K.S. Rangasamy College of Technology

(Autonomous)

CURRICULUM & SYLLABI

of

B.Tech., Food Technology

(For the batch admitted in 2023 – 2024)

R2022

Accredited by NAAC with A++, Approved by AICTE,
Affiliated to Anna University, Chennai.

KSR Kalvi Nagar, Tiruchengode – 637 215.
Namakkal District, Tamil Nadu, India.

Department of Food Technology

VISION

To be a leading center for learning and sharing knowledge in the field of Food Technology across the nation and beyond.

MISSION

- To develop skilled and ethically responsible Food Technology professionals by providing technical knowledge through quality teaching and learning process
- To create an environment that fosters employability skills in Food Technology through collaborations with industry and academia
- To encourage students to focus on research and entrepreneurship in Food Technology, promoting societal welfare and enhancing the quality of life.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: **Core Competence:** Our graduates apply technical knowledge to solve problems in Food safety, quality and sustainability.

PEO2: **Employability:** Our graduates exhibit technical expertise and professionalism to meet the needs of the Food industry and society.

PEO3: **Research and Development:** Our graduates promote research and development in Food Technology through lifelong learning, addressing challenges in Food safety, quality and sustainability.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

PO1: **Engineering knowledge:** Apply the knowledge of mathematics, science, engineeringfundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: **Design /development of solutions**: Design solutions for complex engineering problems anddesign system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations

PO6: **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and normsof the engineering practice.

PO9: **Individual and team work**: Function effectively as an individual, and as a member or leader indiverse teams, and in multidisciplinary settings.

PO10: **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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PROGRAMME SPECIFIC OUTCOMES (PSOs):

Engineering Graduates will be able to:

PSO1: **Food Processing Expertise:** Graduates will design, develop and optimize Food processing techniques to improve product quality, safety and efficiency.

PSO2: **Food Safety and Quality:** Graduates will ensure adherence to high standards of food safety and quality throughout the production process.

PSO3: **Sustainability Practices:** Graduates will implement environmental friendly and energy-efficient practices in food production.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) WITH PROGRAMME OUTCOMES (POs)

The B.Tech Food Technology Programme outcomes leading to the achievement of the objectives are summarized in the following Table.

Programme Educational Objectives	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO 1	3	2	3	3	2	1	1	1	2	2	3	1
PEO 2	3	3	3	3	3	2	1	1	2	2	2	1
PEO 3	3	2	2	2	2	1	1	3	3	2	3	1

Contributions: 1- low, 2- medium, 3- high

MAPPING-UG- FOOD TECHNOLOGY

Year	Sem	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	I	Professional English I	-	-	-	-	-	-	-	2	3	3	2	3	2.4	2.4	2.6
		Matrices and Calculus	3	2	-	-	2	-	-	-	-	-	-	-	2	-	-
		Physics for Food Technology	3	2	-	-	-	-	-	-	-	2	-	-	-	-	3
		Chemistry for Life Sciences	3	2.6	-	-	-	-	-	-	-	-	-	-	2.7	2	-
		Engineering Graphics	3	2.8	3	-	3	-	-	3	-	-	-	-	2.75	2.8	-
		Heritage of Tamils / தமிழர் மரபு	2	-	-	-	-	1.5	1	2.4	2	2	-	1.8	-	-	-
		Applied Physics and Chemistry Laboratory	3	-	-	-	-	-	-	-	2	-	-	-	2.5	2.5	-
		Fabrication and Reverse Engineering Laboratory	3	2	3	-	-	2	2	-	3	-	-	3	-	3	3
		Professional English II	-	-	-	-	-	-	-	2	3	3	2	3	2	2	2.8
		Integrals ,Partial Differential Equations and Laplace transform	3	2	-	-	2	-	-	-	-	-	-	-	2	-	-

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Year	Sem	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	II	Engineering Mechanics	3	2	2	3	-	-	-	-	-	-	-	2	-	-	-
		C Programming	3	3	3		3				2	2		2			2
		Basic Electrical and Electronics Engineering	2.6	2.8	1.6	1.6	2	2	2.3	1.5	2	2	2	2.25	3	2	-
		Environmental Studies and Climate Change	2.8	2	2	2	2.33	2.5	2.6	2	-	-	-	2	-	-	-
		Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	3	-	-	-	3	2	2.75	3	2.5	2.2	-	3	-	-	-
		C Programming Laboratory	3	3	3	-	3	-	-	-	2	2	-	2	3	3	-
		Basic Electrical and Electronics Engineering Laboratory	2.6	2.8	1.67	1.67	2	2	2.33	1.5	2	2	2	2.25	3	2	-
		Career Skill Development I	-	-	-	-	-	-	-	2	3	3	2	3	-	-	-
II	III	Fourier Transform and Numerical Methods	3	2	-	-	2	-	-	-	-	-	-	-	2	-	-
		Engineering Properties of Food materials	3	3	2	3	2	-	-	-	-	-	-	-	2	2	3
		Biochemistry for Food Technologist	3	2.4	-	3	-	3	2	1.8	-	3	-	3	3	2	-
		Food Microbiology for Food Technologist	3	-	-	3	-	3	2	1.8	-	3	-	3	3	2	3
		Food Process Calculations	3	3	2.4	3	-	-	-	-	-	-	-	2	2.8	3	2.5
		Food Processing and Preservation	3	-	3	-	-	-	3	2	2	3	-	2	3	2.6	2.8
		Mandatory – II						3	3	3	2.8	3	2	3			
		Food Biochemistry Laboratory	-	-	3	3	-	-	-		3	3	-	3	3	3	-
		Food Microbiology Laboratory	-	-	3	3	-	-	-		3	3	-	3	3	2.4	3
		Career Skill Development II	-	-	-	-	-	-	-	2	3	3	2	3	2	2	2
		Internship	3	3	2	2	-	-	-		1	2	2	3	2	3	3
	IV	Probability and Statistics	3	2	-	-	2	-	-	-	-	-	-	-	2	-	-
		Fluid Mechanics and Mechanical Operation	3	2.2	2.8	2	-	-	-	-	-	-	-	-	3	2	-
		Meat, Fish and Poultry Process Technology	3	3	2.2	-	-	1.4	2.4	3	-	-	-	-	3	3	2
		Food Chemistry and Nutrition	3	3	2.2	-	-	2.4	2.4	3	-	-	-	-	3	2	2
		Food Chemistry and Nutrition Laboratory	3	3	3	-	-	-	3	-	3	3	-	-	2.4	3	3

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Year	Sem	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Unit Operations Laboratory	3	3	3	-	-	-	3	-	3	3	-	-	2.4	3	3
		Career Skill Development III	2.6	2.6	2.6	2.8	-	2.4	-	-	-	2	3	3	-	-	-
III	V	Dairy Technology	3	3	3	-	-	-	2.4	-	-	-	-	-	3	2.6	2
		Food Process Engineering	3	3	3	2	-	2	-	-	-	-	-	-	3	3	2
		Food Safety and Quality Regulation	3	2	3	2	-	-	3	2	2	3	-	2	2	3	3
		Heat and Mass Transfer	3	3	3	2	-	2.4	-	-	-	-	-	-	-	-	2
		Startups and Entrepreneurship	2.8	2.6	3	2.4	2.2	2.5	1.7	1.75	1.33	2	2.2	2.4	-	-	2
		Dairy Technology Laboratory	3	2.2	2.8	3	-	2	2	2	2.8	3	-	-	2	3	-
		Food Process Engineering Laboratory	2.6	2.6	2.33	1.75	2.4	2	2.2	2	2.75	2.8	-	2.4	2	3	-
		Design Thinking and Innovation Laboratory	3	3	2.8	3	-	-	-	3	3	3	-	3	3	2.8	3
		Career Skill Development IV	2.6	2.6	2.6	2.8	-	2.4	-	-	-	2	3	3	2	-	2
		NCC/NSS/NSO/ YRC/RRC/Fine Arts*	3	2	1	1	3	3	3	3	3	3	-	-	-	-	-
	VI	Engineering Economics And Financial Accounting	2.67	3	2.5	2.75	3	2	2.33	2	-	-	2.75	2.5	2.75	2.6	2.33
		Baking and Confectionary Technology	3	3	3	-	-	-	2	-	-	-	-	-	2	2.75	2.75
		Food Process plant layout and safety	3	3	3	2.6	-	2	2.6	-	-	-	-	-	2.67	2	2
		Refrigeration and Cold Chain Management	3	3	2.6	2	-	-	2.2	-	-	-	-	-	2.33	2	2.67
		Baking and Confectionary Laboratory	1	1	2.6	2.4	-	2.4	2.4	2.8	3	2	-	3	3	3	3
		Computational Laboratory for Food Technology	3	3	3	2	-	2	-	-	2	3	-	-	3	3	-
		Design Thinking and Product Development Laboratory	3	3	2.8	3	-	-	-	3	3	3	-	3	3	2.8	3
		Comprehension Test	3	3	2	2	-	-	-	-	1	2	2	3	2	-	-

