	**640**	**360**	**1000**

SEMESTER V

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
1.	21FT5201	Baking and ConfectioneryTechnology	PC	3	0	0	3	40	60	100
2.	21FT5202	Food Additives	PC	3	0	0	3	40	60	100
3.	21FT5203	Live Stock and Fish Processing Technology	PC	3	0	0	3	40	60	100
4.	21FT5204	Principles of Food Processing	PC	3	0	0	3	40	60	100
5.	21FT5205	Unit Operations in FoodProcessing	PC	3	0	0	3	40	60	100
6.	21FT53XX	Professional Elective -I	PE	3	0	0	3	40	60	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	100	0	100
10.	21HE5072	Design Thinking	EEC	1	0	0	1	100	0	100
			TOTAL	**20**	**0**	**8**	**24**	**540**	**460**	**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	40	60	100
2.	21FT6202	Plantation crops and Spices Products Technology	PC	3	0	0	3	40	60	100
3.	21FT6203	Fruits and Vegetable Processing Technology	PC	3	0	0	3	40	60	100
4.	21FT6181	Professional Ethics inEngineering	HS	3	0	0	3	40	60	100
5.	21FT63XX	**Professional Elective - II**	PE	3	0	0	3	40	60	100
6.	21XX64XX	**Open Elective– I**	OE	3	0	0	3	40	60	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	100	0	100
11.	21HE6072	Intellectual Property Rights(IPR)	EEC	1	0	0	1	100	0	100
			TOTAL	**20**	**0**	**6**	**24**	**540**	**560**	**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	40	60	100
2	21FT5302	Food Storage and Infestation Control	PE	3	0	0	3	40	60	100
3	21FT5303	Food Process Calculations	PE	3	0	0	3	40	60	100
4	21FT5304	Post-Harvest Technology	PE	3	0	0	3	40	60	100
5	21FT5305	Cane sugar Technology	PE	3	0	0	3	40	60	100
6	21FT5306	Milling Technology for Food Materials	PE	3	0	0	3	40	60	100
7	21FT5307	Food Colors and Flavor Technology	PE	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE II										
1	21FT6301	Beverage Technology	PE	3	0	0	3	40	60	100
2	21FT6302	Technology of Snack and Extruded Foods	PE	3	0	0	3	40	60	100
3	21FT6303	Food Biotechnology	PE	3	0	0	3	40	60	100
4	21FT6304	Bioprocess Engineering	PE	3	0	0	3	40	60	100
5	21FT6305	Enzyme Technology	PE	3	0	0	3	40	60	100
6	21FT6306	Crop Process Engineering	PE	3	0	0	3	40	60	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	40	60	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	40	60	100

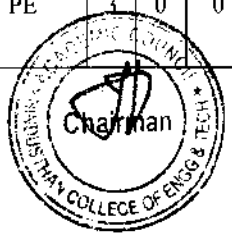
2.	21FT7202	Food Packaging	PC	3	0	0	3	40	60	100
3.	21FT7203	Food Plant Layout and Management	PC	3	0	0	3	40	60	100
4.	21FT73XX	**Professional Elective-III**	PE	3	0	0	3	40	60	100
5.	21XX74XX	**Open Elective – II**	OE	3	0	0	3	40	60	100
PRACTICALS										
6.	21FT7001	Food Packaging Laboratory	PC	0	0	3	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**	**350**	**450**	**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	40	60	100
2.	21FT83XX	**Professional Elective- V**	PE	3	0	0	3	40	60	100
PRACTICAL										
3.	21FT8901	Project Work – Phase II	EEC	0	0	16	8	100	100	200
			TOTAL	**6**	**0**	**16**	**14**	**180**	**220**	**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	40	60	100
2.	21FT7302	Biology and Chemistry of Food Flavors	PE	3	0	0	3	40	60	100
3.	21FT7303	Food Toxicology and Allergy	PE	3	0	0	3	40	60	100
4.	21FT7304	Advanced Drying Technology	PE	3	0	0	3	40	60	100
5.	21FT7305	Cereal Technology	PE	3	0	0	3	40	60	100
6.	21FT7306	Processing Technology of Legumes and Oilseeds	PE	3	0	0	3	40	60	100
7.	21FT7307	Emerging Non-Thermal Processing of Foods	PE	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE IV										
1.	21FT8301	Food Process Economics and Industrial Management	PE	3	0	0	3	40	60	100
2.	21FT8302	Food Laws and Safety	PE	3	0	0	3	40	60	100
3.	21FT8303	Waste Management and By-Product Utilization in Food Industries	PE	3	0	0	3	40	60	100



4.	21FT8304	Instrumentation and Process Control	PE	3	0	0	3	40	60	100
5.	21FT8305	Economics and Management	PE	3	0	0	3	40	60	100
6.	21FT8312	Total Quality Management	PE	3	0	0	3	40	60	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	40	60	100
2.	21FT8307	Energy Management in Process Industries	PE	3	0	0	3	40	60	100
3.	21FT8308	Emerging Technologies in Food Processing	PE	3	0	0	3	40	60	100
4.	21FT8309	Separation Techniques in Food Processing	PE	3	0	0	3	40	60	100
5.	21FT8310	Analytical Instruments in Food Industries	PE	3	0	0	3	40	60	100
6.	21FT8311	Entrepreneurship Opportunities for Food Technologists	PE	3	0	0	3	40	60	100
7.	21FT8313	Application of Nanotechnology and Cryogenics in Food Processing	PE	3	0	0	3	40	60	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	40	60	100
	LIFE SKILL COURSES									
1.	21LSZ401	General Studies for Competitive Examinations	OE	3	0	0	3	40	60	100
2.	21LSZ402	Human Rights, Women's Rights and Gender Equality	OE	3	0	0	3	40	60	100
3.	21LSZ403	Indian Ethos and Human Values	OE	3	0	0	3	40	60	100
4.	21LSZ404	Indian Constitution and Political System	OE	3	0	0	3	40	60	100
5.	21LSZ405	Yoga for Human Excellence	OE	3	0	0	3	40	60	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.	21FT5601	Sem 5: Food Quality Analysis	MDC	3	0	0	3	3
2.	21FT6601	Sem 6: Technology of Fruits and Vegetable Processing	MDC	3	0	0	3	3
3.	21FT6602	Sem6: Meat Processing Technology	MDC	3	0	0	3	3
4.	21FT7601	Sem 7: Processing of milk and milk products	MDC	3	0	0	3	3
5.	21FT7602	Sem 7: Technology of Baking and Confectionery	MDC	3	0	0	3	3
6.	21FT8601	Sem 8: Food Packaging Technology	MDC	3	0	0	3	3

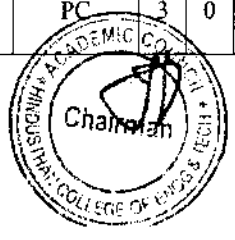
*MDC – Minor Degree Course

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
21CS5601- Financial Management	21BA5601 Foundation of Entrepreneurship	21CEXXXX Sustainable Infrastructure Development
21CSXXXX - Fundamentals of Investment	21BAXXXX Introduction to Business Venture	21CEXXXX Sustainable Agriculture and Environmental Management
21CSXXXX - Banking, Financial Services and Insurance	21BAXXXX Team Building &	21CEXXXX Sustainable Bio Materials
21CSXXXX Introduction to Blockchain and its Applications	21BAXXXX Creativity & Innovation in Entrepreneurship	21CEXXXX Materials for Energy Sustainability
21CSXXXX Fintech Personal Finance and Payments	21BAXXX Principles of Marketing Management for Business	21CEXXXX Green Technology
Introduction to Fintech	21BAXXXX Human Resource Management for Entrepreneurs	21CEXXXX Environmental Quality Monitoring and Analysis

