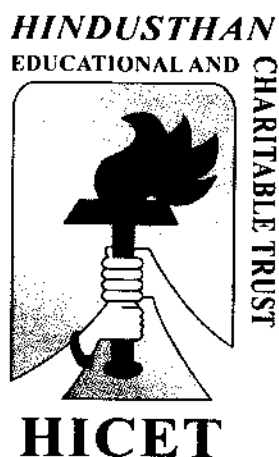


HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution Affiliated to Anna University, Chennai)
(Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade)
Coimbatore - 641 032.

B.TECH. FOOD TECHNOLOGY



CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the 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

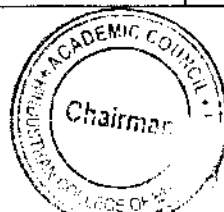
For the students admitted during the academic year 2023-2024 and onwards

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	தமிழர் மரபு /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



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



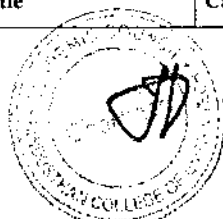
S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22HE4101	IPR and Start-ups	HSC	2	0	0	2	2	40	60	100
2.	22MA4104	Probability and Operations Research	BSC	3	0	0	3	3	40	60	100
3.	22FT4201	Principles of Thermodynamics	PCC	3	1	0	4	3	40	60	100
4.	22FT4202	Refrigeration 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
<p>* Two weeks internship carries 1 credit and it will be done during Semester III summer vacation and same will be evaluated in Semester IV. If students unable to undergo in semester III, then the Internship I offered in the semester IV can be clubbed with Internship II (Total: 4 weeks-2 credits)</p>											

SEMESTER V

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

SEMESTER VI

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
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HICET NCC and Air Wing are eligible to undergo this subject. The earned extra credits printed in the Consolidated Mark sheet as per the regulation.

- NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.
- The above-mentioned NCC Courses will be offered to the students who are going to be admitted in the Academic Year 2021 – 22.

OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES)

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

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	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

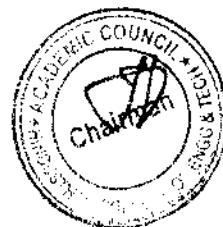
OPEN ELECTIVE I AND II

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	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3
6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3
10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	22EE6401	Digital Marketing	OEC	3	0	0	3	3
13	22EE6402	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3	3
15	22AG6401	Urban Agriculture and Organic Farming	OEC	3	0	0	3	3
16	22CH6401	Biomass and Biorefinery	OEC	3	0	0	3	3

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

OPEN ELECTIVE III



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

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

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

OPEN ELECTIVE IV

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

PROFESSIONAL ELECTIVE COURSES: VERTICALS

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



22FT6302 Technology of Malting and Brewing	22FT6304 Processing of cocoa and Chocolate	22FT6306 Food Safety in Hospitality Industry & GLP in Food Industries	22FT6308 Energy Audit in Food Processing Industry	22FT6310 Food Toxicology and Allergy	22FT6312 Emerging Non-Thermal Processing of Foods
22FT7301 By Products Management	22FT7302 Packaging of Spices, Plantation products	22FT7303 Food Analysis, Testing & Microbial Safety Analysis	22FT7304 Food Process Economics & Industrial Management	22FT7305 Genetically Modified Foods	22FT7306 Emerging Technologies in Food Processing
22FT7307 Quality, Laws and Regulations in Grain Processing Industries	22FT7308 Spice Processing and Products Laws, Quality Standards and Regulations	22FT7309 Food quality, Assurance and Quality Control	22FT7310 Supply Chain and Retail Management	22FT7311 Waste Management and By-Product Utilization in Food Industries	22FT7312 Technology of Snack and Extruded Foods

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

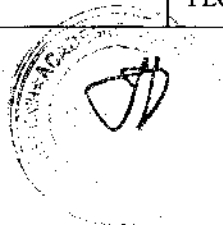
PROFESSIONAL ELECTIVE COURSES: VERTICALS

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

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

Details of Vertical II: Spices and Plantation Technology

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5304	Processing of spices & plantation crops	PEC	3	0	0	3	3
2.	22FT5305	Blending and Value Addition	PEC	3	0	0	3	3
3.	22FT5306	Processing of Coffee	PEC	3	0	0	3	3
4.	22FT6303	Processing of Tea	PEC	3	0	0	3	3
5.	22FT6304	Processing of cocoa and chocolate	PEC	3	0	0	3	3



6.	22FT7302	Packaging of spices and plantation products	PEC	3	0	0	3	3
7.	22FT7308	Spice Processing and products laws, quality standards and regulations	PEC	3	0	0	3	3

Details of Vertical III: Food Safety Management System

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

Details of Vertical IV: Entrepreneurship and Management

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



Details of Vertical V: Food Colors & Flavors

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	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	CATEGORY	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	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

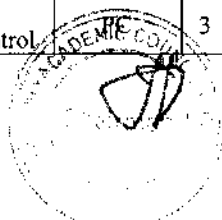
*MDC – Minor Degree Course

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
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

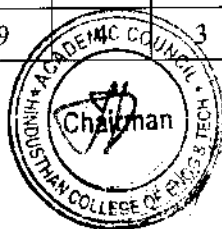
S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	22FT5XXX	Food nutrition and dietics	PC	3	0	0	3	3	40	60	100
2.	22FT6XXX	Food Biotechnology	PC	3	0	0	3	3	40	60	100
3.	22FT6XXX	Downstream Process Engineering	PC	3	0	0	3	3	40	60	100
4.	22FT7XXX	Chemical reaction 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	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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COMBATORE - 641 032.



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

The learner should be able to

- Course Objective**
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. Analyse and discuss the maxima and minima of the functions of several variables.
 4. Evaluate the multiple integrals and apply in solving problems.
 5. Apply vector differential operator for vector function and theorems to solve engineering problems.

Unit	Description	Instructional Hours
I	Matrices Eigen values and Eigen vectors – Properties of Eigen values and Eigen vectors (without proof) - Cayley - Hamilton Theorem (excluding proof) - Reduction of a quadratic form to canonical form by orthogonal transformation.	12
II	Single Variate Calculus Rolle's Theorem–Lagrange's Mean Value Theorem–Maxima and Minima–Taylor's and Maclaurin's Series.	12
III	Functions of Several Variables Partial derivatives–Total derivative, Jacobian, Maxima, minima and saddle points; Method of Lagrange multipliers	12
IV	Integral Calculus Double integrals in Cartesian coordinates–Area enclosed by plane curves (excluding surface area)– Triple integrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates.	12
V	Vector Calculus Gradient, divergence and curl; Green's theorem, Stoke's and Gauss divergence theorem (statement only) for cubes only.	12
Total Instructional Hours		60

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

- Course Outcome**
- 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. Uma and S. Padma, "Engineering Mathematics I (Matrices and Calculus)", Pearson Ltd, 2022.

REFERENCEBOOKS

- R1 Jerrold E. Marsden, Anthony Tromba, "Vector Calculus", W. H. Freeman, 2003.
- R2 Strauss M. J, G. L. Bradley and K. J. Smith, "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

The learner should be able

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

Unit	Description	Instructional Hours
I	PLANE CURVES Importance of engineering drawing; drafting instruments; drawing sheets – layout and folding; Lettering and dimensioning, BIS standards, scales. Geometrical constructions, Engineering Curves Conic sections – Construction of ellipse, parabola and hyperbola by eccentricity method. Construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.	12
II	PROJECTIONS OF POINTS, LINES AND PLANE SURFACES Introduction to Orthographic projections- Projection of points. Projection of straight lines inclined to both the planes, Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).	12
III	PROJECTIONS OF SOLIDS Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane by rotating object method.	12
IV	SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinder and cone. Development of lateral surfaces of truncated solids.	12
V	ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS Isometric views and projections simple and truncated solids such as - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. Free hand sketching of multiple views from a pictorial drawing. Basics of drafting using AutoCAD software.	12
Total Instructional Hours		60

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

- Course Outcome**
- CO1 Understand and interpret the engineering drawings in order to visualize the objects and draw the conics and special curves.
 - CO2 Draw the orthogonal projections of straight lines and planes.
 - CO3 Interpret the projections of simple solid objects in plan and elevation.
 - CO4 Draw the projections of section of solids and development of surfaces of solids.
 - CO5 Draw the isometric projections and the perspective views of different objects.

TEXT BOOK

- T1 K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5th edition New Age International Publishers, New Delhi 2016.
- T2 K.V.Natarajan, "A textbook of Engineering Graphics", Dhanlaksmi Publishers, Chennai 2016.

REFERENCES

- R1 Basant Agrawal and C.M. Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing company Limited New Delhi, 2013.
- R2 N.S. Parthasarathy, Vela Murali, "Engineering Drawing", Oxford University PRESS, India 2015.

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Programme/Sem	Course Code	Name of the Course	L	T	P	C
B.Tech/I	22PH1151	PHYSICS FOR NON- CIRCUIT ENGINEERING	2	0	2	3

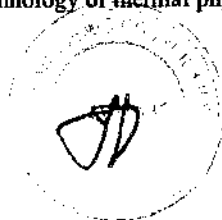
The student should be able to

- Course Objective**
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 – Determination 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

After completion of the course the learner will be able to

- Course Outcome**
- 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

The student should be able

- Course Objective**
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

After completion of the course the learner will be able

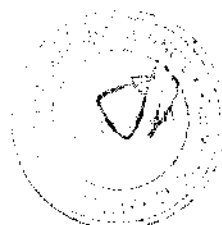
- Course Outcome**
- CO1 To communicate in a professional forum
 - CO2 To speak or write a content in the proficient language
 - CO3 To maintain and use appropriate one of the communications.
 - CO4 To read, write and present in a professional way.
 - CO5 To follow the etiquettes in formal communication.

TEXT BOOKS

- T1 Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press,2016.
- T2 Raymond Murphy, "Essential English Grammar", Cambridge University Press,2019.

REFERENCE BOOKS

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



- R2 Raymond Murphy, "English Grammar in Use" - 4th edition Cambridge University Press, 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

The learner should be able

Course Objective

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) of two 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, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension. Illustrative programs: List Manipulation, Finding Maximum in a List, String processing.	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

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

Course Outcome

- 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 Guide 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 Python1, 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

The student should be made

Course Objectives

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/entrepreneurship>
W3 <https://blof.forgeforward.in/tagged/minimum-viable-product>
W4 <https://blof.forgeforward.in/tagged/minimum-viable-product>
W5 <https://blof.forgeforward.in/tagged/innovation>


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Programme	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 Logical Reasoning	2
II	Problem Solving - Critical Thinking- Lateral Thinking - Coding and Decoding – Series – Analogy - Odd Man Out - Visual Reasoning - Sudoku puzzles - Attention to detail Quantitative Aptitude	11
III	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 Verbal Ability	2
V	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

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அலகு I மொழி மற்றும் இலக்கியம்:

3

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

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

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

3

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

அலகு III நாட்டுப்பாடல் கலைகள் மற்றும் வீர விளையாட்டுகள்:

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தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாலைக் கூத்து, சிலம்பாட்டம், வளரி, புனியாட்டம், தமிழர்களின்

விளையாட்டுகள்.

அலகு IV தமிழர்களின் இணைக் கோட்பாடுகள்:

3

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


அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:

3

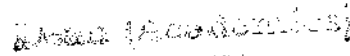
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.



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


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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 handicrafts - 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, Karagattam, Villupattu, Kaniyan koothu, Oyilattam, Leather puppetry, Silambattam., Valari Tiger dance – Sports and Games of Tamils.	6
IV 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 – Export 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.
CO3: Appreciate 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 Book and Educational Services Corporation, Tamil Nadu)
R3-Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

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FT - HiCET



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Dean Academics
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

The students should be made

Course Objectives

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implication of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Unit	Description	Instructional Hours
	Introduction to Value Education	
I	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
	Harmony in the Human Being and Harmony in the Family	
II	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
	Harmony in the Family and Society	
III	Harmony in the Family – the Basic Unit of Human Interaction. Values in Human to Human Relationship 'Trust' – the Foundational Value in Relationship Values in Human to Human Relationship 'Respect' – as the Right Evaluation Understanding Harmony in the Society	6
	Harmony in the Nature / Existence	
IV	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
	Implications of the Holistic Understanding – a Look at Professional Ethics	
V	Natural Acceptance of Human Values Definitiveness of (Ethical) Human Conduct A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies Strategies for Transition towards Value-based Life and Profession	6
Total Instructional Hours		30

- At the end of the course, the learner will be able
- Course Outcome
- 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:

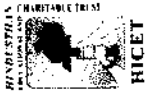
- R1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
- R2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-53-2
- R3. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
- R4. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

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Dean Academics

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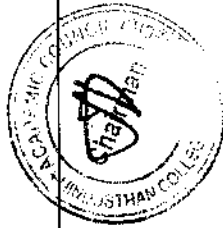


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 Valley Campus, Pollachi Highways, Coimbatore, Tamilnadu.



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

S. N. O	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 of Testing 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%





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

<p>Churning & Assimilation, Interpreting Ideas - Interpreting Graphs in Technical Writing.</p>	<p>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 .</p>	<p>UNIT –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- Reading - Justaminate feature articles (from newspapers</p>
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SYLLABUS REVISION DETAILS FOR THE REGULATION 22 – ACADEMIC YEAR 2023-24 ODD SEMESTER

			presenting as a team, Reading- Biographies, travelogues, technical blogs.	
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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 QUEUEING 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)
		22MA3106	DISCRETE MATHEMATICS(AIML)
		22MA3107	NUMERICAL METHODS (CHEM & FT)
		22MA3108	STATISTICS & NUMERICAL METHODS (CIVIL)
		22MA3109	TRANSFORMS AND APPLICATIONS (AGRU)
21MA3152	PROBABILITY AND APPLIED STATISTICS (AI&ML)	22MA3151	STATISTICS AND NUMERICAL METHODS WITH R PROGRAM (BME)

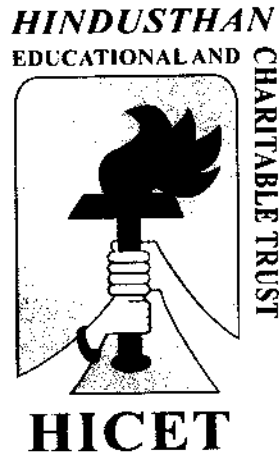


S. JAYAN
 Chairman
 (Board of studies)

Chairman - BOS
FT - HICET

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Coimbatore - 641 032.

B.TECH. FOOD TECHNOLOGY



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 நட்புமும் 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	1	25	29	470	430	900

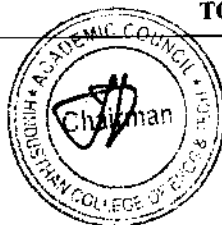


SEMESTER IV

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22HE4101	IPR and Start-ups	HSC	2	0	0	2	2	40	60	100
2.	22MA4104	Probability and Operations Research	BSC	3	0	0	3	3	40	60	100
3.	22FT4201	Principles of Thermodynamics	PCC	3	1	0	4	3	40	60	100
4.	22FT4202	Refrigeration and Cold Chain Management	PCC	3	1	0	4	4	40	60	100
5.	22FT4203	Unit operations in Food Processing	PCC	3	0	0	3	4	40	60	100
6.	22FT4204	Food Analysis and Quality Control	PCC	3	0	0	3	4	40	60	100
PRACTICAL											
7.	22FT4001	Food Analysis and Quality Control Laboratory	PCC	0	0	4	2	4	60	40	100
8.	22FT4002	Unit Operations in Food Processing Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9.	22HE4071	Soft Skills -III	SEC	1	0	0	1	1	100	0	100
TOTAL				18	2	8	24	29	460	440	900
<p>* Two weeks internship carries 1 credit and it will be done during Semester III summer vacation and same will be evaluated in Semester IV. If students unable to undergo in semester III, then the Internship I offered in the semester IV can be clubbed with Internship II (Total: 4 weeks-2 credits)</p>											

SEMESTER V

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



SEMESTER VI

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22FT6201	Dairy Engineering	PCC	3	0	0	3	3	40	60	100
2.	22HS6101	Professional Ethics (Common)	HSC	3	0	0	3	3	40	60	100
3.	22FT63XX	Professional Elective-4	PEC	3	0	0	3	3	40	60	100
4.	22FT63XX	Professional Elective-5	PEC	3	0	0	3	3	40	60	100
5.	22XX64XX	Open Elective - 1*	OEC	3	0	0	3	3	40	60	100
6.	22XX64XX	Open Elective - 2*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
7.	22FT6001	Dairy Engineering Laboratory	PCC	0	0	4	2	4	60	40	100
8.	22FT6002	Food Process Equipment Design Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9.	22HE6071	Soft Skills - 5	SEC	2	0	0	2	2	100	0	100
TOTAL				20	0	8	24	28	460	440	900

SEMESTER VII

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22FT7201	Food Packaging	PCC	3	0	0	3	3	40	60	100
2.	22FT7202	Food Plant Layout and Management	PCC	3	1	0	4	4	40	60	100
3.	22FT730X	Professional Elective-6	PEC	3	0	0	3	3	40	60	100
4.	22FT740X	Open Elective - 3*	OEC	3	0	0	3	3	40	60	100
5.	22FT740X	Open Elective - 4*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
6.	22FT7001	Food Packaging Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
7.	22FT7701	Internship - II'	SEC	-	-	-	2	1	100	0	100
TOTAL				15	1	4	20	21	360	340	700
* - Two weeks internship carries 1 credit and it will be done during Semester VI summer vacation/placement training and same will be evaluated in Semester VII.											

SEMESTER VIII

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
EEC COURSES (SE/AE)											



1.	22FT8901	Project Work/Granted Patent	SEC9	0	0	20	10	20	100	100	200
TOTAL				0	0	20	10	20	100	100	200

Note:

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

OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES)

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

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	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	CATE GORY	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
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22FT5301 Technology of Fats and Oils	22FT5304 Processing of Spices & Plantation Crops	22FT5307 Introduction to food safety Analysis and Quality Risk Management	22FT5310 Entrepreneurship Opportunities for Food Technologist	22FT5314 Food additives	22FT5317 Principles of Food Processing
22FT5302 Cereal Technology	22FT5305 Blending and Value Addition	22FT5308 HACCP in Food Processing and Preservation	22FT5311 Total Quality Management	22FT5315 Food colors and flavor Technology	22FT5318 Post-Harvest Technology
22FT5303 Processing of Legumes and Oilseeds	22FT5306 Processing of Coffee	22FT5309 FSMS & Food Product and Supply Chain Management	22FT5312 Enterprise for resource planning	22FT5316 Biology and Chemistry of Food Flavors	22FT5319 Cane sugar Technology
22FT6301 Milling Technology for Food Materials	22FT6303 Processing of Tea	22FT6305 Food laws – Indian and International	22FT6307 Consumer acceptance and Market survey in Food Processing	22FT6309 Functional Foods and Nutraceuticals	22FT6311 Beverage Technology
22FT6302 Technology of Malting and Brewing	22FT6304 Processing of cocoa and Chocolate	22FT6306 Food Safety in Hospitality Industry & GLP in Food Industries	22FT6308 Energy Audit in Food Processing Industry	22FT6310 Food Toxicology and Allergy	22FT6312 Emerging Non-Thermal Processing of Foods
22FT7301 By Products Management	22FT7302 Packaging of Spices, Plantation products	22FT7303 Food Analysis, Testing & Microbial Safety Analysis	22FT7304 Food Process Economics & Industrial Management	22FT7305 Genetically Modified Foods	22FT7306 Emerging Technologies in Food Processing
22FT7307 Quality, Laws and Regulations in Grain Processing Industries	22FT7308 Spice Processing and Products Laws, Quality Standards and Regulations	22FT7309 Food quality, Assurance and Quality Control	22FT7310 Supply Chain and Retail Management	22FT7311 Waste Management and By-Product Utilization in Food Industries	22FT7312 Technology of Snack and Extruded Foods

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

PROFESSIONAL ELECTIVE COURSES: VERTICALS

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

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5301	Technology of Fats and Oils	PEC	3	0	0	3	3
2.	22FT5302	Cereal Technology	PEC	3	0	0	3	3
3.	22FT5303	Processing of Legumes and Oilseeds	PEC	3	0	0	3	3



4.	22FT6301	Milling Technology for Food Materials	PEC	3	0	0	3	3
5.	22FT6302	Technology of Malting and Brewing	PEC	3	0	0	3	3
6.	22FT7301	By Products Management	PEC	3	0	0	3	3
7.	22FT7307	Quality, Laws and Regulations in grain processing Industries	PEC	3	0	0	3	3

Details of Vertical II: Spices and Plantation Technology

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

Details of Vertical III: Food Safety Management System

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



Details of Vertical IV: Entrepreneurship and Management

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

Details of Vertical V: Food Colors & Flavors

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

Details of Vertical VI: Novel Technologies

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5317	Principles of Food Processing	PEC	3	0	0	3	3
2.	22FT5318	Post-Harvest Technology	PEC	3	0	0	3	3
3.	22FT5319	Cane sugar Technology	PEC	3	0	0	3	3
4.	22FT6311	Beverage Technology	PEC	3	0	0	3	3



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

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

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

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

VERTICALS FOR MINOR DEGREE

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

Note: Each programme should provide verticals for minor degree

S. NO.	COURSE CODE	COURSE TITLE	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.



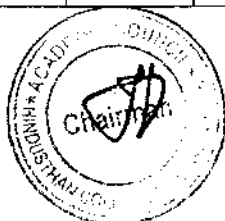
Vertical I Fintech and Block Chain	Vertical II Entrepreneurship	Vertical III Environment and Sustainability
21CS5601-Financial Management	22BA5601 - Foundation of Entrepreneurship	Sustainable infrastructure Development
Fundamentals of Investment	22BA6601- Introduction to Business Venture	Sustainable 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	22BA8601 -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

[Signature]
Chairman BoS
**Chairman - BoS
FT - HICET**



[Signature]
Dean Academics
**Dean (Academics)
HICET**

[Signature]
Principal
PRINCIPAL
Hindusthan College Of Engineering & T
COIMBATORE - 541 000

SYLLABUS
III SEMESTER

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

- Course Objective**
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 Raphson method . 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

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

- Course Outcome**
- 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 perform 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

- To understand and apply the principles in heat transfer phenomena
- To understand and apply the principles in mass transfer phenomena
- 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:

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

REFERENCES:

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

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Programme B.TECH.	Course code 22FT3203	Name of the course FLUID MECHANICS	L 3	T 1	P 0	C 4
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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 EngineeringI, 7th Edition, McGraw Hill, New York, 2017.
2. Gavhane K.A., —Unit Operations – I, 8th Edition, Nirali Prakashan Publications, Pune, 2017.

REFERENCE BOOKS:

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

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

The student should be able

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

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

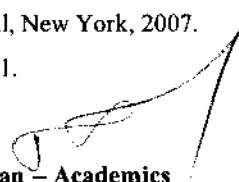
R1 McCabe W.L., Smith J.C. and Harriot P., —Unit Operations of Chemical EngineeringI, 7th Edition, McGraw Hill, New York, 2005.

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

Treybal R.E., —Mass Transfer OperationsI, 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 Manual, Wiley Interscience Publications, 2003.
- R2 McLandsborough L., —Food Microbiology Laboratory, 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 Verbal Ability	12
III	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. Writing skills for placements	7
IV	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 B.TECH.	Course code 22HE3072	Name of the course IDEATION SKILLS	L 2	T 0	P 0	C 0
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The student should be able

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

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


Course Outcome	CO1	Develop a strong understanding and importance of ideation
	CO2	Learn about the different kinds of tools for Ideation.
	CO3	Learn the need and significance of prototyping and its significance.

TEXT BOOK:


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

REFERENCES:

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


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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**
- To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
 - To make the students understand the traditional knowledge and analyze it and apply it to their day-to-day life.
 - To impart basic principles of thought process, Itihas and Dharma Shastra and connecting society and nature.
 - To understand the concept of Intellectual and intellectual property rights with special reference.
 - 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 <i>Siddhanta</i>	6
Total Instructional Hours		30

Course Outcome	CO1	CO2	CO3	CO4	CO5
	Identify the concept of Traditional knowledge and its importance.	Explain the need and importance of protecting traditional knowledge.	Explain the need and importance of Itihas and Dharma Shastra.	Interpret the concepts of Intellectual property to protect the traditional knowledge.	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, International Chinmay Foundation, Velliamad Amakuum.

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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	<p>UNIT II Heat Transfer – Convection: Newton Rikhman's law – film coefficient of heat transfer - 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.</p> <p>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.</p>	<p>UNIT II Heat Transfer – Convection: Newton Rikhman's law – film coefficient of heat transfer - 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</p> <p>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.</p>	A topic included Deletion and inclusion of a topic	12%





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			<p>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.</p>	<p>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 Plating Techniques: Pour plate, Spread plate and Streak plate methods for the Isolation and Counting of Viable Microorganisms in Food samples</p>	<p>Deletion and inclusion of topics</p>	
<p>2</p>	<p>22FT3002 Food Microbiology Laboratory</p>	<p>Changes in experiment II, V, IX, XII, XIII were suggested</p>	<p>Exp II: Culture Techniques, Isolation and Preservation of Cultures- Broth: flask, test tubes; Solid: Pour plates, streak plates, slants, stabs</p> <p>EXP V: Microbiological Quality of Water (MPN)</p> <p>EXP IX: Enumeration of spores from pepper</p> <p>EXP XII: Thermal destruction of microbes: TDT & IDP</p> <p>EXP XIII: Enumeration & Isolation of Staphylococci from ready to eat street foods</p>	<p>Determination and Enumeration of Pathogenic and Indicator Organisms in Foods (MPN Method)</p> <p>Microbial Examination of Spices for Spores</p> <p>Determination of Thermal Death Time</p> <p>Detection of <i>Staphylococcus aureus</i> from food sample</p>	<p>New experiments added instead of the existing experiments</p>	<p>53.8 %</p>

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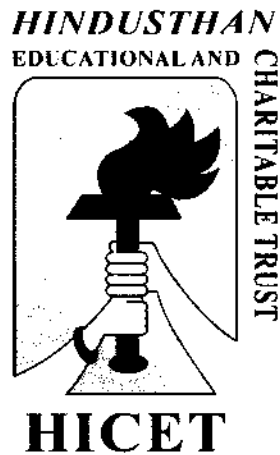


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Coimbatore - 641 032.

B.TECH. FOOD TECHNOLOGY



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

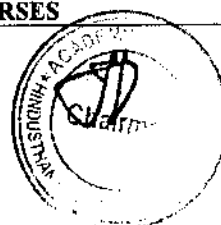
The course code 21 indicates that the students joined in the academic year 2021

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										



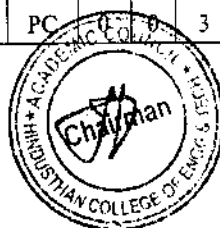
9.	21HE2072	Career Guidance Level – II Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	21HE2073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
Total:				17	2	12	22	630	370	1000

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 Career Development	EEC	2	0	0	0	100	0	100
10.	21HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
Total				19	2	8	20	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 Mass Transfer	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 Chain Management	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 Confectionery Technology	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 Food Processing	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 in Engineering	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

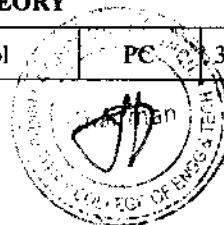
S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1	21FT5301	Technology of Fats and Oils	PE	3	0	0	3	40	60	100
2	21FT5302	Food Storage and Infestation Control	PE	3	0	0	3	40	60	100
3	21FT5303	Food Process Calculations	PE	3	0	0	3	40	60	100
4	21FT5304	Post-Harvest 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

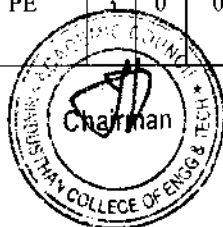
S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	21FT83XX	Professional Elective –IV	PE	3	0	0	3	40	60	100
2.	21FT83XX	Professional Elective- V	PE	3	0	0	3	40	60	100
PRACTICAL										
3.	21FT8901	Project Work – Phase II	EEC	0	0	16	8	100	100	200
TOTAL				6	0	16	14	180	220	400

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

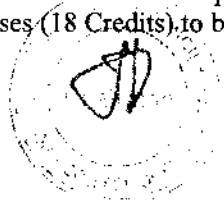
Enrollment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

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	CATE GORY	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

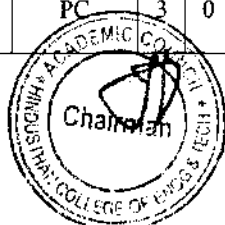
*MDC – Minor Degree Course

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
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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

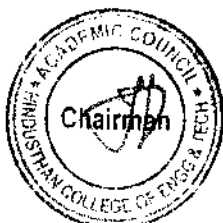
B.E. / B.TECH. PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HS	04	04	-	-	-	03	-	-	11
2	BS	10	10	04	04	-	-	-	-	28
3	ES	06	05	-	-	-	-	-	-	11
4	PC	-	03	16	17	19	12	12	-	79
5	PE	-	-	-	-	03	03	03	06	15
6	OE	-	-	-	-	-	03	03	-	06
7	BEC	-	-	-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

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Dean Academics

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Principal

Hindustan College of Engineering & Technology
COIMBATORE - 641 032.

SYLLABUS
V SEMESTER

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH. Course Objectives	21FT5201	BAKING AND CONFECTIONERY TECHNOLOGY	3	0	0	3

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

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

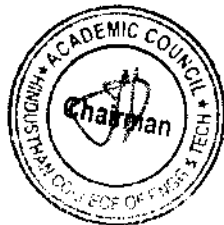
TEXT BOOKS:

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

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	21FT5202	FOOD ADDITIVES	3	0	0	3

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

Upon completion of the course, students can be able to

CO1- To understand the principles of chemical preservation of foods
CO2- To understand the role of different food additives in the processing of different foods
CO3- To know the specific functions of different food additives in improving the shelf life, quality, texture and other physical and sensory characteristics of foods
CO4- To expose the different food additives in improving the physical and sensory characteristics of foods
CO5- To know the regulations and the monitoring agencies involved in controlling the safer use of additives in foods

TEXT BOOKS:

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

REFERENCES BOOKS:

1. Fellows, P.J, "Food Processing Technology" 2001.
2. Leninger, H.A. and Beverlode, 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.

Chairman, Board of Studies

Dean – Academics

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FT - HiCET

Dean (Academics)
HiCET



Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	21FT5203	LIVESTOCK AND FISH PROCESSING TECHNOLOGY	3	0	0	3

The students will be able to

- Course Objectives**
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

Upon completion of the course, students can be able to

- Course Outcomes**
- 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, Montepplier, 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 Quality, 1st Edition, CRC Press, London, 2004.
3. Alan R. Sams, —Poultry Meat Processing, 1st Edition, CRC Press, London, 2001.
4. Joseph Kerry, John Kerry and David Ledwood. —Meat Processing, Woodhead Publishing Limited, England (CRC Press), 2002.


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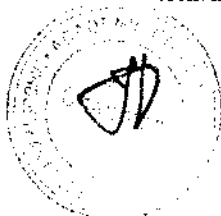
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Programme	Course Code	Name of the Course				
B.TECH. Course	21FT5204	PRINCIPLES OF FOOD PROCESSING	3	0	0	3
Objectives	<ul style="list-style-type: none"> • To understand the principles of food processing and their impact on the shelf life and quality 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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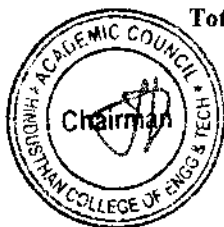
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Programme	Course Code	Name of the Course	HiCET	L	T	P	C
B.TECH.	21FT5205	UNIT OPERATIONS IN FOOD PROCESSING		3	0	0	3

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



Upon completion of the course, students can be able to

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

Total: 45 Hours

TEXT BOOKS:

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 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 B.TECH.	Course Code 21FT5001	Name of the Course BAKING AND CONFECTIONERY TECHNOLOGY LABORATORY	L 0	T 0	P 4	C 2
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- 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 Industry], Woodhead Publishing, England, 2001.
2. Yogambal Ashokkumar, —Text book of Bakery and Confectionery], 2nd Edition, PHI Learning Pvt. Ltd., New Delhi, 2012.
1. Samuel A. Matz, —Bakery Technology and Engineering], 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.

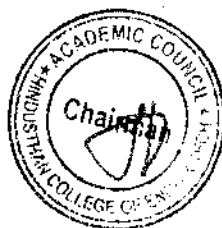
CO4 - Analyze the performance of different mills and distillation equipment.

CO5 - Analyze the conveying efficiency of screw conveyors and bucket elevators for designing equipment.

REFERENCES BOOKS:

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

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Programme	Course Code	Course Title	L	T	P	C
B.TECH.	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

OBJECTIVES:

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

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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


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PROFESSIONAL ELECTIVE I

Programme B.TECH.	Course Code 21FT5301	Name of the Course TECHNOLOGY OF FATS AND OIL	L	T	P	C
			3	0	0	3

Course Objectives

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

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

Upon completion of the course, students can be able to

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

TEXT BOOKS:

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

REFERENCES BOOKS:

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

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

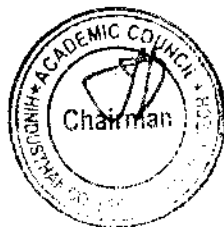
- Mohan and Awaknavar J.S., —Pest Management in Store Grainsl, Satish Serial Publishing House, New Delhi, 2009.
- Nair K.R., —Integrated Production and Pest Managementl, DK Publishers and Distributors, Delhi, 2007.

REFERENCES BOOKS:

- Hagstrum D.W., and Subramanyam B., —Fundamentals of Stored Product Entomologyl American Association of Cereal Chemists Inc., 2006
- Subramanyam B., —Integrated Management of Insects in Stored Productsl, CRC Press, 1995.
- Slansky Jr. F., and Rodriguez J.G., —Nutritional Ecology of insects, mites, spiders and related invertebratesl, John Wiley, 1987.
- 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**
- To have an idea about different systems of units and dimensions, estimation compositions of mixtures and solutions
 - To understand the material balance for different unit operations
 - To apply material balance for recycle operations and perform humidification calculations
 - To perform energy balance calculations
 - To determine the heat values and composition of fuels

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	Units and Dimensions, Fundamental Calculations: Basic and derived units, unit conversions, use of model units in calculations, methods of expression, compositions of mixture and solutions. Ideal and real gas laws – gas constant - calculations of pressure, volume and temperature using ideal gas law, Use of partial pressure and pure component volume in gas calculations, applications of real gas relationship in gas calculation.	9
II	Material Balance and Stoichiometry: Stoichiometric principles, Importance of material balance and energy balance in a process Industry, material balance with chemical reaction and without chemical reaction- application of material balance to unit operations like distillation, evaporation, crystallization, drying and extraction.	9
III	Recycle Operations: Recycle stream, block diagram, purging operations, purge ratio, recycle ratio and purge stream. Humidity and Saturation: Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity, wet and dry bulb temperature, dew point - Humidity chart usage.	9
IV	Energy Balance: Heat capacity of solids, liquids, gases and solutions, use of mean heat capacity in heat calculations, problems involving sensible heat and latent heats, evaluation of enthalpy. Standard heat of reaction, heats of formation, combustion, solution, mixing etc., calculation of standard heat of reaction - Effect of pressure and temperature on heat of reaction - Energy balance for systems without chemical reaction.	9
V	Combustion: Combustion of solids, liquid and gas, determination of NHV and GHV. Determination of composition by Orsat analysis - Calculation of excess air, theoretical oxygen requirement.	9
TOTAL INSTRUCTIONAL HOURS		45

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

TEXT BOOKS:

T1.Gavhane K.A., —Introduction to Process Calculations (Stoichiometry)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	<ul style="list-style-type: none"> • To understand and identify the specific processing technologies used for different foods and the various products derived from these materials. • To understand the application of scientific principles in the processing technologies specific to the materials. 					