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Year	Sem	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IV	VII	Food Additives, Nutraceutical And Functional Foods	3	3	2	2	-	2	-	-	-	-	-	-	2	3	-
		Food Packaging Technology	3	3	3	3	2	-	2	-	-	-	-	2	2	2	-
		Fermentation Technology	2.8	3	2.6	2.8	-	-	2.4	-	-	-	-	-	2	-	-
		Research Skill Development	2	2	2	2	3	2	2	3	3	3	-	3	-	-	-
		Food Packaging Laboratory	3	3	3	3	-	-	3	-	2	-	-	2	2.2	3	2.4
		Project Work Phase – I	3	2	3	3	3	3	-	-	3	-	-	2	2	3	3
	VIII	Project Work Phase – II	3	2	3	3	3	3	-	-	3	-	-	2	2	3	3

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K.S. RANGASAMY COLLEGE OF TECHNOLOGY
Credit Distribution for B. Tech. Food Technology Programme–2023 –2024 Batch

SUMMARY

S.No.	Category	Credits Per Semester								Total Credits	Percentage %
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	2	2	-	-	-	3	AB	-	**7**	**2.45**
2.	BS	12	4	4	4	-	-	-	-	**24**	**14.72**
3.	ES	6	14	-	-	-	-	-	-	**20**	**12.26**
4.	PC	-	-	19	14	18	15	14	8	**88**	**55.82**
5.	PE	-	-	-	3	3	3	3	3	**15**	**9.20**
6.	OE	-	-	-	3	3	3	-	-	**9**	**5.52**
7.	EEC	-	-	-	-	-	EEC-I	-	-	**-**	**-**
8.	MC		MC-I	MC-II	-	MC-III	-	-	-	-	-
9.	GE	-	GE-1	GE-II	-	-	-	-	-	**-**	**-**
10.	CG	-	CG-I	CG-II	CG-III	CG-IV	CG-V	CG-VI	CG-VI	**-**	**-**
Total		**20**	**20**	**23**	**24**	**24**	**24**	**17**	**11**	**163**	**100**

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(An Autonomous Institution affiliated to Anna University)

HUMANITIES AND SOCIAL SCIENCE (HS)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 EN 001	Professional English I	HS	3	1	0	2	2	Basic knowledge of reading and writing in English
2.	60 EN 002	Professional English II	HS	3	1	0	2	2	Professional English I
3.	60 AB 001	National Cadet Corps (Air Wing)	HS	4	2	0	2	3€	NIL
4.	60 AB 002	National Cadet Corps (Army Wing)	HS	4	2	0	2	3€	NIL
5.	60 HS 002	Engineering Economics and Financial Accounting	HS	3	3	0	0	3	NIL

BASIC SCIENCE (BS)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1	60 MA 001	Matrices and Calculus	BS	5	3	1	0	4	NIL
2	60 CH 005	Chemistry for Life Sciences	BS	3	3	0	0	3	NIL
3	60 CP 0P3	Applied Physics and Chemistry Laboratory	BS	4	0	0	4	2	NIL
4	60 MA 003	Integrals, Partial Differential Equations and Laplace transform	BS	5	3	1	0	4	NIL
5	60 PH 006	Physics for Food Technology	BS	3	3	0	0	3	NIL
6	60 MA 012	Fourier Transform and Numerical Methods	BS	5	3	1	0	4	NIL
7	60 MA 021	Probability and Statistics	BS	5	3	1	0	4	NIL

ENGINEERING SCIENCES (ES)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1	60 ME 004	Engineering Mechanics	ES	5	3	1	0	4	NIL
2	60 CS 001	C Programming	ES	3	3	0	0	3	NIL
3	60 CS 0P1	C Programming Laboratory	ES	4	0	0	4	2	NIL

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4	60 EE 001	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3	NIL
5	60 ME 002	Engineering Graphics	ES	6	2	0	4	4	NIL
6	60 ME 0P1	Fabrication and Reverse Engineering Laboratory	ES	4	0	0	4	2	NIL
7	60 EE 0P1	Basic Electrical and Electronics Engineering Laboratory	ES	4	0	0	4	2	NIL

CAREER ENHANCEMENT COURSE (CG)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1	60 CG 0P1	Career Skill Development I	CG	2	0	0	2	1*	Basic knowledge of reading and writing in English
2	60 CG 0P2	Career Skill Development II	CG	2	0	0	2	1*	Basic knowledge of reading and writing in English
3	60 CG 0P3	Career Skill Development III	CG	2	0	0	2	1*	Basic knowledge of Arithmetic and Logical Reasoning
4	60 CG 0P4	Career Skill Development IV	CG	2	0	0	2	1*	Basic knowledge of Arithmetic and Logical Reasoning
5	60 CG 0P5	Comprehension Test	CG	2	0	0	2	1*	Fundamental knowledge in all core subjects
6	60 FT 8P2	Internship	CG	0	0	0	0	1/2/3$	NIL

PROFESSIONAL CORE (PC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 FT 301	Engineering Properties of Food materials	PC	3	3	0	0	3	NIL
2.	60 FT 302	Biochemistry for Food Technologist	PC	3	3	0	0	3	NIL
3.	60 FT 303	Food Microbiology for FoodTechnologist	PC	3	3	0	0	3	NIL

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4.	60 FT 304	Food Process Calculations	PC	4	2	1	0	3	NIL
5.	60 FT 305	Food Processing and Preservation	PC	3	3	0	0	3	NIL
6.	60 FT 3P1	Food Biochemistry Laboratory	PC	4	0	0	4	2	NIL
7.	60 FT 3P2	Food Microbiology Laboratory	PC	4	0	0	4	2	NIL
8.	60 FT 401	Fluid Mechanics and Mechanical Operation	PC	5	3	1	0	4	NIL
9.	60 FT 402	Meat, Fish and Poultry Process Technology	PC	3	3	0	0	3	NIL
10.	60 FT 403	Food Chemistry and Nutrition	PC	3	3	0	0	3	NIL
11.	60 FT 4P1	Food Chemistry and Nutrition Laboratory	PC	4	0	0	4	2	NIL
12.	60 FT 4P2	Unit Operations Laboratory	PC	4	0	0	4	2	NIL
13.	60 FT 501	Dairy Technology	PC	3	3	0	0	3	NIL
14.	60 FT 502	Food Process Engineering	PC	5	3	1	0	4	NIL
15.	60 FT 503	Food Safety and Quality Regulations	PC	4	2	0	2	3	NIL
16.	60 FT 504	Heat and Mass Transfer	PC	5	3	1	0	4	NIL
17.	61 FT 5P1	Dairy Technology Laboratory	PC	3	0	0	3	1.5	NIL
18.	60 FT 5P2	Food Process Engineering Laboratory	PC	3	0	0	3	1.5	NIL
19.	60 FT 5P3	Design Thinking and Innovation Laboratory	PC	2	0	0	2	1	NIL
20.	60 FT 601	Baking and Confectionary Technology	PC	3	3	0	0	3	NIL
21.	60 FT 602	Food process plant layout and safety	PC	5	3	1	0	4	NIL
22.	60 FT 603	Refrigeration and Cold Chain Management	PC	5	3	1	0	4	NIL
23.	61 FT 6P1	Baking and Confectionary Laboratory	PC	3	0	0	3	1.5	NIL
24.	60 FT 6P2	Computational Laboratory for Food Technology	PC	3	0	0	3	1.5	NIL
25.	60 FT 6P3	Design Thinking and Product Development Laboratory	PC	2	0	0	2	1	NIL
26.	60 FT 701	Food Additives, Nutraceutical and Functional Foods	PC	3	3	0	0	3	NIL
27.	60 FT 702	Food Packaging Technology	PC	5	3	1	0	4	NIL

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28.	60 FT 703	Fermentation Technology	PC	3	3	0	0	3	NIL
29.	60 FT 7P1	Food Packaging Laboratory	PC	4	0	0	4	2	NIL
30.	60 FT 7P2	Project Work Phase - I	PC	4	0	0	4	2	NIL
31.	60 FT 8P1	Project Work Phase - II	PC	16	0	0	16	8	NIL

PROFESSIONAL ELECTIVES (PE)/HONOR

SEMESTER IV, ELECTIVE I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 FT E11	Introduction to Food Biotechnology	PE	3	3	0	0	3	NIL
2.	60 FT E12	Therapeutics and Nutrition	PE	3	3	0	0	3	NIL
3.	60 FT E13	Technology of Fruit and Vegetable Processing	PE	3	3	0	0	3	NIL
4.	60 FT E14	Instrumental Techniques in Food Analysis	PE	3	3	0	0	3	NIL
5.	60 FT E15	Food Safety and Quality Auditing	PE	3	3	0	0	3	NIL
6.	60 FT E16	Flour Chemistry and Rheology	PE	3	3	0	0	3	NIL
7.	60 FT E17	Drying Technology	PE	3	3	0	0	3	NIL