B Tech (Hons) Food Technology with Specialization in Machine Learning Applications

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21FT5XXX	Basics of AI in Food	PC	3	0	0	3	3	40	60	100
2.	21FT6XXX	Computer Applications in Food Processing	PC	3	0	0	3	3	40	60	100
3.	21FT6XXX	IoT Applications in Food Industry	PC	3	0	0	3	3	40	60	100
4.	21FT7XXX	Computer simulation and modelling in food processing	PC	3	0	0	3	3	40	60	100
5.	21FT7XXX	Instrumentation and process control in food processing	PC	3	0	0	3	3	40	60	100



6.	21FT8XXX	Image Processing for the Food Industry	PC	3	0	0	3	3	40	60	100

B Tech (Hons) Food Technology with Specialization in Processing and Value Addition

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21FT5XXX	Technology of milk and milk products	PC	3	0	0	3	3	40	60	100
2.	21FT6XXX	Ready to Eat foods	PC	3	0	0	3	3	40	60	100
3.	21FT6XXX	Cane sugar Technology	PC	3	0	0	3	3	40	60	100
4.	21FT7XXX	Beverage Technology	PC	3	0	0	3	3	40	60	100
5.	21FT7XXX	Technology of snack and extruded foods	PC	3	0	0	3	3	40	60	100
6.	21FT8XXX	Mushroom Processing Technology	PC	3	0	0	3	3	40	60	100

B Tech (Hons) Food Technology with Specialization in Food Science and Biotechnology

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21FT5XXX	Food nutrition and dietics	PC	3	0	0	3	3	40	60	100
2.	21FT6XXX	Food Biotechnology	PC	3	0	0	3	3	40	60	100
3.	21FT6XXX	Downstream Process Engineering	PC	3	0	0	3	3	40	60	100
4.	21FT7XXX	Chemical reaction Engineering	PC	3	0	0	3	3	40	60	100
5.	21FT7XXX	Fermentation Technology	PC	3	0	0	3	3	40	60	100
6.	21FT8XXX	Enzymes 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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SYLLABUS

V SEMESTER

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21FT5201	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 recrystalization 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 pretreatment 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	21FT5202	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 / illustrations58	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**

Course Outcomes

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

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. ManoranjanKalia 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	21FT5203	LIVESTOCK AND FISH PROCESSING TECHNOLOGY	3	0	0	3

Course Objectives

The students will be able to

1. Understand the process of slaughtering of meat and meat-based products
2. Apply basic food processing principles on meat, fish and poultry processing
3. Understand the quality analysis of Meat, Poultry and egg products.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**POULTRY PROCESSING:** Poultry classification – chicken, Turkey, goose, duck, Guinea fowl and pigeon. Unit operation in poultry processing. Pre-slaughter factors affecting poultry meat quality. Slaughter through chilling, Types of poultry cuts.. Sensory quality of poultry meat- color, texture and flavor. Eating quality – tests-Warner_Bratzler Shearing blade and the Volodkevich method, Electronic nose Indian standards for dressed chicken. The Kosher and halal market – dietary laws, Kosher poultry and halal poultry.	9
II	**EGG PROCESSING:** Formation of egg, Structure, composition, nutritive value of egg. Functional properties of eggs, Factors affecting egg quality and evaluation of egg quality. Preservation and maintenance of egg – cleaning, oil treatment, cold storage, thermostabilization, immersion in liquids. Microbial spoilage of eggs, Egg powder processing-spray drying, Foam mat drying.	9
III	**MEAT PROCESSING:** Types of Meat and its sources, composition, structure of meat. Pre-slaughter care, handling and transportation. Ante mortem handling, slaughtering and dressing of animals, Post-mortem inspection and grading of meat, biochemical changes in meat muscle, microbiology and spoilage factors,. Meat - Tenderization, Meat quality evaluation. Mechanically deboned meat. Preservation of meat- curing, smoking, drying, freezing, canning and irradiation. Meat adulteration	9
IV	**FISH PROCESSING**: Classification of fisheries, composition and nutritive value of fish. Fishing techniques, Handling of fishes, Transportation, Spoilage factors of fish. Bacteriology of fish, Preservation- Freezing and Individual quick freezing, Canning and smoking operations, Salting and drying of fish, pickling. Value added products	9
V	**MEAT PLANT HYGIENE AND REGULATION:** Modern abattoirs and its features Handling and maintenance of tools and core equipment. Agents used in sanitation, properties and classification of sanitizing agents – sanitizers and disinfectants, SSOP's, Organization of cleaning schedule, Manual cleaning, Specialized cleaning techniques, Automated cleaning systems. Meat regulations – International level – FAO, WHO, OIE, CEC, ICMSF, ISO and National level – APEDA, AGMARK, PFA, MFPO, BIS, state and local self-government and MOU's.	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- Understand the different processing and preservation operations of fish
CO5- Remember safety measures and hygienic conditions

TEXT BOOKS:

1.Panada P.C., —Text book on Egg and Poultry Technologyl, 1st Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 1996.

2.Gunter Heinz and Peter Hautzinger, —Meat Processing Technologyl, 1st Edition, Rap Publication, Monteplier, 2007.

REFERENCES BOOKS:

1.Ionnis S. Boziaris, —Seafood Handbook: Technology, Quality and Safetyl, Wiley Blackwell, UK, 2014.

2.Mead G.C., —Poultry Meat Processing and Qualityl, 1st Edition, CRC Press, London, 2004.
3.Alan R. Sams, —Poultry Meat Processingl, 1st Edition, CRC Press, London, 2001.
4.Joseph Kerry, John Kerry and David Ledwood. —Meat Processingl, Woodhead Publishing Limited, England (CRC Press), 2002.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21FT5204	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:

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

REFERENCES BOOKS:

1. James G Brennan, —Food Processing Handbookl, 2nd Edition, Wiley VCH, Weinheim, 2011.
2. Paul Singh R and Dennis R. Heldman, —Introduction to Food Process Engineeringl, 5th Edition, Academic Press, USA, 2014
3. Sahay K.M. and Singh K.K., —Unit Operations of Agricultural Processingl, 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.	21FT5205	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**

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Course Outcomes

Upon completion of the course, students can be able to

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:

1. Fellows P.J., —Food processing Technology: Principles and Practicel, 3rd Edition, Woodhead Publishing Ltd., New Delhi, 2009

2. Earle R.L., —Unit Operations in Food Processingl, Web Edition, Pergamon Press, UK, 2004.

REFERENCES BOOKS:

1. James G Brennan, —Food Processing Handbookll, 2nd Edition, Wiley VCH, Weinheim, 2011.

2. Paul Singh R and Dennis R. Heldman, —Introduction to Food Process Engineeringl, 5th Edition, Academic Press, USA, 2014

3. Sahay K.M. and Singh K.K., —Unit Operations of Agricultural Processingl, 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.	21FT5001	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:

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21FT5002	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
1.	Determination of size, roundness, sphericity and 1000 grain weight of food grains
2.	Determination of bulk density, true density, porosity, angle of repose for grain sample, and coefficient of friction for grain sample
3.	Determination of separation efficiency of centrifugal separator
4.	Determination of collection efficiency in cyclone separator
5.	Determination of efficiency of liquid solid separation by filtration
6.	Determination of particle size of granular foods by sieve analysis
7.	Experiment on cold extrusion and quality analysis of extruded products
8.	Experiment on Crystallization process
9.	Determination of energy requirement in size reduction using hammer mill/ball mill
10.	Performance evaluation of a steam distillation process
11.	Experiment on paddy dehusker to determine the shelling efficiency
12.	Determination of conveying efficiency and power requirement of screw conveyor
13.	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 Handbookl, 2nd Edition, Wiley VCH, Weinheim, 2011.