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	<p>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.</p>	9
II	<p>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; Ddehydration– 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.</p>	9
III	<p>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.</p>	9
IV	<p>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.</p>	9
V	<p>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</p>	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
B.TECH. **21FT5305**

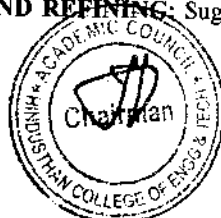
Name of the Course
CANE SUGAR TECHNOLOGY

HiCET	L	T	P	C
	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 disadvantages. Evaporator- types-performance measures.	9
III	CLARIFICATION: Clarification - importance, methods, clarifying agent, bleaching agent. Role of pH, non-sugars, colloids and gums in cane juice clarification. Lime - specification, storage. Preparation of milk of lime, rotary lime slacker, classifier, MOL tanks, lime pumps, use of hydrated lime powder. Sulphur - specification and storage, production of sulphur dioxide gas, construction and working of sulphur burner, film type sulphur burner.	9
IV	CRYSTALLIZATION AND REFINING: Sugar boiling, Nucleation and crystal	9



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.

MANUFACTURING OF JAGGERY/ GUR AND OTHER BY PRODUCTS:

V	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
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Total Instructional Hours 45

Upon completion of the course, students can be able to

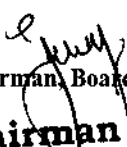
Course Outcomes	CO1- Remember the sugar cane constituents and apply preprocessing operations
	CO2- Understand the suitable cane juice extraction and concentration methods
	CO3- Understand the appropriate clarification methods for sugarcane juice
	CO4- Remember crystallization and refining techniques
	CO5- Understand the knowledge for manufacturing of cane sugar by-products


TEXT BOOKS:

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

REFERENCES BOOKS:

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


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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21FT5306	MILLING TECHNOLOGY FOR FOOD GRAINS	3	0	0	3
Course Objectives	<ul style="list-style-type: none"> 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	<p>Upon completion of the course, students can be able to</p> <p>CO1- Understand the structure and storage of grains</p> <p>CO2- Remember the processing of paddy</p> <p>CO3- Remember the processing of wheat</p> <p>CO4- Understand the importance of milling of pulses</p> <p>CO5- Understand the milling process of oil seeds</p>
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TEXT BOOKS:

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



House, New Delhi, 2008.

REFERENCES BOOKS:

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

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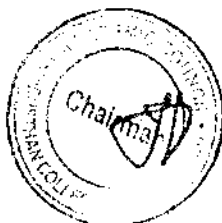
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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21FT5307	FOOD COLORS AND FLAVOR TECHNOLOGY	3	0	0	3

- 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



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
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Total Instructional Hours 45

Upon completion of the course, students can be able to

Course	CO1 Identify the synthetic and natural colors and its regulations
Outcomes	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				
	INTRODUCTION TO FINANCIAL MANGEMENT					
I	Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization- Time Value of money- Risk and return concepts	9				
	SOURCES OF FINANCE					
II	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				
	INVESTMENT DECISIONS:					
III	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				
	FINANCING AND DIVIDEND DECISION					
IV	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				
	WORKING CAPITAL DECISION					
V	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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HICE1

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.Poomima, 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**
- To gain knowledge on concepts and socio-economic policies of sustainable development.
 - To examine the strategies for implementing sustainable development programmes.
 - To learn the various sustainability and performance indicators, their assessment techniques and constraints
 - To explore the different approaches for resource management for a sustainable urban planning.
 - 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

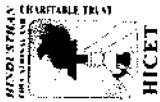

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Hindustan College of Engineering and Technology
 (An Autonomous Institution, Affiliated to Anna University, Chennai
 Approved by AICTE, New Delhi & Accredited by NAAC with 'A' Grade)
 Valley Campus, Pollachi Highways, Coimbatore, Tamilnadu.



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 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 egg 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 egg. 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	



			liquids. Microbial spoilage of eggs, Egg powder processing-spray drying, Foam mat drying.	
		<p>UNIT III MEAT PROCESSING: Types of Meat and its sources, composition, structure of meat. Ante mortem handling, slaughtering and grading of meat. Inspection and grading of meat. 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.</p>	<p>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</p>	Deletion and inclusion of topics
		<p>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.</p>	<p>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.</p>	Deletion and inclusion of topics
		<p>UNIT V HYGIENE AND SANITATION: Handling and maintenance of tools and core equipment. Meat plant layout. Meat processing hygiene. Cleaning and</p>	<p>MEAT PLANT HYGIENE AND REGULATION: Modern abattoirs and its features Handling and maintenance of tools and core equipment. Agents</p>	Deletion and inclusion of topics





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 Valley Campus, Pollachi Highways, Coimbatore, Tamilnadu.



			<p>sanitation in meat plants. Food safety measures –GMP and GHP, Safety standards in meat, poultry and egg industry: HACCP/ISO/MFPO/FSSAI/Kosher/Halal</p>	<p>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.</p>		
	<p>21FT5002 Unit Operations in Food Processing Laboratory</p>	<p>Changes in experiment VII, VIII, IX, XIII were suggested</p>	<p>Exp VII : Determination of performance characteristics in size reduction using the burr mill jaw crusher EXP VIII: Determination of energy requirement in size reduction and performance evaluation using ball mill EXP IX: Determination of energy requirement in size reduction using hammer mill/ EXP XIII: Determination of economy and thermal efficiency of evaporator</p>	<p>Exp VII: Experiment on cold extrusion and quality analysis of extruded products Exp VIII: Experiment on Crystallization process Exp IX: Determination of energy requirement in size reduction using hammer mill/ball mill EXP XIII: Determination of conveying efficiency of bucket elevator</p>	<p>New experiments added instead of the existing experiments</p>	<p>30.7 %</p>

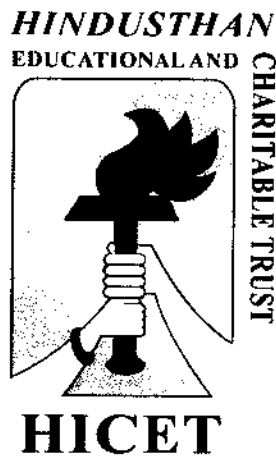
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Chairman - BoS
Chairman - HICET



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Dean Academics
Dean (Academics)

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY
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Coimbatore - 641 032.

B.TECH. FOOD TECHNOLOGY



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 - I Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
Total:				16	2	8	20	425	375	800
As Per AICTE Norms 3 Weeks Induction Programme is Added in The First Semester as an Audit Course										

SEMESTER II

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



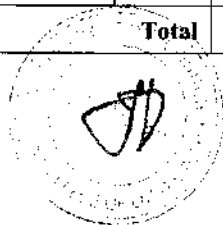
		Personality, Aptitude and Career Development								
10.	19HE2073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
Total:				17	2	12	22	575	425	1000

SEMESTER III

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

SEMESTER IV

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



SEMESTER V

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

SEMESTER VI

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



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

OPEN ELECTIVE

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

SEMESTER VII

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	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.	19FT7801R	Food Packaging Laboratory	PC	0	0	3	1.5	50	50	100
7.	19FT7802R	Food Analysis and Quality Control Laboratory	PC	0	0	3	1.5	50	50	100
PROJECT WORK										
8.	19FT7901	Project Phase I	EEC	0	0	4	2	50	50	100



TOTAL	15	0	10	20	275	525	800
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SEMESTER VIII

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

PROFESSIONAL ELECTIVE III

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

PROFESSIONAL ELECTIVE IV

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

PROFESSIONAL ELECTIVE V

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



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

LIST OF OPEN ELECTIVES - FOOD TECHNOLOGY

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

SEMESTER-WISE CREDIT DISTRIBUTION

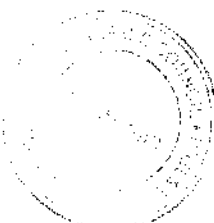
B.E. / B.TECH. PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HS	04	04	-	-	-	03	-	-	11
2	BS	10	10	04	04	-	-	-	-	28
3	ES	06	05	-	-	-	-	-	-	11
4	PC	-	03	16	17	19	12	12		79
5	PE	-	-	-	-	03	03	03	06	15
6	OE	-	-	-	-	-	03	03	-	06
7	EEC	-	-	-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

Credit Distribution R2019

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

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**Chairman - BoS
FT - HICET**



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Dean Academics

**Dean (Academics)
HICET**

[Signature]
Principal

PRINCIPAL
Hindustan 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	<ul style="list-style-type: none"> 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 column, Detectors; Quality standards, and adulterants. MINERALS: Sample Preparation: 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), <i>In vitro</i> 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, IEC. 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 Practices!, 2nd Edition, Taylor and Francis, UK, 2014.					
REFERENCES BOOKS:						
1.	David Kilcast, —Sensory Analysis for Food and Beverage Quality Control: A Pracial Guidel, Woodhead Publishing Ltd, Cambridge, 2010.					
2.	Singh, S. P., —Food Safety, Quality Assurance, and Global Trade: Concerns and Strategies!, International Book Distributing Company, Lucknow, 2009.					
3.	Manuals of Food Quality Control: Quality Assurance in Food Control Chemical Laboratory!, 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	<p>Upon completion of the course, students can be able to</p> 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
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TEXT BOOKS:

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

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

REFERENCES BOOKS:

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

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

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

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

Chairman, Board of Studies
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Dean (Acad.)
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

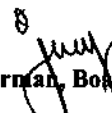
Total Practical Hours 45

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

The students will able to

Course Objectives

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

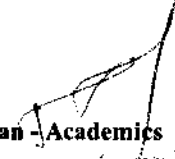
Total Practical Hours 45

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**
- To understand the flavour compounds involved in development of flavor.
 - To understand the analytical techniques involved in flavor analysis.

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

- Upon completion of the course, students can be able to**
- Course Outcomes**
- 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:

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

REFERENCES BOOKS:

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

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

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

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	INTRODUCTION TO FOOD TOXICOLOGY: Definition and need for understanding food toxicology; Hazards -Microbiological, nutritional and environmental. Basics of immune response - humoral and cell mediated response. Allergen and mechanism of allergic response.	9



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


- Upon completion of the course, students can be able to**
- Course Outcomes**
- 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:

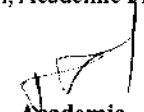
1. Hefnerich, William and Carl K. Winter "Food Toxicology" CRC Press, 2001.
2. Alluwalla, Vikas "Food Hygiene and Toxicology" Paragon International Publishers, 2007

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	<ul style="list-style-type: none"> To study the advanced drying technologies used for specific food material according to its nature 					

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

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

TEXT BOOKS:

- 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 ProcessingI, 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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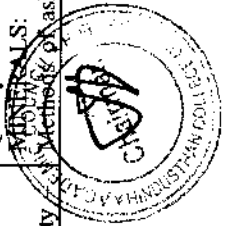
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SYLLABUS REVISION DETAILS FOR THE REGULATION 2019 – SEMESTER VII						
S.NO	COURSE CODE/COURSE NAME	SUGGESTION BY EXPERTS	EXISTING CONTENT (IN THE AY 2022-23 ODD)	REVISED CONTENT(FOR AY 2023-24 ODD)	TYPE OF REVISION/ DELETION/ INSERTION/ MODIFICATION	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	<p>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 β-Glucan content, Degree of Methylation and Acetylation of pectin.</p> <p>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</p>	<p>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</p> <p>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 colour, Detectors; Quality standards, and adulterants. SAMPLE PREPARATION: Sample Preparation: Grinding; Washing; Dry ashing and</p>	Deletion and inclusion of a topics	20 %





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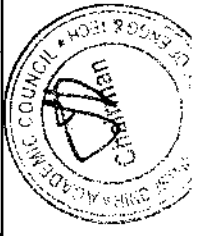


	<p>wet ashing, AAS, ICP, OES</p>	<p>Protein Efficiency Ratio (PER), Net Protein Utilization (NPU), Biological Value, Protein Digestibility- Corrected Amino acid Score (PDCAAS), <i>In vitro</i> Protein digestibility for C-PER; Measurement of Functional properties of proteins- Protein hydration properties, Surface properties of protein, Protein gel properties. Calculation of proximate and ultimate composition of foods.</p>	
	<p>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), <i>In vitro</i> Protein digestibility for C-PER; Analysis of Functional properties of proteins- Water absorption, fat absorption, solubility, gelling and foaming.</p>	<p>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</p>	
	<p>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</p>	<p>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</p>	

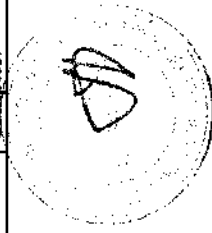




		<p>Systems - ISO 9000, ISO 14000, ISO 22000, Mechanism of developing and fixing food standards, Good Manufacturing Practice, HACCP, Standards of Weights and Measures</p>	
	<p>UNIT I BASICS IN FOOD PACKAGING: Definitions and basic functions of a food package. Food package design and development. Packaged product quality and shelf life. Current status of food packaging in India. Package standards and regulation. Inks, adhesives. Labeling, Bar coding.</p>	<p>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.</p>	
<p>19FT7202 R Food Packaging</p>	<p>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.</p>	<p>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.</p>	<p>New portions were included in all the units as per the suggestion</p>
	<p>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.</p>	<p>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.</p>	
	<p>UNIT IV METAL CANS: Raw materials for can making - steel, aluminum. Can making processes -</p>	<p>UNIT IV METAL CANS: Raw materials for can making - steel, aluminum. Can making processes -</p>	



	<p>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 for glass containers. Application of glass containers in food industries.</p>	<p>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.</p>	<p>Experiments changed and new experiments included as per the suggestion 30.7%</p>
	<p>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.</p>	<p>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.</p>	<p>I Identification of different packaging materials. IX Gas/Vacuum packaging of foods and shelf-life studies. XI Edible packaging of Food Samples.</p>
<p>Changes in experiment I, IX, and experiment XI and XII suggested</p>	<p>I Measuring GSM of various paper and flexible film-based packaging materials. IX Experiment on opening and closing torques of foods packed in bottles/Jars using torque tester.</p>		
<p>19FT7001 R Food Packaging Laboratory</p>			
<p>3</p>			





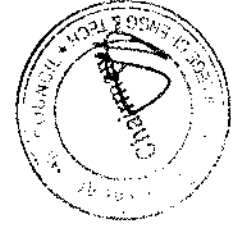
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 Valley Campus, Pollachi Highways, Coimbatore, Tamilnadu.



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. IV Measurement and analysis of Cooking Quality Parameters VII Quality analysis of raw materials used for bakery products X Isolation and estimation of synthetic food colors	XII Study on retort packing Detection and estimation of salt in pickle in food materials. Swelling capacity and extract release volume of meat Quality evaluation of egg Determination of soluble and insoluble fibre in foods.	Repetition experiments in Food Chemistry and Food Analysis have been revised	36.36%
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[Signature]
 Chairman B08
Chairman - B08
FT - HICET

[Signature]
 Dean Academics
Dean (Academics)
HICET



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	PO12	PSO1	PSO2	PSO3
C01	2	-	-	-	-	1	2	2	2	3	1	1	1	2	1
C02	2	1	-	-	1	1	1	2	2	3	-	2	-	2	1
C03	2	1	-	-	1	1	2	3	3	3	-	1	1	2	2
C04	2	1	-	-	-	1	2	2	2	3	1	1	-	-	1
C05	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	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3	3	3	2	2	-	-	-	-	-	-	2	1	1	1
C02	3	3	3	2	2	-	-	-	-	-	-	3	2	2	2
C03	3	3	3	2	2	-	-	-	-	-	-	3	3	3	1
C04	3	3	3	2	2	-	-	-	-	-	-	3	1	1	1
C05	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
C01	3	3	3	3	2	-	-	-	-	-	-	2	2	2	2
C02	3	3	3	3	3	-	-	-	-	-	-	2	2	1	2
C03	3	3	3	3	2	-	-	-	-	-	-	2	2	1	1
C04	3	3	3	3	3	-	-	-	-	-	-	2	2	1	1
C05	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	PSO3
C01	2												1	1	2
C02		2											1	1	2
C03		2	2	2	2								1	1	1
C04			2	2									1	1	1

Avg	2.5	2	2.3	2	3	2	2				3		1.3	2.8	1.6
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Course Code & Name : 22FT3001/Unit Operations Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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	PO10	PO11	PO12	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	PO10	PO11	PO12	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	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	2	
CO4	3		2										3	1	
CO5	1	3	3	3								1	3	2	
Avg	2.5	1.75	2.2	2.5								1	3	2	
												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	3	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	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						1	2	3
CO2	2	3	3	2	3		2				3		2	3	
CO3	2	3	3	1			2							3	
CO4	3	2	1	2									1	3	
CO5	2	3	3										1	3	
Avg	2.25	2.75	2.5	1.66	3		1						1	2	
							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	PSO3
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	1		3	3	1	-
CO4	1	3	1	2		3	1		2	3	1	3	3	3	-
CO5	2	2	1	1	1	3	1		2	3	1	3	3	2	-
Avg	2.2	2.8	1.6	2.2	2	2.6	1.4		2	1.8	1	3	3	2	-

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	1	1	
CO3	1	-	2	1	1	2	2	-	-	-	-	1	2	1	
CO4	1	-	2	2	2	2	2	-	-	-	-	1	2	1	
CO5	1	-	3	2	2	2	2	-	-	-	-	1	1	1	
Avg	1	-	2.2	2	1.6	2	2	-	-	-	-	1	2	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	2	1	1	2	3
CO4	3	2	3	2	1	1	1	1	1	1	1	1	1	2	3
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	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	2	3	1	2	2	-	-	-	-	1	1	1	
CO2	1	-	2	2	2	2	2	-	-	-	-	1	1	1	
CO3	1	-	2	1	1	2	2	-	-	-	-	1	2	1	
CO4	1	-	2	2	2	2	2	-	-	-	-	1	2	1	
CO5	1	-	3	2	2	2	2	-	-	-	-	1	1	1	
Avg	1	-	2.2	2	1.6	2	2	-	-	-	-	1	2	1	

Course Code and Name: 21FT7303/ FOOD TOXICOLOGY AND ALLERGY

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	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	1	1	1	2	3
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	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	2	

Course Code and Name: 21FT7305/ CEREAL TECHNOLOGY

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

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CHAIRMAN-BOS

DEAN ACADEMICS



**Chairman - BoS
FT - HiCET**

**Dean (Academics)
HiCET**

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

B.TECH. FOOD TECHNOLOGY



CHOICE BASED CREDIT SYSTEM

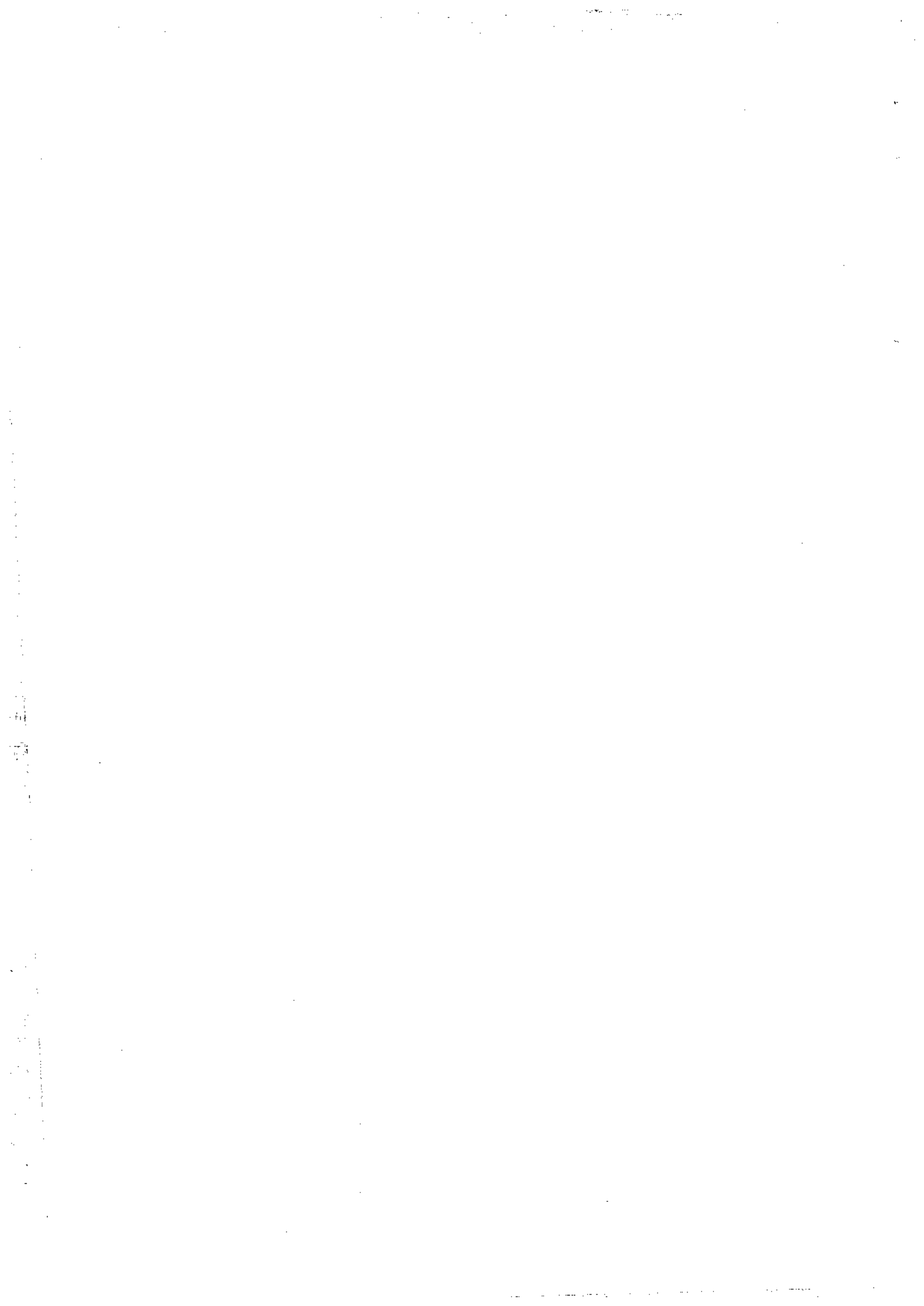
Revised Curriculum and Syllabus for the Odd semester

Semester II

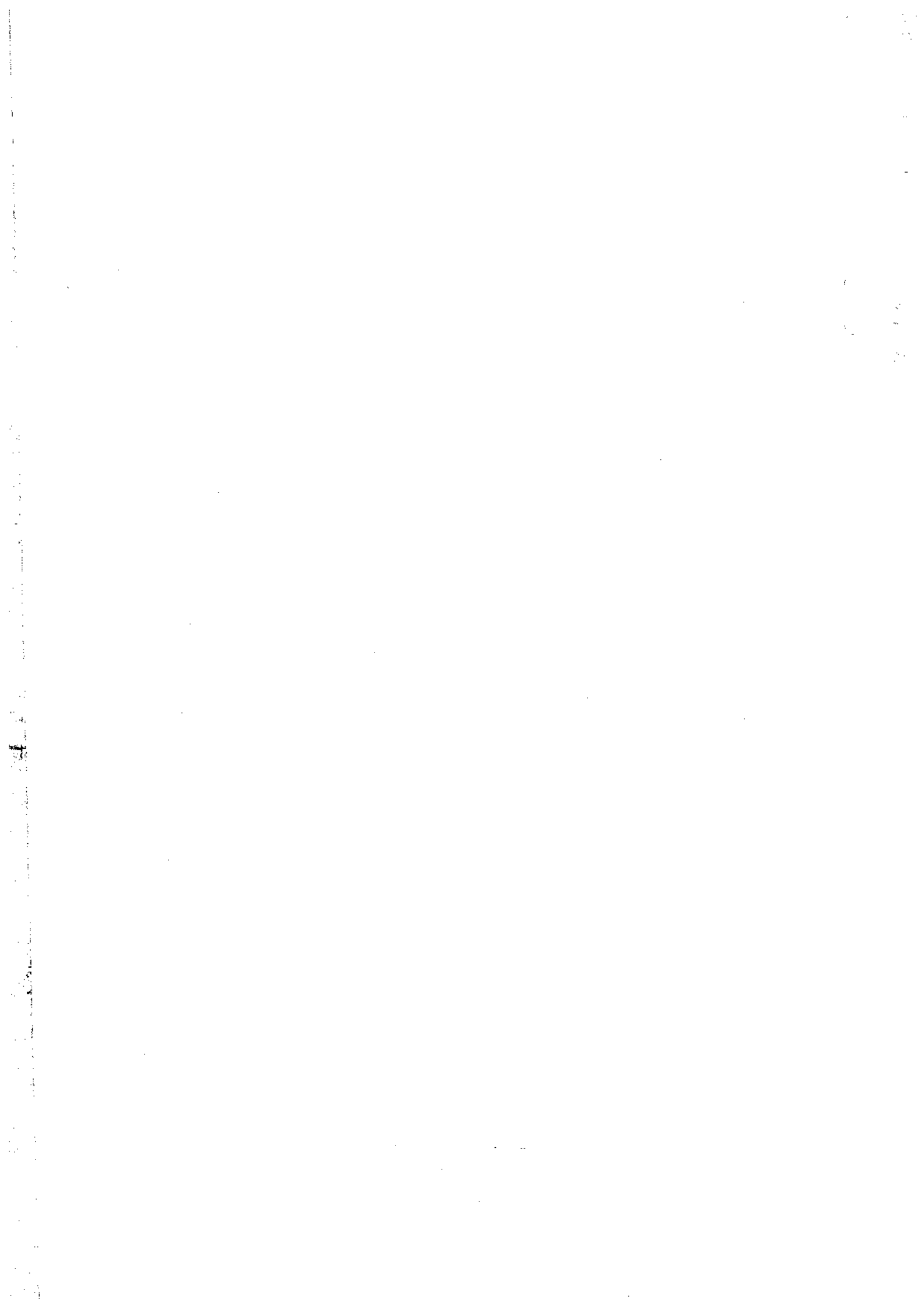
Academic year 2023-24

Batch 2023-2027

Academic council Meeting Held on 19.12.2023



CURRICULUM R2022





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



DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. FOOD TECHNOLOGY (UG)

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



THEORY WITH LAB COMPONENT											
5.	22FT2152	Food Biochemistry and Nutrition	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
<p>* Two weeks internship carries 1 credit and it will be done during Semester III summer vacation and same will be evaluated in Semester IV. If students unable to undergo in semester III, then the Internship I offered in the semester IV can be clubbed with Internship II (Total: 4 weeks-2 credits)</p>											

SEMESTER V

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



SEMESTER VI

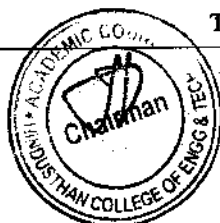
S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22FT6201	Dairy Engineering	PCC	3	0	0	3	3	40	60	100
2.	22HS6101	Professional Ethics (Common)	HSC	3	0	0	3	3	40	60	100
3.	22FT63XX	Professional Elective-4	PEC	3	0	0	3	3	40	60	100
4.	22FT63XX	Professional Elective-5	PEC	3	0	0	3	3	40	60	100
5.	22XX64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
6.	22XX64XX	Open Elective – 2*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
7.	22FT6001	Dairy Engineering Laboratory	PCC	0	0	4	2	4	60	40	100
8.	22FT6002	Food Process Equipment Design Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9.	22HE6071	Soft Skills – 5	SEC	2	0	0	2	2	100	0	100
TOTAL				20	0	8	24	28	460	440	900

SEMESTER VII

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22FT7201	Food Packaging	PCC	3	0	0	3	3	40	60	100
2.	22FT7202	Food Plant Layout and Management	PCC	3	1	0	4	4	40	60	100
3.	22FT730X	Professional Elective-6	PEC	3	0	0	3	3	40	60	100
4.	22FT740X	Open Elective – 3*	OEC	3	0	0	3	3	40	60	100
5.	22FT740X	Open Elective – 4*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
6.	22FT7001	Food Packaging Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
7.	22FT7701	Internship - II*	SEC	-	-	-	2	1	100	0	100
TOTAL				15	1	4	20	21	360	340	700
* - Two weeks internship carries 1 credit and it will be done during Semester VI summer vacation/placement training and same will be evaluated in Semester VII.											

SEMESTER VIII

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



Note:

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)

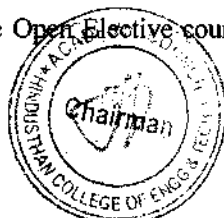
To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

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

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

circuit branches

OPEN ELECTIVE III

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

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

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

OPEN ELECTIVE IV

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

PROFESSIONAL ELECTIVE COURSES: VERTICALS

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



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

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

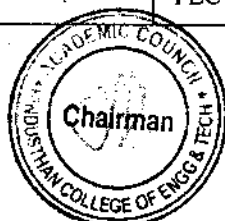
PROFESSIONAL ELECTIVE COURSES: VERTICALS

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

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

Details of Vertical II: Spices and Plantation Technology

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5304	Processing of spices & plantation crops	PEC	3	0	0	3	3
2.	22FT5305	Blending and Value Addition	PEC	3	0	0	3	3



3.	22FT5306	Processing of Coffee	PEC	3	0	0	3	3
4.	22FT6303	Processing of Tea	PEC	3	0	0	3	3
5.	22FT6304	Processing of cocoa and chocolate	PEC	3	0	0	3	3
6.	22FT7302	Packaging of spices and plantation products	PEC	3	0	0	3	3
7.	22FT7308	Spice Processing and products laws, quality standards and regulations	PEC	3	0	0	3	3

Details of Vertical III: Food Safety Management System

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

Details of Vertical IV: Entrepreneurship and Management

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



Details of Vertical V: Food Colors & Flavors

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

Details of Vertical VI: Novel Technologies

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

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

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

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

VERTICALS FOR MINOR DEGREE

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

Note: Each programme should provide verticals for minor degree



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

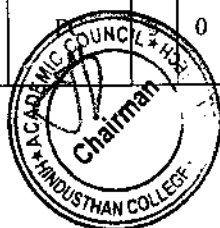
*MDC – Minor Degree Course

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
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			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
Theory with Lab Component											
5.	22FT7XXX	Processing and Value addition of Tuber crops	PC	2	0	2	3	4	40	60	100
6.	22FT8XXX	Mushroom Processing Technology	PC	2	0	2	3	4	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
Theory with Lab Component											
5.	22FT7XXX	Fermentation Technology	PC	2	0	2	3	4	40	60	100
6.	22FT8XXX	Enzymes in Food Processing	PC	2	0	2	3	4	40	60	100

Note: Each programme should provide verticals for Honours degree





SEMESTER-WISE CREDIT DISTRIBUTION

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

Credit Distribution R2022

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


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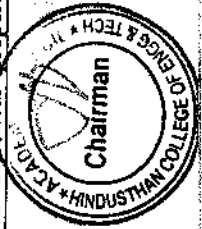

 Principal

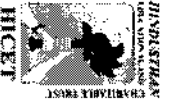




SYLLABUS REVISION DETAILS FOR THE REGULATION 2022 – SEMESTER II

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	22FT2251 BIOCHEMISTRY	Change of title as Food Biochemistry and Nutrition-22FT2252 New portions were included in all the units.	<p>UNIT I</p> <p>Carbohydrates: Classification; Simple Sugars: mono and disaccharides, Hygroscopicity and solubility, optical rotation, mutarotation; Sweetness: structure-activity relationship and sweetness index; Dextrose Equivalent, Degree of polymerisation; Sugar alcohols; Oligosaccharides: structure and occurrence. Polysaccharides: Starch- amylose and amylopectin- properties. Cellulose, Pectins, gums and seaweeds – structure & properties. Dietary fibres - Food sources, functional role and uses in foods. Qualitative tests for reducing sugars and proteins. Estimation of reducing sugar by dinitrosalicylic acid method. Estimation of carbohydrates by anthrone method</p> <p>UNIT II</p> <p>Lipids: Structure, classification and composition of fats. Physical properties of fats and oils: crystal formation, polymorphism, melting point, plasticity, radiolysis. Shortening power of fats, emulsification, smoke point and polymerization. Chemical properties of</p>	<p>UNIT I Metabolism of Biomolecules: Digestion and absorption of carbohydrates, fatty acids and proteins; Glycolysis (EMP) pathway, CORI's cycle, Energy yield from glycolysis, TCA cycle – Energetics, HMP/PP pathway, Gluconeogenesis; Synthesis of TAG's, adipose tissue, cholesterol biosynthesis, Urea cycle. Estimation of proteins by Biuret and Lowry's method</p> <p>UNIT II Biochemistry of Milk and Muscle Foods: Lactose - properties and derivatives; Heterogeneity and molecular properties of milk proteins; Lipid oxidation in milk; Biochemical changes in cheese during ripening, Factors affecting</p>	<p>Deletion and inclusion of a topics</p> <p>Change in entire unit</p>	75%

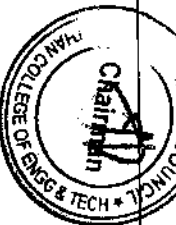




Hindusthan College of Engineering and Technology
 (An Autonomous Institution, Affiliated to Anna University, Chennai
 Approved by AICTE, New Delhi & Accredited by NAAC with 'A++' Grade)
 Valley Campus, Pollachi Highways, Coimbatore, Tamilnadu.