Note: Any of the Elective course can be opted for Honor Degree

SEMESTER V, ELECTIVE II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 FT E21	Process Control and Instrumentation	PE	**3**	3	0	0	3	NIL
2.	60 FT E22	Community Nutrition	PE	**3**	3	0	0	3	NIL
3.	60 FT E23	Fruits and Vegetables as Nutraceuticals	PE	**3**	3	0	0	3	NIL
4.	60 FT E24	Modelling, Simulation and Soft Tools for Food Technology	PE	**3**	3	0	0	3	NIL
5.	60 FT E25	Food Storage and Cold Chain Management	PE	**3**	3	0	0	3	NIL
6.	60 FT E26	Confectionery Products	PE	**3**	3	0	0	3	NIL
7.	60 FT E27	Flavouring Technology	PE	**3**	3	0	0	3	NIL

Note: Any of the Elective course can be opted for Honor Degree

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SEMESTER VI, ELECTIVE III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 FT E31	Bioprocess Engineering	PE	4	2	0	2	3	NIL
2.	60 FT E32	Traditional Foods	PE	4	2	0	2	3	NIL
3.	60 FT E33	Advances in Fruit and Vegetable Processing Technologies	PE	4	2	0	2	3	NIL
4.	60 FT E34	Modern Technology in Cereals, Pulses and Spices	PE	4	2	0	2	3	NIL
5.	60 FT E35	Food Industry Waste Management	PE	4	2	0	2	3	NIL
6.	60 FT E36	Industrial Production of Cookies and Biscuits	PE	4	2	0	2	3	NIL
7.	60 FT E37	Technology of Fats and Oils	PE	4	2	0	2	3	NIL

Note: Any of the Elective course can be opted for Honor Degree

SEMESTER VII, ELECTIVE IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 FT E41	Downstream Processing of Bioproducts	PE	3	3	0	0	3	NIL
2.	60 FT E42	Food Product Development	PE	3	3	0	0	3	NIL
3.	60 FT E43	Fruit and Vegetable Storage	PE	3	3	0	0	3	NIL
4.	60 FT E44	Technology of Snacks and Extruded Products	PE	3	3	0	0	3	NIL
5.	60 FT E45	Food Quality Assurance and Quality Control	PE	3	3	0	0	3	NIL
6.	60 FT E46	Industrial Production of Bun, Bread, Cakes and Pastries	PE	3	3	0	0	3	NIL
7.	60 FT E47	Cane Sugar Technology	PE	3	3	0	0	3	NIL

Note: Any of the Elective course can be opted for Honor Degree

SEMESTER VIII, ELECTIVE V

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 FT E51	Food Allergy and Toxicology	PE	3	3	0	0	3	NIL
2.	60 FT E52	Food Processing Equipment Design	PE	3	3	0	0	3	NIL
3.	60 FT E53	Fruit and Vegetable Industry Safety and Laws	PE	3	3	0	0	3	NIL

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4.	60 FT E54	Energy Management in Modern Food Process Industries	PE	3	3	0	0	3	NIL
5.	60 FT E55	Food Laws – Indian and International	PE	3	3	0	0	3	NIL
6.	60 FT E56	Packaging of Bakery and Confectionery Products	PE	3	3	0	0	3	NIL
7.	60 FT E57	Waste Management and By-products Development in Food Industries	PE	3	3	0	0	3	NIL

Note: Any of the Elective course can be opted for Honor Degree

MANDATORY COURSES (MC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 MY 001	Environmental Studies and Climate Change	MC	2	2	0	0	0	NIL
2.	60 MY 002	Universal Human Values	MC	3	3	0	0	3#	NIL
3.	60 MY 003	Startups and Entrepreneurship	MC	2	2	0	0	2@	NIL

OPEN ELECTIVES I / II / III (OE)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1	60 FT L01	Nutrition and Healthy Life	OE	3	3	0	0	3	NIL
2	60 FT L02	Livestock, Poultry and Fish Production Management	OE	3	3	0	0	3	NIL
3	60 FT L03	Food Supply Chain Management	OE	3	3	0	0	3	NIL
4	60 FT L04	Basics of Packaging Technology	OE	3	3	0	0	3	NIL

GENERAL ELECTIVE COURSES (GE)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 GE 001	Heritage of Tamils / தமிழர் மரபு	GE	1	1	0	0	1¥	NIL

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2.	60 GE 002	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	GE	1	1	0	0	1¥	Heritage of Tamils

INTEGRATED COURSE

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 FT 503	Food Safety and Quality Regulations	PC	4	2	0	2	3	NIL
2.	60 FT E31	Bioprocess Engineering	PE	4	2	0	2	3	NIL
3.	60 FT E32	Traditional Foods	PE	4	2	0	2	3	NIL
4.	60 FT E33	Advances in fruit and vegetable processing technologies	PE	4	2	0	2	3	NIL
5.	60 FT E34	Modern Technology in Cereals,Pulses and Spices	PE	4	2	0	2	3	NIL
6.	60 FT E35	Food Industry Waste Management	PE	4	2	0	2	3	NIL
7.	60 FT E36	Industrial Production of Cookies and Biscuits	PE	4	2	0	2	3	NIL
8.	60 FT E37	Technology of Fats and Oils	PE	4	2	0	2	3	NIL

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VERTICALS

	Vertical I Food Biotechnology	**Vertical II** Food Nutrition and Product Development	**Vertical III** Fruit and Vegetable Processing Technology	**Vertical IV** Next Generation Techniques in Food Sectors	**Vertical V** Food Storage and Management System	**Vertical VI** Techniques in Baking and Confectionery Manufacturing	**Vertical VII** Technology in Food Processing
Elective I	Introduction to Food Biotechnology	Therapeutics and Nutrition	Technology of fruit and vegetable processing	Instrumental Techniques in Food Analysis	Food Safety and Quality Auditing	Flour chemistry and rheology	Drying Technology
Elective II	Process Control and Instrumentation	Community Nutrition	Fruits and vegetables as nutraceuticals	Modelling, Simulation and Soft tools for food technology	Food Storage and Cold Chain Management	Confectionery products	Flavouring Technology
Elective III	Bioprocess Engineering	Traditional Foods	Advances in fruit and vegetable processing technologies	Modern Technology in Cereals, Pulses and Spices	Food Industry Waste Management	Industrial production of cookies and biscuits	Technology of Fats and Oils
Elective IV	Down Stream Processing of Bio-products	Food Product Development	Fruit and vegetable storage	Technology of Snacks and Extruded Products	Food Quality Assurance and Quality Control	Industrial production of bun, bread, cakes and pastries	Cane Sugar Technology
Elective V	Food Allergy and Toxicology	Functional Foods	Fruit and vegetable industry safety & laws	Energy Management in modern Food Process industries	Food laws – Indian and International	Packaging of bakery and confectionery products	Waste Management and by-products development In food industries

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K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)
COURSES OF STUDY
(For the candidates admitted in 2023-2024)

SEMESTER – I								
S.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1.		Induction Programme	-	-	-	-	-	**0**
THEORY								
2.	60 EN 001	Professional English I	HS	3	1	0	2	2
3.	60 MA 001	Matrices and Calculus	BS	5	3	1	0	4
4.	60 PH 006	Physics for Food Technology	BS	3	3	0	0	3
5.	60 CH 005	Chemistry for Life Sciences	BS	3	3	0	0	3
6.	60 ME 002	Engineering Graphics	ES	6	2	0	4	4
7.	60 GE 001	Heritage of Tamils / தமிழர் மரபு	HS	1	1	0	0	1¥
PRACTICALS								
8.	60 CP 0P3	Applied Physics and Chemistry Laboratory	BS	4	0	0	4	2
9.	60 ME 0P1	Fabrication and Reverse Engineering Laboratory	ES	4	0	0	4	2
			Total	29	13	1	14	20

I to VII Semester
€ NCC – Course can be waived with 3 credits in VII semester or offered as extra credits
€ NSS/NSO/YRC/RRC/Fine Arts - 3 credits is not accounted for CGPA
* Career Skill Development - Extra 1 credit is offered and not accounted for CGPA
I to VIII Semester
Internship 3 additional credits not accounted for CGPA is offered based on the Internship duration
¥ Heritage of Tamils additional 1 credit is offered and not account for CGPA

SEMESTER – II								
S.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1.	60 EN 002	Professional English II	HS	3	1	0	2	2
2.	60 MA 003	Integrals, Partial Differential Equations and Laplace transform	BS	5	3	1	0	4
3.	60 ME 004	Engineering Mechanics	ES	5	3	1	0	4
4.	60 CS 001	C Programming	ES	3	3	0	0	3
5.	60 EE 001	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3
6.	60 MY 001	Environmental Studies and Climate Change	MC	2	2	0	0	0
7.	60 GE 002	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	HS	1	1	0	0	1¥
PRACTICALS								
8.	60 CS 0P1	C Programming Laboratory	ES	4	0	0	4	2
9.	60 EE 0P1	Basic Electrical and Electronics Engineering Laboratory	ES	4	0	0	4	2
10.	60 CG 0P1	Career Skill Development I	EEC	2	0	0	2	1*
			Total	32	16	2	12	20

¥ Tamils and Technology additional1 credit is offered and not account for CGPA.
* Career Skill Development I additional credit is offered not accounted for CGPA.