R2 2. Paul Singh R and Dennis R. Heldman, —Introduction to Food Process Engineeringl, 5th Edition, Academic Press, USA, 2014

R3 3. Sahay K.M. and Singh K.K., —Unit Operations of Agricultural Processingl, 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.	21HE5071	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: A 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.	21HE5072	DESIGN THINKING	1	0	0	1

Course Objective

OBJECTIVES:

- 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.	21FT5301	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**

Course Outcomes

Upon completion of the course, students can be able to

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 Productsl, 6th Edition, Wiley - Interscience, New Jersey, 2005.

2. Richard D. O'Brien, —Fats and Oils: Formulating and Processing for Applicationsl, 3rd Edition, CRC Press, London, 2010.

REFERENCES BOOKS:

1. Casimir C. Akoh and David B. Min, —Food Lipids: Chemistry, Nutrition and Biotechnologyl, CRC Press, USA, 2008.

2.Wolf Hamm and Richard J. Hamilton, —Edible Oil Processingl, Wiley - Blackwell, UK, 2013.

3. Kanes K. Rajah, —Fats in Food Technologyl, 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.	21FT5302	FOOD STORAGE AND INFESTATION CONTROL	3	0	0	3

Course Objectives

- 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 invertebratesll, 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
B.Tech	19FT5303	FOOD PROCESS CALCULATIONS	3	0	0	3

COURSE OBJECTIVES

1. To have an idea about different systems of units and dimensions, estimation compositions of mixtures and solutions
2. To understand the material balance for different unit operations
3. To apply material balance for recycle operations and perform humidification calculations
4. To perform energy balance calculations
5. 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

TEXT BOOKS:

T1.Gavhane K.A., —Introduction to Process Calculations (Stoichiometery)l, 22nd Edition, Nirali Prakashan Publications, Pune, 2009.
T2.Venkataramani V. and Anantharaman N., —Process Calculationsl, Prentice Hall of India, New Delhi, 2003.

REFERENCE BOOKS:

R1.Bhatt B.L. and Vora S.M., —Stoichiometryl, 4th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2004.
R2.Himmelblau D.M., —Basic Principles and Calculations in Chemical Engineeringl, 6th Edition, Prentice Hall of India, New Delhi, 2003.
R3.Narayanan K.V. and Lakshmikutty B., —Stoichiometry and Process Calculationsl, Prentice Hall of India, New Delhi, 2006.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21FT5304	POST HARVEST TECHNOLOGY	3	0	0	3

Course Objectives

- 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 preprocessing, 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	9

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.

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.	21FT5305	CANE SUGAR TECHNOLOGY	3	0	0	3

Course Objectives

- 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 9disadvantages. 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	9

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	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.	
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 Industryl, 2nd Edition, Elsevier Publishing Company, New York, 1989.

2. Baikow V.E., —Manufacturing and Refining of Raw Cane Sugarl, 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 Beetl, Read Books, New York, 2007.

2. Ram BehariLal and Mathur, —Hand Book of Cane Sugar Technologyl, 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 Facilitiesl, 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.	21FT5306	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**

Course Outcomes

Upon completion of the course, students can be able to

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:

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

House, New Delhi, 2008.

REFERENCES BOOKS:

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21FT5307	FOOD COLORS AND FLAVOR TECHNOLOGY	3	0	0	3

Course Objectives

1. To analyse different food colors and application in food formulations
2. To understand different food flavors and its applications
3. To know the quality control techniques and regulations involved in colors and flavors

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**FOOD COLOURS FOOD COLOURS** Introduction - Natural and Synthetic food Colours - Class and description of food colours -Physical form of food colours - Stability, storage and solubility of food colours -Regulations and safety assessment - Labeling requirements for food containing colour additives -Adulteration and misbranding of colour additives in foods.	9
II	**PROPERTIES AND ANALYSIS OF FOOD COLOURS** Food colour stability, Importance of food colours for food products - Methods of analysis for food colour - Quality and safety assessment - Applications of natural and synthetic food colours.	9
III	**FOOD FLAVOURS** Introduction - Classification - flavor forms: water soluble liquid flavours - oil soluble liquid flavours, emulsion-based flavours, dispersed flavours, spray dried flavours - commercial considerations - Flavor characteristics - Flavor compounds - Natural and artificial flavoring materials - Flavoring constituent of various foods like meat, fish, milk, vegetables, fruits, fats & oils, spices & herbs, cereals and pulses. Changes in flavouring components and characteristics during cooking/processing of various foods. Effects of storage, processing, transportation and environmental conditions on flavour components/constituents	9
IV	**FOOD FLAVOR: APPLICATIONS AND RECENT DEVELOPMENT** Culinary and Meat Products, bakery products, snack foods, sugar based confectionary products, dairy products and soft drinks - Changes in food flavor due to processing -flavor release from foods -Factors that affect the flavour and control of flavour in processed foods. Recent developments in flavour research, processing and technology.	9

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	FOOD FLAVOR: QUALITY CONTROL	
V	Flavouring and coating technologies for preservation and processing of foods. Natural flavor enhancers for food and beverage, Quality Control - analytical, sensory and adulteration testing. Measurement of flavour, particularly for wine, tea, coffee, species and condiments.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1 Identify the synthetic and natural colors and its regulations

CO2 Evaluate the properties and the importance of colors in food industry

CO3 Classify the food flavours and its stability.

CO4 Determine the recent developments of application of flavor in food industry

CO5 Analyze the methods of estimation of colors and flavors in foods

TEXT BOOKS:

T1 Spices and Flavor Technology. J.S. Pruthi, ICAR Publications, 2nd Edition, 1998

T2 Fenaroli, G, Handbook of flavour ingredients, CRC Press. Bota Rica, New York, 2005

T3 Yamanishi, T, Recent advances in flavour researches, Dekker, New York, 2005

REFERENCES BOOKS:

R1 Andrew J. Taylor and Robert S. T. Linforth, Food Flavour Technology, Blackwell Publishing Ltd, 2010.

R2 Suvendu Bhattacharya, Conventional and Advanced Food Processing Technologies, Wiley Publishers, 2015.

R3 Heath, HB, Flavour chemistry and technology, CBS Publ., New Delhi, 2005.

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MINOR DEGREE COURSES

Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS5602	FINANCIAL MANAGEMENT	3	0	0	3

Course Objective

1. To acquire the knowledge of the decision areas in finance.
2. To learn the various sources of Finance
3. To describe about capital budgeting and cost of capital
4. To discuss on how to construct a robust capital structure and dividend policy
5. To develop an understanding of tools on Working Capital Management.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO FINANCIAL MANGEMENT** Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization- Time Value of money- Risk and return concepts	9
II	**SOURCES OF FINANCE** Long term sources of Finance -Equity Shares – Debentures - Preferred Stock – Features – Merits and Demerits. Short term sources - Bank Sources, Trade Credit, Overdrafts, Commercial Papers, Certificate of Deposits, Money market mutual funds etc	9
III	**INVESTMENT DECISIONS:** Investment Decisions: capital budgeting – Need and Importance – Techniques of Capital Budgeting — Payback -ARR – NPV – IRR –Profitability Index. Cost of Capital - Cost of Specific Sources of Capital - Equity -Preferred Stock- Debt - Reserves - Concept and measurement of cost of capital - Weighted Average Cost of Capital.	9
IV	**FINANCING AND DIVIDEND DECISION** Operating Leverage and Financial Leverage- EBIT-EPS analysis. Capital Structure – determinants of Capital structure- Designing an Optimum capital structure . Dividend policy - Aspects of dividend policy - practical consideration - forms of dividend policy - - Determinants of Dividend Policy	9
V	**WORKING CAPITAL DECISION** Working Capital Management: Working Capital Management - concepts - importance - Determinants of Working capital. Cash Management: Motives for holding cash – Objectives and Strategies of Cash Management. Receivables Management: Objectives - Credit policies	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Acquire the knowledge of the decision areas in finance.
CO2: learn the various sources of Finance
CO3: describe about capital budgeting and cost of capital
CO4: construct a robust capital structure and dividend policy
CO5: develop an understanding of tools on Working Capital Management.