			<p>fats – Hydrolysis, saponification, halogenation. Hydrolytic rancidity and oxidative rancidity. Determination of oxidative rancidity of oils</p>	<p>biochemical characteristics of meat, Proteolysis, Glycolysis and Lipolysis of meat products, Oxidative reactions; Biochemical changes in seafood storage. Estimation of oxidative rancidity of food products.</p>		
2			<p>UNIT III Proteins: Amino acids - Definition, structure and classification. Protein - structure and conformation. Food sources and biological role. Properties of proteins in food systems: Dissociation, optical activity, solubility, hydration, swelling, foam formation and stabilization, gel formation, emulsifying effect. Denaturation. Estimation of foaming and emulsion properties of proteins. Estimation of protein by biuret method and Lowry's Method.</p>	<p>UNIT III Biochemistry of Fruits, Vegetables and Cereals: Biochemical changes in fruits – ripening and softening; Biosynthesis of isoprenoids; Anthocyanins and ester volatiles; Biochemistry of minimally processed vegetables; Synthesis of starch. Biochemical changes in beer fermentation. Estimation of starch by anthrone method, Estimation of anthocyanins in fruits and vegetables.</p>	<p>Change in entire unit</p>	
			<p>UNIT IV Enzymes as food processing aids: Introduction, Nature, classification and nomenclature of enzymes. Specificity. Enzyme kinetics – Michaelis - Menten equation, Factors affecting enzyme action, mechanism of enzyme action; active site. Immobilization methods. Enzyme activity – Amylase-enzyme.</p>	<p>Enzymes in Food Processing: Enzyme classification – common enzymes in food industry – Enzyme inhibition – Enzyme kinetics – Michaelis-Menten – Lineweaver-Burk plots, Eadie-Hofstee plots, Hanes-Wolf plots, Eisenthal-Cornish-Bowden plots; Factors affecting enzyme activity – enzyme, substrate and cofactor concentration, pH, and temperature; Enzyme immobilization; Enzymes in food</p>	<p>inclusion of topics</p>	





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	<p>manufacture. Effect of pH and temperature on enzyme Amylase activity.</p>		
	<p>Food and Nutrition: Food as a source of nutrition. Nutrition in phytochemicals and non-nutrient components, Nutrigenomics, Nutritional disorders – overweight, underweight and obesity, CVD, diabetes, inborn errors of metabolism, Nutritional requirements for infants, preschool and school children, adolescence, geriatric, sports and fitness, adults, pregnancy and lactation. Estimation of total antioxidant activity. Qualitative phytochemical screening of nutraceuticals in foods.</p>	<p>UNIT V Nucleic Acids: Composition and structure of DNA and RNA. Metabolism: Metabolism - Glycolysis; TCA cycle; substrate level phosphorylation. Protein metabolism – urea cycle. Cellular respiration - electron transport chain. Lipid metabolism – lipases and phospholipases. Fatty acid metabolism – beta oxidation and fatty acid synthesis. Inter relationship of metabolic pathways.</p>	<p>Deletion and inclusion of topics</p>

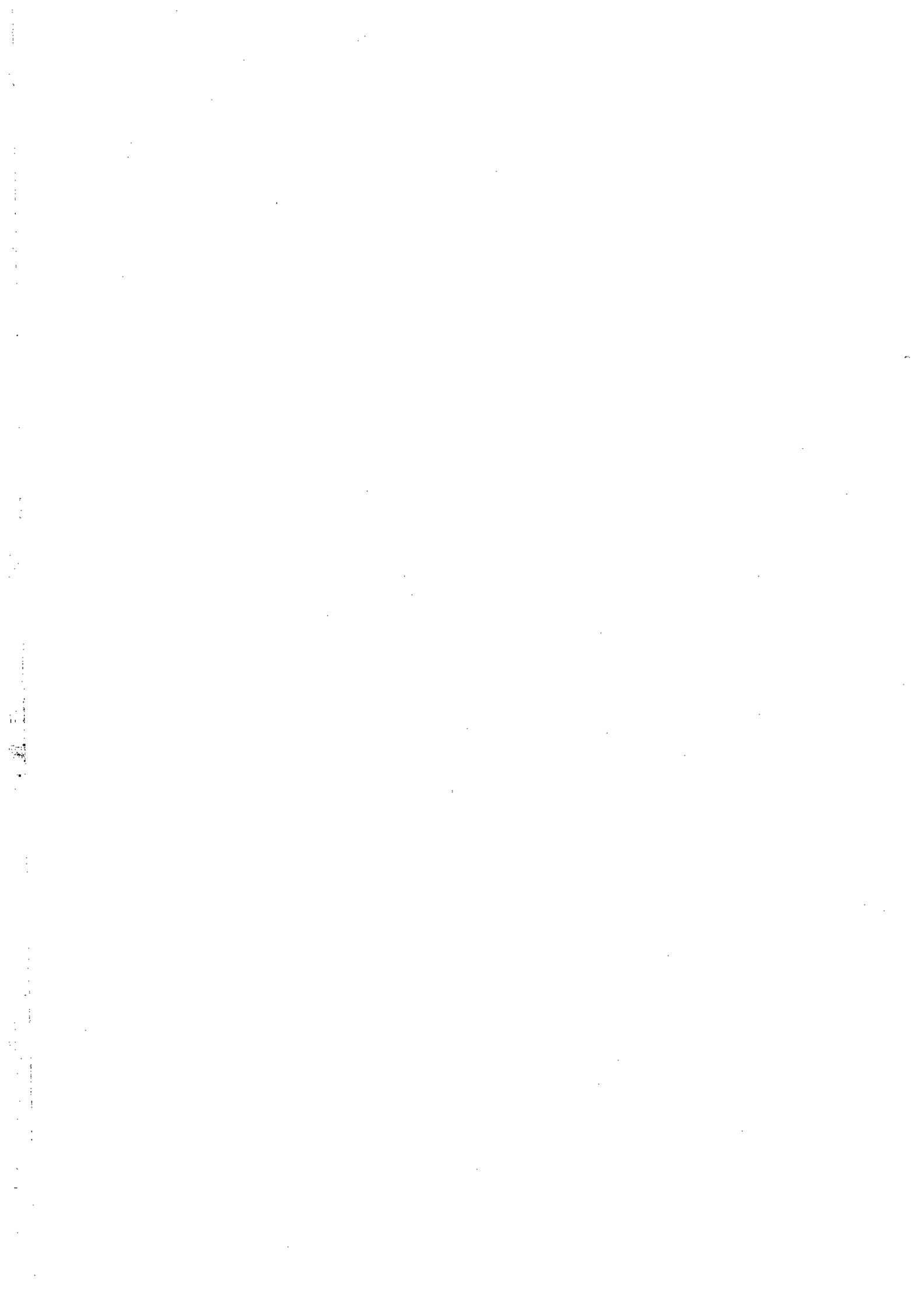

 Chairman BOS

**Chairman - BOS
 FT - HICET**


 Dean Academics

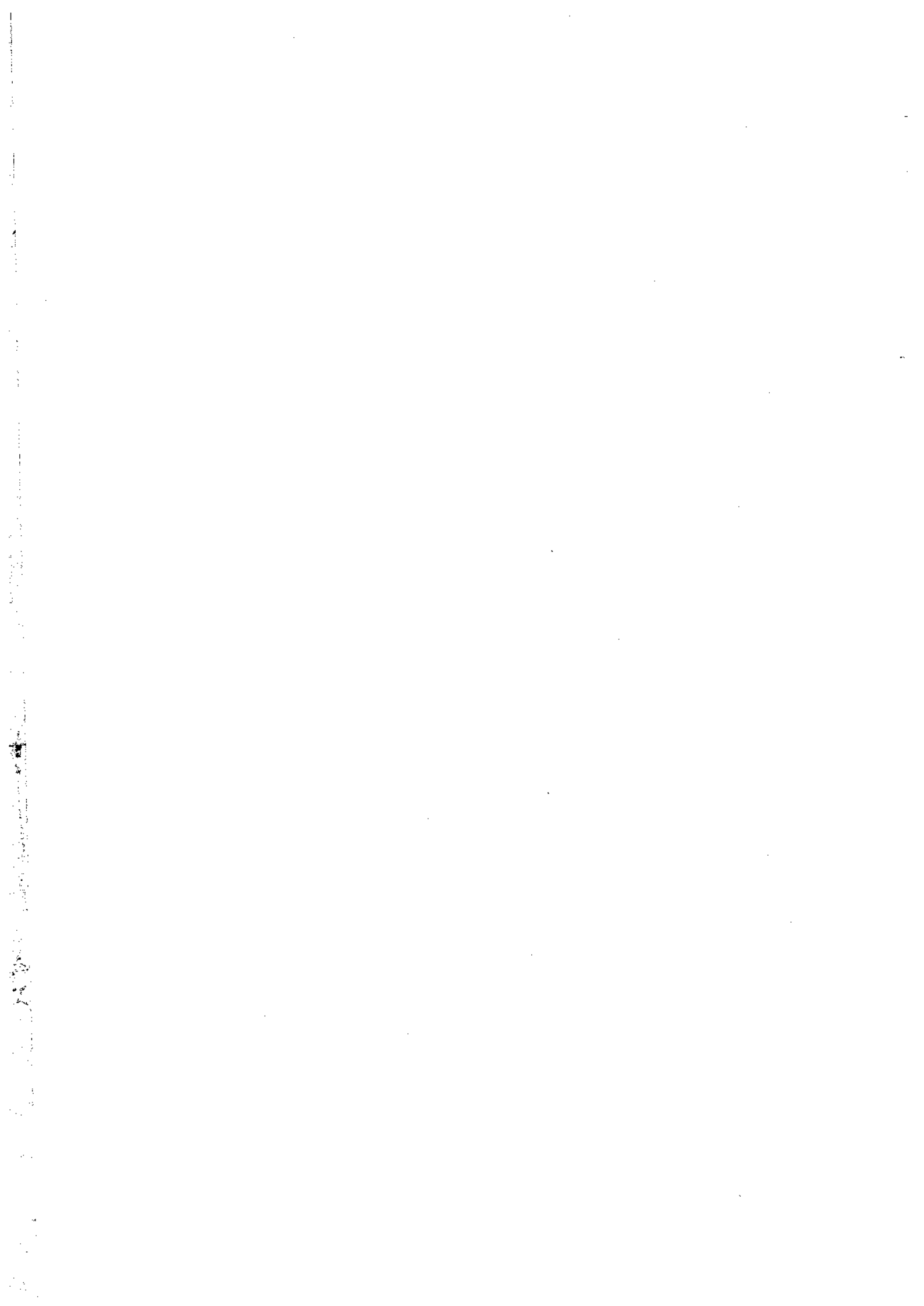
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SYLLABUS

II SEMESTER



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

The student should be able

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

Unit	Description	Instructional Hours
	PARTIAL DIFFERENTIAL EQUATIONS	
I	Formation of partial differential equations by eliminating arbitrary constants and functions – Solution of first order partial differential equations of the form $f(p,q)=0$, Clairaut's equation – Lagrange's equation.	12
	FOURIER SERIES	
II	Dirichlet's conditions- General Fourier Series – Odd and Even Functions – Change of Interval - Parseval's Identity - Harmonic analysis.	12
	BOUNDARY VALUE PROBLEMS	
III	Classification of PDE - Solutions of one-dimensional wave equation-One dimensional equation of heat conduction (excluding insulated edges).	12
	FOURIER TRANSFORMS	
IV	Fourier Transform Pair - Fourier sine and cosine transform Pair – Properties- Transforms of Simple functions – Convolution Theorem (Statement only).	12
	Z - TRANSFORMS	
V	Z- Transforms - Elementary properties – Inverse Z - transform (using partial fraction only) –Solution of difference equations using Z – transform.	12
	Total Instructional Hours	60

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

TEXT BOOK:


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

REFERENCES:

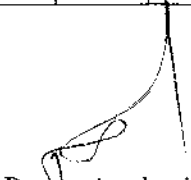
- R1 Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.
- R2 Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2018.
- R3 Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw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

CO-PO PSO MAPPING

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


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

The student should be able

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

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

Total Instructional Hours 45

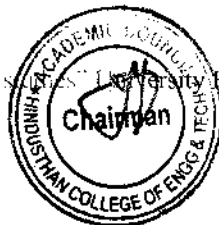
Course Outcome	CO1	Discuss the importance of ecosystem and biodiversity for maintaining ecological balance.
	CO2	Identify the causes of environmental pollution and hazards due to manmade activities
	CO3	Develop an understanding of different natural resources including renewable resources.
	CO4	Demonstrate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

TEXT BOOK:

- T1 S.Annadurai and P.N. Magudeswaran, "Environmental studies", Cengage Learning India Pvt.Ltd, Delhi, 2020.
- T2 Anubha Kaushik and C. P. Kaushik, "Perspectives in Environmental studies", Sixth edition, New Age International Publishers, New Delhi, 2019.

REFERENCES:

- R1 Erach Bharucha, "Textbook of environmental studies", University Press (I) Pvt.Ltd, Hyderabad, 2015.




- R2 G.Tyler Miller, Jr and Scott E. Spoolman "Environmental Science" Thirteenth Edition, Cengage Learning, 2010.
- R3 Gilbert M. Masters and Wendell P. Ela "Introduction to Environmental Engineering and Science", 3rd edition, Pearson Education, 2013.

CO-PO, PSO MAPPING

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


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

The student should be able

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

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

Total Instructional Hours 30

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

TEXT BOOK:

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

REFERENCES:

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

CO-PO PSO MAPPING

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

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

The student should be able

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

Unit	Description	Instructional Hours
I	DC CIRCUITS —Electrical Quantities-Circuit Components-Types of Electrical Networks - Energy Sources-Electrical Power--Energy -Ohm's Law - Kirchhoff's Laws - Resistors in Series Parallel Circuit – Star – Delta Transformation – Source Transformation – Active and Passive Element	9
II	AC CIRCUITS – Introduction to AC Circuits- Phasor Representation – Relationship Between Voltage And Current in Resistor - Inductor and Capacitor – Simple AC circuits – Power – Power factor - RLC Series & Parallel Circuit (Quantitative approach only) – Resonance in RLC series Circuits - Band width – Q-Factor.	9
III	BASIC ELECTRICAL INSTRUMENTATION —Introduction - Classification of Instruments - Operating principles - Essential features of measuring Instruments (Elementary Treatment only) - Moving coil - Permanent Magnet (PMMC) Instruments Voltmeter and Ammeter- Moving Iron Ammeters and Voltmeters - Energy meter – Wattmeter.	9
IV	BASICS OF POWER SUPPLY AND ELECTRICAL WIRING Introduction to Power supply circuits: Half wave, Full wave Rectifier – SMPS, UPS (online & offline). Wiring types and applications. - Brief discussion on concealed conduit wiring. One way and two-way control.	9
V	ELECTRICAL SAFETY - Need for Electrical safety - Electric shock - Precautions against shock - Elementary discussion on Circuit protective devices - Fuse and Miniature Circuit Breaker (MCB's) –Earthing – Types –Neutral Earthing - Pipe and plate Earthing - Residual current circuit Breaker.	9
Total Instructional Hours		45

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

TEXT BOOK:

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

REFERENCES:

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

CO PO PSO MAPPING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	1	1	1	1	-	1	-	1	2	-	-
CO2	2	3	2	1	1	1	1	-	1	-	1	2	-	-
CO3	2	3	2	2	1	1	1	-	1	-	1	2	-	-
CO4	2	3	3	1	2	1	1	-	1	-	2	2	-	1
CO5	2	3	3	2	2	1	1	-	1	-	1	2	-	-
Avg	2	3	2.5	1.4	1.4	1	1		1		1.2	2		1

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22FI2152	FOOD BIOCHEMISTRY AND NUTRITION	2	0	2	3

The student should be able

- | | | |
|-------------------------|---|--|
| Course Objective | 1 | To understand the digestion, absorption and metabolic pathways of biomolecules |
| | 2 | To recognize the biochemical changes in processing of milk and muscle foods |
| | 3 | To summarize the biochemical changes in fruits, vegetables and cereal processing |
| | 4 | To classify the enzymes, roles and activity in food production |
| | 5 | To categorize the nutrients for different age groups and sports people |

Unit	Description	Instructional Hours
I	Metabolism of Biomolecules: Digestion and absorption of carbohydrates, fatty acids and proteins; Glycolysis (EMP) pathway, CORI's cycle, Energy yield from glycolysis, TCA cycle – Energetics, HMP/PP pathway, Gluconeogenesis; Synthesis of TAG's, adipose tissue, cholesterol biosynthesis, Urea cycle. Estimation of proteins by Biuret and Lowry's method.	9+2=11
II	Biochemistry of Milk and Muscle Foods: Lactose -properties and derivatives; Heterogeneity and molecular properties of milk proteins; Lipid oxidation in milk; Biochemical changes in cheese during ripening, Factors affecting biochemical characteristics of meat, Proteolysis, Glycolysis and Lipolysis of meat products, Oxidative reactions; Biochemical changes in seafood storage. Estimation of oxidative rancidity of food products.	9+2=11
III	Biochemistry of Fruits, Vegetables and Cereals: Biochemical changes in fruits – ripening and softening; Biosynthesis of isoprenoids, anthocyanins and ester volatiles; Biochemistry of minimally processed vegetables; Synthesis of starch, Biochemical changes in beer fermentation. Estimation of starch by anthrone method, Estimation of anthocyanins in fruits and vegetables.	9+5=14
IV	Enzymes in Food Processing: Enzyme classification – common enzymes in food industry – Enzyme inhibition – Enzyme kinetics – Michaelis-Menten – Lineweaver-Burk plots, Eadie-Hofstee plots, Hanes-Wolf plots, Eisenthal-Cornish-Bowden plots; Factors affecting enzyme activity – enzyme, substrate and cofactor concentration, pH, and temperature; Enzyme immobilization; Enzymes in food manufacture. Effect of pH and temperature on enzyme Amylase activity.	9+2=11
V	Food and Nutrition: Food as a source of nutrition. Nutrition in phytochemicals and non-nutrient components, Nutrigenomics, Nutritional disorders – overweight, underweight and obesity, CVD, diabetes, inborn errors of metabolism, Nutritional requirements for infants, preschool and school children, adolescence, geriatric, sports and fitness, adults, pregnancy and lactation. Estimation of total antioxidant activity. Qualitative phytochemical screening of nutraceuticals in foods.	9+4+ 13
Total Instructional Hours		45+15=60
Course Outcome	CO1	Explain the digestion, absorption and metabolic pathways of biomolecules
	CO2	Interpret the biochemical changes in processing of milk and muscle foods
	CO3	Identify the biochemical changes during processing of fruits, vegetables and cereals
	CO4	Apply the specific enzymes for processing and preservation of food products
	CO5	Recommend a required nutrition for different age group people

TEXT BOOK:

- T1 Benjamin K. Simpson. Food Biochemistry and Food Processing. Edition -2, Wiley-Blackwell Publication, 2012.
- T2 Nelson DL and Cox MM. Lehninger Principles of Biochemistry. Edition – 7, WH. Freeman Company, 2017.
- T3 Shubhangini A.J. Nutrition and Dietetics. Edition – 4, McGraw Hill Education, 2015.

REFERENCES:


- R1 Fatih Yildiz. Advances in Food Biochemistry. CRC Press, 2010.
- R2 Jain J.L., Sunjay Jain and Nitin Jain. Fundamentals of Biochemistry, S. Chand & Co. 2008.
- R3 Finely, John, W.W., Jeffrey Hurst and Chang Yong Lee. Principles of Food Chemistry. Springer, 2018.




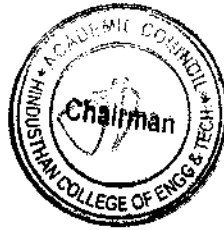
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CO PO PSO MAPPING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	1	1	1	1	1	1	-	1	2	-	-
CO2	2	3	2	1	1	1	1	1	1	-	1	2	-	-
CO3	2	2	2	2	1	1	1	1	1	-	1	2	-	-
CO4	2	2	3	1	2	1	1	1	1	-	2	2	-	1
CO5	2	3	3	2	2	1	1	1	1	-	1	2	-	-
Avg	2	2.6	2.6	1.4	1.4	1	1	1	1		1.2	2		1


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

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

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

GROUP B (ELECTRICAL ENGINEERING)

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

Total Instructional Hours 45+15=60

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

CO-PO PSO MAPPING

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	1	-	-	1	-	2	3	1	2
CO2	3	2	2	2	1	1	-	-	1	-	2	2	1	1
CO3	3	3	2	2	2	1	-	-	1	-	1	2	1	2
Avg	2.2	2.66	2.33	2	2	1	1	1	1	-	1.4	2.2	1.6	2.2

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

The student should be able

- Course Objective**
- To improve essential business communication skills.
 - To enrich employability knowledge.
 - To acquire the crucial organizing ability in official forum.
 - To impart important business writings.
 - To make effective presentation with essential etiquette.

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

Total Instructional Hours 45

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

TEXT BOOK:

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

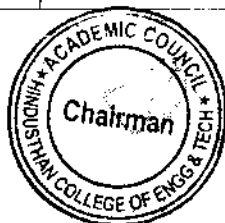
REFERENCES:

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

CO-PO PSO MAPPING

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

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

The student should be able

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

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

Total Instructional Hours 30

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

TEXT BOOK:

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

REFERENCES:

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

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

The student should be able

- Course Objective
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

Unit	Description	Instructional Hours
I	Logical Reasoning Word group categorization questions - Cryptarithmic - Data arrangements - Blood relations	8
II	Quantitative Aptitude Ratio and Proportion: Ratio, Proportion, Variation, Simple equations, Problems on Ages, Mixtures and alligations - Percentages, Simple and Compound Interest: Percentages as Fractions and Decimals, Percentage Increase / Decrease, Simple Interest, Compound Interest, Relation Between Simple and Compound Interest - Number System	12
III	Verbal Ability Essential grammar for placements: Prepositions, Adjectives and Adverbs, Tenses, Forms and Speech and Voice, Idioms and Phrasal Verbs, Collocations, Gerund and Infinitives - Reading Comprehension for placements: Types of questions, Comprehension strategies - Articles, Prepositions and Interrogatives: Definite and Indefinite Articles, Omission of Articles, Prepositions, Compound Prepositions and Prepositional Phrases, Interrogatives - Vocabulary for placements: Exposure to solving questions of Synonyms, Antonyms, Analogy, Confusing words and Spelling correctness	10

Total Instructional Hours 30

Course Outcome	CO1	Students will analyze and critique logical reasoning, including situations for which the student will recognize underlying assumptions and make reasonable assumptions.
	CO2	Students will be able to make decisions with mathematical, statistical, and quantitative information.
	CO3	Students would have obtained a multitude of opportunities resulting in the refinement of his/her language skills and the ability to use the skills for effective communication.

REFERENCES:

- R1 How to Prepare for Quantitative Aptitude for the CAT- Arun Sharma
- R2 How to Prepare for Logical Reasoning for CAT
- R3 Objective General English – S.P.Bakshi

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22MC2094/ 22MC2095	TAMILS AND TECHNOLOGY	2	0	0	1

The student should be able to

- | | | |
|--------------------------|----|---|
| Course Objectives | 1. | Acquiring knowledge of industry during the Sangam Period. |
| | 2. | Collaborat learning about house design, sculpture and temples during Sangam Period |
| | 3. | Develop Knowledge in metallurgical studies as a source of historical and archaeological evidence. |
| | 4. | Acquiring knowledge about ancient techniques used in agriculture and agro processing |
| | 5. | Knowledge of Tamil language literature. |

UNIT	DESCRIPTION	TOTAL HOURS
-------------	--------------------	--------------------

- | | | |
|------------|--|--|
| I | WEAVING AND CERAMIC TECHNOLOGY
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries. | |
| II | DESIGN AND CONSTRUCTION TECHNOLOGY
Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal – Chetti Nadu Houses, Indo – Saracenic architecture at Madras during British Period. | |
| III | MANUFACTURING TECHNOLOGY
Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel - Copper and goldCoins as source of history – Minting of Coins – Beads making- industries Stone beads -Glass beads – Terracotta beads -Shell beads/ bone beats – Archeological evidences – Gem stone types described in Silappathikaram. | |
| IV | AGRICULTURE AND IRRIGATION TECHNOLOGY
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry – Wells designed for cattle use – Agriculture and Agro Processing – Knowledge of Sea – Fisheries – Pearl – Conche diving – Ancient Knowledge of Ocean – Knowledge Specific Society. | |
| V | SCIENTIFIC TAMIL & TAMIL COMPUTING
Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy · Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project. | |

Total

- | | | |
|-----------------------|-----|---|
| Course Outcome | CO1 | Recognize ancient business |
| | CO2 | Distinguish Sangam period building material and types of sculpture. |
| | CO3 | Identify the source of historical and archaeological |
| | CO4 | Demonstrate the techniques used in agriculture and agro processing. |
| | CO5 | Understand the new software of Tamil language. |

Text Books:

- T1 Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay)
T2 Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by:
T3 Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

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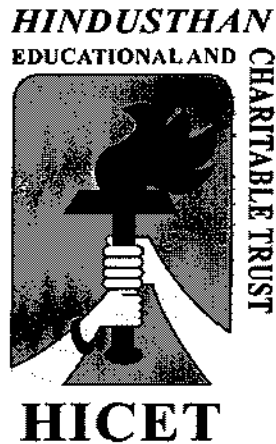


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HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution Affiliated to Anna University, Chennai)
(Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade)
Coimbatore - 641 032.

B.TECH. FOOD TECHNOLOGY



CHOICE BASED CREDIT SYSTEM

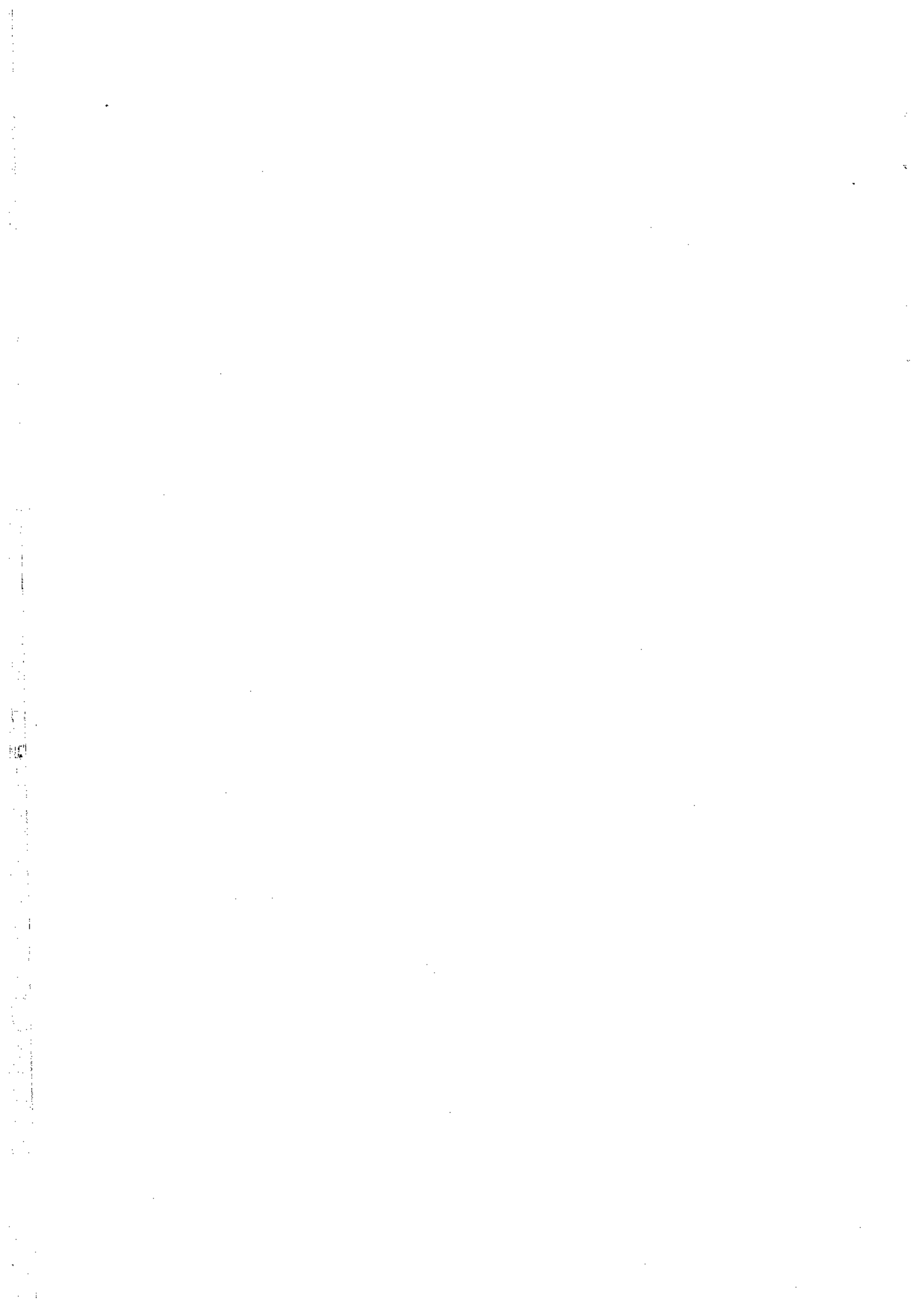
Revised Curriculum and Syllabus for the Odd semester

For

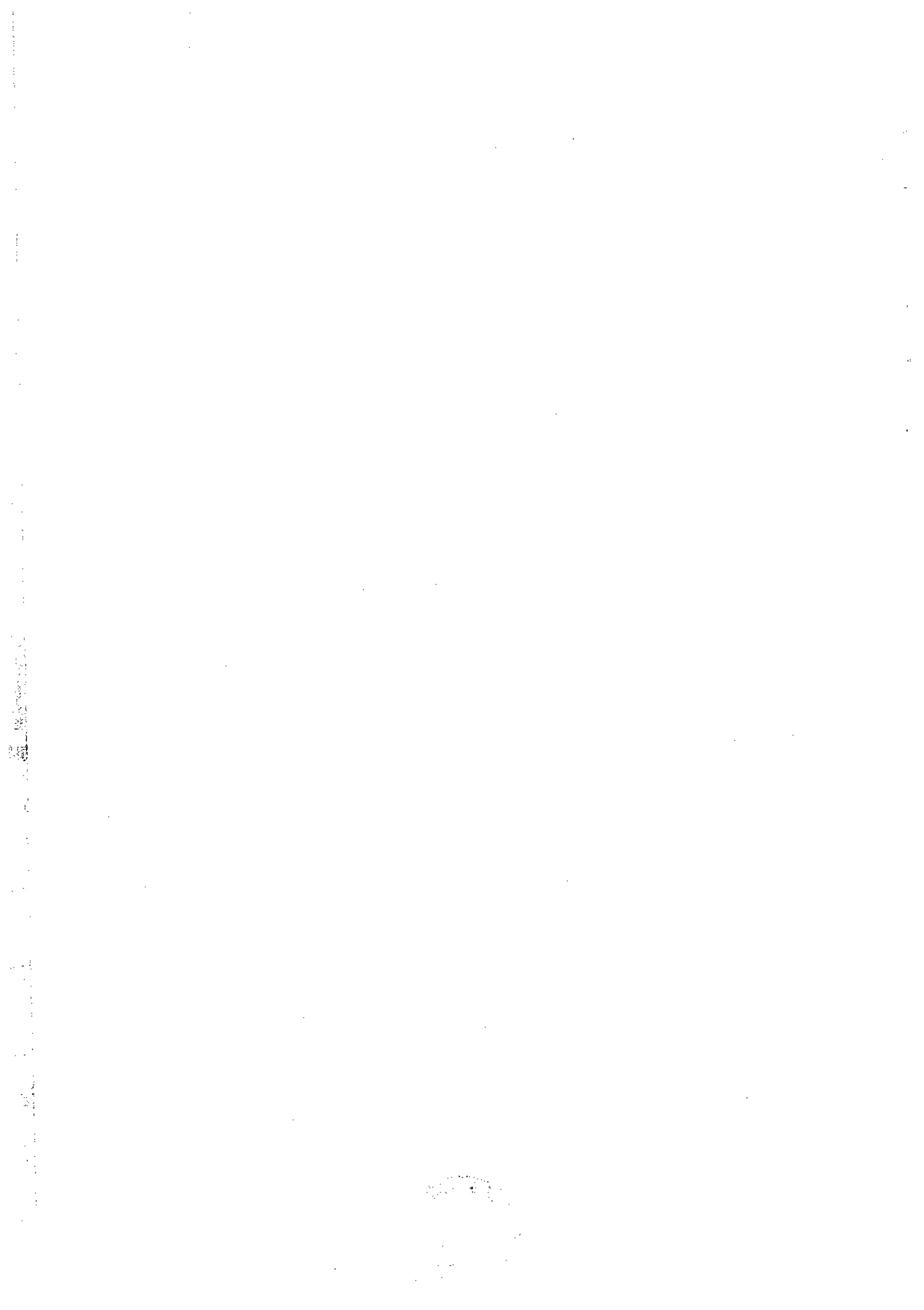
SEMESTER IV

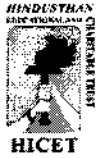
Academic year 2023-24

Batch 2022-2026



CURRICULUM R2022





DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. FOOD TECHNOLOGY (UG)

REGULATION-2022

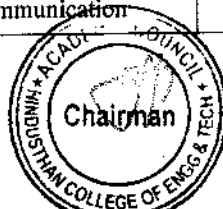
For the students admitted during the academic year 2022-2023 and onwards

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 நாட்பமும் 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





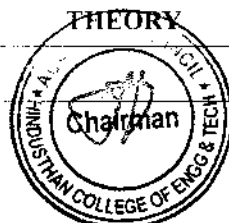
PRACTICAL											
7.	22ME2001	Engineering Practices	ESC	0	0	4	2	2	60	40	100
EEC COURSES (SE/AE)											
8.	22HE2071	Design Thinking	AEC	2	0	0	2	2	100	0	100
9.	22HE2072	Soft Skills -1	AEC	1	0	0	1	1	100	0	100
MANDATORY COURSE											
10.	22MC2091/ 22MC2092	தமிழர் மரபு/ Heritage of Tamils	MC	2	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



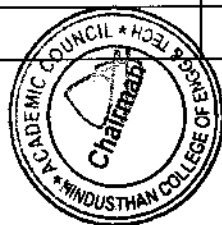
2.	22MA4104	Probability and Operations Research	BSC	3	0	0	3	3	40	60	100
3.	22FT4201	Principles of Thermodynamics	PCC	3	1	0	4	3	40	60	100
4.	22FT4202	Refrigeration and Cold Chain Management	PCC	3	1	0	4	4	40	60	100
5.	22FT4203	Unit operations in Food Processing	PCC	3	0	0	3	4	40	60	100
6.	22FT4204	Food 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
<p>* Two weeks internship carries 1 credit and it will be done during Semester III summer vacation and same will be evaluated in Semester IV. If students unable to undergo in semester III, then the Internship I offered in the semester IV can be clubbed with Internship II (Total: 4 weeks-2 credits)</p>											

SEMESTER V

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

SEMESTER VI

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



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

SEMESTER VII

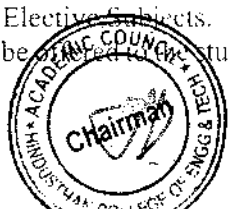
S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22FT7201	Food Packaging	PCC	3	0	0	3	3	40	60	100
2.	22FT7202	Food Plant Layout and Management	PCC	3	1	0	4	4	40	60	100
3.	22FT730X	Professional Elective-6	PEC	3	0	0	3	3	40	60	100
4.	22FT740X	Open Elective – 3*	OEC	3	0	0	3	3	40	60	100
5.	22FT740X	Open Elective – 4*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
6.	22FT7001	Food Packaging Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
7.	22FT7701	Internship - II*	SEC	-	-	-	2	1	100	0	100
TOTAL				15	1	4	20	21	360	340	700
* - Two weeks internship carries 1 credit and it will be done during Semester VI summer vacation/placement training and same will be evaluated in Semester VII.											