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SEMESTER – III								
S. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1.	60 MA 012	Fourier Transform and Numerical Methods	BS	5	3	1	0	4
2.	60 FT 301	Engineering Properties of Food Materials	PC	3	3	0	0	3
3.	60 FT 302	Biochemistry for Food Technologist	PC	3	3	0	0	3
4.	60 FT 303	Food Microbiology for Food Technologist	PC	3	3	0	0	3
5.	60 FT 304	Food Process Calculations	PC	4	2	1	0	3
6.	60 FT 305	Food Processing and Preservation	PC	3	3	0	0	3
7.	60 MY 002	Universal Human Values	MC	3	3	0	0	3#
PRACTICALS								
8.	60 FT 3P1	Food Biochemistry Laboratory	PC	4	0	0	4	2
9.	60 FT 3P2	Food Microbiology Laboratory	PC	4	0	0	4	2
10.	60 CG 0P2	Career Skill Development II	CG	2	0	0	2	1*
11.	60 CG 0P6	Internship	CG	-	-	-	-	1/2/3$
				34	20	2	10	23

UHV additional 3 credit is offered and not accounted for CGPA

* Career Skill Development II additional credit is offered not accounted for CGPA.

$ Internship 1 or 2 or 3 additional credits not accounted for CGPA is offered based on the Internship duration.

SEMESTER – IV								
S. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1.	60 MA 021	Probability and Statistics	BS	5	3	1	0	4
2.	60 FT 401	Fluid Mechanics and Mechanical Operation	PC	5	3	1	0	4
3.	60 FT 402	Meat, Fish and Poultry Process Technology	PC	3	3	0	0	3
4.	60 FT 403	Food Chemistry and Nutrition	PC	3	3	0	0	3
5.	60 FT E1*	Professional Elective – I	PE	3	3	0	0	3
6.	60 OE L0*	Open Elective – I	OE	3	3	0	0	3
PRACTICALS								
7.	60 FT 4P1	Food Chemistry and Nutrition Laboratory	PC	4	0	0	4	2
8.	60 FT 4P2	Unit Operations Laboratory	PC	4	0	0	4	2
9.	60 CG 0P3	Career Skill Development III	CG	2	0	0	2	1*
10.	60 CG 0P6	Internship	CG	-	-	-	-	1/2/3$
Total				32	18	2	10	24

* Career Skill Development III additional credit is offered not accounted for CGPA.

$ Internship 1 or 2 or 3 additional credits not accounted for CGPA is offered based on the Internship duration.

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SEMESTER – V								
S.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1.	60 FT 501	Dairy Technology	PC	3	3	0	0	3
2.	60 FT 502	Food Process Engineering	PC	5	3	1	0	4
3.	60 FT 503	Food Safety and Quality Regulation	PC	4	2	0	2	3
4.	60 FT 504	Heat and Mass Transfer	PC	5	3	1	0	4
5.	60 FT E2*	Professional Elective – II	PE	3	3	0	0	3
6.	60 OE L0*	Open Elective – II	OE	3	3	0	0	3
7.	60 MY 003	Startups and Entrepreneurship	MC	2	2	0	0	2@
PRACTICALS								
8.	61 FT 5P1	Dairy Technology Laboratory	PC	3	0	0	3	1.5
9.	60 FT 5P2	Food Process Engineering Laboratory	PC	3	0	0	3	1.5
10.	60 FT 5P3	Design Thinking and Innovation Laboratory	PC	2	0	0	2	1
11.	60 CG 0P4	Career Skill Development IV	CG	2	0	0	2	1*
12.	60 CG 0P6	Internship	**CG**	-	-	-	-	1/2/3$
				35	19	2	12	24

* Career Skill Development V additional credit is offered not accounted for CGPA.
$ Internship 1 or 2 or 3 additional credits not accounted for CGPA is offered based on the Internshipduration.

SEMESTER – VI								
S.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1.	60 HS 002	Engineering Economics and Financial Accounting	PC	3	3	0	0	3
2.	60 FT 601	Baking and Confectionery Technology	PC	3	3	0	0	3
3.	60 FT 602	Food Process Plant Layout and Safety	PC	5	3	1	0	4
4.	60 FT 603	Refrigeration and Cold Chain Management	PC	5	3	1	0	4
5.	60 FT E3*	Professional Elective – III	PE	4	2	0	2	3
6.	60 OE L0*	Open Elective – III	OE	3	3	0	0	3
PRACTICALS								
7.	61 FT 6P1	Baking and Confectionery Laboratory	PC	3	0	0	3	1.5
8.	60 FT 6P2	Computational Laboratory for Food Technology	PC	3	0	0	3	1.5
9.	60 FT 6P3	Design Thinking and Product Development Laboratory	PC	2	0	0	2	1
10.	60 CG 0P5	Comprehension Test	CG	2	0	0	2	1*
11.	60 CG 0P6	Internship	CG	-	-	-	-	1/2/3$
				35	17	2	14	24

* Comprehension Test one additional credit is offered and not accounted for CGPA calculation.
$ Internship 1 or 2 or 3 additional credits not accounted for CGPA is offered based on the Internship duration.

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SEMESTER – VII								
S.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1.	60 FT 701	Food Additives, Nutraceutical and Functional Foods	PC	3	3	0	0	3
2.	60 FT 702	Food Packaging Technology	PC	5	3	1	0	4
3.	60 FT 703	Fermentation Technology	PC	3	3	0	0	3
4.	60 FT E4*	Professional Elective – IV	PE	3	3	0	0	3
5.	60 AC 001	Research Skill Development	AC	1	1	0	0	0
PRACTICALS								
6.	60 FT 7P1	Food Packaging Laboratory	PC	4	0	0	4	2
7.	60 FT 7P2	Project Work Phase – I	PC	4	0	0	4	2
8.	60 CG 0P6	Internship	CG	-	-	-	-	1/2/3$
9.	60 AB 00*	NCC/NSS/NSO/YRC/RRC/Fine Arts	HS	4	2	0	2	3€
Total				23	13	1	8	17

$ Internship 1 or 2 or 3 additional credits not accounted for CGPA is offered based on the Internship duration.
€ NCC Course can be waived with 3 credits in VII semester or offered as extra credits
€ NSS/NSO/YRC/RRC/Fine Arts 3 credits is not accounted for CGPA

SEMESTER – VIII								
S.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1.	60 FT E5*	Professional Elective – V	PE	3	3	0	0	3
PRACTICALS								
3.	60 FT 8P1	Project Work Phase – II	PC	16	0	0	16	8
4.	60 CG 0P6	Internship	CG	-	-	-	-	1/2/3$
Total				19	3	0	16	11

$ Internship 1 or 2 or 3 additional credits not accounted for CGPA is offered based on the Internship duration.

TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 163

Note: HS- Humanities and Social Sciences including Management Courses, BS- Basic Science Courses, ES-Engineering Science Courses, PE-Professional Core Courses, PE-Professional Elective Courses, GE-General Elective Courses, OE- Open Elective Courses, CG -Career Enhancement Course, MC- Mandatory Courses

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K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)
B.E. / B.Tech. Degree Programme
SCHEME OF EXAMINATIONS
(For the candidates admitted in 2023-2024)
FIRST SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1	60 EN 001	Professional English I	2	40	60	100	45	100
2	60 MA 001	Matrices and Calculus	2	40	60	100	45	100
3	60 PH 006	Physics for Food Technology	2	40	60	100	45	100
4	60 CH 005	Chemistry for Life Sciences	2	40	60	100	45	100
5	60 ME 002	Engineering Graphics	2	40	60	100	45	100
6	60 GE 001	Heritage of Tamils / தமிழர் மரபு	2	100	-	100	-	100
PRACTICAL								
7	60 CP 0P3	Applied Physics and Chemistry Laboratory	3	60	40	100	45	100
8	60 ME 0P1	Fabrication and Reverse Engineering Laboratory	3	60	40	100	45	100

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory End Semester Examination and 40 marks for practical End Semester Examination.

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60 EN 001	Professional English I	Category	L	T	P	Credit
		HS	1	0	2	2

Objectives

- To help learners improve their vocabulary and to enable them to use words appropriately in different academic and professional contexts.
- To help learners develop strategies that could be adopted while reading texts.
- To help learners acquire the ability to speak effectively in English in real life and career related situations.
- To equip students with effective speaking and listening skills in English.
- To facilitate learners to enhance their writing skills with coherence and appropriate format effectively.