TEXT BOOKS

T1 M.Y. Khan and P.K.Jain Financial management, Text, Tata McGraw Hill
T2 M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd

REFERENCE BOOKS

R1 James C. Vanhorne –Fundamentals of Financial Management– PHI Learning.
R2 Prasanna Chandra, Financial Management,
R3 Srivatsava, Mishra, Financial Management, Oxford University Press, 2011

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Programme	Course Code	Name of the course	L	T	P	C
BE/B.Tech	21BA5601	Foundations of Entrepreneurship	3	0	0	3

Course Objective

CO1: To enable students gain insights on entrepreneurship.
CO2: To make students understand the sources of product & business ideas.
CO3: To provide knowledge on business opportunity identification.
CO4: To enable students to develop business plan
CO5: To enable students to prepare feasibility reports and understand trends in entrepreneurship.

Unit	Description	Instructional Hours
I	**Introduction to Entrepreneurship:** Entrepreneurial growth in India; sources of entrepreneurship in India. Entrepreneurship process; entrepreneurial mindset: concept and impact; Entrepreneurial growth strategies. Characteristics of an Entrepreneur – Qualities of an Entrepreneur. Entrepreneurial success and failure - reasons and remedies.	9
II	**Product Development:** Introduction and Meaning of a Product – Sources of Business or Product Ideas – Criteria for Selecting a Product – Barriers to the successful development of New Products – Why do new products fail. Technology - Considerations in selecting technology.	9
III	**Business Opportunity Identification:** Need and Importance - Steps in identification of Business Opportunity. Techniques of market Survey – Market Research Procedure.	9
IV	**Business Plan Development**: Business modelling: concept, types and functions; Innovation and Entrepreneurship: concept and challenges. The business plan as an entrepreneurial tool, Elements of business planning, Objectives, Market analysis, development of Product/idea, Marketing, Finance, Organization and management, Ownership, Critical risk contingencies of the proposal, Scheduling and milestones.	9
V	**Feasibility Report & trends:** Contents of a feasibility report – Considerations while preparing a feasibility report – Proforma of a feasibility report. Technical, Financial, Marketing, Personnel, and management feasibility reports. Trends in entrepreneurship: Rural, Social and women entrepreneurship.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the basics of entrepreneurship and its process.
CO2: Understand the concept of product development and the role of technology.
CO3: Able to understand and identify business opportunity
CO4: Able to develop business plan / business model
CO5: Able to prepare feasibility reports and understand the trends in entrepreneurship.

TEXT BOOKS:

T1- S.Anil Kumar, S.C.Poornima, Mini KAbraham, K.Jayashree "Entrepreneurship Development", New Age International Publishers.

T2- Jasmer singh Sain, Entrepreneurship and small Business" Deep and Deep publication

T3- Shankar Raj, "Entrepreneurship Theory and Practice" Vijay Nicole Imprints Pvt ltd.

T4- Khanka, S.S, "Entrepreneurship Development", S. Chand & company

T5- Vasant Desai, "Fundamentals of Entrepreneurship "Himalaya Publishing House.

REFERENCE BOOKS:

R1- Khanna, S. S., Entrepreneurial Development, S. Chand, New Delhi.

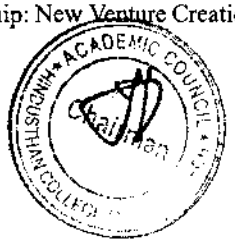
R2- Hisrich D. Robert, Michael P. Peters, Dean A. Sheperd, Entrepreneurship, McGraw-Hill,6 ed.

R3- Zimmerer W. Thomas,Norman M.Scarborough, Essentials of Entrepreneurship and Small Business Management, PHI,4 ed.

R4- Holt H. David, Entrepreneurship: New Venture Creation, Prentice- Hall of India, New Delhi, Latest edition.

R5- Kuratko, F. Donald, Richard M. Hodgetts, Entrepreneurship: Theory, Process, Practice, Thomson, 7ed.

R6- Desai, Vasant, Dynamics of Entrepreneurship: New Venture Creation, Prentice-Hall of India, New Delhi, Latest edition.



R7- Patel, V. G., The Seven Business Crises and How to Beat Them, Tata McGraw-Hill, New Delhi, 1995.

R8- Roberts, Edward B.(ed.), Innovation: Driving Product, Process, and Market Change, San Francisco: Jossey Bass, 2002.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	22CEXXXX	SUSTAINABLE INFRASTRUCTURE DEVELOPMENT	3	0	0	3

Course Objective

1. To gain knowledge on concepts and socio-economic policies of sustainable development.
2. To examine the strategies for implementing sustainable development programmes.
3. To learn the various sustainability and performance indicators, their assessment techniques and constraints
4. To explore the different approaches for resource management for a sustainable urban planning.
5. To understand the principles of urban planning and built-in environment.

Unit	Description	Instructional Hours
	INTRODUCTION TO SUSTAINABLE DEVELOPMENT	
I	Definitions and principles of Sustainable Development - History and emergence of the concept of Sustainable Development - Environment and Development linkages- Globalization and environment – Millennium Development Goals: Status (global and Indian) Impacts on approach to development policy and practice in India, future directions.	9
	ENVIRONMENTAL SUSTAINABILITY	
II	Land, Water and Food production - Moving towards sustainability: Energy powering Sustainable Development - Financing the environment and Sustainable Development.	9
	SUSTAINABILITY INDICATORS	
III	Sustainability indicators – Hurdles to Sustainability-Operational Guidelines-Interconnected prerequisites for sustainable development - Science and Technology for sustainable development – Performance indicators of sustainability and Assessment mechanism – Constraints and barriers for sustainable development.	9
	URBAN PLANNING AND ENVIRONMENT	
IV	Environment and Resources, Sustainability Assessment, Future Scenarios, Form of Urban Region, Managing the change, Integrated Planning, Sustainable Development.	9
	THE BUILT-IN ENVIRONMENT	
V	Urban Form, Land Use, Compact Development, Principles of street design- complete streets, Transport Integrated Urban land use Planning, Guidelines for Environmentally Sound Transportation.	9
	Total Instructional Hours	**45**

Course Outcome

The students will be able to:
CO1: Describe the concepts and socio-economic policies of sustainable development.
CO2: Recognize and identify the strategies for implementing sustainable development programmes.
CO3: Comprehend the various sustainability and performance indicators, their assessment techniques and constraints
CO4: Identify the different approaches for resource management for a sustainable urban planning
CO5: Illustrate the principles of urban planning and built-in environment.