SEMESTER VIII

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
EEC COURSES (SE/AE)											
1.	22FT8901	Project Work/Granted Patent	SEC ⁹	0	0	20	10	20	100	100	200
TOTAL				0	0	20	10	20	100	100	200

Note:

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



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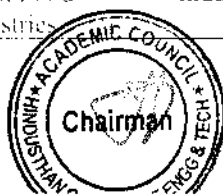
S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22EE7401	Fundamentals of Solar Energy & its applications	OEC	3	0	0	3	3

OPEN ELECTIVE IV

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

PROFESSIONAL ELECTIVE COURSES: VERTICALS

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



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

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

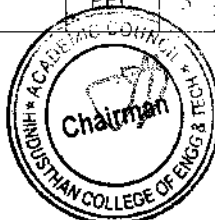
PROFESSIONAL ELECTIVE COURSES: VERTICALS

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

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

Details of Vertical II: Spices and Plantation Technology

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



Details of Vertical III: Food Safety Management System

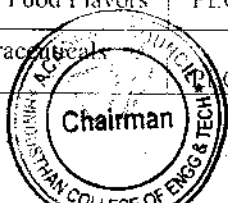
S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22FT5307	Introduction to food safety analysis and quality Risk management	PEC	3	0	0	3	3
2.	22FT5308	HACCP in Food Processing and Preservation	PEC	3	0	0	3	3
3.	22FT5309	FSMS & Food Product and Supply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

Details of Vertical IV: Entrepreneurship and Management

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

Details of Vertical V: Food Colors & Flavors

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



5.	22FT6310	Food Toxicology and Allergy	PEC	3	0	0	3	3
6.	22FT7305	Genetically Modified Foods	PEC	3	0	0	3	3
7.	22FT7311	Waste Management and By-Product Utilization in Food Industries	PEC	3	0	0	3	3

Details of Vertical VI: Novel Technologies

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

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

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

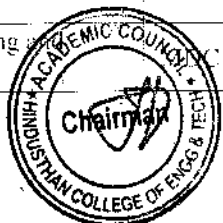
Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

VERTICALS FOR MINOR DEGREE

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

Note: Each programme should provide verticals for minor degree

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	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 Confectionery	MDC	3	0	0	3	3



6.	22FT8601	Sem 8: Food Packaging Technology	MDC	3	0	0	3	3
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*MDC – Minor Degree Course

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

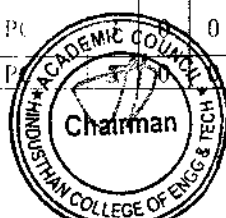
Vertical I Fintech and Block Chain	Vertical II Entrepreneurship	Vertical III Environment and Sustainability
21CS5601-Financial Management	22BA5601 - Foundation of Entrepreneurship	Sustainable infrastructure Development
Fundamentals of Investment	22BA6601 - Introduction to Business Venture	Sustainable 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	22BA8601 -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			0	3	3	40	60	100
3.	22FT6XXX	Cane sugar	P				3	3	40	60	100



		Technology									
4.	22FT7XXX	Beverage Technology	PC	3	0	0	3	3	40	60	100
Theory with Lab Component											
5.	22FT7XXX	Processing and Value Addition of Tuber crops	PC	2	0	2	3	4	40	60	100
6.	22FT8XXX	Mushroom Processing Technology	PC	2	0	2	3	4	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
Theory with Lab Component											
5.	22FT7XXX	Fermentation Technology	PC	2	0	2	3	4	40	60	100
6.	22FT8XXX	Enzymes in Food Processing	PC	2	0	2	3	4	40	60	100

Note: Each programme should provide verticals for Honours degree

SEMESTER-WISE CREDIT DISTRIBUTION

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

Credit Distribution R2022

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

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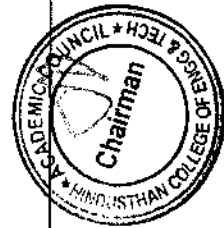


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SYLLABUS REVISION DETAILS FOR THE REGULATION 2022 – SEMESTER IV

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
	22FT4203 UNIT OPERATIONS in FOOD PROCESSING	Include topics to membrane separation and distillation	<p>MECHANICAL SEPARATION: Sedimentation in liquids - Gravitational sedimentation – Flootation - 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</p>	<p>MECHANICAL AND MEMBRANE SEPARATION: Sedimentation in liquids - Gravitational sedimentation – Flootation - Sedimentation of particles in gas, settling under combined forces. Centrifugal separation – Velocity of particles – Radius of neutral zone – Equipment. Filtration – Constant rate and Constant pressure filtration – Equipment: plate and frame filter press, rotary filters, centrifugal filters, air filters. Membrane Separation: osmotic pressure, ultra filtration, reverse osmosis, rate of flow through membranes.</p>	Deletion and inclusion of topics	20%
			<p>CRYSTALLIZATION: Crystallization Equilibrium – Nucleation – Meta stable region – Seed Crystals. Heat of Crystallization - Rate of crystal growth. Stage equilibrium crystallization. Equipment - Types – Applications</p>	<p>CRYSTALLIZATION AND DISTILLATION: Crystallization Equilibrium – Nucleation – Meta stable region – Seed Crystals. Heat of Crystallization - Rate of crystal growth. Stage equilibrium crystallization. Equipment - Types – Applications. Distillation: Distillation process - binary mixtures - flash and differential distillation-steam</p>	Deletion and inclusion of topics	





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			distillation - theory - consumption - continuous distillation with rectification - vacuum distillation - batch and fractional distillation - operation and process - advantages and limitations Experiment on extrusion and quality analysis of extruded products Determination of efficiency of colloid mill used to reduce the particle size of a solid in suspension in a liquid	New experiments added instead of the existing experiments	20 %
2 22FT4002 - Unit Operations in Food Processing Laboratory	Changes in experiment VII, VIII, were suggested	VII Experiment on cold extrusion and quality analysis of extruded products VIII Experiment on Crystallization process			

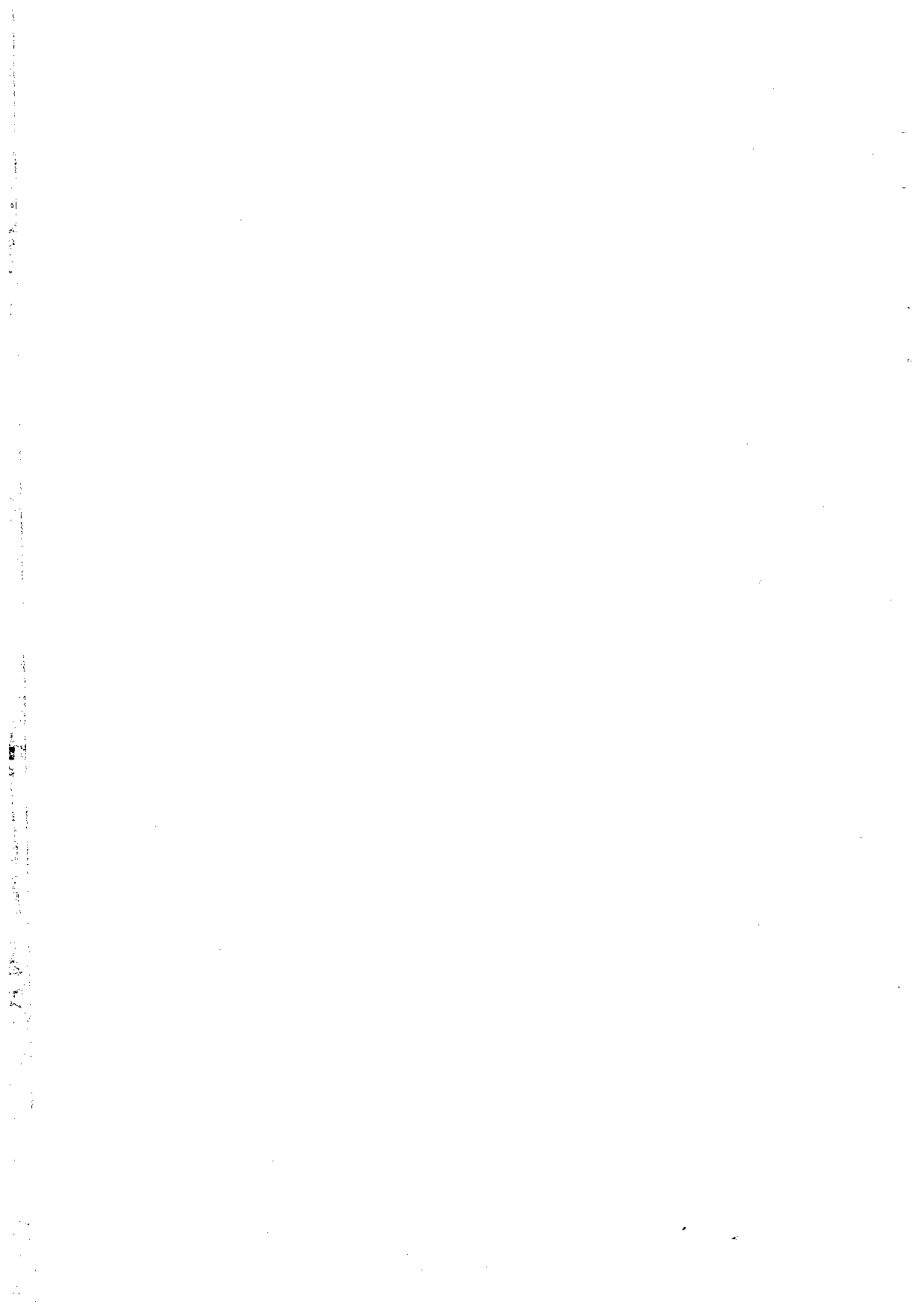
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SEMESTER IV



Programme B.Tech	Course code 22HE4101	Name of the course IPR AND START-UPS	L 2	T 0	P 0	C 2
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The student should be able

- Course Objective**
1. The main objective of the IPR is to make the students aware of their rights for the protection of their invention done in their project work.
 2. To get registration in our country and foreign countries of their invention, designs and thesis or theory written by the students during their project work and for this they must have knowledge of patents, copy right,
 3. To learn about the trademarks in our country and foreign countries of their invention.
 4. To know the designs and information Technology Act of IPR
 5. Further teacher will have to demonstrate with products and ask the student to identify the different types of IPR's.

Unit	Description	Instructional Hours
I	INTRODUCTION TO IPR Meaning of property, Origin, Nature, Meaning of Intellectual Property Rights Introduction to Trade-Related of Intellectual Property Rights (TRIPS) and World Trade Organization (WTO). - Kinds of Intellectual property rights—Copy Right, Patent, Trade Mark, Trade Secret and trade dress, Design, Layout Design, Geographical Indication, Plant Varieties and Traditional Knowledge.	6
II	PATENT RIGHTS AND COPY RIGHTS Origin, Meaning of Patent, Types, Procedure to follow the methods of IP agents, Inventions, which are not patentable, Registration Procedure, Rights and Duties of Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties. COPY RIGHT- Origin, Definition & Types of Copy Right, Patent Ethics, Registration procedure, Assignment & licence, Terms of Copy Right, Piracy, Infringement, Remedies, Copy rights with special reference to software.	9
III	TRADE MARKS Origin, Meaning & Nature of Trade Marks, Types, Registration of Trade Marks, Infringement & Remedies, Offences relating to Trade Marks, Passing off, Penalties. Domain Names on cyber space.	6
IV	DESIGN Meaning, Definition, Object, Registration of Design, Cancellation of Registration, International convention on design, functions of Design. Semiconductor Integrated circuits and layout design Act-2000.	6
V	BASIC TENENTS OF INFORMATION TECHNOLOGY ACT-2000 IT Act – Introduction, Latest Amendments, E-Commerce and legal provisions, E-Governance and legal provisions, Digital signature and Electronic Signature, Cybercrimes.	3
Total Instructional Hours		30

- Course Outcome**
- Upon completion of the course, the students will be able to:
- CO1: To understand IPR and aware the invention rights.
- CO2: The students once they complete their academic projects, they get awareness of acquiring the patent
- CO3: They also learn to have copyright for their innovative works.
- CO4: To understand the designs and information Technology Act of IPR
- CO5: They also get the knowledge of plagiarism in their innovations which can be questioned legally.

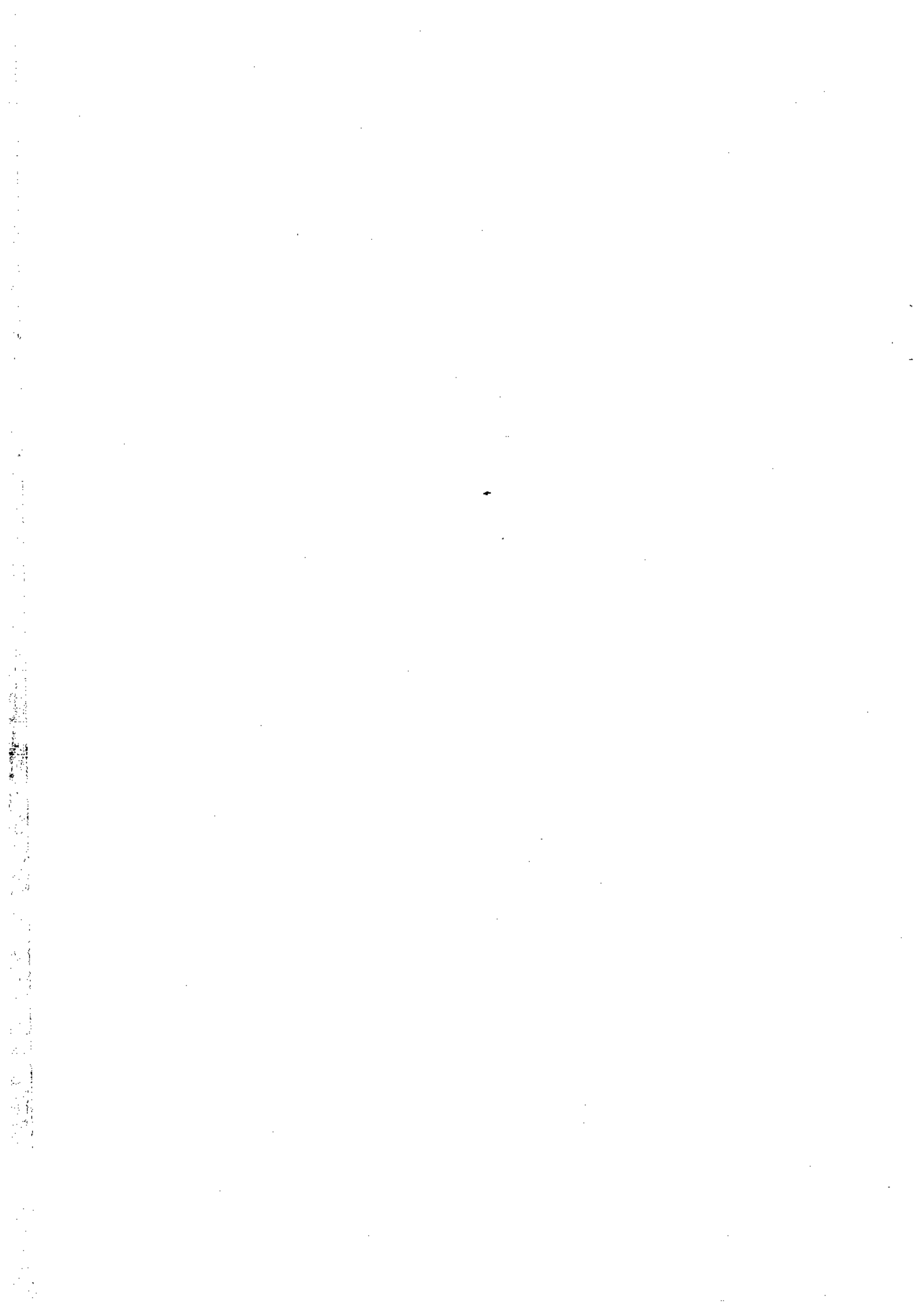
TEXT BOOK:

- T1. Intellectual Property Rights (IPR) by M.K Bhandari 2021
- T2. Law relating to Intellectual Property Rights, by V.K Ahuja 2017
- T3. Intellectual Property Rights (IPR) for Start-ups by Vinay Vaish 2016
- T4. Intellectual Property - Patents, Copyright, Trade Marks and Allied Rights (South Asian Edition) by W Cornish and D Llewelyn and T Pain 8th South Asian Edition, 2016

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CO-PO PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSC	
CO1	2	1	1	-	-	-	1	2	2	-	-	2	3	
CO2	2	1	1	-	-	-	1	2	2	-	-	2	3	
CO3	2	1	1	-	-	-	1	2	2	-	-	2	3	
CO4	2	1	1	-	-	-	1	2	2	-	-	2	3	
CO5	2	1	1	-	-	-	1	2	1	-	-	2	2	1
AVG	2	1	1	-	-	-	1	2	1.8	-	-	2	2.8	2.6

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Programme B.TECH.	Course code 22FT101	Name of the course PRINCIPLES OF THERMODYNAMICS	L 3	T 1	P 0	C 4
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The student should be able

COURSE OBJECTIVES

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

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

TOTAL INSTRUCTIONAL HOURS 60

COURSE OUTCOMES

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

TEXT BOOKS

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

REFERENCE BOOKS

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



Programme/sem	Course Code	Name of the Course	L	T	P	C
B. TECH/ IV	22MA4103	PROBABILITY & OPERATIONS RESEARCH	2	1	0	3

Course Objective

1. To construct a well-defined knowledge of Probability.
2. To interpret measures of central tendency, dispersion, and association.
3. To introduce Correlation concepts to understand the relation between two random variables
4. To acquaint the basic concepts in Operations Research Techniques
5. To educate the concept of mathematical model in Transportation and Assignment problems.

Unit	Description	Instructional Hours
PROBABILITY		
I	Definition – Axioms of Probability – Conditional Probability – Total Probability – Baye's Theorem (without proof).	9
DESCRIPTIVE STATISTICS		
II	Measures of Central Tendency - Mean – Median – Mode, Measures of Dispersion - Range – Quartile Deviation – Standard Deviation – Coefficient of Variation.	9
CORRELATION AND REGRESSION		
III	Correlation – Karl Pearson's correlation coefficient – Spearman's Rank Correlation – Regression lines (problems based on Raw data only).	6
LINEAR PROGRAMMING MODELS		
IV	Mathematical Formulation of LPP- Graphical method-- Simplex method – Artificial variable Techniques- Duality-Dual Simplex method.	12
TRANSPORTATION AND ASSIGNMENT MODELS		
V	Mathematical formulation of transportation problem- Methods for finding initial basic feasible solution – optimum solution - degeneracy – Mathematical formulation of assignment models – Hungarian Algorithm.	9
Total Instructional Hours		45

Course Outcome

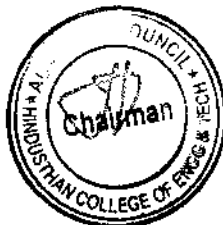
- CO1: Understand the concepts of probability.
 CO2: Understand the concepts of Descriptive Statistics.
 CO3: Compute correlation and predict unknown values using regression.
 CO4: Understand the concepts of Operation research.
 CO5: Analyze to find optimal solution in warehousing and Travelling by apply transportation and assignment models. .

TEXT BOOKS:

- T1 -Veerarajan, T., Probability, Statistics and Random Processes, Tata McGraw-Hill, 2nd Edition, New Delhi, 2010.
 T2 - Taha H.A., "Operations Research: An Introduction " 10th Edition, Pearson Education, 2019.

REFERENCE BOOKS:

- R1. O.C. Ibe, "Fundamentals of Applied Probability and Random Processes", Elsevier, First Indian Reprint, 2010.
 R2. Man Mohan, Kanti Swarup, P. K. Gupta, "Introduction to Management Science Operations Research" Sultan Chand & Sons, 2014.
 R3. A.M.Natarajan, P.Balasubramani, A.Tamilarasi, "Operations Research", Pearson Education, Asia, 2014.



CO-PO PSO MAPPING

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	2	3	3	3
CO2	3	3	3	3	3	1	-	-	-	-	2	3	3	3
CO3	3	3	3	3	3	3	-	-	-	-	3	3	3	3
CO4	3	3	3	2	2	-	-	-	-	-	1	2	2	2
CO5	3	3	2	2	1	-	-	-	-	-	3	3	3	3
Avg	3	3	2.8	2	2.4	2	-	-	-	-	2.2	2.8	2.8	2.8

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B.TECH. 22FT4202 REFRIGERATION AND COLD CHAIN MANAGEMENT 3 1 0 4

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

Unit	DESCRIPTION	Instructional Hours
I	INTRODUCTION: Introduction to refrigeration, unit of refrigeration capacity. Review of Second law of thermodynamics and interpretation. Production of low temperatures - principles and process. Refrigerants - classification and thermodynamic properties – Eco friendly refrigerants. Ozone depletion potential. Reversed Carnot cycle. Limitations of reversed Carnot systems. Psychrometry-terms-psychrometric chart- sensible heating- sensible cooling process -by-pass factor-	9
II	REFRIGERATION SYSTEMS: Refrigeration cycle – simple vapour compression, vapour absorption cycle, p-h and T-s diagrams, COP. Energy ratios and Power consumption of a refrigerating machine. Standard rating cycle and effect of operating conditions. Air refrigeration system – reversed Brayton cycle.	9
III	COMPONENTS OF A REFRIGERATION SYSTEM: Evaporator- dry and flooded type, liquid cooling evaporator. Condenser- water cooled, air cooled and evaporative condenser. Compressor - Reciprocating type compressors. Expansion valve - thermostatic expansion valve	9
IV	LOW TEMPERATURE STORAGE SYSTEMS: Pre-cooling systems, Cold storage- construction, insulation and operation. Design of cold storage unit. Calculation of refrigeration load in cold store. Prefabricated systems, walk-in-coolers. Frozen storage, Cryogenics – Linde and Claude system for liquefaction of air.	9
V	COLD CHAIN: Introduction, Components of cold chain. Refrigerated Transport, Handling and Distribution – refrigerated vans (reefer vans) - Transportation regulations, Cold chain in retail, Traceability- Application of RFID in cold chain. Role of packaging in cold chain– MAS, MAP, CAS, CAP, Role of refrigeration in food production , beverage processing, bakery products, meat products, poultry products, fishery products, fruit /vegetables and dairy products.	9

Total Instructional Hours 45

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

TEXT BOOK:

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

REFERENCES:

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




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CO-PO PSO MAPPING

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


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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	22FT4203	UNIT OPERATIONS IN FOOD PROCESSING	3	0	0	3

Course Objectives The student should be able 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	8
II	MECHANICAL AND MEMBRANE SEPARATION: Sedimentation in liquids - Gravitational sedimentation – Floatation - Sedimentation of particles in gas, settling under combined forces. Centrifugal separation – Velocity of particles – Radius of neutral zone – Equipment. Filtration – Constant rate and Constant pressure filtration – Equipment: plate and frame filter press, rotary filters, centrifugal filters, air filters. Membrane Separation: osmotic pressure, ultra filtration, reverse osmosis, rate of flow through membranes.	10
III	CRYSTALLIZATION AND DISTILLATION: Crystallization Equilibrium – Nucleation – Meta stable region – Seed Crystals. Heat of Crystallization - Rate of crystal growth. Stage equilibrium crystallization. Equipment - Types – Applications. Distillation: Distillation process - binary mixtures - flash and differential distillation-steam distillation - theory - consumption - continuous distillation with rectification - vacuum distillation - batch and fractional distillation - operation and process - advantages and limitations	9
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.	9
V	EXTRUSION: Theory – Rheological properties, and Operating Characteristics. Extrusion system components, Types of Extrusion - 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.	9
Total Instructional Hours		45

Upon completion of the course, students can be able to

Course Outcomes

CO1 - Understand and apply the size reduction techniques to convert solids and liquids into uniform particles

CO2 - Understand and apply the mechanical separation process like sedimentation, centrifugation, and filtration to separate solids, liquids and gas in food processing

CO3 - Understanding the mechanism of crystallization process and applying the principles of crystallization for the production of crystals

CO4 - Applying mixing equipment for the uniform mixing of solids, semi solids and liquids

CO5- Apply the extrusion process for the preparation of extruded products and its texture analysis and understanding the material handling process with its application.

Total: 45 Hours

TEXT BOOKS:

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



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

REFERENCES BOOKS:

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

CO-PO PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	2	2	-	1	1	1	-	-	-	3	2	3
CO2	2	2	2	2	1	1	1	1	-	-	-	2	3	3
CO3	2	2	2	2	-	1	1	1	-	-	-	2	2	3
CO4	2	2	2	2	-	1	1	1	-	-	-	2	2	3
CO5	3	2	3	2	-	1	1	1	-	-	-	3	2	3
AVG	2.2	2	2.2	2	1	1	1	1	-	-	-	2.4	2.2	3

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Programme B.TECH.	Course Code 22FT4204	Name of the Course FOOD ANALYSIS AND QUALITY CONTROL	L 3	T 0	P 0	C 3
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- Course Objectives**
- The student should be able
- Identify the major components of food, including macronutrients
 - Comprehend various analytical methods and techniques used in food analysis
 - Understand the principles of quality assurance and control in the food industry

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 column, Detectors; Quality standards, and adulterants. MINERALS: Sample Preparation: 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), <i>In vitro</i> 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 minerals
 - CO3- Examine the analytical techniques to determine the protein concentration in foods
 - CO4- Explain the food quality and standards ensuring the quality of food
 - CO5- Explain the regulations and standards mandated for food safety

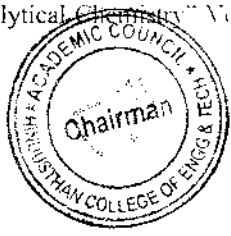
TEXT BOOKS:

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

REFERENCES BOOKS:

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

CO-PO PSO MAPPING




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CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	2	3	2	1	1	1	-	-	-	2	3	2
CO2	3	2	2	3	2	1	1	1	-	-	-	2	3	2
CO3	3	1	-	1	-	2	1	1	-	-	-	1	2	2
CO4	3	1	-	1	-	1	1	1	-	-	-	1	3	2
CO5	3	1	-	-	-	1	1	1	-	-	-	2	2	2
AVG	3	1.4	2	2	2	1.2	1	1	-	-	-	1.6	2.6	2


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.	22FT4001	FOOD ANALYSIS AND QUALITY CONTROL LABORATORY	0	0	3	2

The students will able to

Course Objectives

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

CO-PO PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	-	3	2	1	1	1	1	-	-	2	3	1
CO2	2	2	-	3	2	1	1	1	1	-	-	2	3	1
CO3	2	2	-	3	-	1	1	1	1	-	-	1	3	1
CO4	2	2	-	3	2	1	1	1	1	-	-	1	3	1
CO5	2	2	-	3	2	1	1	1	1	-	-	2	3	1
AVG	2	2	3	2	2	1	1	1	1	-	-	1.6	3	1

Chairman, Board of Studies

**Chairman - BoS
FT HICET**



Dean - Academics

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	22FT4002	UNIT OPERATIONS IN FOOD PROCESSING LABORATORY	0	0	4	2

Course Objectives

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

S.No.

DESCRIPTION

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

Total Practical Hours 30

Course Outcomes

Upon completion of the course, students can be able to

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

REFERENCES BOOKS:

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

CO-PO PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	-	2	2	1	1	1	1	-	-	1	3	2
CO2	2	2	-	2	2	1	1	1	1	-	-	1	3	2
CO3	2	2	-	2	2	1	1	1	1	-	-	1	3	2
CO4	2	2	-	2	2	1	1	1	1	-	-	1	3	2
CO5	2	2	-	2	2	1	1	1	1	-	-	1	3	2
AVG	2	2	2	2	2	1	1	1	1	-	-	1	3	2

Chairman, Board of Studies

Dean – Academics

**Chairman - BoS
FT - HICET**



**Dean (Academics)
HICET**

Programme	Course Code	Course Title	L	T	P	C
B.TECH	22HE4071	Soft Skills and Aptitude III	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 - Syllogism	10
II	Quantitative Aptitude Time and work: Work with different efficiencies, Pipes and cisterns, Work equivalence, Division of wages - Time, Speed and Distance: Basics of time, speed and distance, Relative speed, Problems based on trains, Problems based on boats and streams, Problems based on races - Profit and loss, Partnerships and averages: Basic terminologies in profit and loss - Partnership - Averages - Weighted average Permutation, Combination: Fundamental Counting Principle, Permutation and Combination, Computation of Permutation, Circular Permutations, Computation of Combination - Probability	12
III	Verbal Ability Sentence Correction: Subject-Verb Agreement, Modifiers, Parallelism, Pronoun-Antecedent Agreement, Verb Time Sequences, Comparisons, - Sentence Completion and Para-jumbles-Critical Reasoning: Argument - Identifying the Different Parts (Premise, assumption, conclusion), Strengthening statement, Weakening statement, Mimic the pattern	6
IV	Recruitment Essentials Cracking interviews - demonstration through a few mocks - Sample mock interviews to demonstrate how to crack the: HR interview, MR interview, Technical interview - Cracking other kinds of interviews: Skype/ Telephonic interviews, Panel interviews, Stress interviews - Resume building - workshop: A workshop to make students write an accurate resume- Essay Writing	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

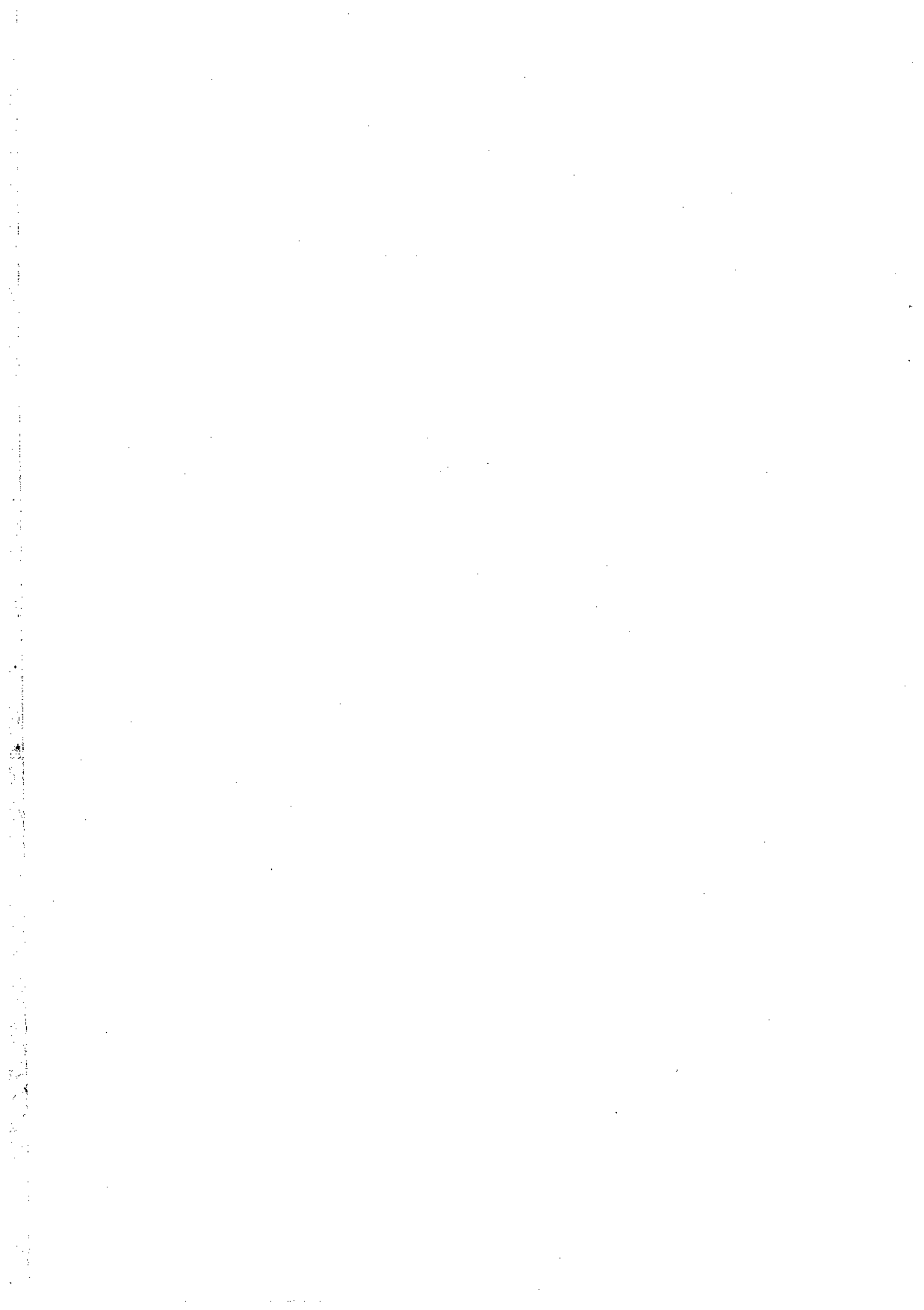
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**Dean (Academics)
HICET**