Pre-requisites

Basic knowledge of reading and writing in English

Course Outcomes

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

CO1	Compare and interpret complex academic texts	Understand
CO2	Recall the denotative and connotative meanings of technical texts	Remember
CO3	Interpret definitions, descriptions, narrations, and essays on various topics	Understand
CO4	Express fluently and accurately in formal and informal communicative Contexts	Understand
CO5	Summarize their opinions effectively in both oral and written medium of communication	Understand

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	10	20	20	20
Understand	50	80	80	80
Apply	-	-	-	-
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
Total	60	100	100	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech. Food Technology

60 EN 001 - Professional English I

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	1	0	2	45	2	40	60	100

Introduction to Fundamentals of Communication **Listening:** General information-specific details-conversation: introduction to classmates – audio / video (formal & informal). **Speaking:** Self Introduction; Introducing a friend; conversation - politeness strategies. **Reading:** Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. **Writing:** Writing letters – informal and formal – basics and format orientation **Language Focus:** Present Tenses; word formation (affixes); synonyms, antonyms and contranyms, and phrasal verbs; abbreviations & acronyms (as used in technical contexts).	[9]
Narration and Summation **Listening:** Podcast, anecdotes / stories / event narration; documentaries and interviews with celebrities. **Speaking:** Narrating personal experiences / events; Interviewing a celebrity; reporting / and summarizing of documentaries / podcasts/ interviews. **Reading:** Biographies, travelogues, newspaper reports, excerpts from literature, and travel & technical blogs. **Writing:** Paragraph writing, short report on an event (field trip etc.). **Language Focus:** Past tenses and prepositions; One-word substitution.	[9]
Description of a process / product **Listening:** Listen to a product and process descriptions; advertisements about products or services **Speaking:** Picture description; giving instruction to use the product; presenting a product. **Reading:** Advertisements, gadget reviews and user manuals. **Writing:** Definitions; instructions; and product /process description. **Language Focus:** Imperatives; comparative adjectives; future tenses. Homonyms; and Homophones, discourse markers (connectives & sequence words)	[9]
Classification and Recommendations **Listening:** TED Talks; scientific lectures; and educational videos. **Speaking:** Small Talk; Mini presentations **Reading:** Newspaper articles and Journal reports Note-making / Note-taking; recommendations; Transferring information from non-verbal (chart, graph etc, to verbal mode) **Language Focus:** Articles; Pronouns -Possessive & Relative pronouns; subject-verb agreement; collocations.	[9]
Expression **Listening:** Debates/ discussions; different viewpoints on an issue; and panel discussions. **Speaking:** Group discussions, debates & role plays. **Reading:** Editorials; and opinion blogs. **Writing:** Essay Writing (Descriptive or narrative). **Language Focus:** Punctuation; Compound Nouns; simple, compound & complex sentences. cause & effect expressions.	[9]
Total Hours:	**45**

Text Book(s):

1.	*'English for Engineers & Technologists'* Orient Blackswan Private Ltd. Department of English, Anna University, 2020
2.	Norman Lewis, *'Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book'*, Penguin Random House India, 2020

Reference(s):

1.	Paul Emmerson and Nick Hamilton, *'Five Minute Activities for Business English',* Cambridge University Press, New York, 2005
2.	Arthur Brookes and Peter Grundy,' *Beginning to Write: Writing Activities for Elementary and Intermediate Learners',* Cambridge University Press, New York, 2003
3.	Michael McCarthy and Felicity O Dell, *'English Vocabulary in Use: Upper Intermediate',* Cambridge University Press, N.York, 2012
4.	Lakshmi Narayanan, *'A Course Book on Technical English'* Scitech Publications (India) Pvt. Ltd. 2020

*** SDG- 04- Quality Education**

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Fundamentals of Communication**	
1.1	Listening for general information and Specific details	1
1.2	Self-introduction	1
1.3	Narrating personal experiences	1
1.4	Reading relevant to technical contexts and emails	1
1.5	Writing letters – informal	1
1.6	Writing letters – formal	1
1.7	Present Tenses	1
1.8	synonyms, antonyms and contranyms, and affixes	1
1.9	Phrasal verbs; abbreviations & acronyms	1
2.0	**Narration and Summation**	
2.1	Listening to podcasts, documentaries and interviews with celebrities	1
2.2	Narrating personal experiences	1
2.3	Summarizing of documentaries	1
2.4	Reading travelogues, and excerpts from literature	1
2.5	Paragraph writing	1
2.6	Short report on an event (field trip etc.).	1
2.7	Past tenses	1
2.8	Prepositions	1
2.9	One-word substitution	1
3.0	**Description of a process / product**	
3.1	Listen to a product and process descriptions	1
3.2	Picture description	1
3.3	Giving instruction to use the product	1
3.4	Reading Advertisements, gadget reviews and user manuals	1
3.5	Writing Definitions and instructions	1
3.6	Future Tenses	1
3.7	Homonyms and Homophones	1
3.8	Imperatives	1
3.9	comparative adjectives, and discourse markers	1
4.0	**Classification and Recommendations**	
4.1	Listening to TED Talks and educational videos	1
4.2	Listening to scientific lectures	1
4.3	Small Talk and mini presentations	1
4.4	Reading newspaper articles and journal reports	1
4.5	Note-making / Note-taking	1
4.6	Recommendations	1
4.7	Transferring information from non-verbal	1
4.8	Articles and Pronouns	1
4.9	Subject-verb agreement and collocations	1
5.0	**Expression**	
5.1	Listening to debates and panel discussions	1
5.2	Group discussions	2
5.3	Role plays	1
5.4	Reading editorials and opinion blogs	1
5.5	Essay Writing (Descriptive or narrative)	1
5.6	Punctuation and cause & effect expressions.	1
5.7	Compound Nouns	1
5.8	Simple, compound & complex sentences	1

Course Designer(s)

Dr.A.Palaniappan -palaniappan@ksrct.ac.in

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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60 MA 001	Matrices and Calculus	Category	L	T	P	Credit
		BS	3	1	0	4

Objectives

- To familiarize the basic concepts in Cayley-Hamilton theorem and orthogonal transformation
- To get exposed to the fundamentals of differentiation
- To acquire skills to understand the concepts involved in Jacobians and maxima and minima
- To solve various linear differential equations and method of variation of parameters
- To learn various techniques and methods in solving definite and indefinite integrals

Pre-requisites

Nil

Course Outcomes

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

CO1	Apply the concepts of Cayley-hamilton theorem and orthogonal transformation to the matrix	Apply
CO2	Apply the concepts of differentiation in solving various Engineering problems	Apply
CO3	Obtain Jacobians and maxima and minima of functions of two variables	Apply
CO4	Employ various methods in solving differential equations	Apply
CO5	Apply different techniques to evaluate definite and indefinite integrals	Apply

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	2	-	-	-	-	-	-	-	2	-	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	2	-	-
CO3	3	2	-	-	2	-	-	-	-	-	-	-	2	-	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	2	-	-
CO5	3	2	-	-	2	-	-	-	-	-	-	-	2	-	-

3 - Strong; 2 - Medium; 1 - Some

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	10	10	10	10
Understand	10	10	20	20
Apply	40	40	70	70
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
Total	60	60	100	100

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K. S. Rangasamy College of Technology – Autonomous (R2022)								
B.Tech. Food Technology								
60 MA 001 – Matrices and Calculus								
Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	1	0	60	4	40	60	100

Matrices Characteristic equation - Eigen values and Eigen vectors of a real matrix - Properties of Eigen values and Eigen vectors - Cayley-Hamilton theorem - Orthogonal transformation of a symmetric matrix to diagonal form - Reduction of quadratic form to canonical form by an Orthogonal transformation - Nature of quadratic form - Applications: Stretching of an elastic membrane **Hands-on:** **Matrix Operations - Addition, Multiplication, Transpose, Inverse and Rank**	**[9]**
Differentiation Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Successive Differentiation - Leibnitz's theorem **- Applications: Maxima and Minima of functions of one variable*** **Hands-on:** **Determine the solution of system of linear equations**	**[9]**
Functions of Several Variables Partial differentiation - Homogeneous functions and Euler's theorem - Jacobians - Taylor's series for functions of two variables - **Applications: Maxima and minima of functions of two variables - Constrained maxima and minima: Lagrange's Method of Undetermined Multipliers*** **Hands-on:** **Compute the Eigen values and Eigen vectors of a Matrix**	**[9]**
Differential Equations Linear differential equations of second and higher order with constant coefficients - R.H.S is of the form $e^{\alpha X}$, sin α x, cos α x, x^n, n > 0 - Differential equations with variable coefficients: Cauchy's and Legendre's form of linear equations - Method of variation of parameters **Hands-on:** **Solve the first and second order ordinary differential equations**	**[9]**
Integration Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications: Hydrostatic force and pressure, moments and centres of mass **Hands-on:** **Compute the Maxima and Minima of a function of one variable**	**[9]**
Total Hours: 45 + 5 (Hands-on) + 10 (Tutorial)	**60**

Text Book(s):

1. Grewal B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2017.
2. Kreyszig Erwin, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Limited, New Delhi, 2016.

Reference(s):

1. Dass H.K, "Higher Engineering Mathematics", 3rd (Revised) Edition, S.Chand & Company Ltd, New Delhi, 2014.
2. Veerarajan T, "Engineering Mathematics", for Semesters I & II, 1st Edition, Tata McGraw Hill Publishing Co., New Delhi, 2019.
3. Kandasamy P, Thilagavathy K and Gunavathy K, "Engineering Mathematics - I", S.Chand & Company Ltd, New Delhi, 2017.
4. Bali N P and Manish Goyal," A text book of Engineering Mathematics",10th Edition, Laxmi Publications (P) Ltd, 2016.