REFERENCE BOOKS:

R1. Gilg A W and Yarwood R," Rural Change and Sustainability-Agriculture, the Environment and Communities", CABI Edited by S J Essex, September 2005.
R2. Ganesha Somayaji and Sakarama Somayaji, "Environmental Concerns and Sustainable development: Some perspectives from India", Editors: publisher TERI Press, ISBN 8179932249.
R3. James H. Weaver, Michael T. Rock, Kenneth Kustere, "Achieving Broad-Based Sustainable Development: Governance, Environment, and Growth with Equity", Kumarian Press, West Hartford, CT. Publication Year,1997.
R4. Kirkby. J, O'Keefe P. and Timberlake, "Sustainable development" Earth Scan Publication, London,1996.
R5. Kerry Turner. R, "Sustainable Environmental Management", Principles and Practice Publisher: Belhaven Press,ISBN:1852930039.
R6. Munier N, "Introduction to Sustainability", Springer2005

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SYLLABUS REVISION DETAILS FOR THE REGULATION 2019 – SEMESTER V

S.NO	COURSE CODE/COURSE NAME	SUGGESTION BY EXPERTS	EXISTING CONTENT (IN THE AY 2022-23 ODD)	REVISED CONTENT(FOR AY 2023-24 ODD)	TYPE OF REVISION DELETION/ INSERTION/ MODIFICATION	PERCENTAGE OF REVISION
1	**2IFT5203 Poultry, Meat and Fish Processing Technology/ Livestock and Fish Processing technology**	Change of title as Livestock and Fish Processing technology was suggested. New portions were included in all the units. University nominee had suggested to include Marine processing unit and merge Poultry and egg products.	**UNIT 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.	**UNIT I POULTRY PROCESSING:** Poultry classification – chicken, Turkey, goose, duck, Guinea fowl and pigeon. Unit operation in poultry processing. Pre-slaughter factors affecting poultry meat quality. Slaughter through chilling, Types of poultry cuts. Sensory quality of poultry meat-color, texture and flavor. Eating quality – tests-Warner Bratzler Shearing blade and the Volodkevich method, electronic nose Indian standards for dressed chicken. The Kosher and halal market – dietary laws, Kosher poultry and halal poultry.	Deletion and inclusion of a topics	50%
			UNIT 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.	**UNIT II EGG PROCESSING** Formation of egg, Structure, composition, nutritive value of egg. Functional properties of eggs, Factors affecting egg quality and evaluation of egg quality. Preservation and maintenance of egg – cleaning, oil treatment, cold storage, thermostabilization, immersion in	Deletion and inclusion of a topics	

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				liquids. Microbial spoilage of eggs, Egg powder processing-spray drying, Foam mat drying.		
			UNIT 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.	**MEAT PROCESSING:** Types of Meat and its sources, composition, structure of meat. Pre-slaughter care, handling and transportation. Ante mortem handling, slaughtering and dressing of animals, Post-mortem inspection and grading of meat, biochemical changes in meat muscle, microbiology and spoilage factors, Meat - Tenderization, Meat quality evaluation. Mechanically deboned meat. Preservation of meat- curing, smoking, drying, freezing, canning and irradiation. Meat adulteration	Deletion and inclusion of topics	
			UNIT 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.	**UNIT IV FISH PROCESSING** Classification of fisheries, composition and nutritive value of fish. Fishing techniques, Handling of fishes, Transportation, Spoilage factors of fish. Bacteriology of fish, Preservation- Freezing and Individual quick freezing, Canning and smoking operations, Salting and drying of fish, pickling. Value added products.	Deletion and inclusion of topics	
			UNIT V **HYGIENE AND SANITATION:** Handling and maintenance of tools and core equipment. Meat plant layout. Meat processing hygiene. Cleaning and	**MEAT PLANT HYGIENE AND REGULATION:** Modern abattoirs and its features Handling and maintenance of tools and core equipment. Agents	Deletion and inclusion of topics	

			sanitation in meat plants. Food safety measures –GMP and GHP, Safety standards in meat, poultry and egg industry: HACCP/ISO/MFPO/FSSAI/Kosher/Halal .	used in sanitation, properties and classification of sanitizing agents – sanitizers and disinfectants, SSOP's, Organization of cleaning schedule, Manual cleaning, Specialized cleaning techniques, Automated cleaning systems. Meat regulations - International level – FAO, WHO, OIE, CEC, ICMSF, ISO and National level – APEDA, AGMARK, PFA, MFPO, BIS, state and local self-government and MOU's.		
	21FT5002 Unit Operations in Food Processing Laboratory	Changes in experiment VII, VIII, IX, XIII were suggested	Exp VII : Determination of performance characteristics in size reduction using the burr mill jaw crusher	Exp VII: Experiment on cold extrusion and quality analysis of extruded products	New experiments added instead of the existing experiments	30.7 %
			EXP VIII: Determination of energy requirement in size reduction and performance evaluation using ball mill	Exp VIII: Experiment on Crystallization process		
			EXP IX: Determination of energy requirement in size reduction using hammer mill/	Exp IX: Determination of energy requirement in size reduction using hammer mill/ball mill		
			EXP XIII: Determination of economy and thermal efficiency of evaporator	EXP XIII: Determination of conveying efficiency of bucket elevator		

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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

HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST
HICET

CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the Odd semester

For

Semester VII

Academic year 2023-24

Batch 2020-2024

CURRICULUM
R2019

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. FOOD TECHNOLOGY (UG)

REGULATION-2019

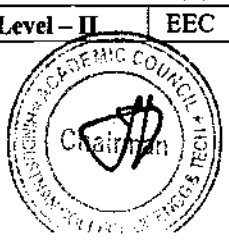
For the students admitted during the academic year 2019-2020 and onwards

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 – 1** 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**

SEMESTER V

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
1.	19FT5201	Baking and ConfectioneryTechnology	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 FishProcess 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 FoodProcessing	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 inEngineering	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.	**19FT7201R**	**Food Analysis and Quality Control**	PC	3	0	0	3	25	75	100
2.	**19FT7202R**	**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.	**19FT7001R**	**Food Packaging Laboratory**	PC	0	0	3	1.5	50	50	100
7.	**19FT7002R**	**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

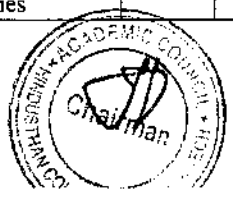
TOTAL	15	0	10	20	275	525	800

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

Chairman BoS

Chairman - BoS
FT - HiCET

Dean Academics

Dean (Academics)
HiCET

Principal

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

SYLLABUS
VII SEMESTER

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT7201R	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 HOURS
1	**GENERAL AND CARBOHYDRATE ANALYSIS** Proximate analysis of foods- Moisture in 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; Analysis of Artificial Sweeteners.	9
2	**LIPIDS AND MINERAL ANALYSIS** Determination of Total fat in foods by different methods (classification: Direct and Indirect); Analysis of oils and fats for physical and chemical parameters, Instrumental methods; GCMS, Instrumentation, FAMES, Injection types, oven and coloum, Detectors; Quality standards, and adulterants. MINERALS: Sample Prepration: Methods of ashing; Dry ashing and wet ashing, AAS, ICP, OES	9
3	**PROTEINS ANALYSIS** Determination of Proteins Concentration- Colorimetric and methods, Determination of Total nitrogen,; Protein Characterization- Isoelectric focussing; Analysis of Protein quality – Protein Efficiency Ratio (PER), Net Protein Utilization (NPU), Biological Value, Protein Digestibility- Corrected Amino acid Score (PDCAAS), *In vitro* Protein digestibility for C-PER; Analysis of Functional properties of proteins- Water absorption, fat absorption, solubility, gelling and foaming.	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	**FOOD SAFETY AND STANDARDS**: Food adulteration and food safety, Food laws - Food Safety and Standards Act (FSSAI), Prevention of Food Adulteration Act, Packaged Commodities Rules - Genetically Modified Foods, Fortification, Pesticide Residues, Organic Foods, 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
	Total Instructional Hours	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 and standards mandated for food safety