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

B.TECH. FOOD TECHNOLOGY



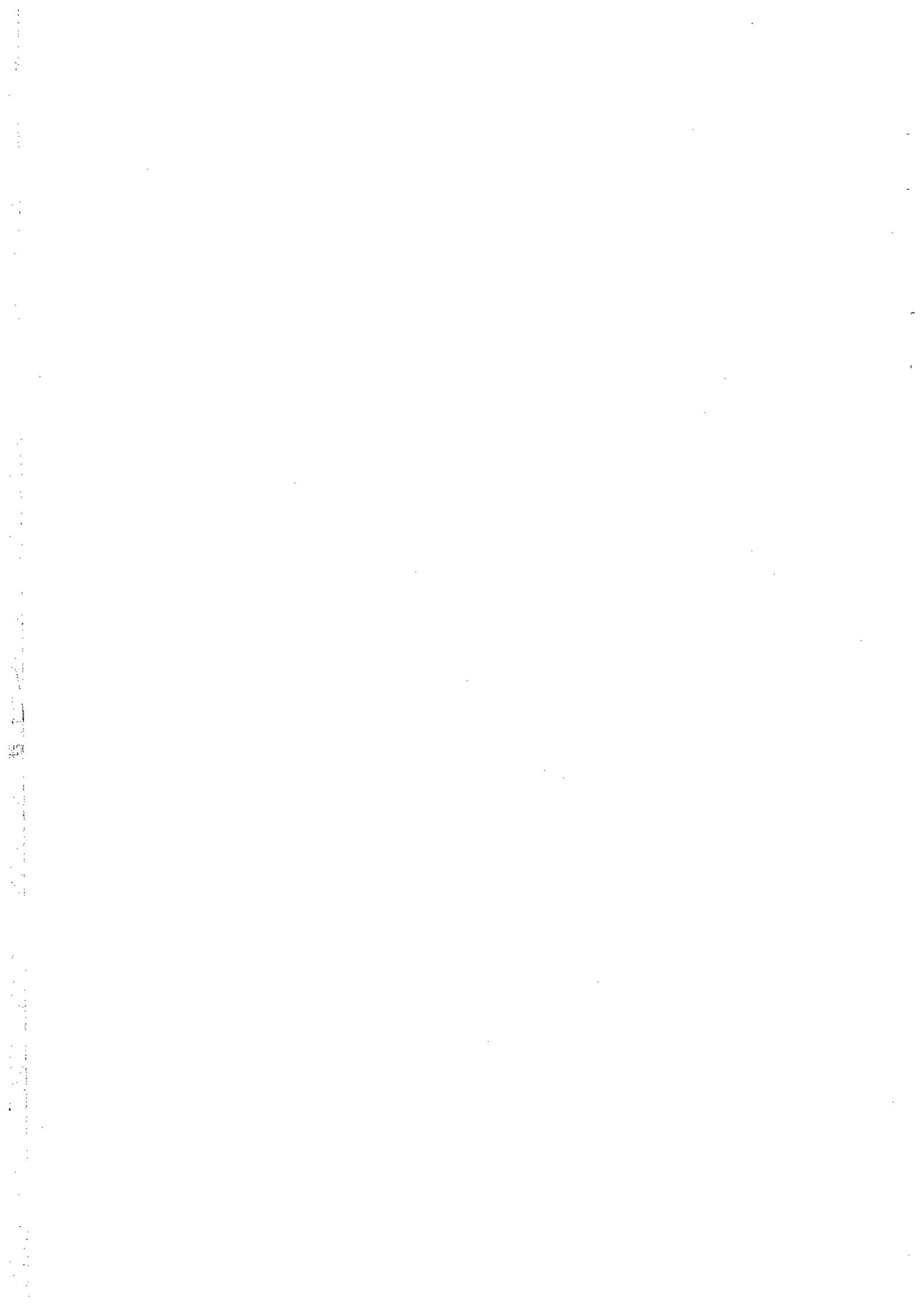
CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the Odd Semester
For
Semester VI
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

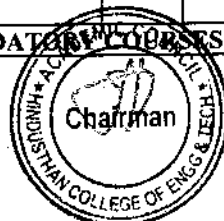
The course code 21 indicates that the students joined in the academic year 2021

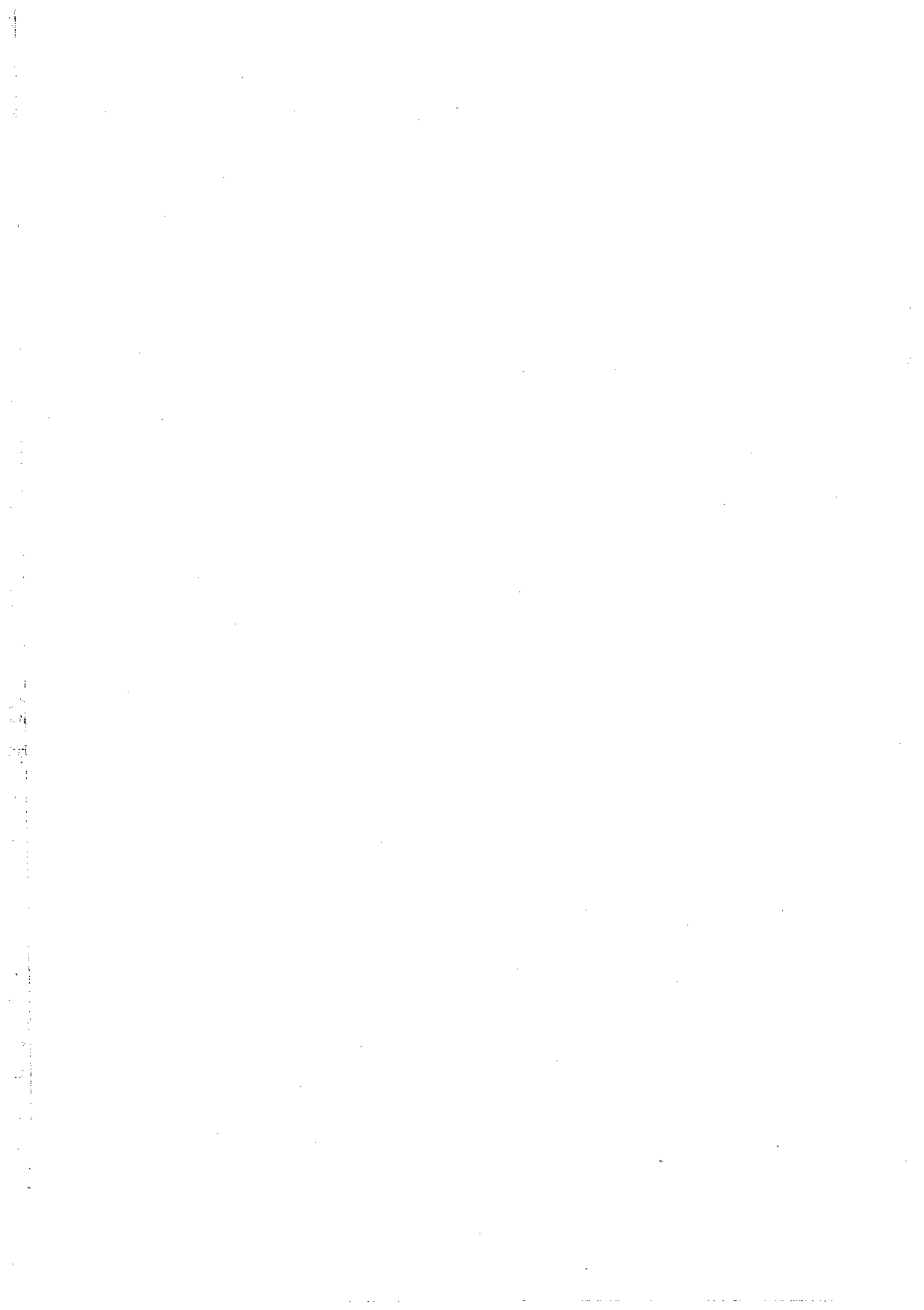
SEMESTER I

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										





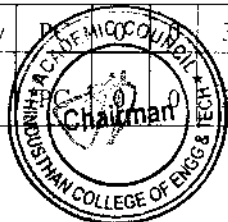
9.	21HE2072	Career Guidance Level – II Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	21HE2073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
Total:				17	2	12	22	630	370	1000

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 Career Development	EEC	2	0	0	0	100	0	100
10.	21HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
Total				19	2	8	20	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 Mass Transfer	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 Chain Management	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



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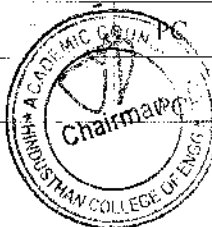
MANDATORY COURSES										
8.	21MC4191	Essence of Indian tradition knowledge/Value Education	MC	2	0	0	0	100	0	100
9.	21HE4072	Career Guidance Level – IV Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10.	21HE4073	Ideation Skills	EEC	2	0	0	0	100	0	100
Total				20	2	10	21	640	360	1000

SEMESTER V

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
1.	21FT5201	Baking and Confectionery Technology	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 Food Processing	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 in Engineering	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

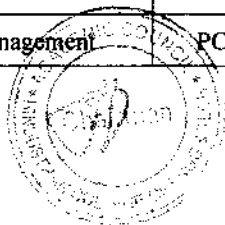
S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1	21FT5301	Technology of Fats and Oils	PE	3	0	0	3	40	60	100
2	21FT5302	Food Storage and Infestation Control	PE	3	0	0	3	40	60	100
3	21FT5303	Food Process Calculations	PE	3	0	0	3	40	60	100
4	21FT5304	Post-Harvest Technology	PE	3	0	0	3	40	60	100
5	21FT5305	Cereal 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	Food Preservation by Irradiation	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

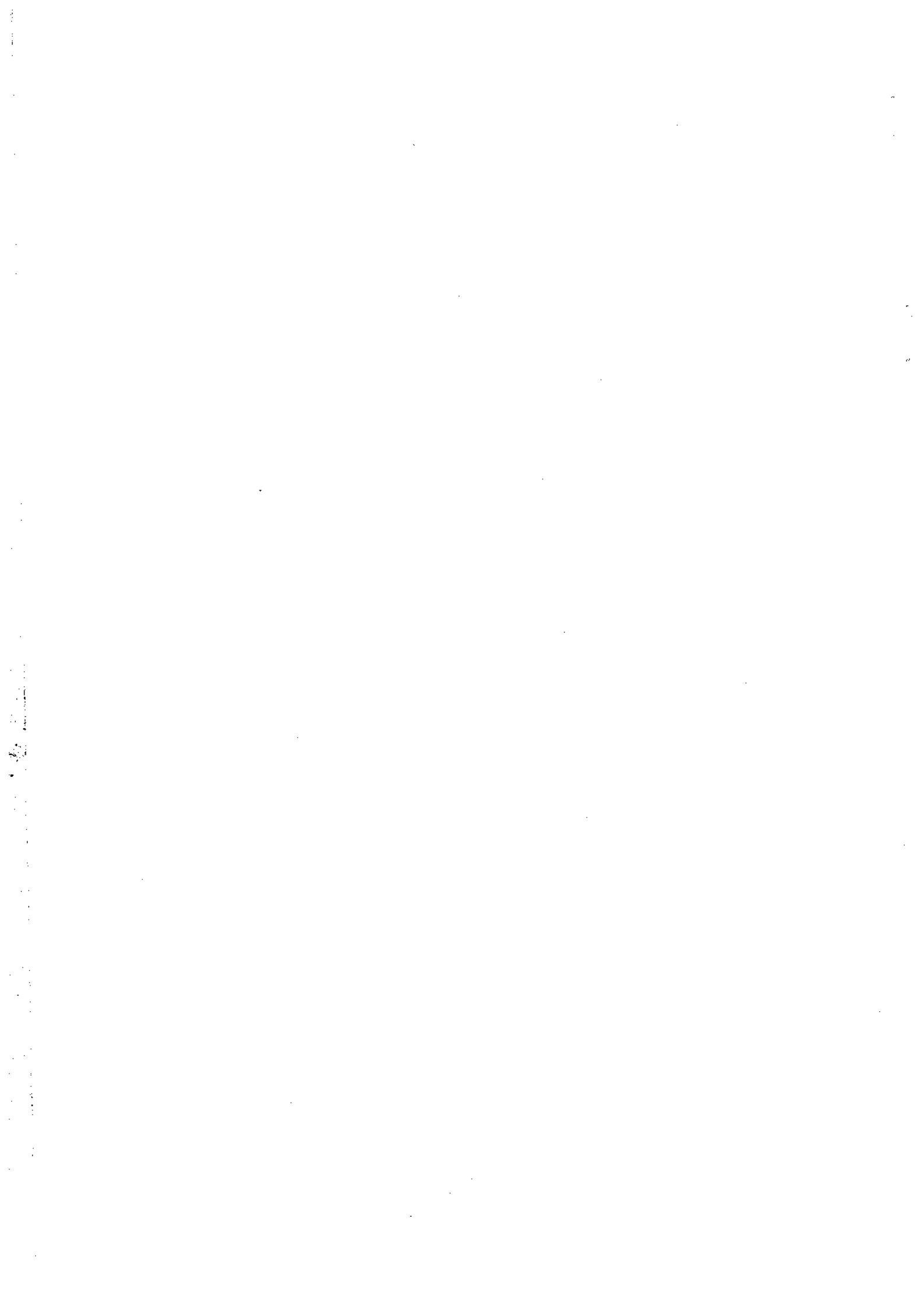
S.No.	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1.	21FT6401	Traditional Foods	OE	3	0	0	3	40	60	100

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



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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

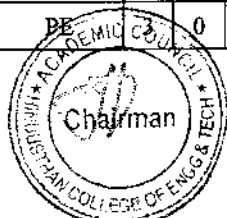
S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	21FT83XX	Professional Elective –IV	PE	3	0	0	3	40	60	100
2.	21FT83XX	Professional Elective- V	PE	3	0	0	3	40	60	100
PRACTICAL										
3.	21FT8901	Project Work – Phase II	EEC	0	0	16	8	100	100	200
TOTAL				6	0	16	14	180	220	400

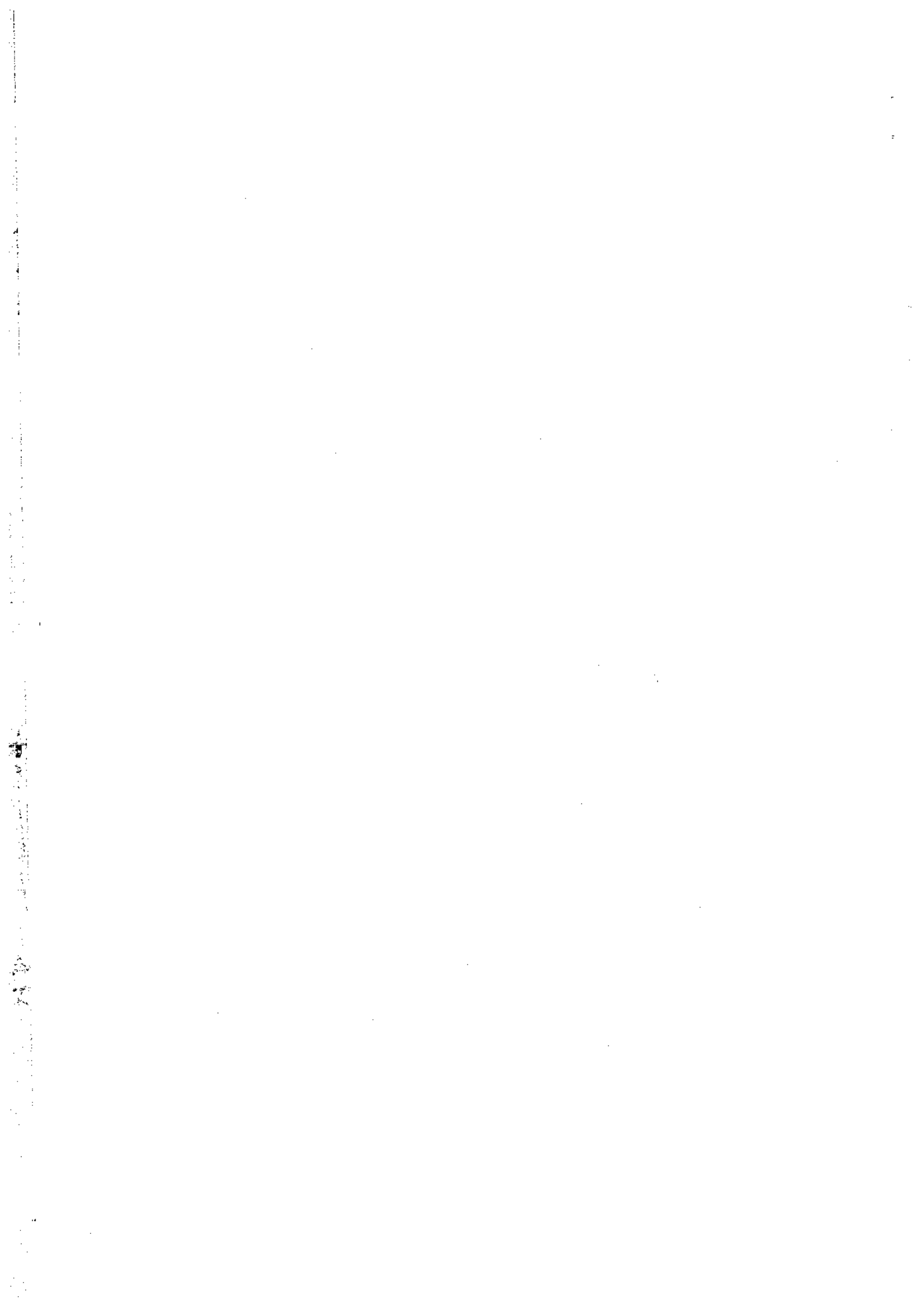
PROFESSIONAL ELECTIVE III

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
6.	21FT7305	Processing Technology of Legumes and Oilseeds	PE	3	0	0	3	40	60	100
7.	21FT7306	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	PE	3	0	0	3	40	60	100





		Management								
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	CATE GORY	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

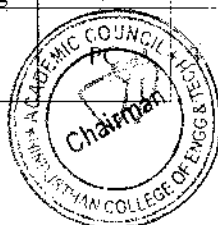
*MDC – Minor Degree Course

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	21BAXXXX 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	0	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.	21FT5206	Technology of milk and milk products	PC	3	0	0	3	3	40	60	100
2.	21FT6204	Ready to Eat foods	PC	3	0	0	3	3	40	60	100
3.	21FT6205	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
THEORY WITH LAB COMPONENT											
5.	21FT7XXX	Processing and Value Addition of Tuber Crops	PC	2	0	2	3	3	50	50	100
6.	21FT8XXX	Mushroom Processing Technology	PC	2	0	2	3	3	50	50	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
THEORY WITH LAB COMPONENT											
5.	21FT7XXX	Fermentation Technology	PC	2	0	2	3	3	50	50	100
6.	21FT8XXX	Enzymes in Food Processing	PC	2	0	2	3	3	50	50	100

Note: Each programme should provide verticals for Honours degree

SEMESTER-WISE CREDIT DISTRIBUTION

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

Credit Distribution R2019

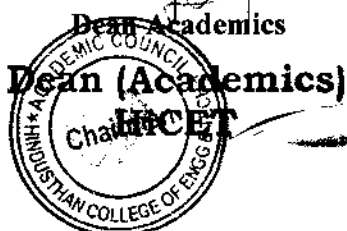
Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165

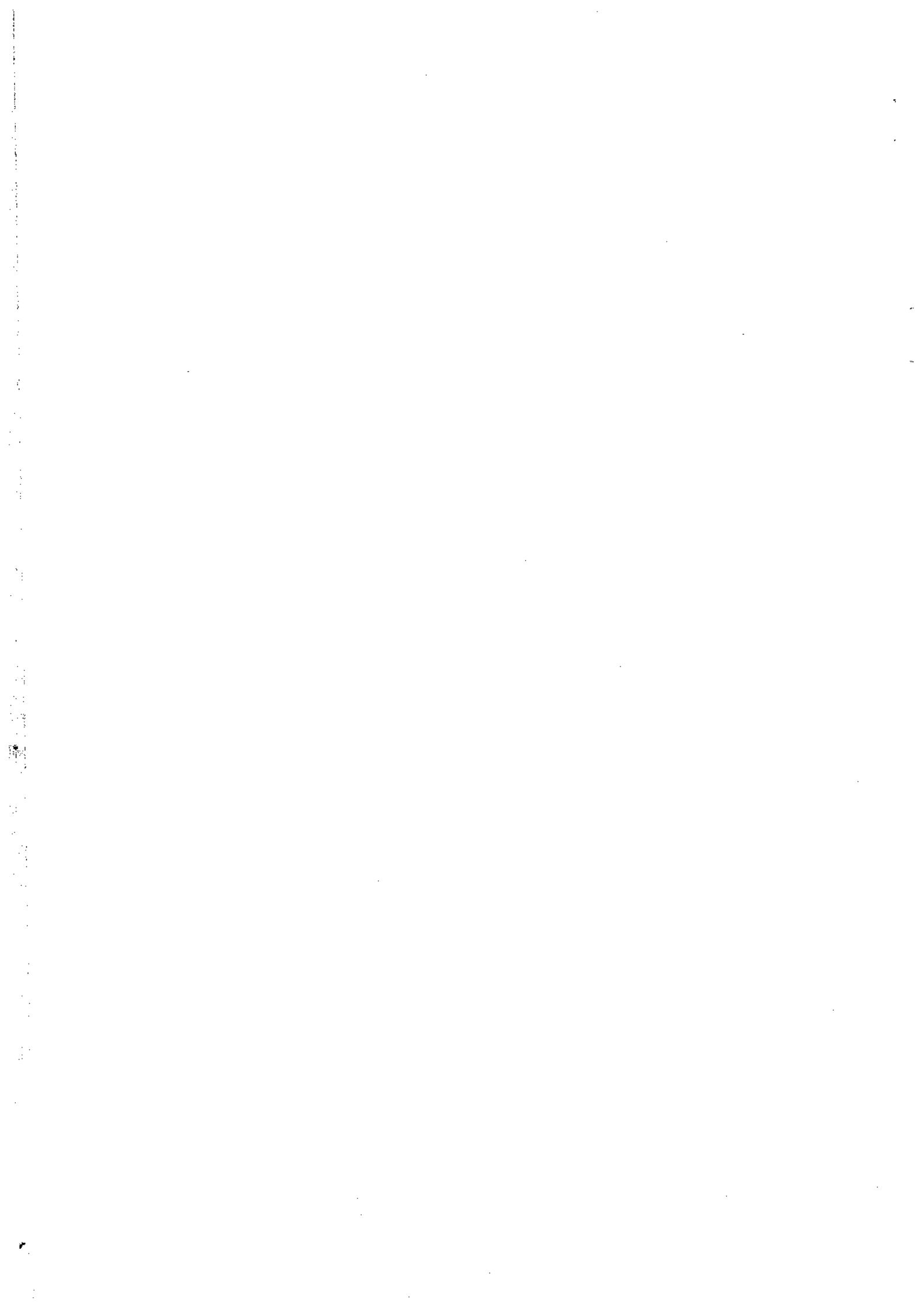
Chairman BoS

Dean Academics

Principal

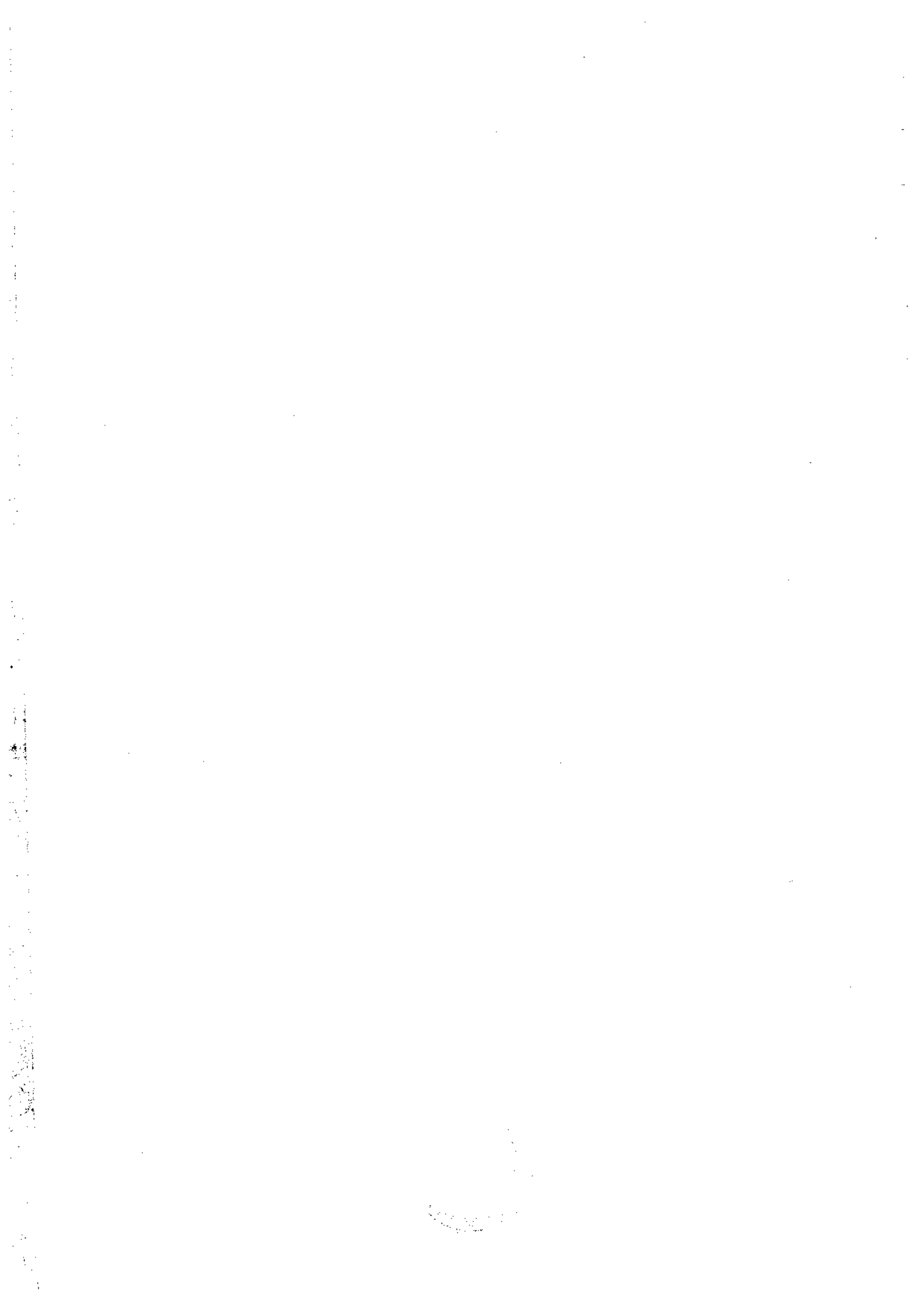
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SYLLABUS

SEMESTER VI



Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT6201	DAIRY ENGINEERING	3	0	0	3

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

Unit	Description	Instructional Hours
I	PROPERTIES OF Milk: Indian Dairy industry, Milk - Definition, types of market milk, Composition of milk, Factors affecting composition of milk, System of pricing of milk, Nutritive value of milk, Physico-chemical properties of milk: Color, Flavour, Specific Gravity, Boiling point, Freezing point, Refractive Index, Acidity and pH, Viscosity, Surface Tension.	9
II	Raw Milk Collection, Transportation and Reception: Raw milk collection system, Cooling and Transportation of milk, Platform tests of milk: Smell, Appearance, Temperature, Sediment, Acidity, Lactometer Reading, Fat, Solids-Not-Fat, Dye Reduction Test: MBRT test, Resazurin tests, Mastitis test, Filtration/Clarification of raw milk, Bactofugation of milk, Cooling and storage of raw milk, Bulk transportation technologies – carbon dioxide impregnation.	9
III	Design of Equipment: Selection of Accessories - Pipes, Aseptic valves, Filters, Pumps, Blenders, Storage Tank. Design of dairy equipment – Heat exchangers, Homogenizer, Spray dryer, Bulk coolers, Evaporators, Butter churner, Separators. Calculation of Refrigeration Load. Process Automation.	9
IV	Fluid Milk Processing: Milk Standardization, Cream separation, Homogenization, Milk Pasteurization: HTST and Batch Pasteurization, Milk Sterilization, Bottling/Packaging of milk, Liquid milk filling, Aseptic filling of milk. Milk Products: Manufacture of cheese, ice-cream, yoghurt, condensed milk, milk powder using drum and spray dryer, probiotics.	9
V	Cleaning and Sanitization of Dairy Equipment: Basic principles, Cleaning and Sanitizing – agents and methods. Can washer - Rotary type and straight through type. Selection and maintenance of can washers, CIP - Types of CIP system, Design of CIP system, CIP of dairy equipment. Applications of Non thermal processing in dairy industry.	9
Total Instructional Hours		45

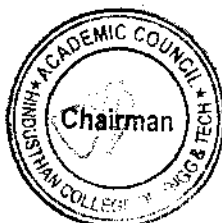
Course Outcome	CO1	Recall the current Dairy sector status, constituents, and physico-chemical properties of milk
	CO2	Reproduce the pre-handling operations and analyze the quality of raw milk using different tests
	CO3	Experiment the concepts of designing the equipment's for processing of milk
	CO4	Show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

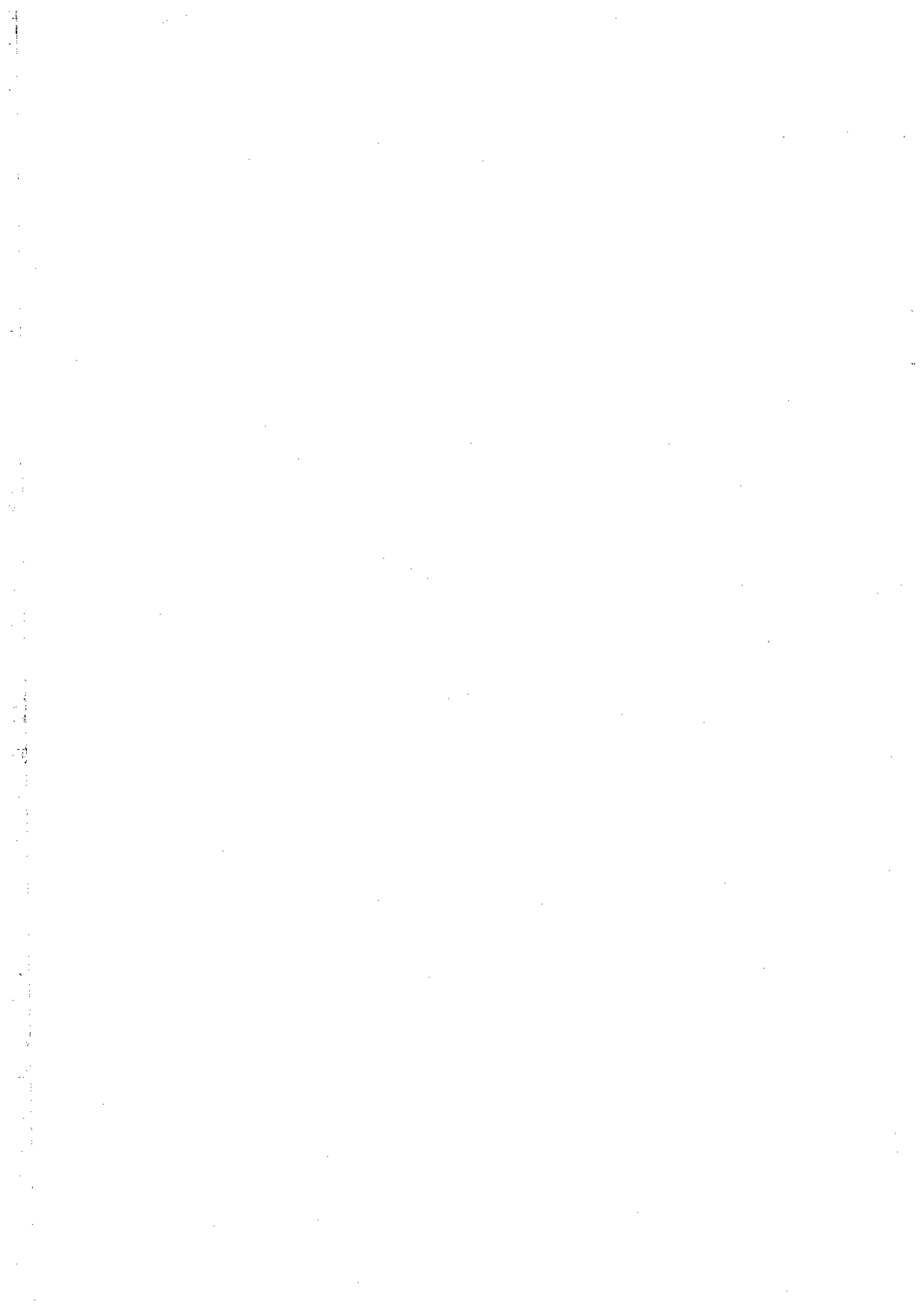
TEXT BOOK:

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

REFERENCES:

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






CO-PO & PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	-	2	1	1	1	1	-	-	-	2	3	3
CO2	2	2	-	2	1	1	1	1	-	-	-	2	3	3
CO3	2	-	3	2	2	1	1	1	-	-	-	2	2	2
CO4	2	2	3	2	-	1	1	1	-	-	-	2	3	3
CO5	2	-	2	1	-	1	1	1	-	-	-	2	2	1
AVG	2	2	2.66	1.8	1.33	1	1	1	-	-	-	2	2.6	2.4



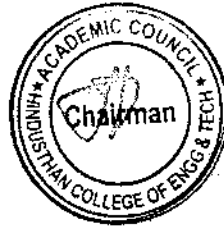
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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT6202	PLANTATION CROPS AND SPICES PRODUCTS TECHNOLOGY	3	0	0	3

The student should be able to

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

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

Total Instructional Hours

45

Course Outcome

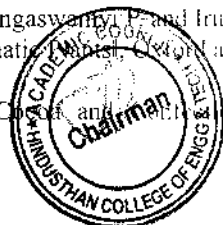
- CO1 Build the steps involved in processing of plantation of major spices.
 CO2 Select the appropriate techniques for processing of minor spices.
 CO3 Identify the technology for processing of tea, coffee and Cocoa based on their chemical composition.
 CO4 Utilize food processing operations to produce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

TEXT BOOK:

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

REFERENCES:

- R1 Minifie Bernard W.. —Chocolate, Cocoa and Confectionery TechnologyI, 3rd Edition. Springer Netherlands, 2012.



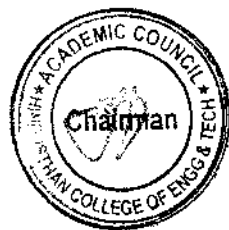
- R2 Shanmugavelu K.G., Kumar N. and Peter K.V., —Production Technology of Spices and Plantation Crops, Jodhpur Agrobios (India) Agro House, 2005
- R3 National Institute of Industrial Research (NIIR) Board, —Handbook on Spices, Asia Pacific Business Press Inc., New Delhi, 2004.
- R4 Pruthi, J.S. Spices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

CO-PO, PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	2	1	-	1	1	1	-	-	-	2	2	2
CO2	2	1	2	1	-	1	1	1	-	-	-	2	2	2
CO3	2	2	3	1	1	1	1	1	-	-	-	2	2	3
CO4	3	2	2	2	2	1	1	1	-	-	-	2	2	3
CO5	2	3	2	3	1	1	1	1	-	-	-	2	2	2
AVG	2.4	2	2.2	1.6	1.33	1	1	1	-	-	-	2	2	2.4


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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT6203	FRUITS AND VEGETABLE PROCESSING TECHNOLOGY	3	0	0	3

The student should be able to

- Course Objective**
1. Understand the maturity standards of fruits and vegetables.
 2. Learn post-harvest handling of fruits and vegetables.
 3. Understand the technology of processing fruits and vegetable products.