***SDG: 4 – Quality Education**

Passed in BoS Meeting held on 23.12.22
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Course Contents and Lecture Schedule

S.No.	Topic	No. of Hours
1.	**Matrices**	
1.1	Characteristic equation	1
1.2	Eigen values and Eigen vectors of a real matrix	1
1.3	Properties of Eigen values and Eigen vectors	1
1.4	Cayley-Hamilton theorem	1
1.5	Orthogonal transformation of a symmetric matrix to diagonal form	1
1.6	Nature of quadratic form	1
1.7	Reduction of quadratic form to canonical form by Orthogonal transformation	2
1.8	Stretching of an elastic membrane	1
1.9	Tutorial	2
1.10	Hands-on	1
2.	**Differentiation**	
2.1	Representation of functions	1
2.2	Limit of a function and Continuity	1
2.3	Differentiation rules (sum, product, quotient, chain rules)	2
2.4	Successive differentiation	1
2.5	Leibnitz's theorem	2
2.6	Maxima and minima of functions of one variable	2
2.7	Tutorial	2
2.8	Hands-on	1
3.	**Functions of Several Variables**	
3.1	Partial differentiation	1
3.2	Homogeneous functions and Euler's theorem	1
3.3	Jacobians	2
3.4	Taylor's series for functions of two variables	1
3.5	Maxima and minima of functions of two variables	2
3.6	Lagrange's Method of Undetermined Multipliers	2
3.7	Tutorial	2
3.8	Hands-on	1
4.	**Differential Equations**	
4.1	Linear differential equations of second and higher order with constant co-efficient	1
4.2	R.H.S is of the form $e^{\alpha X}$, $\sin \alpha x$, $\cos \alpha x$, x^n, $n > 0$	2
4.3	Differential equations with variable coefficients: Cauchy's form of linear equations	2
4.4	Differential equations with variable coefficients: Legendre's form of linear equations	2
4.5	Method of variation of parameters	2
4.6	Tutorial	2
4.7	Hands-on	1
5.	**Integration**	
5.1	Definite and Indefinite integrals	2
5.2	Substitution rule	1
5.3	Techniques of Integration: Integration by parts	1
5.4	Integration of rational functions by partial fraction	1
5.5	Integration of irrational functions	1
5.6	Improper integrals	1
5.7	Hydrostatic force.	1
5.8	Pressure, moments and centres of mass.	1
5.9	Tutorial	2
5.10	Hands-on	1
	Total	60

Course Designers

1. Dr.C.Chandran - cchandran@ksrct.ac.in
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Approved in Academic Council Meeting held on 07.01.23

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BOARD OF STUDIES

60 PH 006	Physics for Food Technology	Category	L	T	P	Credit
		BS	3	0	0	3

Objectives

- To analyze the crystal parameters to investigate crystal structures and to classify the type of the defect present in the crystal
- To enable the students in understanding the importance of quantum physics and its applications.
- To introduce the basics of laser, types and its applications in food processing.
- To study the basic concept of ultrasonic waves, production of ultrasonic waves and its applications
- To obtain fundamental concepts and current knowledge of nanotechnology for engineering applications

Pre-requisites

Nil

Course Outcomes

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

CO1	Recognize the basics of crystallography, crystal imperfections and nucleation	Remember
CO2	Acquire the fundamentals of quantum mechanics and apply to one dimensional motion of particles.	Apply
CO3	Realize a strong foundational knowledge in lasers and its applications	Understand
CO4	Comprehend the principle, production, properties and applications of ultrasonic waves	Understand
CO5	Infer the preparation and properties of nano materials for potential applications	Understand

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests(Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	10	20	20	20
Understand	40	70	70	70
Apply	10	10	10	10
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
Total	60	100	100	100

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

60 PH 006 - Physics for Food Technology

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100

***Crystallography** Lattice - Unit cell – crystal systems and Bravais lattice - Crystal planes and Miller indices - d spacing in cubic lattice – Packing factor for HCP – Crystal imperfections- edge and screw dislocations, Burgers vector and elastic strain energy- surface imperfections – grain and twin boundaries – Polymorphism – phase changes – nucleation and growth – homogeneous and heterogeneous nucleation.	[9]
***Quantum Mechanics** Introduction to Quantum mechanics-Wave nature of Particles- de-Broglie hypothesis – Matter waves - Time-dependent and time independent Schrodinger equation for wave function- Applications: Particle in a box (one dimensional and three dimensional) - Uncertainty principle and its applications- Electron microscope: Scanning electron microscope.	[9]
Laser Technology Theory of laser - characteristics - Einstein's coefficients - population inversion - Types of lasers: gas lasers (CO_2), solid-state lasers (Nd: YAG), Semiconductor laser (Homojunction and Hetero junction)- **application of laser technology in food processing: Preservation and Packaging- Laser-induced breakdown spectroscopy (LIBS) for food analysis	[9]
Ultrasonics and Applications Introduction-Properties-Production: Magnetostriction effect, Magnetostriction generator- piezoelectric effect, piezoelectric generator – Ultrasonic detection- acoustical grating- Applications: Cavitation, cleaning, SONAR– Nondestructive testing: Pulse echo system, through transmission, resonance system- applications- **Quality assessment using ultrasonics in food industry	[9]
Nanotechnology Nanomaterials: Properties- Top-down process: Ball Milling method – Bottom-up process: Sol-Gel Technique, Vapour Phase Deposition method- Carbon Nano Tube (CNT): Properties, preparation by electric arc method, Applications- **Nanotechnology in food industry and packaging - Smart packaging, Nano structured coating, advantages of nanomaterials in food packaging applications.	[9]
Total Hours:	**45**

Text Book(s):

1.	M. N. Avadhanulu, P. G. Kshirsagar, TVS Arun Murthy "A Text Book of Engineering Physics", S Chand Publications, New Delhi, 2022.
2.	H. K. Malik, A. K. Singh "Engineering Physics" McGraw Hill Education Private Limited, New Delhi.
3.	D. R. Joshi "Engineering Physics" McGraw Hill Education Private Limited, New Delhi. 2010

Reference(s):

1.	S.O. Pillai "A Textbook Of Engineering Physics" New Age International (P) Limited, New Delhi, 2014
2.	B.B. Laud "Lasers and Non-Linear Optics "New Age International Publications, New Delhi,2015
3.	Palanisamy, P.K., "Physics of Materials", Scitech Publications, Chennai. 2012

* **SDG:4- Quality Education**
**** SDG:2 - Achieve food security**

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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Course Contents and Lecture Schedule

S. No.	Topic	No. of hours
1.0	**CRYSTALLOGRAPHY**	
1.1	Lattice - Unit cell – crystal systems and Bravais lattice	2
1.2	Crystal planes and Miller indices	1
1.3	d spacing in cubic lattice	1
1.4	Packing factor for HCP	1
1.5	Crystal imperfections- edge and screw dislocations, Burgers vector and elastic strain energy	2
1.6	surface imperfections – grain and twin boundaries – Polymorphism	1
1.7	phase changes – nucleation and growth – homogeneous and heterogeneous nucleation.	1
2.0	**QUANTUM MECHANICS**	
2.1	Introduction to Quantum mechanics	1
2.2	Wave nature of Particles- de-Broglie hypothesis – Matter waves	2
2.3	Time-dependent and time independent Schrodinger equation for wave function	2
2.4	Applications: Particle in a box (one dimensional and three dimensional)	2
2.5	Uncertainty principle and its applications	1
2.6	Electron microscope: Scanning electron microscope.	1
3.0	**LASER TECHNOLOGY**	
3.1	Theory of laser - characteristics	1
3.2	Einstein's coefficients	1
3.3	Population inversion - Types of lasers: gas lasers (CO_2)	1
3.4	Solid-state lasers (Nd: YAG)	1
3.5	Semiconductor laser (Homojunction and Hetero junction)	2
3.6	Application of laser technology in food processing: Preservation and Packaging	2
3.7	Laser-induced breakdown spectroscopy (LIBS) for food analysis	1
4.0	**ULTRASONICS AND APPLICATIONS**	
4.1	Introduction-Properties	1
4.2	Production: Magnetostriction effect, Magnetostriction generator	1
4.3	piezoelectric effect, piezoelectric generator	1
4.4	Ultrasonic detection- acoustical grating	1
4.5	Applications: Cavitation, cleaning, SONAR	2
4.6	Nondestructive testing: Pulse echo system, through transmission, resonance system	2
4.7	applications- Quality assessment using ultrasonics in food industry	1
5.0	**NANOTECHNOLOGY**	
5.1	Nanomaterials: Properties- Top-down process: Ball Milling method	2
5.2	Bottom-up process: Sol-Gel Technique	1
5.3	Vapour Phase Depositionmethod	2
5.4	Carbon Nano Tube (CNT): Properties, preparation by electric arc method	1
5.5	Applications- Nanotechnology in food industry and packaging	1
5.6	Smart packaging, Nano structured coating, advantages of nanomaterials in food packaging applications	2