TEXT BOOKS:

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

REFERENCES BOOKS:

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

Chairman, Board of Studies

Chairman - BoS
FT - HiCET

Dean – Academic

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT7202R	FOOD PACKAGING	3	0	0	3

Course Objectives

1. To understand the concepts of packaging for various food products
2. To select suitable packaging material for food packaging applications
3. To show the recent trends in food packaging

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 of food packaging in India. Package standards and regulation. Inks, adhesives. Labeling, Bar coding.	9
II	**PAPER AND PAPERBOARD PACKAGING:** Paper and paperboard manufacture - SBB, SUB, FBB, WLC. Properties and types of paper and paperboard. Package types – cartons, boxes, molded pulp containers, corrugated board, sacks, bags. 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 – extrusion, coating and laminating, injection and blow molding. Food contact and barrier properties. Sealability and closure. Application of plastics for food packaging.	9
IV	**METAL CANS:** Raw materials for can making – steel, aluminum. Can making processes - three-piece cans, two-piece cans- DWI, DRD – end making processes – coating. Film laminates. 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 for glass containers. Glass container design. Application of glass containers in food industries.	9
V	**TRENDS IN FOOD PACKAGING**: Active and intelligent packaging. 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- Explain the types and properties of paper and paperboard for food packaging
CO3- Illustrate the classification of plastics and elaborate their properties
CO4- Summarize the food packaging applications of metal cans and glass containers
CO5- Utilize the recent trends in food packaging for packaging applications

TEXT BOOKS:

T1. Robertson Gordon L., -Food Packaging: Principles and Practicel, 3rd Edition, Marcel Dekker Inc, USA, 2012.

T2. Richard Coles and Mark J. Kirwan, -Food and Beverage Packaging Technologyll, 2nd Edition, Blackwell Publishing Asia Pty Ltd, CRC press, USA, 2011.

REFERENCES BOOKS:

R1. Han Jung H., -Innovations in Food Packagingl, 2nd Edition, Academic Press, USA 2013.

R2. Dong Sun Lee, Kit L. Yam and Luciano Piergiovanni, -Food Packaging Science and Technologyll, CRC press, USA, 2008.

R3. Otto G. Piringer and A.L. Baner, -Plastic Packaging Materials for Foodl, 1st Edition, Wiley- VCH, Germany, 2008.

R4.Mathlouthi, M. "Food packaging and Preservation". Aspen Publications, 2013

Chairman, Board of Studies

Chairman - BoS
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Dean – Academics

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19FT7203	FOOD PLANT LAYOUT AND MANAGEMENT	3	0	0	3

Course Objectives

4. Impart basic knowledge in selecting a location as well as plant layout with respect to material handling, space utilization, future expansion etc.
5. Understand the importance of availability of raw material and facilities for production of goods
6. 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, DhanpatRai 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.	19FT7001R	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.

EX.NO.	DESCRIPTION
1.	Identification of different packaging materials.
2.	Measuring GSM of various paper and flexible film based packaging materials.
3.	Measuring water absorption of different paper and paper boards using Cobb tester.
4.	Measuring tensile strength of flexible films.
5.	Measuring compressive strength of carton boxes.
6.	Measuring drop strength of packaged food material using drop tester.
7.	Measuring compressive strength of oil packaged in flexible pouches using Pouch burst tester.
8.	Measuring bursting strength of different paper board-based packaging materials.
9.	Gas/Vacuum packaging of foods and shelf life studies.
10.	Experiment on opening and closing torques of foods packed in bottles/Jars using torque tester.
11.	Edible packaging of Food Samples.Study on retort packing

Total Practical Hours 45

Course Outcomes

Upon completion of the course, students can be able to

1. Understand and apply fundamental requirement for packed foods
2. Select a suitable packaging material for perishable and non-perishable foods
3. Demonstrate testing properties of packaging materials for its regulatory requirements for raw and processed foods
4. Analyze the various packaging technology used for food materials
5. Evaluate the quality of packing materials using latest machineries

REFERENCE BOOKS:

R1 "Manual of methods for the Analysis of Foods", Ministry of Health and Family Welfare, Government of India, New Delhi, 2005.

R2 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.	19FT7002R	FOOD ANALYSIS AND QUALITY CONTROL LABORATORY	0	0	3	1.5

Course Objectives

The students will able to

1. Understand the method to estimate viscosity, specific gravity and preservatives in food materials
2. Determine the amount of fat and analyze the cooking quality parameters
3. Select the suitable sensory analysis method to find the quality of food materials
4. Examine the level of food additives present in the various food products
5. 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 salt in pickle in food materials.
3.	Extraction and estimation of fat content in fried food samples
4.	Swelling capacity and extract release volume of meat
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 evaluation of egg
8.	Estimation of food additives present in the given food sample
9.	Estimation of total Polyphenols in tea/coffee extract
10.	Determination of soluble and insoluble fibre in foods.
11.	Estimation of total sugar content in fruits

Total Practical Hours 45

Course Outcomes

Upon completion of the course, students can be able to

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:

R1 1."Manual of methods for the Analysis of Foods", Ministry of Health and Family Welfare, Government of India, New Delhi, 2005.

R2 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

1. To understand the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction.
2. 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

1. To understand the flavour compounds involved in development of flavor.
2. 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

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	**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

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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:

1.Helferich, William and Carl K.Winter "Food Toxicology" CRC Press, 2001.

2. Alluwalia, Vikas "Food Hygiene and Toxicology" Paragon International Publishers, 2007

REFERENCES BOOKS:

1.Labbe, Ronald G. and Santos Garcia "Guide to Food Borne Pathogens" John Wiley & Sons, 2001.

2.Cliver, Dean O. and Hans P.Riemann "Food Borne Diseases" 2nd Edition., Academic Press / Elsevier, 2002.

3.Riemann, Hans P. and Dean O. Cliver "Food Borne Infections and Intoxications" 3rd Edition., Academic Press/Elsevier, 2006.

4. 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

- 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:

T1. A.S.Mujumdar. Handbook of Industrial drying – Third edition, CRC press, Taylor and Francis group.UK.2007.

T2.Potter, N. N. and Hotchkiss, J. H.., —Food Science. Fifth Edition, CBS Publishers and Distributors, New Delhi. 1996.

REFERENCES BOOKS:

R1.Kudra, T and A.S. Mujumdar. Advanced Drying Technologies. Second Edition, CRC press, Taylor and Francis Group. UK. 2009.

R2.Rao, M. A. and Rizvi, S.S.H., —Engineering Properties of Foods, Marcel Dekker, Inc. New York. 1986.

R3. Sahay K.M. and Singh K.K., —Unit Operations of Agricultural Processingl, 2nd Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2012.