Unit	Description	Instructional Hours
I	PHYSIOLOGY AND HARVESTING OF FRESH FRUITS AND VEGETABLES: Scope of Fruits and Vegetables Processing Industry in India and World-present status. Physical, Textural characteristics, structure and composition. Harvesting of important fruits and vegetables. Maturity standards; Importance, methods of Maturity determinations maturity indices for selected fruits and vegetables. Fruit ripening- physiological changes, regulations, methods. Factors leading to deterioration of fruits and vegetables. Methods to reduce post-harvest losses	9
II	POST HARVEST STORAGE AND PRE- PROCESSING OF FRUITS & VEGETABLES: Storage practices: Control atmospheric, hypobaric storage, cool store, zero emerge cool chamber. Pre-processing of fruits and vegetables: Precooling, Cleaning, washing, sorting, grading, peeling, blanching. Freezing- General preprocessing. Dehydration – General preprocessing; problems associated with specific fruits and vegetables. Indian Food Regulation and Quality assurance.	9
III	MINIMAL PROCESSING AND CANNING: Primary processing: Peeling, slicing, cubing, cutting and other size reduction operations for fruits and vegetables. Minimal Processing of Fruits and Vegetables. Canning - principles, types of cans - preparation of canned products - packing of canned products - spoilage of canned foods. Bottling of fruit and vegetable. Precautions in canning operations. General considerations in establishing a commercial fruit and vegetable cannery, machineries involved in canning and bottling unit.	9
IV	FRUIT AND VEGETABLE PRODUCTS I: Fruit Juice / pulp/ Nectar/Drinks, concentrates – General and specific processing, packaging. Vegetable Purces/ pastes - General and specific processing, packaging. Ready to eat fruit and vegetable products, Jams/Marmalades, Squashes/cordials, Ketchup/sauces, Chutneys, Fruit Bar, Soup powders, Candied Fruits- General and specific processing, packaging. Indian Food Regulation and Quality assurance.	9
V	FRUIT AND VEGETABLE PRODUCTS II: Natural colors, Fruit and Vegetable Fibres- General and specific processing, packaging. Onion: Dried, Powder. Garlic: Dried Garlic, Powder, Oil. Potato: Wafer; starch, Papad, Carrot: Preserve, candy, Pickle, Jam. Cauliflower and cabbage: Dried cauliflower and cabbage, Sauerkraut, Pickle Leafy vegetables; Dried Leafy Vegetables. (Spinach, Fenugreek, Coriander leaves, Curry leaves). Bitter gourd: Pickle, Dried bitter gourd. Indian Food Regulation and Quality assurance.	9
Total Instructional Hours		45

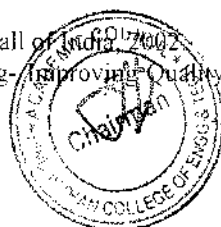
Course Outcome	CO1	CO2	CO3	CO4	CO5
	Remember and understand the physiological aspects of fruits and vegetables and analyze the physical and chemical components	Understand the basic pre- processing operations and its applications for fresh fruits and vegetables	Apply the pre-treatments and canning principle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

TEXT BOOK:

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

REFERENCES:

- R1 "Food Processing & Preservation". Prentice Hall of India, 2002
- R2 Wim Jongen, -Fruit and Vegetable Processing- Improving Quality. Wood Head Publishing Ltd, England, 2002



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- R3 Thompson A. K., -Fruits and Vegetable - Harvesting, Handling and Storage, Blackwell Publishing, USA, 2003.
- R4 Lal G., Siddappa G. and Tondon G.L., -Preservation of Fruits and Vegetables, Indian Council of Agricultural Research, New Delhi, 1986.

CO-PO, PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	1	2	1	-	1	1	1	-	-	-	2	2	2
CO2	2	1	2	1	-	1	2	1	-	-	-	2	2	1
CO3	2	2	2	1	-	1	1	1	-	-	-	2	2	1
CO4	2	2	2	2	1	1	1	1	-	-	-	2	2	3
CO5	2	2	3	2	1	1	1	1	-	-	-	2	3	3
AVG	2	1.6	2.2	1.4	1	1	1.2	1	-	-	-	2	2.2	2


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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT6181	PROFESSIONAL ETHICS IN ENGINEERING	3	0	0	3

Course Objective
The student should be able to
Be aware on Engineering Ethics and Human Values,
Moral and Social Values, Loyalty and appreciate the rights of others

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

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

TEXT BOOK:

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

REFERENCES:

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

CO-PO, PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	-	-	-	-	1	2	3	-	-	-	2	1	-
CO2	2	-	2	-	-	2	2	3	-	-	-	2	2	-
CO3	2	1	2	1	-	1	1	3	-	-	-	2	2	-
CO4	2	1	2	1	-	2	2	3	-	-	-	2	2	1
CO5	1	-	-	2	-	2	2	2	-	-	-	2	2	1
AVG	1.8	1	2	1.33	-	1.6	1.8	2.8	-	-	-	2	1.8	1

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Dean (Academics)
H.CET

Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT6001	DAIRY ENGINEERING LABORATORY	0	0	3	2

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

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

Total Instructional Hours **45**

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

REFERENCES:

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

CO-PO, PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	-	2	-	2	-	1	1	1	-	-	-	2	3	2
CO2	1	2	-	2	2	1	1	1	-	-	-	2	3	2
CO3	1	2	-	2	2	1	1	1	-	-	-	2	3	2
CO4	1	2	-	2	2	1	1	1	-	-	-	2	3	2
CO5	1	2	-	2	-	1	1	2	-	-	-	2	3	2
AVG	1	2	2	2	2	1	1	1.2	-	-	-	2	3	2

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT6002	FRUITS & VEGETABLE PROCESSING LABORATORY	0	0	3	2

The student should be able to

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

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

Total Instructional Hours 45

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

REFERENCES:

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

CO-PO, PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	-	2	2	1	2	2	-	-	-	2	1	2
CO2	2	2	-	2	2	1	2	2	-	-	-	2	2	1
CO3	-	2	-	2	2	1	2	2	-	-	-	2	2	-
CO4	2	2	-	2	1	1	2	2	-	-	-	2	2	3
CO5	-	2	-	2	-	1	2	2	-	-	-	2	2	3
AVG	2	2	2	1.75	1.75	1	2	2	-	-	-	2	1.8	2.25

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Programme B.TECH.	Course code 21HE6071	Name of the course SOFT SKILL-II	L 1	T 0	P 0	C 1
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The student should be able to

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

Unit	Description	Instructional Hours
I	Group Discussion & Presentation Skills: GD skills – Understanding the objective and skills tested in a GD – General types of GDs – Roles in a GD – Do's & Don'ts – Mock GD & Feedback. - Presentation Skills – Stages involved in an effective presentation – selection of topic, content, aids – Engaging the audience – Time management – Mock Presentations & Feedback	9
II	Interview Skills and Personality Skills: Interview handling Skills – Self preparation checklist – Grooming tips: do's & don'ts – mock interview & feedback - Interpersonal skills-creative thinking-problem solving-analytical skills	9
III	Business Etiquette & Ethics: Etiquette – Telephone & E-mail etiquette – Dining etiquette – do's & Don'ts in a formal setting – how to impress. Ethics – Importance of Ethics and Values – Choices and Dilemmas faced – Discussions from news headlines.	9
IV	Quantitative Aptitude: Permutation, Combination - Probability - Logarithm - Quadratic Equations - Algebra - Progression - Geometry - Mensuration.	9
V	Logical Reasoning: Logical Connectives - Syllogisms - Venn Diagrams – Cubes - Coded inequalities - Conditions and Grouping	9
Total Instructional Hours		45

Course Outcome	Description
CO1	Students will have learnt to keep going according to plan, coping with the unfamiliar, managing disappointment and dealing with conflict.
CO2	Students will Actively participate meetings, Group Discussions / interviews and prepare & deliver presentations
CO3	Students will define professional behavior and suggest standards for appearance, actions and attitude in a business environment
CO4	Students will be able to apply quantitative reasoning and mathematical analysis methodologies to understand and solve problems.
CO5	Students will excel in complex reasoning.

REFERENCES:

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

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21HE6072	INTELLECTUAL PROPERTY RIGHTS (IPR)	1	0	0	1

The student should be able to

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

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

Total Instructional Hours 45

Course Outcome	Description
CO1	Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.
CO2	Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.
CO3	Identify, apply and assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing.
CO4	Identify different types of trademarks and procedure for registration
CO5	Recognize the concept of design, geographical indication and procedure for registration

TEXT BOOK:

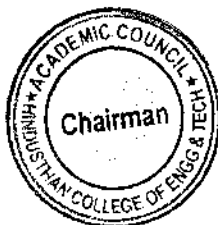
- T1 Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.
T2 V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt. Ltd, 2012.

REFERENCES:

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

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PROFESSIONAL ELECTIVE II

Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT6301	RADIATION PRESERVATION AND PROCESSING OF FOOD PRODUCTS	3	0	0	3

The student should be able to

- Course Objective**
- Identify the importance of non-thermal methods like irradiation as an alternative to the conventional methods of processing
 - Understand the effect of radiation as a processing and preservation method
 - Learn the importance and safety issues of the irradiated foods

Unit	Description	Instructional Hours
I	BASICS OF RADIATION CHEMISTRY Electromagnetic energy, ionizing radiation, Concept of radiation, dielectric properties, ionization and excitation, Radiation chemistry basics - primary chemical effects and secondary effects on food, G value, irradiation parameters, instruments for measuring radiation, effect of food irradiation and potentialities for radiation processing of foods	9
II	RADIATION CHEMISTRY OF FOOD COMPONENTS Basics-carbohydrates, proteins, lipids, vitamins etc. Radiation effect on contaminating microorganisms like bacteria, viruses, yeasts and molds - Dosages of radiation for various plant foods and animal foods-meat and poultry, fruits, vegetables, spices, dairy products; Radiation equipment, salient features; Packaging of irradiated foods and safety issues	9
III	MICROWAVES IN FOOD PROCESSING Microwave heating, nature of energy, batch and continuous ovens, microwave generators, wave guides, brief description of oven construction, application of microwave radiation and safety measures	9
IV	INFRA RED RADIATION Absorption and scattering characteristics of various food materials, Polarization characteristics of IR radiation, Propagation of IR radiation in food stuffs. IR generators, applications, Relative merits and demerits	9
V	RADIO FREQUENCY HEATING PRINCIPLES RF heating equipment, Advantages of Radio frequency heating of foods - Ultra violet radiation and its effect on microorganisms in foods - UV treatment application and equipment.	9
Total Instructional Hours		45

Course Outcome

CO1	Understand the role of ingredients used in beverage processing
CO2	Understand the processing of beer and wine processing
CO3	Understand the procedure of carbonated beverages
CO4	Understand the procedure of non-carbonated beverages
CO5	Understand the steps for quality control

TEXT BOOK:

- T1 Welter M. Urbain: Food Irradiation Academic Press, New York, 1986.
 T2 Ohlsson and Bengtson, Microwave Processing Technologies Woodhead Publishing. Cambridge, UK, 2002

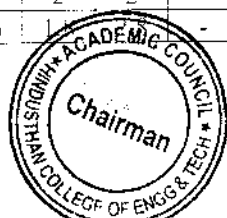
REFERENCES:

- R1 Gould G.W., New Methods of Food Preservation. Aspen Publishers Inc., Maryland, 1999.
 R2 S.G.Lyasar and V.V. Krasnikov, Physical Principles of Infra Red Irradiation of Food Stuffs: Hemisphere Publishing Corporation, London, 1991.
 R3 Philip Richardson, Thermal Technologies for Food Processing, Wood head Publishing Limited, CRC Press, 2001.
 R4 Robert V. Decareau, Microwave Foods, New Product Development Food & Nutrition Press Inc., USA, 1992.

CO-PO, PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	-	-	-	-	1	2	3	-	-	-	2	1	-
CO2	2	-	2	-	-	2	2	3	-	-	-	2	2	-
CO3	2	1	2	1	-	1	1	3	-	-	-	2	2	-
CO4	2	-	2	1	-	2	2	3	-	-	-	2	2	1
CO5	1	-	-	2	-	2	2	2	-	-	-	2	2	1
AVG	1.8	-	2	1.33	-	1.6	1.6	2.6	-	-	-	2	1.8	1

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT6302	TECHNOLOGY OF SNACKS AND EXTRUDED FOODS	3	0	0	3

The student should be able to

- | | |
|-------------------------|---|
| Course Objective | <ol style="list-style-type: none"> 1. Outline the types, processes and ingredients involved in snacks preparation 2. Simplify the sequential steps involved in the processing and preparation of snacks from potatoes and rice 3. Explain the production processes of tortilla chip, popcorn and mechanism of extrusion 4. Discuss the preparation and types of pasta and pretzel manufacturing 5. Summarize the concepts of snacks packaging, filling and quality control |
|-------------------------|---|

Unit	Description	Instructional Hours
I	INTRODUCTION: Current status of snack food industry in India. Types of snack food – Raw Vegetable Snack, Formed dough products from potato and maize derivatives, Half Products, Directly expanded extruded snack, Puffed Snacks and other. Types and Functions of ingredients – structure forming materials, dispersed phase/filling materials, plasticizers/lubricants, soluble solids, nucleating substances, coloring and flavouring substances.	9
II	POTATO AND RICE BASED SNACKS: Potato Chip - Pre cleaning and peeling, slicing, drying/frying, salting and seasoning, quality control. Fabricated potato snacks – potato flakes, potato granules, potato starch, ground and crushed dehydrated potato. Rice based Snacks – Products using whole grains – Gun puffed rice. Products using flours	9
III	CORN AND EXTRUSION BASED SNACKS: Tortilla chip – Corn soaking and smoking, Grinding, Masa flour, Sheeting and Cutting, Baking and Frying. Popcorn – Popping methods, oil popping and dry popping. Commercial and industrial popcorn process. Flavorings and Applicators. Extruder components – Single and Twin screw, Single and Multiple die extruders. Second generation and Third generation snacks, Co extruded snacks, Masa based snacks, Flat bread, Crisp bread.	9
IV	PASTA PRODUCTS: Raw materials. Preparation of raw materials for extrusion. Spaghetti, noodles, macaroni and similar products. Dry and frozen pasta products. Pretzel – Types – Formulation and Processing - mixing, extrusion, proofing, cooking, surface salting, baking and drying. Problems in pretzel manufacture.	9
V	SNACKS PACKAGING AND QUALITY ASSURANCE Snacks filling and packaging – package styles - case filling – cartoning – Trouble shooting – problems and suggested solutions - Processes for healthy foods and reduction in unhealthy items – Quality programs – evaluation methods – quality control and quality assurance	9
Total Instructional Hours		45
Course Outcome	<p>CO1 Classify the types of snacks and ingredients used in snack preparation</p> <p>CO2 Propose and develop an innovative potato and rice-based snacks</p> <p>CO3 Understand the preparation process of tortilla chip, popcorn and mechanism of extrusion</p> <p>CO4 Remember the methods involved in pasta and pretzel preparation</p> <p>CO5 Choose the appropriate snacks filling and packaging systems and quality control techniques</p>	

TEXT BOOK:

T1 Edmund W. Lusas and Lloyd W. Rooney, —Snack Food ProcessingI, 1st Edition, CRC Press, Florida, 2001.

T2 Robin Guy, —Extrusion cooking: Technologies and ApplicationsI, 1st Edition, CRC Press, Florida, 2001.


REFERENCES:


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



CO-PO, PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	-	-	-	-	1	2	3	-	-	-	2	1	-
CO2	2	-	2	-	-	2	2	3	-	-	-	2	2	-
CO3	2	1	2	1	-	1	1	3	-	-	-	2	2	-
CO4	2	1	2	1	-	2	2	3	-	-	-	2	2	1
CO5	1	-	-	2	-	2	2	2	-	-	-	2	2	1
AVG	1.8	1	2	1.33	-	1.6	1.8	2.8	-	-	-	2	1.8	1


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Programme B.TECH.	Course code 21FT6303	Name of the course FOOD BIOTECHNOLOGY	L 3	T 0	P 0	C 3
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Course Objective
The student should be able to
1. To understand application of biotechnology in food processing industries, understand downstream processing concepts, process involving production of enzymes

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

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

TEXT BOOK:

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

REFERENCES:

- R1 Kalaichelvan, P.T, "Bioprocess technology", MJP publishers, Chennai 2007.
R2 Sathnarayana U, "Biotechnology", Arunavhazan publishers, kolkatta 2006.
R3 National Research Council, "Application of biotechnology to traditional fermented foods", National academy press, Washington 2192.
R4 Najafpour, D. Ghasem. "Biochemical Engineering & Biotechnology". Elsevier, 2007

CO-PO, PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	-	-	-	-	1	2	3	-	-	-	2	1	-
CO2	2	-	2	-	-	2	2	3	-	-	-	2	2	-
CO3	2	1	2	1	-	1	1	3	-	-	-	2	2	-
CO4	2	1	2	1	-	2	2	3	-	-	-	2	2	1
CO5	1	-	-	2	-	2	2	2	-	-	-	2	2	1
AVG	1.8	1	2	1.33	-	1.6	1.8	2.8	-	-	-	2	1.8	1

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT6304	BIOPROCESS ENGINEERING	3	0	0	3

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

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

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

TEXT BOOK:

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

REFERENCES:

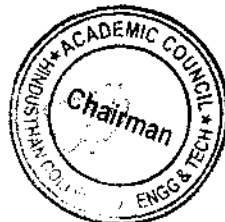
- R1 Stanbury, P.F., A. Whitaker and S.J. Hall "Principles of Fermentation Technology", 3rd Edition, Butterworth – Heinemann (an imprint of Elsevier), 2016.
R2 Doran, P.M. "Bioprocess Engineering Principles", 2nd Edition Academic Press, 2013.
R3 Najafpour, D. Ghasem. "Biochemical Engineering & Biotechnology". Elsevier, 2007.
R4 Bryce, C.F.A and EL. Mansi. "Fermentation Microbiology & Biotechnology, 2199.

CO-PO, PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	-	-	-	-	1	2	3	-	-	-	2	1	-
CO2	2	-	2	-	-	2	2	3	-	-	-	2	2	-
CO3	2	1	2	1	-	1	1	3	-	-	-	2	2	-
CO4	2	1	2	1	-	2	2	3	-	-	-	2	2	1
CO5	2	-	-	2	-	2	2	2	-	-	-	2	2	1
AVG	2	1	2	1.33	-	1.6	1.8	2.8	-	-	-	2	1.8	1

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Programme B.TECH.	Course code 21FT6305	Name of the course ENZYME TECHNOLOGY	L 3	T 0	P 0	C 3
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Course Objective The student should be able to
1 To know about Isolation and Purification of enzymes, understand the concept of enzyme immobilization techniques and the application of enzymes in food industries.

Unit	DESCRIPTION	Instructional Hours
I	INTRODUCTION Introduction-Definition-Historical highlights-classification of enzymes nomenclature-structural features of enzyme-Methods of extraction and purification of enzymes.	9
II	MECHANISM OF ENZYME ACTION Specificity-types of specificity-role of 3D structure -active site-substrate and enzyme concentration relationships-different effects -pH and temperature.	9
III	ENZYME KINETICS MM equation, Lineweaver Plot, - kinetics. Immobilization-need for immobilization advantages-disadvantages-immobilization techniques- effects of pH, temperature, substrate concentration, stability, kinetic properties-role of immobilized enzymes in food processing-commercial food application	9
IV	ENZYMES OF FOOD IMPORTANCE Endogeneous enzymes in food quality-color- lipoxynase, chlorophyllase, polyphenol oxidase, texture- Pectic enzymes, Amylases, cellulases, proteases, flavour and aroma-nutritional quality	9
V	APPLICATION OF ENZYMES IN FOOD INDUSTRIES Mechanism and application of enzymes in food processing-enzymatic browning. Application of enzyme in meat industry, fruit and vegetable industry, dairy industry- bakery industry.	9
Total Instructional Hours		45
Course Outcome	CO1 Understand the enzyme structure and nomenclature	
	CO2 Remember the importance of enzyme in foods	
	CO3 Understand the application of enzyme in food industries	
	CO4 Understand the appropriate staining techniques	
	CO5 Understand the cell production mechanism	

TEXT BOOK:

- T1 Price, N. L. and Steven L., "Fundamentals of Enzymology", Oxford Scientific 2000.
T2 Godfrey T. West S (Eds), "Industrial Enzymology" 2nd Edition Mac Millan Press, London 2196

REFERENCES:

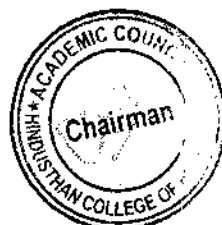
- R1 Colowick, S.P. and Kalpan, N.O. (Eds), "Methods of enzymology" Academic press 1977.
R2 Tauber ph.D and Hentry, "Enzyme technology" 2000
R3 Marangoni, A.G, "Enzyme Kinetics". A modern approach A John Wiley & Sons 2003.
R4 Trevor Palmer. Understanding Enzymes. Fourth Edition. Prentice Hall, London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

CO-PO, PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	-	-	-	-	1	2	3	-	-	-	2	1	-
CO2	2	-	2	-	-	2	2	3	-	-	-	2	2	-
CO3	2	1	2	1	-	1	1	3	-	-	-	2	2	-
CO4	2	1	2	1	-	2	2	3	-	-	-	2	2	1
CO5	1	-	-	2	-	2	2	2	-	-	-	2	2	1
AVG	1.8	1	2	1.33	-	1.6	1.8	2.8	-	-	-	2	1.8	1

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT6306	CROP PROCESS ENGINEERING	3	0	0	3

The student should be able to

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

Unit	DESCRIPTION	Instructional Hours
I	ENGINEERING PROPERTIES AND MOISTURE CONTENT Post harvest losses in field crops - optimum stage of harvest, properties of grains - physical, thermal, electrical and aerodynamic properties, moisture content - measurement - direct and indirect methods - moisture meters, equilibrium moisture content - equilibrium relative humidity, relationship and isotherm models, methods of determination.	9
II	THRESHING, SHELLING, CLEANING, GRADING AND DRYING Threshing - threshers, types, cleaning and grading- principles, types, efficiency of separation, performance index, shelling and decortication - principles, maize sheller, husker sheller, groundnut decorticator and castor sheller, psychrometry - properties of air - water vapour mixture, grain drying - principles, types, heat sources, performance of dryers.	9
III	RICE AND PULSES PROCESSING Rice processing - parboiling, drying, dehusking, polishing, modern rice mill machineries - construction details and adjustments, layout of modern rice mills, manufacture of beaten rice, expanded rice and puffed rice, traditional and improved methods, processes and equipments, material handling equipment - types, construction and working - pulse milling - wet and dry method.	9
IV	STORAGE Storage of food grains - factors affecting storage, traditional methods, types - bag and bulk storage, storage structure, storage losses - estimation, storage of grains in large bins, modified atmosphere storage of grains - facilities, construction, operation and maintenance.	9
V	WASTE UTILIZATION Waste materials, sources and classification - crop residues, farm and industrial wastes and by-products, utilization - production of paper and paperboards, particle board, fuel briquettes - production of fibre, activated carbon, furfural and adhesive from tamarind kernel powder.	9
Total Instructional Hours		45

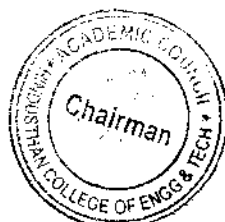
Course Outcome	CO1	CO2	CO3	CO4	CO5
	Demonstrate different engineering properties of grains and the method to determine moisture content	Select suitable equipment for threshing, cleaning and drying of grains and oilseeds	Summarize the operations involved in rice and pulse processing	Apply the knowledge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

TEXT BOOK:

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

REFERENCES:


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



CO-PO, PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	-	-	-	-	1	2	3	-	-	-	2	1	-
CO2	2	-	2	-	-	2	2	3	-	-	-	2	2	-
CO3	2	1	2	1	-	1	1	3	-	-	-	2	2	-
CO4	2	1	2	1	-	2	2	3	-	-	-	2	2	1
CO5	1	-	-	2	-	2	2	2	-	-	-	2	2	1
AVG	1.8	1	2	1.33	-	1.6	1.8	2.8	-	-	-	2	1.8	1


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OPEN ELECTIVE I

Programme	Course code	Name of the course	L	T	P	C
B.TECH.	21FT6401	TRADITIONAL FOODS	3	0	0	3

The student should be able to

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

Unit	DESCRIPTION	Instructional Hours
I	TRADITIONAL METHODS OF FOOD PROCESSING: Introduction - food culture -geographical features and food. Traditional methods of milling grains - rice, wheat and corn - equipments and processes as compared to modern methods. Equipments and processes for edible oil extraction- comparison of traditional and modern methods. Energy costs, efficiency, yield, shelf life and nutrient content comparisons. Traditional methods of food preservation - sun-drying, osmotic drying, brining, pickling and smoking.	9
II	SWEETS, SNACKS AND DAIRY PRODUCTS: Production, formulation, preparation and processing of Indian traditional sweet and snack food products: - Rasgolla, Gulabjamun; formulation and preparation of namkeen, papads, vada, potato chips, banana chips, samosa etc. Acid coagulated and fermented dairy products- paneer, dahi, shrikhand, lassi - processing conditions, defects etc. Fat rich products- Butter, ghee and its processing; milk-based puddings/ desserts	9
III	FERMENTED FOOD PRODUCTS: Idli, Tempe, Soya sauce, fish pickle, dry fish, meat and vegetable fermented products. Various alcohol-based products. Ways to increase nutritional quality of food such as enrichment, fortification, fermentation and mutual supplementation. Best cooking and processing procedures to reduce loses of nutrients	9
IV	COMMERCIAL PRODUCTION: Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozen foods &-types marketed, turnover; role of SHGs, SMES industries, national and multinational companies; commercial production and packaging of traditional beverages such as tender coconut water, neera, lassi, buttermilk, dahi. Commercial production of intermediate foods - ginger and garlic pastes, tamarind pastes, masalas (spice mixes), idli and dosa batters	9
V	HEALTH ASPECTS: Comparison of traditional foods with typical fast foods / junk foods - cost, food safety, nutrient composition, bioactive components; energy and environmental costs of traditional foods; traditional foods used for specific ailments /illnesses.	9
Total Instructional Hours		45
Course Outcome	CO1 Justify the processing methods of traditional foods in terms of its health benefits	
	CO2 Assess the production methods of traditional sweets, snacks and dairy products	
	CO3 Differentiate Traditional fermented foods products based on its raw material	
	CO4 Implement a large-scale production of tradition foods for its increased consumption	
	CO5 Compare the health aspects of traditional foods with modern foods	

TEXT BOOK:

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


REFERENCES:


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

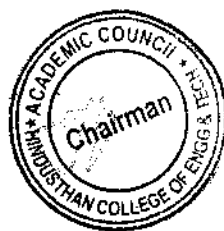


CO-PO, PSO MAPPING

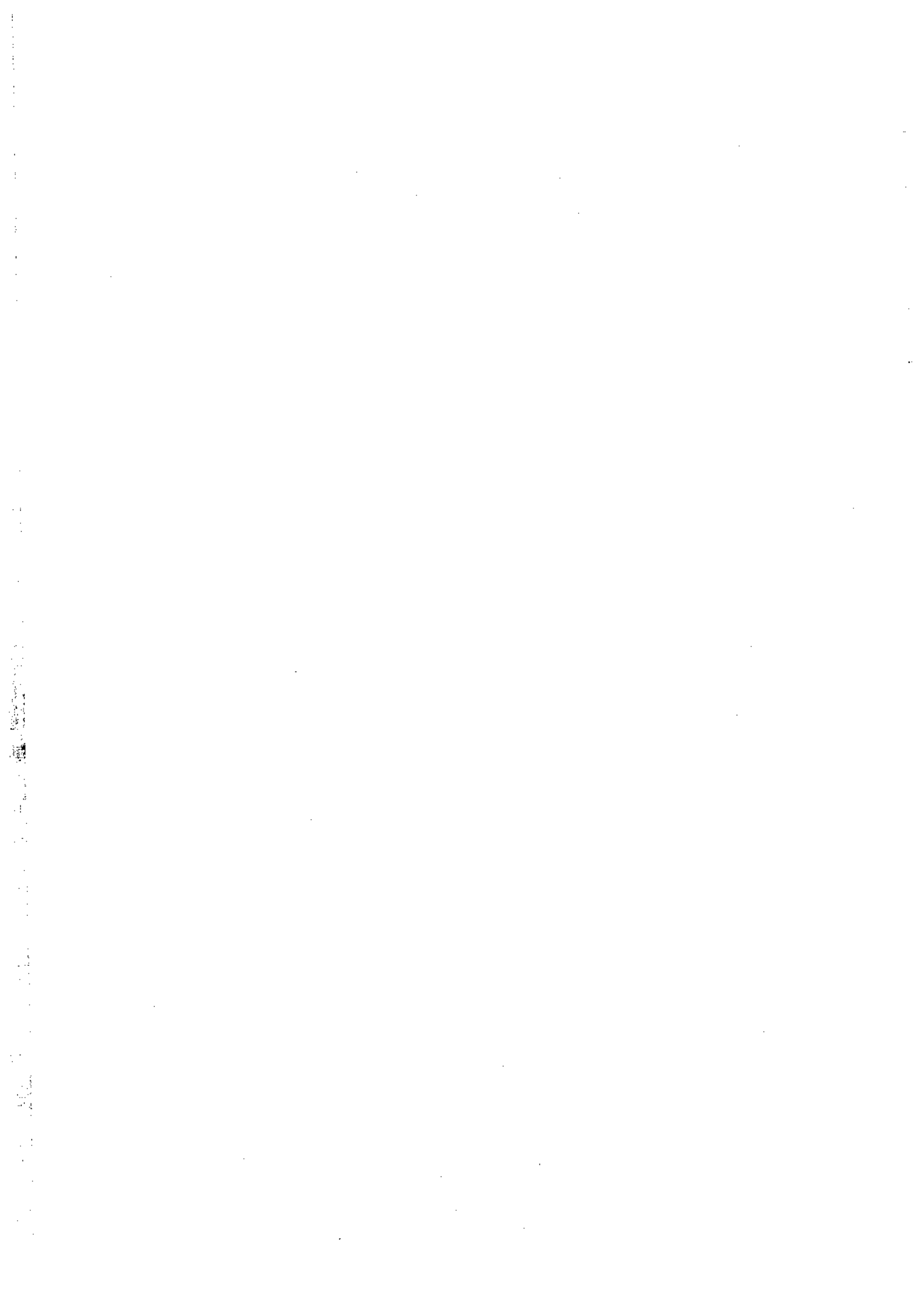
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	1	1	-	-	-	1	2	3	-	-	-	2	1	-
CO2	1	1	-	-	-	1	2	3	-	-	-	2	2	-
CO3	1	1	-	1	-	1	1	3	-	-	-	2	2	-
CO4	1	1	-	1	2	1	2	3	-	-	-	2	2	3
CO5	1	1	-	2	2	1	2	2	-	-	-	2	2	-
AVG	1	1	-	1.33	2	1	1.8	2.8	-	-	-	2	1.8	3


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HONORS DEGREE COURSE SYLLABUS



Programme B.Tech	Course Code 21FT6204	Name of the Course Ready to Eat Foods	L 3	T 0	P 0	C 3
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The students will be able to

- Course Objectives**
- Acquire knowledge about current production and marketing status of Snack foods.
 - Elucidate the advantages of Sensory Evaluation.
 - Packaging technologies in Snack Food Industries.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	SNACK FOOD INDUSTRY : Introduction-History-Past innovations- Outline of snack food industry- Nutrition-Total Quality Management of Technology-Domestic Snack Food Market-Global Market-Snack Food Association Future Considerations	9
II	POTATO AND TORTILLA CHIPS PROCESSING : Potato Production- Potato snack Ingredients- Potato Analysis and Composition-Potato chip manufacturing process-Unit Operations-Other value added products from Potato. Tortilla chips - Raw Materials- Processing steps-Equipment involved-Reconstitution of Dry Maize Flour-Unit operations.	9
III	POPCORN PROCESSING : Introduction- Raw popcorn selection and preparation-Popping Methods-Home preparation of Popcorn-Equipments-Industrial manufacturing process- Flavorings and Applicators-Popcorn Packaging- Relative Nutrition- Marketing.	9
IV	FRUIT BASED SNACKS: Introduction-production and processing of fruit crops – fruit purees – fruit powders – canned fruit snacks – alcoholic preservation of fruit snacks – fruit candies – fruit bars – exotic fruits.	9
V	SENSORY EVALUATION AND PACKAGING : Introduction- Analytical methods-Sensory methods- Sensory Aspect of Processing- Quality properties of Snack Foods and Packaging Materials-Automated Bag- Pouch Packaging- Cartoning Case Packing-Current Issues in Snack Foods Packaging	9
Total Instructional Hours		45

Upon completion of the course, students can be able to

- Course outcomes**
- CO1- Outline the current status of snack food Industry
 - CO2- Describe the production, processing and marketing trends of potato and tortilla chips
 - CO3- Outline the overall processing of popcorn
 - CO4- Explain the production and processing of fruits involved in snack food preparation
 - CO5- Summarize the sensory analysis methods and packaging techniques of snack foods

TEXT BOOKS:

1. Lusas, E. W and Rooney, L. W. Snack Foods Processing. CRC Press, 1st Edition 2001.
2. Baikow V.E., —Manufacturing and Refining of Raw Cane Sugar, 2nd Edition, Volume - I and II, Elsevier Publishing Company, New York, 1967

REFERENCES BOOKS:

1. Sergio O Serna-Saldivar, Industrial Manufacture of Snack Foods, Kennedys Books Ltd. 2008.

CO- PO PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	-	2	-	1	2	2	-	-	1	2	2	3
CO2	2	2	-	2	-	1	2	2	-	-	1	2	2	3
CO3	2	2	-	2	-	1	2	2	-	-	1	2	2	3
CO4	2	2	-	2	-	1	2	2	-	-	1	2	2	3
CO5	2	2	-	2	-	1	2	2	-	-	1	2	2	3
AVG	2	2	-	2	-	1	2	2	-	-	1	2	2	3