Course Designers

1. Dr. V. Vasudevan - vasudevanv@ksrct.ac.in
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BOARD OF STUDIES

60 CH 005	Chemistry for Life Sciences	Category	L	T	P	Credit
		BS	3	0	0	3

Objectives

- To help the learners to analyse the hardness of water and its removal
- To study the behaviour of solutions based on their properties
- To analyse the factors influencing reaction rates and catalysis
- To study the concepts of electrochemistry and its applications
- To explain the characteristics and application of chemical sensors

Pre-requisites

- Nil

Course Outcomes

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

CO1	Identify the types of hardness of water and its removal	Apply
CO2	Summarize the characteristics of solutions and their applications	Apply
CO3	Illustrate the kinetics of reaction rates and catalysis	Understand
CO4	Interpret the applications of electro chemistry	Apply
CO5	Categorize the types of sensors for various applications	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
3 - Strong; 2 - Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	20	20	20	20
Understand	30	30	60	60
Apply	10	10	20	20
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
Total	60	60	100	100

Passed in BoS Meeting held on 23.12.22
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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.TECH. Food Technology

60 CH 005 - Chemistry for Life Sciences

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I/II	3	0	0	45	3	40	60	100

Water Technology* Introduction - Commercial and Industrial uses of Water - Hardness - Types – Estimation of Hardness by EDTA Method Internal Conditioning (Colloidal, Phosphate, Calgon and Carbonate Conditioning Methods) - External Conditioning (Zeolite Process, Demineralization Process) - Desalination Methods (Reverse Osmosis and Electro Dialysis) - Flash Evaporation.	[9]
Solutions** Normality, Molarity, Molality, Percentage Solution, Mole Fraction (Simple Numerical Problems) - Buffer Solutions - Types - Applications - Henderson-Hasselbach Equation. Membrane Permeability - Principle of Diffusion & Osmosis - Donon Membrane Equilibrium. Definition of Osmotic Pressure, Isotonic, Hypotonic & Hypertonic Solutions. Relationship of Osmotic Pressure to Gas Laws. The General Equation for Dilute Solutions, The Influence of Ionization & Molecular Size on Osmotic Pressure - Biological Importance of Osmosis - Colloids - Definition and Types, Gold Number, Preparation and Properties of Colloids - Lyophilic and Lyophobic Sols - Brownian Movements and Tyndall Effect - Emulsion & Emulsifying Agents.	[9]
Chemical Kinetics and Catalysis*** Rate of Reaction, Order and Molecularity - Derivation of First Order Rate Equation - Half- Life Period of First Order Reaction - Determination of Rate Constant of Hydrolysis of Ester - Factors Influencing Rate of Reaction - Activation Energy -Arrhenius Equation -Transition State Theory - Catalyst - Auto Catalyst - Enzyme Catalyst - Michaelis–Menten Equation and its Significance. Catalytic Promoters - Catalytic Poisons - Active Center, Homogeneous and Heterogeneous Catalysis - Reactivity - Coenzymes - Proton Transfer - Metal Ions - Intra Molecular Reactions - Covalent Catalysis - Inclusion Complexation - Industrial Application of Catalysts.	[9]
Electrochemistry ** Electrode Potential - Nernst Equation - Derivation and Problems - Reversible and Irreversible Cells - Types of Electrodes and its Applications - Reference Electrodes - pH, Conductometric and Potentiometric Titrations.	[9]
Chemical Sensors*** Sensors - Chemical Sensors - Characteristics - Elements and Characterization - Potentiometric Sensors - Amperometric Sensors - Sensors Based on Electrochemical Methods - Electrochemical Biosensors - Optical Biosensors: Enzyme Sensors - Bio Affinity Sensors - DNA Sensors. Chemical Sensors as Detectors and Indicators: Indicators for Titration Processes - Separation Methods - Nano Technology in Chemical Sensors.	[9]
Total Hours:	**45**

Text Book(s):

1. O.G. Palanna, “Engineering Chemistry”, Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 2017
2. P.C. Jain and Monica Jain, A Textbook of Engineering Chemistry, Dhanpat Rai publications, New Delhi, 16th edition, 2015

Reference(s):

1. Peter Grundler, “Chemical Sensors”, Springer Berlin Heidelberg New York, 2007
2. B. R. Puri, L.R. Sharma, and S. P. Madan, “Principles of Physical Chemistry” Vishal Publishing Company. Gumber Market, Old Railway Road, Jalandhar
3. Upadhyay, A, Upadhyay, K, and Nath, N, “Biophysical chemistry: Principles and Techniques” Himalaya Publishing House, Bombay.
4. B.S. Bahl G.D. Tuli, Arun Bahl, “Essentials of Physical Chemistry”. S.Chand and Company, Ltd. New Delhi

*SDG 6 – Improve Clean Water and Sanitation
* SDG 11 - Sustainable Cities and Communities
** SDG 3 - Good Health and Well-being
***SDG 9– Industry Innovation and Infrastructure
***SDG 8 – Decent Work and Economic Growth

Passed in BoS Meeting held on 23.12.22
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BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Water Technology**	
1.1	Introduction – Commercial and Industrial uses of Water	1
1.2	Hardness – Types	1
1.3	Estimation of Hardness of Water by EDTA Method	1
1.4	Internal Conditioning (Colloidal, Phosphate, Calgon and Carbonate)	1
1.5	External Conditioning (Zeolite Process)	1
1.6	Demineralization Process	1
1.7	Desalination Methods (Reverse Osmosis)	1
1.8	Electro dialysis	1
1.9	Flash Evaporation	1
2.0	**Solutions**	
2.1	Normality, Molarity, Molality, Percentage Solution, Mole Fractions (Simple Numerical Problems).	1
2.2	Buffer Solutions – Types - Applications-	1
2.3	Henderson-Hasselbach Equation	1
2.4	Membrane Permeability - Principle of Diffusion & Osmosis - Donon Membrane Equilibrium	1
2.5	Definition of Osmotic Pressure, Isotonic, Hypotonic & Hypertonic Solutions.	1
2.6	Relationship of Osmotic Pressure to Gas Laws.	1
2.7	The General Equation for Dilute Solutions, The Influence of Ionization & Molecular Size on Osmotic Pressure.	1
2.8	Colloids - Definition and Types, Gold Number, Preparation and Properties of Colloids – Lyophilic and Lyophobic Sols.	1
2.9	Brownian Movements and Tyndall Effect - Emulsion & Emulsifying Agents.	1
3.0	**Chemical Kinetics and Catalysis**	
3.1	Rate of Reaction, Order and Molecularity	1
3.2	Derivation of First Order Rate Equation – Half-Life Period of First Order Reaction	1
3.3	Determination of Rate Constant of Hydrolysis of Ester	1
3.4	Factors Influencing Rate of Reaction. Activation Energy -Arrhenius Equation- Transition State Theory	1
3.5	Catalyst– Auto Catalyst- Enzyme Catalyst – Michaelis–Menten Equation and its Significance	1
3.6	Catalytic Promoters – Catalytic Poisons	1
3.7	Active Center, Homogeneous and Heterogeneous Catalysis	1
3.8	Reactivity – Coenzymes – Proton Transfer – Metal Ions – Intra Molecular Reactions	1
3.9	Covalent Catalysis – Inclusion Complexation - Industrial Application of Catalysts	1
4.0	**Electrochemistry**	
4.1	Electrode Potential - Nernst Equation - Derivation and Problems	2
4.2	Reversible and Irreversible Cells	1
4.3	Types of Electrodes and its Applications	1
4.4	Reference Electrodes - pH	1
4.5	Conductometric and Potentiometric Titrations	1
4.6	Principles of Electro Plating and Electro Less Plating	2
4.7	Fabrication Process of Printed Circuit Board	1
5.0	**Chemical Sensors**	
5.1	Sensors – Chemical Sensors - Characteristics	1
5.2	Elements and Characterization	1

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5.3	Potentiometric Sensors, Amperometric Sensors	1
5.4	Sensors Based on Electrochemical Methods	1
5.5	Electrochemical Biosensors	1
5.6	Optical Biosensors : Enzyme Sensors – Bio affinity Sensors	1
5.7	DNA Sensors. Chemical Sensors as Detectors and Indicators	1
5.8	Indicators for Titration Processes	1
5.9	Separation Methods. Nano technology in chemical sensors	1

Course Designer(s)

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Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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BOARD OF STUDIES

60 ME 002	Engineering Graphics	Category	L	T	P	Credit
		ES	2	0	4	4

Objectives

- To acquire various concepts of dimensioning, conventions and standards.
- To impart the graphic skills for converting pictorial views of solids in to orthographic views.
- To learn the concept in projection of solids.
- To draws the section of solids and to know development of different types of surfaces.
- To learn the concept in isometric projection.