R4. Albert Ibarz and Gustavo V. Barbosa-Cánovas. Unit Operations in Food Engineering. CRC Press, Boca Raton, FL, USA.2003

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SYLLABUS REVISION DETAILS FOR THE REGULATION 2019 – SEMESTER VII

S.NO	COURSE CODE/COURSE NAME	SUGGESTION BY EXPERTS	EXISTING CONTENT (IN THE AY 2022-23 ODD)	REVISED CONTENT(FOR AY 2023-24 ODD)	TYPE OF REVISION DELETION/ INSERTION/ MODIFICATION	PERCENTAGE OF REVISION
1	**19FT7201R** Food Analysis and Quality Control	New portions can be included in all the units. Few topics may be deleted in Unit 1,2,3,5	**UNIT I 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 ß-Glucan content, Degree of Methylation and Acetylation of pectin.	**UNIT I GENERAL AND CARBOHYDRATE ANALYSIS** Proximate analysis of foods- Moisture in 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; Analysis of Artificial Sweeteners	Deletion and inclusion of a topics	20 %
			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	**LIPIDS AND MINERAL ANALYSIS** Determination of Total fat in foods by different methods (classification: Direct and Indirect); Analysis of oils and fats for physical and chemical parameters, Instrumental methods: GCMS, Instrumentation, FAMES, Injection types, oven and coloum, Detectors; Quality standards, and adulterants. MINERALS: Sample Prepration: Methods of ashing; Dry ashing and		

			Protein Efficiency Ratio (PER), Net Protein Utilization (NPU), Biological Value, Protein Digestibility- Corrected Amino acid Score (PDCAAS), *In vitro* 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.	wet ashing, AAS, ICP, OES		
			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	**PROTEIN ANALYSIS** Determination of Proteins Concentration- Colorimetric and methods, Determination of Total nitrogen; Protein Characterization- Isoelectric focusing; Analysis of Protein quality – Protein Efficiency Ratio (PER), Net Protein Utilization (NPU), Biological Value, Protein Digestibility- Corrected Amino acid Score (PDCAAS), *In vitro* Protein digestibility for C-PER; Analysis of Functional properties of proteins- Water absorption, fat absorption, solubility, gelling and foaming.		
			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	**FOOD SAFETY AND STANDARDS**: Food adulteration and food safety, Food laws - Food Safety and Standards Act (FSSAI), Prevention of Food Adulteration Act, Packaged Commodities Rules, - Genetically Modified Foods, Fortification, Pesticide Residues, Organic Foods, 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		
2	**19FT7202 R Food Packaging**	Topics related to packaging materials, plastic packaging have been added. Suggestions were made by experts to include the topic "Types of Inks"	**UNIT 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.	**UNIT 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 of food packaging in India. Package standards and regulation. Inks, adhesives. Labeling, Bar coding.	New portions were included in all the units as per the suggestion	20%
			UNIT 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.	**UNIT II PAPER AND PAPERBOARD PACKAGING:** Paper and paperboard manufacture - SBB, SUB, FBB, WLC. Properties and types of paper and paperboard. Package types – cartons, boxes, molded pulp containers, corrugated board, sacks, bags. Application of paper and paperboards for food packaging.		
			UNIT 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.	**UNIT III PLASTIC PACKAGING:** Types of plastics used in packaging – PE, PP, PET, PVC, EVOH, PVA. Secondary conversion techniques – extrusion, coating and laminating, injection and blow molding. Food contact and barrier properties. Sealability and closure. Application of plastics for food packaging.		
			UNIT IV METAL CANS: Raw materials for can making – steel, aluminum. Can making processes -	**UNIT IV METAL CANS:** Raw materials for can making – steel, aluminum. Can making processes -		

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			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.	three-piece cans, two-piece cans-DWI, DRD – end making processes – coating. Film laminates. 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 for glass containers. Glass container design. Application of glass containers in food industries.		
			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.	**UNIT V TRENDS IN FOOD PACKAGING:** Active and intelligent packaging. 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.		
3	**19FT7001 R Food Packaging Laboratory**	Changes in experiment I, IX, and include experiment XI and XII suggested	I Measuring GSM of various paper and flexible film-based packaging materials.	I Identification of different packaging materials.	Experiments changed and new experiments included as per the suggestion	30.7%
			IX Experiment on opening and closing torques of foods packed in bottles/Jars using torque tester.	IX Gas/Vacuum packaging of foods and shelf-life studies.		
				XI Edible packaging of Food Samples.		

				XII Study on retort packing		
4	**19FT7001 R Food Analysis and Quality Control Laboratory**	Analytical experiments can be changed based on specific food additives.	I Detection and estimation of preservatives in food materials.	Detection and estimation of salt in pickle in food materials.	Repetition experiments in Food Chemistry and Food Analysis have been revised	36.36%
			IV Measurement and analysis of Cooking Quality Parameters	Swelling capacity and extract release volume of meat		
			VII Quality analysis of raw materials used for bakery products	Quality evaluation of egg		
			X Isolation and estimation of synthetic food colors	Determination of soluble and insoluble fibre in foods.		

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DEPARTMENT OF FOOD TECHNOLOGY

ACADEMIC YEAR 2023-2024[ODD]

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

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	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	2	2	1	1
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2	2	2	1
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	3	1
CO5	3	3	3	3	3	-	-	-	-	-	-	2	1	2	1
AVG	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2	1

Course Code & Name: 22IT1151/PYTHON PROGRAMMING AND PRACTICES

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

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

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	O10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	1	1	1	1	-	1	-	1	2	-	-	1
CO2	2	3	2	1	1	1	1	-	1	-	1	2	-	-	1
CO3	2	2	2	2	1	1	1	-	1	-	1	2	-	-	2
CO4	2	2	3	1	2	1	1	-	1	-	2	2	-	1	1
CO5	2	3	3	2	2	1	1	-	1	-	1	2	-	-	1
Avg	2	2.6	2.6	1.4	1.4	1	1	-	1	-	1.2	2	-	1	1

Course Code & Name : 22HE1151 / ENGLISH FOR ENGINEERS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	1	2	2	2	3	1	1	1	2	1
CO2	2	1	-	-	1	1	1	2	2	3	-	2	-	2	1
CO3	2	1	-	-	1	1	2	3	3	3	-	1	1	2	2
CO4	2	1	-	-	-	1	2	2	2	3	1	1	-	-	1
CO5	2	-	-	-	-	1	1	2	3	3	-	1	1	2	2
Avg	2	1	-	-	1	1	1.6	2.2	2.4	3	1	1.2	1	2	1.3

Course Code & Name: 21ME1201/ENGINEERING DRAWING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	-	-	-	-	-	2	1	1	1
CO2	3	3	3	2	2	-	-	-	-	-	-	3	2	2	2
CO3	3	3	3	2	2	-	-	-		-	-	3	3	3	1
CO4	3	3	3	2	2	-	-	-	-	-	-	3	1	1	1
CO5	3	3	3	2	2	-	-	-	-	-	-	3	2	2	2
Avg	3	3	3	2	2	-	-	-	-	-	-	3	2	2	1

SEMESTER III – R 2022

Course Code & Name : 22MA3107/NUMERICAL METHODS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	-	-	2	2	2	2
CO2	3	3	3	3	3	-	-	-	-	-	-	2	2	1	2
CO3	3	3	3	3	2	-	-	-	-	-	-	2	2	1	1
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	1	1
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	1	2
Avg	3	3	3	3	2.6	-	-	-	-	-	-	2	2	1.2	1.6

Course Code & Name : 22FT3201/ FOOD MICROBIOLOGY

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

CO5		2	2	2	2								1	1	2
Avg	2.8	1.8	1	1.3		1						1	1	1	1.6

Course Code & Name :22FT3202/FUNDAMENTALS OF HEAT AND MASS TRANSFER

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO10	PO12	PSO1	PSO2	PSO3
CO1	2	2										2	1	1	2
CO2	2	2	1									2	2	1	2
CO3	3	2	3	1		1						1	2	1	1
CO4	3	2	2	2		1						1	1	1	1
CO5	3	2	1	1		1						1	1	1	2
Avg	2.8	1.8	1	1.3		1						1	1	1	1.6