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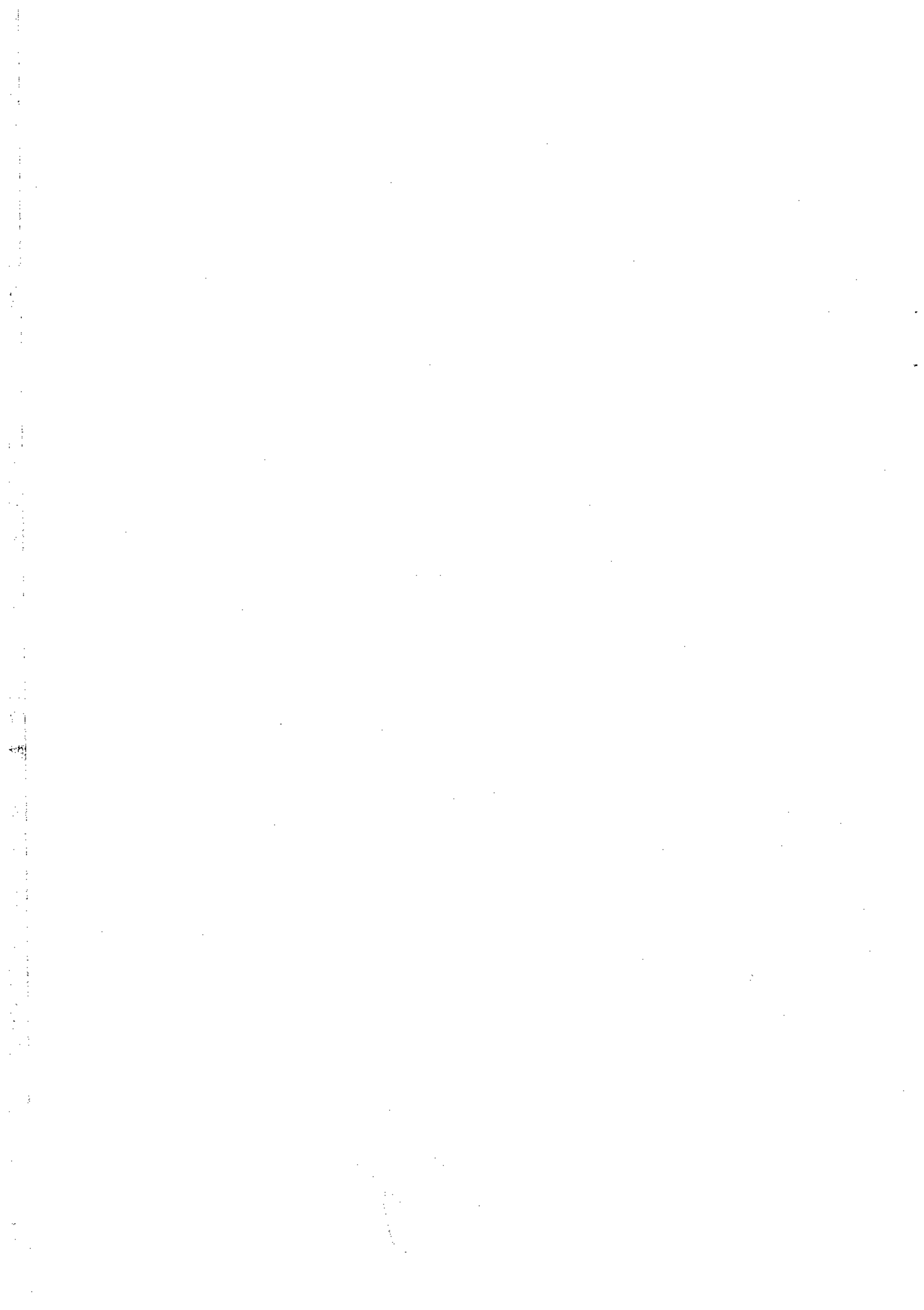
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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	21FT6205	CANE SUGAR TECHNOLOGY	3	0	0	3

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 disadvantages. Evaporator- types- performance measures.	9
III	CLARIFICATION: Clarification – importance, methods, clarifying agent, bleaching agent. Role of pH, non-sugars, colloids and gums in cane juice clarification. Lime - specification, storage. Preparation of milk of lime, rotary lime slacker, classifier, MOL tanks, lime pumps, use of hydrated lime powder. Sulphur - specification and storage, production of sulphur dioxide gas, construction and working of sulphur burner, film type sulphur burner.	9
IV	CRYSTALLIZATION AND REFINING: Sugar boiling, Nucleation and crystal growth, super saturation and meta stable stage, seeding – shock seeding, true seeding. Crystallizers. Refining - Brown sugar, importance of refining, Affination, clarification, carbonation, sulphitation, phosphitation, decolorization, centrifugation - dewatering of sugar. Drying. Bagging and storage. Factors affecting sugar refining process.	9
V	MANUFACTURING OF JAGGERY/GUR AND OTHER BYPRODUCTS: Extraction of Juice, Clarification of Gur, Concentration of Juice, Drying and grading of Gur, Storage of Gur. Byproducts - Drying and uses of Bagasse - Back strap Molasses - Characteristics of Molasses. Direct Utilization of Molasses - Distilling Industries - Applications in animal feed – Biogas – Biofertilizers production- Inverted syrup.	9
Total Instructional Hours		45

Course outcomes Upon completion of the course, students can be able to

CO1- Remember the sugar cane constituents and apply preprocessing operations
 CO2- Understand the suitable cane juice extraction and concentration methods
 CO3- Understand the appropriate clarification methods for sugarcane juice
 CO4- Remember crystallization and refining techniques
 CO5- Understand the knowledge for manufacturing of cane sugar by-products

TEXT BOOKS:

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

REFERENCES BOOKS:


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




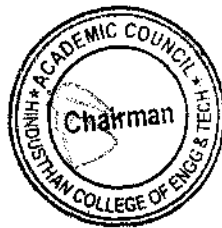
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CO- PO PSO MAPPING

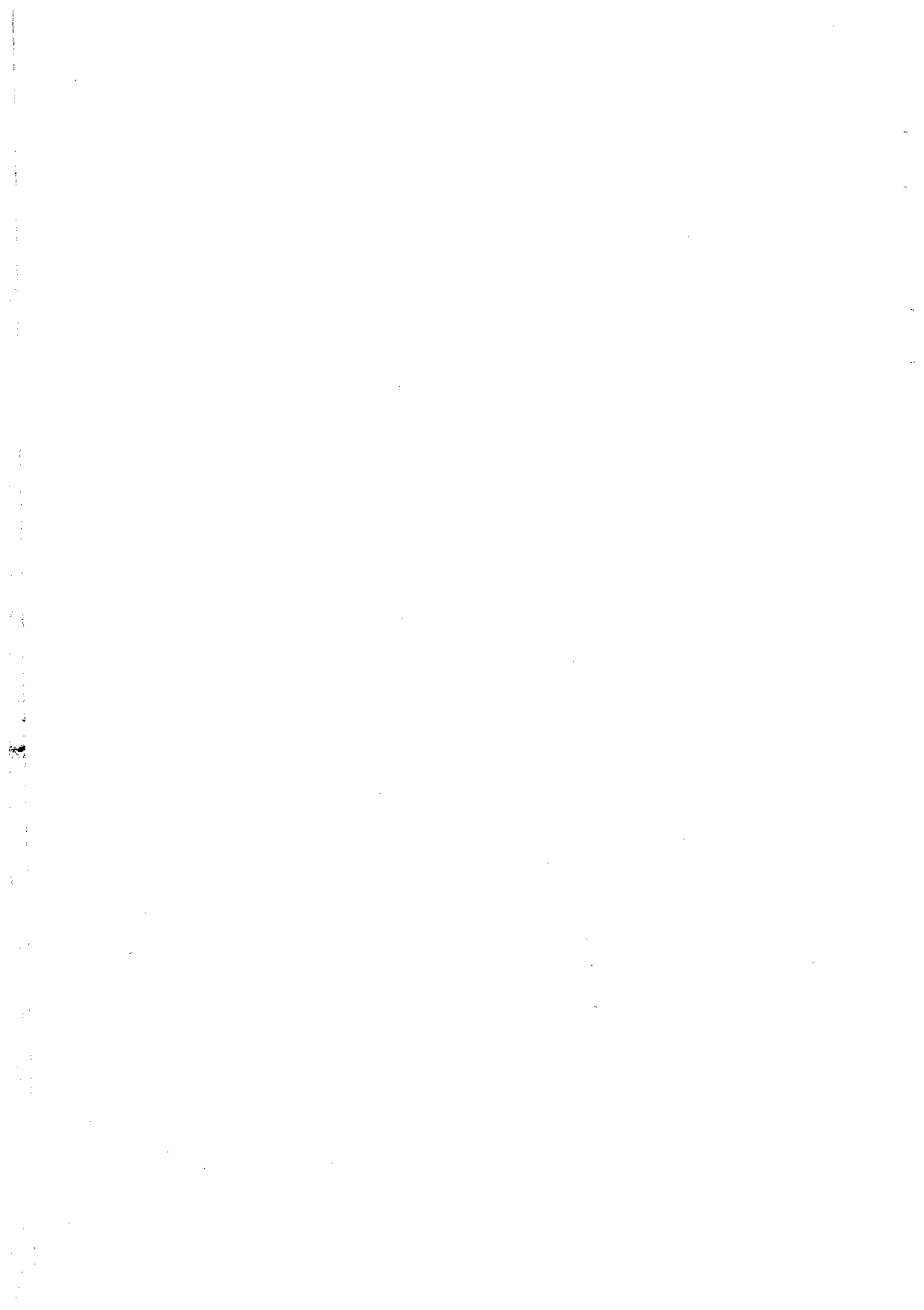
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	-	2	-	1	2	2	-	-	1	2	2	3
CO2	2	2	-	2	-	1	2	2	-	-	1	2	2	3
CO3	2	2	-	2	-	1	2	2	-	-	1	2	2	3
CO4	2	2	-	2	-	1	2	2	-	-	1	2	2	3
CO5	2	2	-	2	-	1	2	2	-	-	1	2	2	3
AVG	2	2	-	2	-	1	2	2	-	-	1	2	2	3


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**MINOR DEGREE COURSE
SYLLABUS**



Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	21FT6601	Technology of Fruits and Vegetable Processing	3	0	0	3

The students will be able to

- Course Objectives**
- Gain a fundamental understanding of the principles and concepts related to the processing of fruits and vegetables.
 - Learn how to adapt processing techniques to meet changing consumer demands.
 - Understand the factors influencing the shelf life of processed products.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	Introduction to Fruit and Vegetable Processing: Production and processing scenario of Fruits and vegetables in India, scope of fruit and vegetable processing industry in India - present status, Physical, Textural characteristics, structure and composition; Maturity standards; Importance, methods of Maturity determinations Fruit ripening- chemical changes, regulations, methods. Spoilage of fruits, vegetable and their processed products.	9
II	Preservation Methods: Preservation by fermentation- Definition, Advantages, disadvantages, Types of fermentation, equipments; Fruit wine. Irradiation applications for fruits and Vegetable. Minimally processed fruits and vegetables, General preprocessing, drying, freezing and osmotic dehydration of fruits and vegetables	9
III	Technology, Quality and Packaging of Canning, Purees and Juices: Canning- General pre-processing, Blanching, exhausting, processing conditions; Vegetable Purees/pastes - General and specific processing; Technology for juice pressing, juice extraction and clarification, methods of bottling, enzymatic clarification and debittering of juices; Indian Food Regulation and Quality assurance for Fruit based products, different packing methods including aseptic packing	9
IV	Fruits and Vegetable based products - Technology of Jam, jelly, Marmalades - Tests for end point determination-Problems in production Processing of Syrups - natural and synthetic, Fruit juice concentrate - Fruit juice powder - Quality specifications, Vegetable processing: Sauces and Ketchups, soup powders - Difference, classification of sauces; Processing technology of vegetable wafers - potato wafers - preparation - types of peeling- discolorations - slicing - Drying - Frying - Salting - packing;	9
V	Fermented products from fruits and vegetables: Vinegar - types of vinegar - methods of vinegar production - Quick method - Orleans slow process - Generator process - problems in vinegar production - Sauerkraut - Role of lactic acid bacteria in pickling, Pickles - Types of Pickling-Pickling with salt - Dry salting - Brining.	9
Total Instructional Hours		45

Upon completion of the course, students can be able to

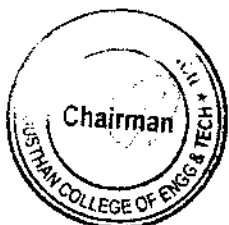
- Course outcomes**
- CO1 Understand the importance of each processing step in maintaining product quality.
 - CO2 Explore various preservation techniques for fruits and vegetables
 - CO3 Familiarize with the various types of equipment and machinery used in fruit and vegetable processing.
 - CO4 Explore innovative product development in fruit and vegetable processing.
 - CO5 Build the fermentation conditions for processing of fruits and vegetables.

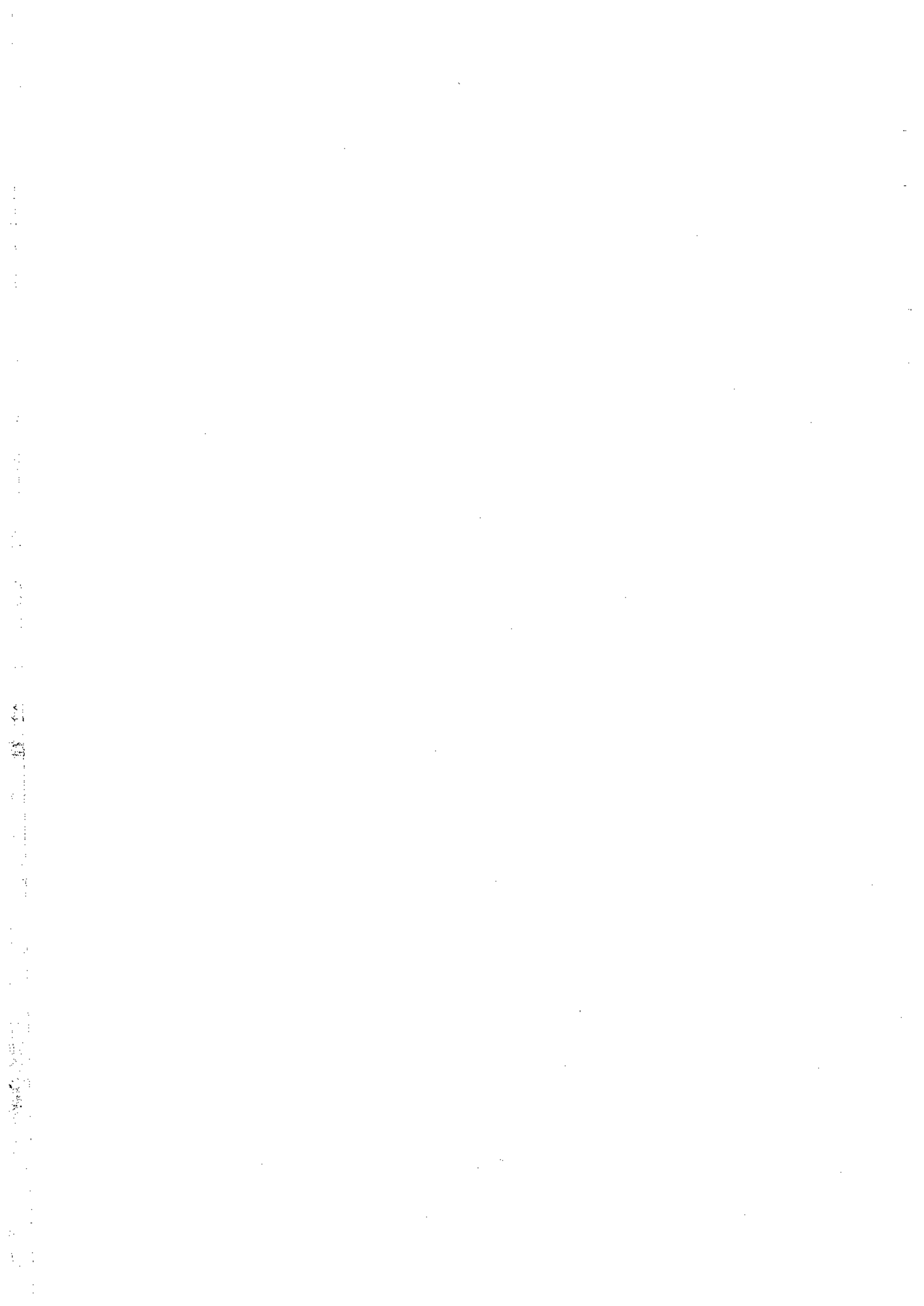
TEXT BOOKS:

- T1 Fellows, P J. "Food Processing Technology Principles and Practice". 3rd Edition, Woodhead, 2009.
- T2 Salunke, D . K and S. S Kadam "Hand Book of Fruit Science and Technology Production, Composition, Storage and Processing". Marcel Dekker, 2005.
- T3 Srivastava.P.R. and Sanjeev Kumar. Fruit and vegetable preservation - 3rd Edition. International, 2009

REFERENCES BOOKS:

- R1 Fruit and Vegetable Preservation: Principles and Practices, Srivastava R.P.& Kumar Sanjeev. CBS publishers and distributors pvt ltd.
- R2 Fruit and Vegetable Processing by FAO.Org.
- R3 Food Processing and Preservation, B Shivsankar PHI Press.





Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	21FT6601	Meat Processing Technology	3	0	0	3

The students will be able to

- Course Objectives**
- Understand the biological and chemical changes that occur during post-mortem muscle conversion to meat.
 - Learn various methods of meat processing, including slaughtering, dressing, and cutting.
 - Explore different processing techniques such as curing, smoking, fermentation, and drying.

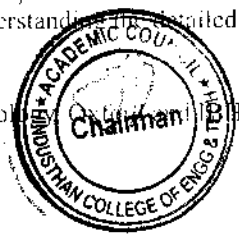
UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	INTRODUCTION Meat composition from different sources-Muscle structure and compositions and its modifiers- White and Red Meat -description of animal fat and its modifiers-description of bone and its modifiers-Post mortem muscle chemistry, Meat colour and Flavor- meat microbiology and safety. Sensory characteristics and evaluation of meat	9
II	SLAUGHTERING AND CARCASS PROCESSING Modern abattoirs and some features, Ante mortem handling and welfare of animals, design of handling facilities, Hoisting rail and traveling pulley system, and stunning methods, stunning pen, slaughtering equipment, Washing area, Sticking, bleeding, dressing, Beef/Sheep and Pig Dressing operations, Offal handling and inspection, Inedible by products: Carcass processing equipment, Operational factors affecting meat quality, effects of processing on meat tenderization; meat processing equipment. Meat plant hygiene, GMP and HACCP.	9
III	Processing of Poultry and Poultry Meat Products Poultry industry in India, measuring the yields and quality characteristics of poultry products, microbiology of poultry meat, spoilage factors; Plant sanitation; Poultry meat processing operations in detail along with equipment used- Unloading, Stunning, Bleeding, Scalding, De-feathering, Electrical Stimulation, Evisceration etc. Chilling, Weighing and Grading. Packaging of poultry products, refrigerated storage of poultry meat, HACCP in poultry processing.	12
IV	Egg: Structure, composition, nutritive value, calculation of nutritive value and functional properties of eggs, Estimation of External and Internal Quality of Chicken Egg — Factors affecting the quality of Eggs. Meat Products and Processing Methods Processing methods of meat and meat products- Chilling and Freezing of Meat, Irradiation of Meat. Secondary methods: Mechanical Deboning, Breeding, Marination-Drying: Principles and Applications. Canned meat, Meat- Cured Meat, Smoked meat, Fermented Meat- Processing of meat and meat products like Cooked Ham, Cooked Sausages, Bacon, Dry-Cured Ham, Mold-Ripened Sausages, Semidry and Dry Fermented Sausages -Intermediate moisture meat products	6
V	SPOILAGE AND TEST METHODS OF MEAT Colour, microbiology and spoilage factors of meat and meat products, Factors affecting post-mortem changes, properties and shelf-life of meat. The spoilage of meat by infecting organisms – TEST METHODS: Physical, Chemical and microbiological testing of meat, Sensory evaluation	9
Total Instructional Hours		45

Upon completion of the course, students can be able to

- Course outcomes**
- CO1 Understand and identify the specific processing technologies used for meat and marine products.
 - CO2 Familiarize with quality evaluation techniques of meat and marine products.
 - CO3 Interpret the changes in the composition of foods with respect to the type of processing technology used.
 - CO4 Aware of Feed, Breed Management on production and quality Get through Pre and Post slaughter handling techniques
 - CO5 Capable of detailed understanding of detailed process flow of value added products from poultry species.

TEXT BOOKS:

T1 Govindan. T.K. —Fish Processing Technology, Food and Agriculture Publishers, New Delhi, 1985.



CO-PO PSO MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	3	3	-	-	-	1	2	2	1
CO2	3	3	3	3	3	3	3	-	-	-	1	3	2	1
CO3	3	3	3	2	3	2	2	-	-	-	1	3	3	1
CO4	3	3	3	2	3	2	2	-	-	-	1	2	2	1
CO5	3	3	3	3	3	3	3	-	-	-	2	3	2	1
Avg	3	2.8	2.8	2.4	2.8	2.6	2.6	0	0	0	1.2	2.6	2.2	1

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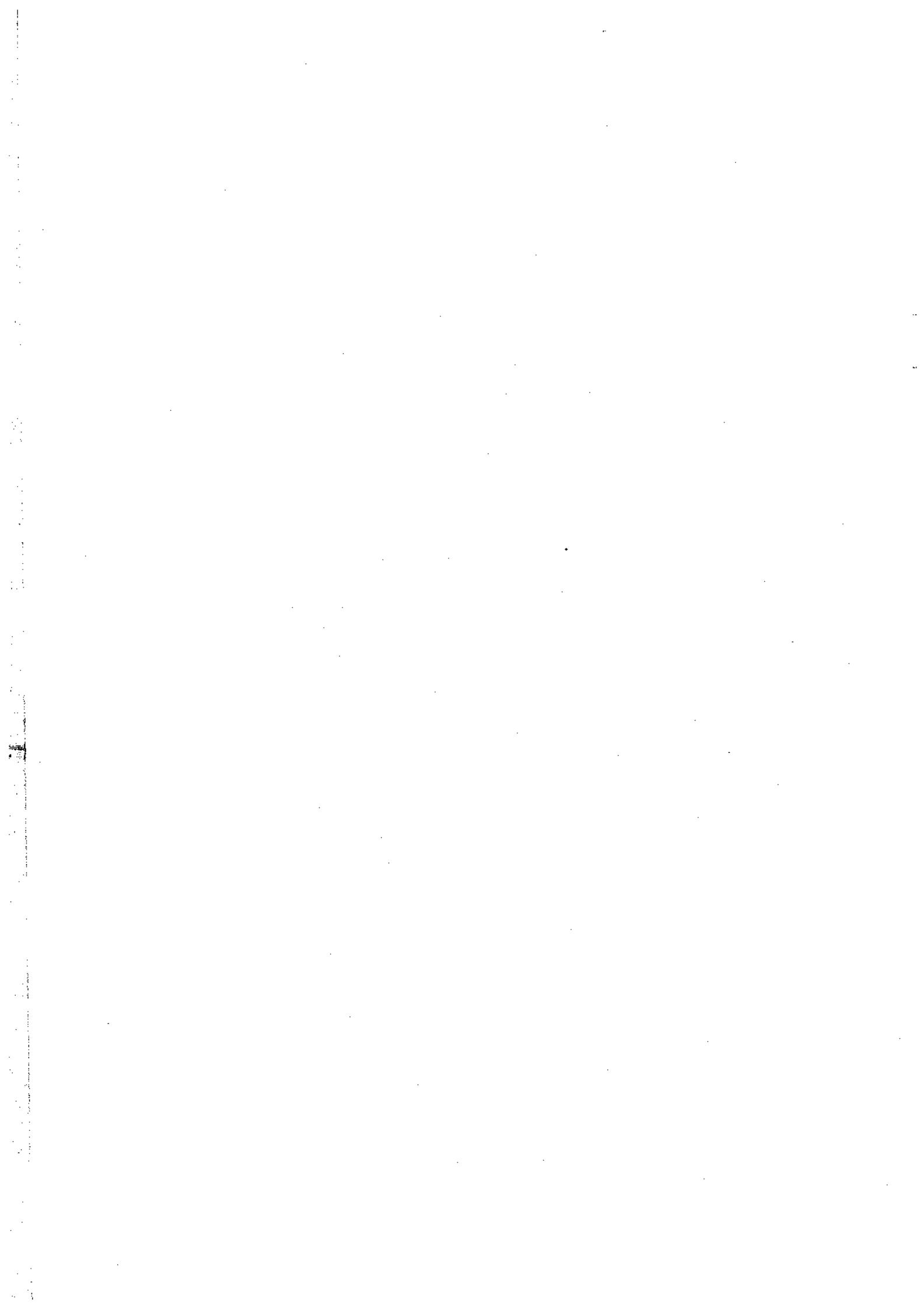
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**Minor Degree
Syllabus
Under
Entrepreneurship ,
Fintech and Block Chain
&
Environment and Sustainability
Verticals**



Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	21CS6603	FUNDAMENTALS OF INVESTMENT	3	0	0	3

- Course Objective**
1. Describe the investment environment in which investment decisions are taken.
 2. Explain how to Value bonds and equities
 3. Explain the various approaches to value securities
 4. Describe how to create efficient portfolios through diversification
 5. Discuss the mechanism of investor protection in India.

Unit	Description	Instructional Hours
	THE INVESTMENT ENVIRONMENT	
I	The investment decision process, Types of Investments – Commodities, Real Estate and Financial Assets, the Indian securities market, the market participants and trading of securities, security market indices, sources of financial information, Concept of return and risk, Impact of Taxes and Inflation on return.	9
	FIXED INCOME SECURITIES	
II	Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, default risk And credit rating.	9
	APPROACHES TO EQUITY ANALYSIS	
III	Introduction to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalisation models, and price-earnings multiple approach to equity valuation.	9
	PORTFOLIO ANALYSIS AND FINANCIAL DERIVATIVES	
IV	Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives; Financial Derivatives Markets in India	9
	INVESTOR PROTECTION	
V	Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors' awareness and activism	9
Total Instructional Hours		45

Course Outcome	CO1: Associate and classify the the investment environment in which investment decisions are taken.
	CO2: Elaborate the how to Value bonds and equities
	CO3: Interpret the the various approaches to value securities
	CO4: Acquire how to create efficient portfolios through diversification
	CO5: Illustrate how to create efficient portfolios through diversification

TEXT BOOKS:

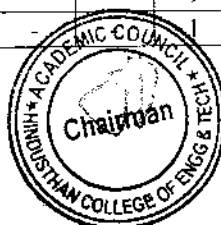
- T1: Charles P. Jones, Gerald R. Jensen. Investments: analysis and management. Wiley, 14TH Edition, 2019
- T2: Chandra, Prasanna. Investment analysis and portfolio management. McGraw-hill education, 5th, Edition, 2017.

REFERENCE BOOKS:

- R1: Rustagi, R. P. Investment Management Theory and Practice. Sultan Chand & Sons, 2021.
- R2: ZviBodie, Alex Kane, Alan J Marcus, Pitabus Mohanty, Investments. McGraw Hill Education(India), 11 Edition(SIE), 2019

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

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Programme B.E	Course Code 21CS6604	Name of the Course BANKING, FINANCIAL SERVICES AND INSURANCE	L 3	T 0	P 0	C 3
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- Course Objective**
- To Understand the Banking system in India
 - To Grasp how banks raise their sources and how they deploy it
 - To Understand the development in banking technology
 - To Understand the financial services in India
 - To Understand the insurance Industry in India

Unit	Description	Instructional Hours
	INTRODUCTION TO INDIAN BANKING SYSTEM	
I	Overview of Banking system – Structure – Functions –Banking system in India - Key Regulations in Indian Banking sector –RBI. Relationship between Banker and Customer - Retail & Wholesale Banking – types of Accounts - Opening and operation of Accounts.	9
	MANAGING BANK FUNDS/ PRODUCTS	
II	Liquid Assets - Investment in securities - Advances - Loans.Negotiable Instruments – Cheques, Bills of Exchange & Promissory Notes.Designing deposit schemes– Asset and Liability Management –NPA’s – Current issues on NPA’s – M&A’s of banks into securities market.	9
	DEVELOPMENT IN BANKING TECHNOLOGY	
III	Payment system in India – paper based – e payment –electronic banking –plastic money – e-money–forecasting of cash demand at ATM’s –The Information Technology Act, 2000 in India – RBI’s Financial Sector Technology vision document – security threats in e-banking & RBI’s Initiative.	9
	FINANCIAL SERVICES	
IV	Introduction – Need for Financial Services – Financial Services Market in India – NBFC – Leasing and Hire Purchase – mutual funds. Venture Capital Financing –Bill discounting – factoring –Merchant Banking	9
	INSURANCE	
V	Insurance –Concept - Need - History of Insurance industry in India. Insurance Act, 1938 -- IRDA –Regulations – Life Insurance - Annuities and Unit Linked Policies - Lapse of the Policy – revival –settlement of claim	9
Total Instructional Hours		45

- Course Outcome**
- CO1: Understand the Banking system in India
CO2: Grasp how banks raise their sources and how they deploy it
CO3: Understand the development in banking technology
CO4: Understand the financial services in India
CO5: Understand the insurance Industry in India

TEXT BOOKS:

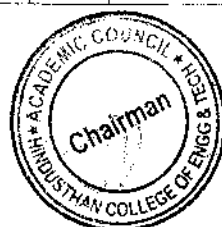
- T1. I. Padmalatha Suresh and Justin Paul, “Management of Banking and Financial Services, Pearson, Delhi, 2017.
- T2 Meera Sharma, “Management of Financial Institutions -- with emphasis on Bank and Risk Management”, PHI Learning Pvt. Ltd., New Delhi 2010

REFERENCE BOOKS:

- R1 Peter S. Rose and Sylvia C. and Hudgins, “Bank Management and Financial Services”, Tata McGraw Hill, New Delhi, 2017

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech (Minor Degree)	21BA6601	Introduction to New Business Venture	3	0	0	3

- Course Objective
- To create awareness toward development of business idea
 - To develop value proposing and market segmentation
 - To demonstrate the benefits of marketing mix
 - To explore operations management in business
 - To demonstrate financial forecast for small business units

Unit	Description	Instructional Hours
I	Business Idea New venture typologies-Creating and identifying opportunities-Techniques for exploring change-Techniques for exploring product inadequacies. Defining the market / industry-concentration and geographic spread-Estimating market size-SWOT analysis-selecting appropriate option	9
II	Value proposition and market segmentation New venture creation framework-Generic business models and competitive advantage-Niche business model-Internet business model-Characteristics of good business model-Low cost market testing. Identifying target customers-value proposition-Differentiation through branding-Sustainable entrepreneurship-Mission statement	9
III	Developing marketing mix Product features and benefits-Channels of distribution-Cost, price and volume; pricing decisions-Sales force planning and allocation. Communicating the value proposition-Communications media-Social networks-Guerilla marketing-Publicity, PR and advertising-CRM.	
IV	Managing operations Marketing activities-Retail activities-Internet business activities-Internet business activities. Managing and leading people-Attracting the right people-Using professional advisors-Team building-Organizational structure, design and control-Leadership and management	9
V	Preparing and using financial forecasts Forecast sales turnover, income statement and costs-Forecast breakeven point-SMART Performance metrics-Valuing the business. Business Plan-Difference between business model and business plan-Purpose of a business plan-Structure and components of a business plan-Using the business plan to seek finance-Harvesting the business-	9
Total Instructional Hours		45

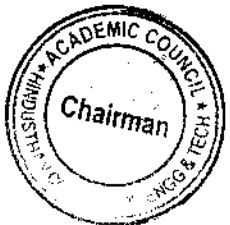
- Course Outcome
- CO1: Awareness on business idea generation
 - CO2: Develop value proposition and market segmentation for business
 - CO3: Marketing mix for various business ventures
 - CO4: Able to manage business operations
 - CO5: Able to make financial forecast for new business

Text and References

- Paul Burns, New Venture Creation: A Framework for Entrepreneurial Start-ups, MacMillan, 2023
- A Sahay, V Sharma, Entrepreneurship and new Venture Creation, Excel, 2023
- Inge Hill, Start-Up: A Practice Based Guide For New Venture Creation, MacMillan, 2023
- Arya Kumar, Entrepreneurship: Creating and Leading an Entrepreneurial Organization, Pearson, 2023
- Kathleen R. Allen, Launching New Ventures: An Entrepreneurial Approach, Cengage, 2023
- Kuratko, New Venture Management: The Entrepreneur's Roadmap. Pearson, 2023

COs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3	3	1	1	1	2	3	2
CO2	3	3	2	1	3	3	3	3
CO3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3
CO5	3	3	1	1	3	3	3	3

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- T2 Lawrie, R.A. —Meat Science, Second Edition. Pergamon Press, Oxford, UK. 1975.
 T3 Isabel Guerrero- Legarreta, "Handbook of Poultry Science and Technology", Wiley, 2010.
 T4 Jhari Sahoo, "Textbook on Meat, Poultry and Fish technology", Daya Publishing House, 2016.

REFERENCES BOOKS:

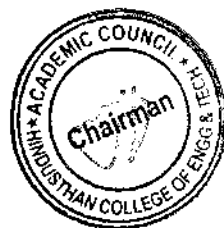
- R1 Joseph Kerry, John Kerry and David Ledwood. —Meat Processing, Woodhead Publishing Limited, England (CRC Press), 2002.
 R2 Mead, G. —Poultry Meat Processing and Quality, Woodhead Publishing, England, 2004.

CO-PO PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	-	2	1	-	-	-	1	2	2	-	2
CO2	3	1	2	1	-	3	2	-	-	-	1	3	3	-	3
CO3	1	1	2	1	-	3	1	-	-	-	2	3	2	-	2
CO4	1	2	2	2	-	2	2	-	-	-	1	2	2	-	2
CO5	2	2	3	2	-	2	2	-	-	-	1	2	2	-	1
avg	1.8	1.6	2.2	1.6	0	2.4	1.6	0	0	0	1.2	2.4	2.2	0	2


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Programme	Course Code	Name of the Course	L	T	P	C
BE/B.Tech (Minor Degree)	21BA6602	Team Building & Leadership Management for Business	3	0	0	3

1. To provide a framework for the students to understand the importance of Leadership and team effectiveness in organizations.

- Course Objective
2. To develop an understanding of the interpersonal processes and group dynamics.
 3. To provide a theoretical understanding of leadership practices in organizations.
 4. To provide an understanding of factors influencing teamwork and team leadership.
 5. To evaluate the role of leadership in the development of an institution.

Unit	Description	Instructional Hours
I	Introduction to Leadership & Team Management; Leadership Myths; Interactional Framework for analysing leadership; Leadership Development Leader Development- The Action-Observation-Reflection Model ,LMX Theory and Normative Decision Model; Situational Leadership Model; Contingency Model and Path Goal Theory; Emotional Approach Charismatic and Transformational Leadership; Leadership for Tomorrow	9
II	Leadership Attributes; Personality Traits and Leadership; Personality Types and Leadership; Intelligence and Leadership; Emotional Intelligence and Leadership, Power and Leadership; The art of influence in leadership; Leadership and "Doing the Right Things; Character-Based Approach to Leadership; Role of Ethics and Values in Organisational Leadership	9
III	Leadership Behaviour; Leadership Pipeline; Assessing Leadership Behaviours: Multi-rater Feedback Instruments; The Dark Side of; Leadership- Destructive Leadership; Managerial Incompetence and Derailment Conflict Management	9
IV	Negotiation and Leadership; Leadership under a crisis situation; The Situation and the Environment; Culture and Leadership; Global Leadership Team Management: Meaning, Types of team, Understand the stages of Team Development skills required for team development, Delegation and Empowerment; Leading teams: Enhancing teamwork within a group; The leader's role in team-based organizations; Leader actions that foster Teamwork Effectiveness; Offsite training and team development	9
V	Understanding Team processes and Team coaching; Team decision making and conflict management; Virtual teams; Managing Multicultural teams; Building great teams; Development Planning: GAP Analysis; Coaching and Mentoring; Building Effective Relationship with subordinates and peers; Fostering Followers satisfaction; The Art of Communication; Setting Goals and Providing Constructive Feedback; Enhancing Creativity problem solving skills Building High-Performance Teams	9
Total Instructional Hours		45

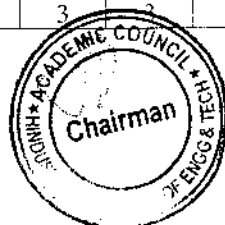
- Course Outcome
- CO1: To understand the concept and the importance of Leadership and team
 - CO2: To understanding of the interpersonal processes and group dynamics
 - CO3: To learn the leadership practices in organizations
 - CO4: To gain knowledge about factors influencing teamwork and team leadership
 - CO5: To gain knowledge on leadership in the development of an institution

Books & Reference

1. Leadership: Enhancing the lessons of experience by Hughes, R.L., Ginnett, R.C., & Curphy, G.J. (2019), 9th Edition, McGraw Hill Education, Chennai, India.
2. Team Building: The Ultimate Guide to Build & Manage Winning Teams (Team Building Activities, Business Management, Leadership Books. Managing) Kindle Edition By Sylvia Reyes (Author)
3. The five dysfunctions of a team- Patrick Lencioni 228 pages, Paperback First published April 11, 2002
4. Icon Team. (2014). Constructive communication in international teams an experience based guide. Münster, DE: Waxmann

COs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3
CO3	3	3	1	1	1	1	2	2
CO4	3	3	3	3	2	2	2	2
CO5	3	3	3	3	3	3	3	3

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21CE6603	SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL MANAGEMENT	3	0	0	3

- Course Objective**
1. To introduce the concepts of agroecology, agroecosystem and sustainable agriculture.
 2. To educate about the issues related to soil health, nutrient and pest management.
 3. To outline the significance of sustainable water management and irrigation.
 4. To explore the concepts and plans for energy and waste management.
 5. To learn about the methods and approaches for evaluating sustainability in agroecosystems.

Unit	Description	Instructional Hours
I	AGROECOLOGY, AGROECOSYSTEM AND SUSTAINABLE AGRICULTURE CONCEPTS Ecosystem definition - Biotic <i>Vs.</i> abiotic factors in an ecosystem - Ecosystem processes - Ecological services and agriculture - Problems associated with industrial agriculture/food systems - Defining sustainability - Characteristics of sustainable agriculture - Difference between regenerative and sustainable agriculture systems	9
II	SOIL HEALTH, NUTRIENT AND PEST MANAGEMENT Soil health definition - Factors to consider (physical, chemical and biological) - Composition of healthy soils - Soil erosion and possible control measures - Techniques to build healthy soil - Management practices for improving soil nutrient - Ecologically sustainable strategies for pest and disease control	9
III	WATER MANAGEMENT Soil water storage and availability - Plant yield response to water - Reducing evaporation in agriculture - Earthworks and tanks for rainwater harvesting - Options for improving the productivity of water - Localized irrigation - Irrigation scheduling - Fertigation - Advanced irrigation systems and agricultural practices for sustainable water use	9
IV	ENERGY AND WASTE MANAGEMENT Types and sources of agricultural wastes - Composition of agricultural wastes – Sustainable technologies for the management of agricultural wastes - Useful and high value materials produced using different processes from agricultural wastes - Renewable energy for sustainable agriculture	9
V	EVALUATING SUSTAINABILITY IN AGROECOSYSTEMS Indicators of sustainability in agriculture - On-farm evaluation of agroecosystem sustainability - Alternative agriculture approaches/ farming techniques for sustainable food production - Goals and components of a community food system - Case studies	9
Total Instructional Hours		45

- Course Outcome**
- On completion of the course, the student is expected to be able to:
- CO1 Have an in-depth knowledge about the concepts, principles and advantages of sustainable agriculture
 - CO2 Discuss the sustainable ways in managing soil health, nutrients, pests and diseases
 - CO3 Suggest the ways to optimize the use of water in agriculture to promote an ecological use of resources
 - CO4 Develop energy and waste management plans for promoting sustainable agriculture in non-sustainable farming areas
 - CO5 Assess an ecosystem for its level of sustainability and prescribe ways of converting to a sustainable system through the redesign of a conventional agroecosystem

TEXT BOOKS:

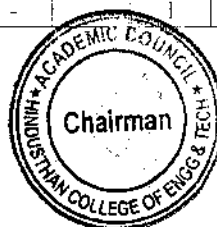
- T1. Approaches to Sustainable Agriculture – Exploring the Pathways Towards the Future of Farming, Oberc, B.P. & Arroyo Schnell, A., IUCN, Belgium, 2020
- T2. Natural bioactive products in sustainable agriculture, Singh, J. & Yadav, A.N., Springer, 2020
- T3. Organic Farming for Sustainable Agriculture, Nandwani, D., Springer, 2016

REFERENCE BOOKS:

- R1. Principles of Agronomy for Sustainable Agriculture, Villalobos, F.J. & Fereres, E., Springer, 2016
- R2. Sustainable Agriculture for Food Security: A Global Perspective, Balkrishna, A., CRC Press, 2021
- R3. Sustainable Energy Solutions in Agriculture, Bundschuh, J. & Chen, G., CRC Press, 2014

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21CE6604	SUSTAINABLE BIOMATERIALS	3	0	0	3

Course Objective
1. To impart knowledge of biomaterials and their properties
2. To learn about Fundamentals aspects of Biopolymers and their applications
3. To learn about bioceramics and biopolymers
4. To introduce the students about metals as biomaterials and their usage as implants
5. To make the students understand the significance of bionanomaterials and its applications.

Unit	Description	Instructional Hours
INTRODUCTION TO BIOMATERIALS		
I	Introduction: Definition of biomaterials, requirements & classification of biomaterials - Types of Biomaterials - Degradable and resorbable biomaterials - engineered natural materials - Biocompatibility - Hydrogels - pyrolytic carbon for long term medical implants-textured and porous materials-Bonding types - crystal structure-imperfection in crystalline structure-surface properties and adhesion of materials - strength of biological tissues - performance of implants-tissue response to implants - Impact and Future of Biomaterials	9
BIO POLYMERS		
II	Molecular structure of polymers - Molecular weight - Types of polymerization techniques - Types of polymerization reactions - Physical states of polymers - Common polymeric biomaterials - Polyethylene - Polymethylmethacrylate (PMMA) - Polylactic acid (PLA) and polyglycolic acid (PGA) - Polycaprolactone (PCL) - Other biodegradable polymers - Polyurethan- reactions polymers for medical purposes - Collagens- Elastin - Cellulose and derivatives-Synthetic polymeric membranes and their biological applications	9
BIO CERAMICS AND BIOCOMPOSITES		
III	General properties - Bio ceramics -Silicate glass - Alumina (Al ₂ O ₃) - Zirconia (ZrO ₂) - Carbon - Calcium phosphates (CaP) - Resorbable Ceramics - surface reactive ceramics - Biomedical Composites- Polymer Matrix Composite (PMC) - Ceramic Matrix Composite (CMC) - Metal Matrix Composite (MMC) - glass ceramics - Orthopedic implants - Tissue engineering scaffolds	9
METALS AS BIOMATERIALS		
IV	Biomedical metals - types and properties - stainless steel - Cobalt chromium alloys - Titanium alloys - Tantalum - Nickel titanium alloy (Nitinol) - magnesium based biodegradable alloys - surface properties of metal implants for osseointegration - medical application - corrosion of metallic implants - biological tolerance of implant metals	9
NANOBIOMATERIALS		
V	Meatllic nano biomaterials - Nanopolymers - Nanoceramics - Nanocomposites - Carbon based nanobiomaterials - transport of nanoparticles - release rate - positive and negative effect of nanosize -nanofibres - Nano and micro features and their importance in implant performance - Nanosurface and coats -Applications nanoantibiotics - Nanomedicines - Biochips - Biomimetics - BioNEMs - Biosensor- Bioimaging / Molecular Imaging - challenges and future perspective.	9
Total Instructional Hours		45

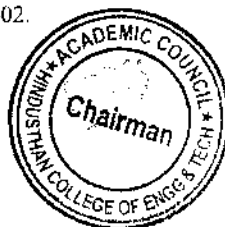
Course Outcome
CO1 Students will gain familiarity with Biomaterials and understand their importance.
CO2 Students will get an overview of different biopolymers and their properties
CO3 Students gain knowledge on the important Bioceramics and Biocomposite materials
CO4 Students gain knowledge on metals as biomaterials
CO5 Students gain knowledge on the importance of nanobiomaterials in engineering applications.

TEXT BOOKS:

- T1. C. Mauli Agrawal, Joo L. Ong, Mark R. Appleford, Gopinath Mani "Introduction to Biomaterials Basic Theory with Engineering Applications" Cambridge University Press, 2014.
- T2. Donglu shi "Introduction to Biomaterials" Tsinghua University press, 2006.
- T3. Joon Park, R.S.Lakes "Biomaterials An Introduction" third edition, Springer 2007.
- T4. M.Jaffe,W.Hammond, P.Tolias and T.Arinzeh "Characterization of Biomaterials" Wood head publishing, 2013.

REFERENCE BOOKS:

- R1. VasifHasirci, NesrinHasirci "Fundamentals of Biomaterials" Springer, 2018
- R2. Leopoldo Javier Rios Gonzalez. "Handbook of Research on Bioenergy and Biomaterials: Consolidated and green process" Apple academic press, 2021.
- R3. Devarajan Thangadurai, Jeyabalan Sangeetha, Ram Prasad "Functional Bionanomaterials" springer, 2020.
- R4. Sujata.V.Bhat Biomaterials: Narosa Publishing house, 2002.



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

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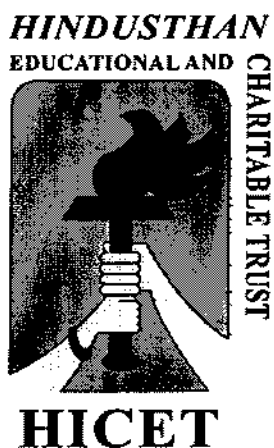
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HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution Affiliated to Anna University, Chennai)
(Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade)
Coimbatore - 641 032.

B.TECH. FOOD TECHNOLOGY



CHOICE BASED CREDIT SYSTEM

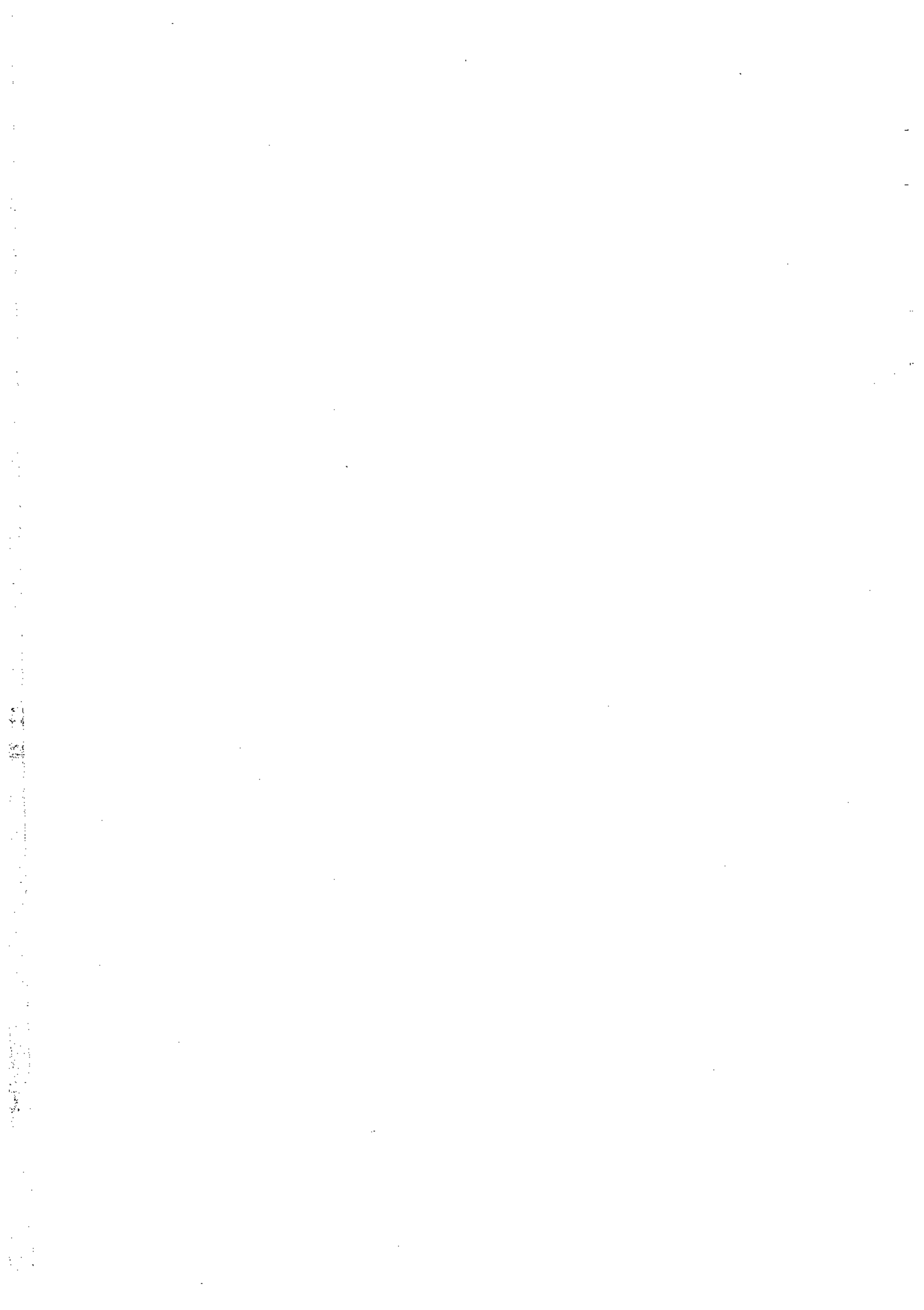
Revised Curriculum and Syllabus for the Odd semester

For

Semester VIII

Academic year 2023-24

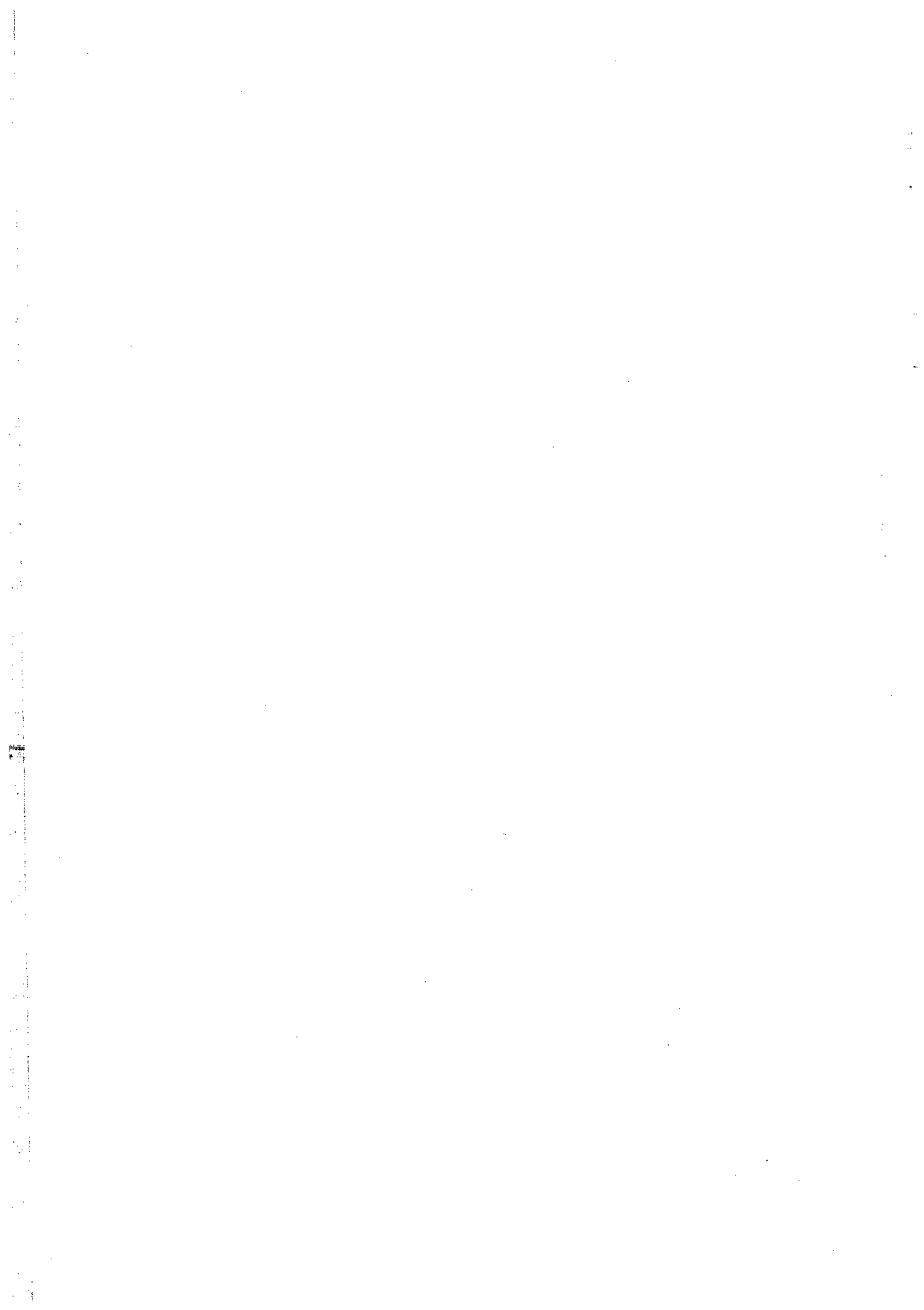
Batch 2020-2024



CURRICULUM R2019



SYLLABUS
SEMESTER VIII



DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. FOOD TECHNOLOGY (UG)

REGULATION-2019

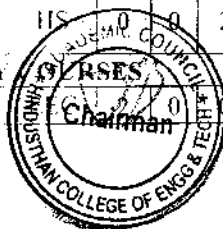
For the students admitted during the academic year 2020-2021 and onwards

SEMESTER I

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

SEMESTER II

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

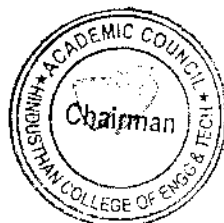
S.No	Course Code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	19FT4201R	Fundamentals of Heat and Mass Transfer	PC	3	1	0	4	25	75	100
2.	19FT4203R	Engineering properties of food materials	PC	3	0	0	3	25	75	100
3.	19FT4204	Refrigeration and Cold Chain Management	PC	3	1	0	4	25	75	100
THEORY 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 Confectionery Technology	PC	3	0	0	3	25	75	100
2.	19FT5202	Food Additives	PC	3	0	0	3	25	75	100
3.	19FT5203	Poultry, Meat and Fish Process Technology	PC	3	0	0	3	25	75	100
4.	19FT5204	Principles of Food Processing	PC	3	0	0	3	25	75	100
5.	19FT5205	Unit Operations in Food Processing	PC	3	0	0	3	25	75	100
6.	19FT53XX	Professional Elective -I	PE	3	0	0	3	25	75	100
PRACTICALS										
7.	19FT5001	Baking and Confectionery Technology Laboratory	PC	0	0	4	2	50	50	100
8.	19FT5002	Unit Operations in Food Processing Laboratory	PC	0	0	4	2	50	50	100
MANDATORY COURSES										
9.	19HE5071	Soft Skills - I	EEC	1	0	0	1	25	75	100
10.	19HE5072	Design Thinking	EEC	1	0	0	1	25	75	100
TOTAL				20	0	8	24	300	700	1000

SEMESTER VI

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



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

OPEN ELECTIVE

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

SEMESTER VII

S. No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	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		0	0	4	2	50	50	100



TOTAL	15	0	10	20	275	525	800
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SEMESTER VIII

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

PROFESSIONAL ELECTIVE III

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

PROFESSIONAL ELECTIVE IV

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

PROFESSIONAL ELECTIVE V

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



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

LIST OF OPEN ELECTIVES - FOOD TECHNOLOGY

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

SEMESTER-WISE CREDIT DISTRIBUTION

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

Credit Distribution R2019

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

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PROFESSIONAL ELECTUVE IV

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

The student should be able to

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

Unit	DESCRIPTION	Instructional Hours
I	PRODUCTION MANAGEMENT AND ORGANISATION Planning, organization, staffing, coordination, directing, controlling, communicating, organization as a process and a structure; types of organizations Method study; work measurement techniques; basic procedure; motion study; motion economy; principles of time study; elements of production control; forecasting; planning; routing; scheduling; dispatching; costs and costs control, inventory and inventory control.	9
II	ENGINEERING ECONOMICS FOR PROCESS ENGINEERS- INTEREST, INVESTMENT COSTS AND COST ESTIMATION Time Value of money; capital costs and depreciation, estimation of capital cost, manufacturing costs and working capital, invested capital and profitability.	9
III	PROFITABILITY, INVESTMENT REPLACEMENT Estimation of project profitability, sensitivity analysis; investment alternatives; replacement policy; forecasting sales; inflation and its impact.	9
IV	ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE Principles of accounting; balance sheet; income statement; financial ratios; analysis of performance and growth.	9
V	ECONOMIC BALANCE AND QUALITY CONTROL Essentials of economic balance – Economic balance approach, economic balance for insulation, evaporation, heat transfer. Elements of quality control, role of control charts in production and quality control.	9
Total Instructional Hours		45

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

TEXT BOOK:

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

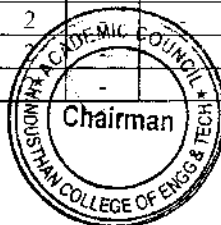
REFERENCES:

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

CO-PO PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	-	2	2	1	2	2	-	-	1	2	1	2
CO2	2	2	-	2	2	1	2	2	-	-	1	2	2	1
CO3	2	2	-	2	2	1	2	2	-	-	1	2	2	-
CO4	2	2	-	2	1	1	2	2	-	-	1	2	2	1
CO5	2	2	-	2	1	1	2	2	-	-	1	2	2	1
AVG	2	2	-	1.75	1.8	1	2	2	-	-	1	2	1.8	1.75

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HiCET

Programme B.TECH.	Course code 19FT8302	Name of the course FOOD LAWS AND SAFETY	L 3	T 0	P 0	C 3
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Course Objective The student should be able to
1 To study various food laws, importance and functions of food safety management systems, to impart knowledge on food laws and safety in food processing

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

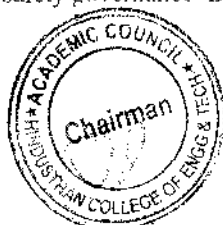
Course Outcome	CO1	Understand the safety during processing
	CO2	Understand the key safety principles
	CO3	Understand the manufacturing practices
	CO4	Understand the need of food laws
	CO5	Understand the management systems

TEXT BOOK:

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

REFERENCES:

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

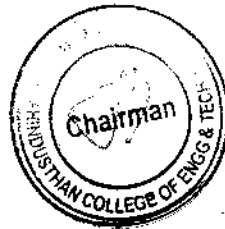


CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	-	2	2	1	2	2	-	-	1	2	1	2
CO2	2	2	-	2	2	1	2	2	-	-	1	2	1	1
CO3	2	2	-	2	2	1	2	2	-	-	1	2	1	3
CO4	2	2	-	2	1	2	2	2	-	-	1	2	1	3
CO5	2	2	-	2	-	1	2	2	-	-	1	2	1	3
AVG	2	2	-	1.75	1.75	1.2	2	2	-	-	1	2	1	2.4

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Chairman - BoS
FT - HICET

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 Dean - Academics
Dean (Academics)
HICET



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

Course Objective The student should be able to
 1 To understand the concepts of waste management and its utilization in food industries

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

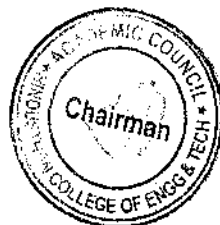
Course Outcome	CO1	CO2	CO3	CO4	CO5
	Understand the classification of food waste and recommend the strategies for waste minimization	Understand and identify the method for treatment of liquid and solid waste	Understand and utilize residues from oil seed and tuber processing industries	Understand the by-product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

TEXT BOOK:

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

REFERENCES:

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



CO- PO PSO MAPPING

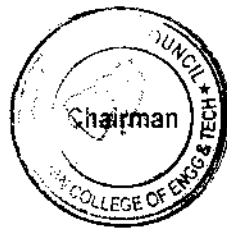
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	-	2	2	1	2	2	-	-	1	2	1	2
CO2	2	2	-	2	2	1	2	2	-	-	1	2	2	1
CO3	2	2	-	2	2	1	2	2	-	-	1	2	2	-
CO4	2	2	-	2	1	1	2	2	-	-	1	2	2	3
CO5	2	2	-	2	-	1	2	2	-	-	1	2	2	3
AVG	2	2	-	1.75	1.75	1	2	2	-	-	1	2	1.8	2.25

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

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

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

Total Instructional Hours 45

Course Outcome	CO1	Understand the use of Laplace transformation for first order control systems
	CO2	Understand the Laplace transformation for second order control systems and determine its dynamic response
	CO3	Understand the concepts of feedback controller, its dynamic response and automation
	CO4	Understand the stability criteria for various controllers
	CO5	Understand the temperature and pressure measuring instruments

TEXT BOOK:

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

REFERENCES:

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




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CO- PO PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	-	2	2	2	2	2	-	-	1	2	1	2
CO2	2	2	-	2	2	2	2	2	-	-	1	2	2	1
CO3	2	2	-	2	2	2	2	2	-	-	1	2	2	1
CO4	2	2	-	2	1	2	2	2	-	-	1	2	2	2
CO5	2	2	-	2	2	2	2	2	-	-	1	2	2	2
AVG	2	2	-	2	1.8	2	2	2	-	-	1	2	1.8	1.6


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Programme B.TECH.	Course code 19FT8305	Name of the course ECONOMICS AND MANAGEMENT	L 3	T 0	P 0	C 3
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Course Objective The student should be able to
1 To enable the students to understand the various concepts of economics, process development, design consideration and cost estimation in chemical industry.

Unit	DESCRIPTION	Instructional Hours
I	INTEREST AND PLANT COST: Time value of money - equivalence, Depreciation, Depletion, estimation of capital cost, Capital requirement for complete plant, cost indices, capital recovery.	9
II	PROJECT PROFITABILITY AND FINANCIAL RATIOS: Estimation of project profitability, Investment alternatives, income statement and financial ratios, balance sheet preparation- problems.	9
III	ECONOMIC BALANCE IN EQUIPMENTS: Essentials of economic balance, economic balance in batch operations, cyclic operations, economic balance for insulation, evaporation, heat transfer equipment	9
IV	PRINCIPLES OF MANAGEMENT: Principles of management, planning, organizing, staffing, coordinating, directing, controlling and communicating. Types of organizations, Management information systems (MIS).	9
V	PRODUCTION PLANNING CONTROL: Work measurement techniques, motion study, principles of time study, elements of production control, forecasting, planning, routing, scheduling, dispatching, inventory and control, role of control charts in production and quality control.	9
Total Instructional Hours		45

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

TEXT BOOK:

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

REFERENCES:

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

CO- PO PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	-	2	2	1	2	2	-	-	1	2	1	2
CO2	2	2	-	2	2	1	2	2	-	-	1	2	2	1
CO3	2	2	-	2	2	1	2	2	-	-	1	2	2	-
CO4	2	2	-	2	1	1	2	2	-	-	1	2	2	3
CO5	2	2	-	2	-	1	2	2	-	-	1	2	2	3
AVG	2	2	-	2	1.75	1	2	2	-	-	1	2	1.8	2.25

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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19FT8312	TOTAL QUALITY MANAGEMENT	3	0	0	3

The student should be able to

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

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

Course Outcome	CO1	CO2	CO3	CO4	CO5
	Apply TQM concepts for improving the quality of products and services	Implement the basic principles of TQM in manufacturing and service-based organization	Apply the tools and techniques of quality management to manufacturing and service processes	Predict the improvement necessary for the better performance	Implement Quality Management System.

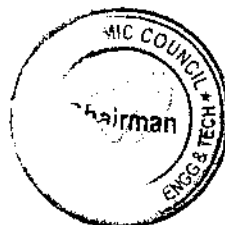
REFERENCES:

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

CO- PO PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	-	2	-	1	-	2	-	-	1	2	2	-
CO2	2	2	-	2	-	1	-	2	-	-	1	2	2	-
CO3	2	2	-	2	-	1	-	2	-	-	1	2	2	-
CO4	2	2	-	2	-	1	-	2	-	-	1	2	2	3
CO5	2	2	-	2	-	1	-	2	-	-	1	2	2	3
AVG	2	2	-	1.75	-	1	-	2	-	-	1	2	2	3

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PROFESSIONAL ELECTIVE V

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

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

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

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

TEXT BOOK:

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

REFERENCES:

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

CO- PO PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	2	2	1	1	2	2	-	-	1	2	1	2
CO2	2	2	2	3	2	1	2	2	-	-	1	2	2	2
CO3	2	2	2	3	2	1	2	2	-	-	1	2	2	2
CO4	2	2	2	3	1	1	2	2	-	-	1	2	2	2
CO5	2	2	2	3	1	1	2	2	-	-	1	2	2	2
AVG	2	2	2	2.8	1.4	1	2	2	-	-	1	2	1.8	2

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

Course Objective The student should be able to

1 To understand the concepts of energy management in process industries

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

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

TEXT BOOK:

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

REFERENCES:

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



CO- PO PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	-	2	2	1	2	2	-	-	1	2	1	2
CO2	2	2	-	2	2	1	2	2	-	-	1	2	2	1
CO3	2	2	-	2	2	1	2	2	-	-	1	2	2	1
CO4	2	2	-	2	2	1	2	2	-	-	1	2	2	1
CO5	2	2	-	2	2	1	2	2	-	-	1	2	2	1
AVG	2	2	-	2	2	1	2	2	-	-	1	2	1.8	1.2

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

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

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

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

TEXT BOOK:

T1 Da-Wen Sun, —Emerging Technologies for Food Processing. 2nd Edition, Elsevier Academic Press, London, 2014.
Howard Q. Zhang, Gustavo V. Barbosa-Canovas, Balasubramaniam V.M., Dunne C. P., Farkas D.F. and
T2 Yuan J.T.C., —Non-thermal Processing Technologies for Food. 1st Edition, John Wiley and Sons Ltd., UK, 2011.

REFERENCES:

R1 Han, Jung H., —Packaging for Non-thermal Processing of Food. Wiley-Blackwell, Oxford, 2007.
R2 Mujumdar A.S., —Handbook of Industrial drying. 4th Edition, CRC Press, UK, 2014.
R3 Lelieveld H.L.M., —Food Preservation by pulsed electric fields: From research to application. Wood Head Publishing Ltd., England, 2007.

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

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

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

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

TEXT BOOK:

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

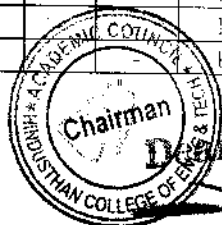
REFERENCES:

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

CO- PO PSO MAPPING

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	-	2	3	1	2	2	-	-	1	2	1	-
CO2	2	2	-	2	3	1	2	2	-	-	1	2	2	-
CO3	2	2	-	2	3	1	2	2	-	-	1	2	2	2
CO4	2	2	-	2	3	1	2	2	-	-	1	2	2	2
CO5	2	2	-	2	3	1	2	2	-	-	1	2	2	-
AVG	2	2	-	2	3	1	2	2	-	-	1	2	1.8	2

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

Course Objective The student should be able to

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

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

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

REFERENCES:

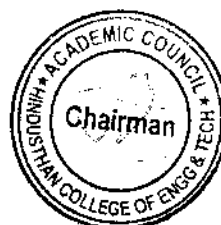
- R1 Hisrich, "Entrepreneurship", Tata McGraw Hill, New Delhi, 2005.
R2 Saravanavel, P., 'Entrepreneurial Development', Ess Pee kay Publishing House, Chennai, 2005
R3 Khanka, S S., "Entrepreneurial Development", S.Chand and Co Limited, New Delhi, 2001.
R4 Jain, P C., "Handbook for New Entrepreneurs",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

CO- PO PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	-	2	-	1	2	2	-	-	1	2	1	3
CO2	2	2	-	2	-	1	2	2	-	-	1	2	2	3
CO3	2	2	-	2	-	1	2	2	-	-	1	2	2	3
CO4	2	2	-	2	-	1	2	2	-	-	1	2	2	3
CO5	2	2	-	2	-	1	2	2	-	-	1	2	2	3
AVG	2	2	-	2	-	1	2	2	-	-	1	2	1.8	3

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

The student should be able to

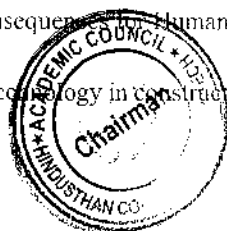
- Course Objective**
1. Understand the concept of Nanotechnology and nano material synthesis
 2. Impart knowledge on synthesis and characterization techniques involved in Nanotechnology
 3. Learn the principle and application of cryogenics in food processing

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

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

REFERENCES:

- R1 Kenneth David & Paul Thompson. What Can Nanotechnology Learn From Biotechnology, ISBN, 2008
- R2 Qasim chaudhry, Laurence castle and Richard Watkins.. Text book on Nanotechnologies in food, RSC
- R3 Nano science and Nano technology, published by the Royal society of chemistry. ISBN 978-0-85404-169-5, 2010
- R4 RE hester and R.M Harrison.. Nanotechnology. Consequences for Human Health and the Environment, ISBN: 978-0-85404-216-6, 2007
- R5 Peter JM Bartos. John J Hughes. Pavel Trtik.. Nanotechnology in Construction. ISBN: 978-0-85404-623-2, 2004



- R5 Randall F. Barron, Cryogenics Systems. Second Edition Oxford Univesity Press New York, Clarendon Press, Oxford, 1985.
- R6 Timmerhaus, Flynn, Cryogenics Process Engineering , Plenum Press, New York.

CO- PO PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	-	2	-	1	2	2	-	-	1	2	-	2
CO2	2	2	-	2	1	1	2	2	-	-	1	2	1	1
CO3	2	2	-	2	3	1	2	2	-	-	1	2	1	-
CO4	2	2	-	2	3	1	2	2	-	-	1	2	-	3
CO5	2	2	-	2	3	1	2	2	-	-	1	2	-	3
AVG	2	2	-	2	2.5	1	2	2	-	-	1	2	1	2.25

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