Course Code & Name : 22FT3203/FLUID MECHANICS

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1										1	1	1	1
CO2	2	2	1									1	1	1	1
CO3	3	2	1	1		1						1	1	1	1
CO4	3	2	1	2		1						1	1	1	1
CO5	3	2	1	1		1						1	1	1	1
Avg	2.8	1.8	1	1.3		1						1	1	1	1

Course Code & Name : 22FT3251/FOOD 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 : 22FT3001/Unit Operations Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	2	2	2	3	2		2					2	2	2	2
CO2	2	2	2	2	2		2					2	2	2	2
CO3	2	1	2	2	2		2					2	2	2	1
Avg	2	1.7	1.7	2	2		2					2	2	2	1.7

Course Code & Name : 22FT3002/FOOD MICROBIOLOGY LABORATORY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	2	2	-	1	1	-	2	3	1	2
CO2	2	1	1	1	2	2	2	-	1	1	-	2	2	1	2
CO3	2	2	1	1	2	2	2	-	1	1	-	2	1	-	2
Avg	2	1	1	1	2	2	2	-	1	1	-	2	1.2	0.4	2

SEMESTER V

Course Code & Name : 21FT5201/BAKING AND CONFECTIONERY TECHNOLOGY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	1	-	1	1	-	1	1	1	2	1
CO2	3	2	3	2	1	1	1	1	3	1	2	1	1	2	1
CO3	3	2	3	2	1	1	1	1	1	1	1	1	1	2	1
CO4	3	2	3	2	1	1	1	1	1	1	2	1	1	2	1
CO5	3	2	3	2	1	1	2	1	1	1	2	1	1	2	1
Avg	3	2	3	2	1	1	1.25	1	1.5	1	1.75	1	1	2	1

Course Code and Name: 21FT5202/Food Additives

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			3			2	1	1				1	3	1	1

CO2	1		2			2		1				1	2	1	1
CO3	1		3			2		1				1	2	1	
CO4			3			2	1	1				1	2	1	1
CO5	1		3			2	1	1				1	2	1	1
Avg	1		2.8			2	1	1				1	2.2	1	1

Course code & Name: 21FT5203/Livestock and Fish Processing Technology

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1		2			3	2	3				3		2	3	
CO2	2	3	3	2	3		2							3	2
CO3	2	3	3	1			2						1	3	1
CO4	3	2	1	2									1	3	2
CO5	2	3	3				1							2	
Avg	2.25	2.75	2.5	1.66	3		1.6						1	2.75	1.66

Course Code and Name: 21FT5204/PRINCIPLES OF FOOD PROCESSING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2										3	2	1
CO2	3	1	2			2							3	2	1
CO3		1	2	2									3	1	1
CO4	3		2									1	3	2	1
CO5	1	3	3	3								1	3	2	1
Avg	**2.5**	**1.75**	**2.2**	**2.5**	**0**	**2**						**1**	**3**	**1.8**	**1**

Course Code and Name: 21FT5205/UNIT OPERATIONS IN FOOD PROCESSING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		1	1	1				1			2	1	2	1
CO2	1	2	2	1	1							1	1	2	1
CO3	1	1		1	1							2		3	1
CO4	1	1	1	1	1							1		2	1
CO5	1	1	3	1								2		3	1
Avg	**1**	**1.25**	**1.75**	**1**	**1**				**1**			**1.6**	**1**	**2.4**	**1**

Course Code and Name : 21FT5001/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	PSO 3
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**	**1.5**	**2.25**	**-**

Course Code and Name :19FT5002/UNIT OPERATIONS IN FOOD PROCESSING LABORATORY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	

PROFESSIONAL ELECTIVE I

Course Code and Name : 21FT5301 Technology of Fats and Oils

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	1	-	1	1	-	1	1	1	2	
CO2	3	2	3	2	1	1	1	1	3	1	2	1	1	2	
CO3	3	2	3	2	1	1	1	1	1	1	1	1	1	2	
CO4	3	2	3	2	1	1	1	1	1	1	2	1	1	2	
CO5	3	2	3	2	1	1	2	1	1	1	2	1	1	2	
Avg	3	2	3	2	1	1	1.25	1	1.5	1	1.75	1	1	2	

Course Code and Name: 1FT5302 Food Storage and Infestation Control

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
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 and Name: 21FT5303/Food Process Calculations

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
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 and Name: 21FT5304/Post-Harvest Technology

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
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 and Name: 21FT5305/CANE SUGAR TECHNOLOGY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS03
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 and Name: 21FT5306/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	PSO 3
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		

21FT5307 Food Colors and Flavor Technology

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	1	1		1	1	2				1	1	1	1
CO2	2	1	2	2		1	1					2	1	2	1
CO3	3	3	2	3		1	1	1				2	1	2	1
CO4	2	3	2	1		1	1					2	1	2	1
CO5	2	1	2	3		1	1	3			1	3	3	3	1
Avg	2.25	2	2	2.25		1	1	2			1	2.25	1.5	2.25	1

SEMESTER VII

Course Code and Name: 19FT7201/FOOD ANALYSIS AND QUALITY CONTROL

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
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 and 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	PSO 3
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 and Name: 19FT7203/Food Plant Layout and Management

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
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 and 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	PSO 3
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 and 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	PSO 3
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 and 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	PSO 3
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	3	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	

PROFESSIONAL ELECTVIVE III

Course Code and Name: 21FT7301/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	PSO 3
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 and Name: 21FT7302/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	PSO 3
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 and Name: 21FT7303/ 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	PSO 3
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 and Name: 21FT7304/ADVANCED DRYING TECHNOLOGY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
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 and Name: 21FT7305/ CEREAL TECHNOLOGY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
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 and Name: 21FT7306/ 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	PSO 3
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 and Name: 21FT7307/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	PSO 3
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	3	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	

Mapping of Course Outcome and Programme Outcome:

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2	PSO 3
I	I	22MA1101 Matrices and Calculus	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2	1
		22IT1151& Python Programming and Practices	2	3	3	-	2	-	-	-	2	-	-	2	2	2	1
		22CY1151/ Physics for Non-Circuit Engineering	2	2.6	2.6	1.4	1.4	1	1	-	1	-	1, 2	2	-	1	1
		22HE1151 / English for Engineers	2	1	-	-	1	1	1.6	2.2	2.4	3	1	1.2	1	2	1.3
		21ME1201 Engineering Drawing	3	3	3	2	2	-	-	-	-	-	-	3	2	2	1

	Food Flavors														
	19FT7303 Food Toxicology and Allergy	3	2	3	2	1	1	1.25	1	1.5	1	1.75	1	1	2	3
	19FT7304 Advanced Drying Technology	2.5	1.75	2.4	2.5		2							3	1.8	
	19FT7305 Cereal Technology	1.6	1.5	2.5	1.7	2	-	-	-	2.6	-	-	2.4	2	2	
	19FT7306 Processing Technology of Legumes and Oilseeds	3	3	2	2	1	1						2	3	3	
	19FT7307 Emerging Non-Thermal Processing of Foods	2.8	2.2	1.8	1.8	1.4	2.2	1.4		2	1		3	3	2	
OEII	19FT7401 Post Harvest Technology of Fruits and Vegetables	2.8	2.2	1.8	1.8	1.4	2.2	1.4		2	1		3	3	2	

CHAIRMAN-BOS

DEAN ACADEMICS

Chairman - BoS
FT - HiCET

Dean (Academics)
HiCET