Pre-requisites

NIL

Course Outcomes

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

CO1	Demonstrate the Impact of computer technologies on graphical Communication	Apply
CO2	Convert the pictorial views in to orthographic views using drafting software	Apply
CO3	Draw the projection of simple solids, true shape of sections and development of surfaces	Apply
CO4	Construct the isometric projections of objects using drafting software.	Apply
CO5	Interpret a design project illustrating engineering graphical skills.	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	30	30
Apply	30	30	50	50
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
Total	60	60	100	100

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech. Food Technology

60 ME 002- Engineering Graphics

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	2	0	4	90	4	40	60	100

Introduction to Computer Aided Drafting (CAD) software Theory of CAD software – Menu System, Tool bars (Standard, Object Properties, Draw, Modify and Dimension) – Drawing Area (Background, Crosshairs, Coordinate System) – Dialog boxes and windows - Shortcut menus (Button Bars) – The Command Line and Status Bar – Different methods of zoom – Select and erase objects.	**[3+12]**
Orthographic Projection Theory of projection – Terminology and Methods of projection – first angle and third angle projection – Conversion of pictorial views into orthographic views	**[3+12]**
Projection of Solids and Sections of Solids Projections of simple solids: prism, pyramid, cylinder and cone (Axis parallel to one plane and perpendicular to other, axis inclined to one plane and parallel to other). Sections of simple solids: prism, pyramid, cylinder and cone in simple positions (cutting plane is inclined to one of the principal planes and perpendicular to the other) – True shape of sections. Principle of development-Methods of development: Parallel line development-Cube, Prism and Cylinder. Radial line development – Pyramid and cone	**[3+12]**
Isometric Projection Principles of Isometric projection – Isometric scale, Isometric views, Conventions – Isometric views of lines, Planes, Simple and compound Solids – Conversion of Orthographic views in to Isometric view	**[3+12]**
Application of Engineering Graphics Geometry and topology of engineered components: Creation of engineering models and their presentation in standard 2D blueprint form, 3D wire-frame and shaded solids – Geometric dimensioning and Tolerance – Use of solid modeling software for creating associative models – Floor plans: windows, doors, and fixtures such as water closet (WC), bath sink, shower, etc. – Applying colour coding according to building drawing practice – Drawing sectional elevation showing foundation to ceiling – Introduction to Building Information Modelling (BIM).	**[3+12]**
Total Hours	**75**

Text Book(s):

1.	Bhatt N.D., Engineering Drawing, Charotar Publishing House Pvt. Ltd., 53rd Edition, Gujarat, 2019.
2.	Venugopal K., Engineering Graphicsll, New Age International (P) Limited, 2014.

Reference(s):

1.	Shah M.B., Rana B.C., and V.K.Jadon., —Engineering Drawing, Pearson Education, 2011.
2.	Natarajan K.V., A Text Book of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 2014.
3.	Agrawal B. & Agrawal C. M., Engineering Graphics, TMH Publication, 2012.
4.	Narayana, K.L. & P Kannaiah,Text book on Engineering Drawing, Scitech Publishers, 2008.

***SDG 9 – Industry Innovation and Infrastructure**

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Computer Aided Drafting (CAD) software**	
1.1	Theory of CAD software	1
1.2	Menu System, Tool bars (Standard, Object Properties, Draw, Modify and Dimension)	2
1.3	Drawing Area (Background, Crosshairs, Coordinate System)	3
1.4	Dialog boxes and windows – Shortcut menus	3
1.5	The Command Line and Status Bar	1
1.6	Different methods of zoom – Select and erase objects.	2
2.0	**Orthographic Projection**	
2.1	Introduction to orthographic projections	2
2.2	Planes of projection,	2
2.3	Projection of points	1
2.4	Projection of lines inclined to both planes.	2
2.5	Projection of planes	2
2.6	Projection of planes Inclined to both planes	1
2.7	Conversions of pictorial views to orthographic views.	3
2.8	Practice class for pictorial views to orthographic views.	2
2.9	Practice class for pictorial views to orthographic views.	1
3.0	**Projection of Solids**	
3.1	Projections of simple solids: prism	2
3.2	Projections of simple solids: cylinder	3
3.3	Projections of simple solids: pyramid	2
3.4	Projections of simple solids: Cone	2
3.5	Practice class for Projection of Solids	2
3.6	Axis of solid inclined to both HP and VP	5
3,7	Section of solids for Prism,	2
3,8	Section of solids for Cylinder,	2
3,9	Section of solids for Pyramid,	2
3,10	Section of solids for Cone	2
3,11	Auxiliary Views - Draw the sectional orthographic views of geometrical solids.	3
3.12	Draw the sectional orthographic views of objects from industry.	3
3,13	Development of surfaces of Right solids Prism,	2
3.14	Development of surfaces of Right solids Pyramid	2
3.15	Development of surfaces of Right solids Cylinder and Cone	2
4.0	**Isometric Projection and Introduction to AutoCAD**	
4.1	Principles of isometric projection	1
4.2	Isometric scale	1
4.3	Isometric projections of simple solids: Prism,	1
4.4	Isometric projections of simple solids: Pyramid,	1
4.5	Isometric projections of simple solids: Cylinder	1
4.6	Isometric projections of simple solids: Cone	1
4.7	Isometric projections of frustum	1
4.8	Isometric projections of truncated solids	2
4.9	Combination of two solid objects in simple vertical positions.	1
5.0	**Application of Engineering Graphics**	
5.1	Geometry and topology of engineered components:	2
5.2	Creation of engineering models and their presentation in standard 2D blue print form	3
5.3	3D wire-frame and shaded solids – Geometric dimensioning and Tolerance – Use of solid modeling software for creating associative models	3
5.4	Floor plans: windows, doors, and fixtures such as water closet (WC), bath sink, shower, etc.	1
5.5	Applying colour coding according to building drawing practice	1
5.6	Drawing sectional elevation showing foundation to ceiling	1
5.7	Introduction to Building Information Modelling (BIM).	1

Course Designer(s)

1. Dr.K.Mohan-mohank@ksrct.ac.in

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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60 GE 001	Heritage of Tamils[&] (Common to all Branches)	Category	L	T	P	Credit
		GE	1	0	0	1[&]

Objectives

- To learn the extensive literature of classical Tamil.
- To review the fine arts heritage of Tamil culture.
- To realize the contribution of Tamils in Indian freedom struggle

Pre-requisites

- Nil

Course Outcomes

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

CO1	Recognize the extensive literature of Tamil and its classical nature.	Understand
CO2	Apprehend the heritage of sculpture, painting and musical instruments of ancient people.	Understand
CO3	Review on folk and martial arts of Tamil people.	Understand
CO4	Insight thinai concepts, trade and victory of Chozha dynasty.	Understand
CO5	Realize the contribution of Tamil in Indian freedom struggle, self-esteem movement and siddha medicine.	Understand

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination (Marks)
	1	2	
Remember	30	30	30
Understand	30	30	70
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B. Tech. Food Technology

60 GE 001- Heritage of Tamils&

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	1	0	0	15	1	100	-	100

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 Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.	[3]
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 - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.	[3]
Folk and Martial Arts Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.	[3]
Thinai Concept of Tamils Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.	[3]
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.	[3]
Total Hours:	**15**

Text Book(s):

1.	தமிழக வரலாறு - மக்களும் பண்பாடும் கே. கே . பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.	கணினித்தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு).
4.	பொருநை - ஆற்றங்கரை நாகரீகம் (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.Subaramanian, 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.

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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60 GE 001	தமிழர் மரபு (அனைத்து துறைகளுக்கும் பொதுவானது)	Category	L	T	P	Credit
		GE	1	0	0	1&

பாடத்தின் நோக்கங்கள்:

- தமிழ் மொழியின் இலக்கணச் செறிவைக் கற்றுணர்தல்.
- தமிழர் பண்பாட்டின் நுண்கலைகள் பற்றிய ஒரு மீள்பார்வை.
- இந்திய சுதந்திரப் போராட்டத்தில் தமிழர்களின் பங்களிப்பை உணருதல்

Pre-requisites

தேவை இல்லை

பாடம்கற்றதின் விளைவுகள்

பாடத்தை வெற்றிகரமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள்

CO1	தமிழ் மொழியின் செந்தண்மை மற்றும் இலக்கியம் குறித்த தெரிதல்.	புரிதல்
CO2	தமிழர்களின் சிற்பக்கலை, ஓவியக்கலை மற்றும் இசைக்கருவிகள் குறித்ததெளிவு.	புரிதல்
CO3	தமிழர்களின் நாட்டுப்புறக்கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்த தெளிவு.	புரிதல்
CO4	தமிழர்களின் திணைக் கோட்பாடுகள், சங்ககால வணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்கள்.	புரிதல்
CO5	இந்திய தேசிய இயக்கம், சுயமரியாதையை இயக்கம் மற்றும் சித்த மருத்துவம் பற்றிய புரிதல்.	புரிதல்

Mapping with Programme Outcomes

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

3 - Strong; 2 - Medium; 1 - Some

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination (Marks)
	1	2	
Remember	30	30	30
Understand	30	30	70
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B. Tech. Food Technology

60 GE 001- தமிழர் மரபு

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	1	0	0	15	1	100	-	100

மொழி மற்றும் இலக்கியம்: 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.	[3]
மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை-சிற்பக் கலை: நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.	[3]
நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.	[3]
தமிழர்களின் திணைக் கோட்பாடுகள்: தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.	[3]
இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.	[3]
Total Hours:	**15**

Text Book(s):

1.	தமிழக வரலாறு - மக்களும் பண்பாடும் கே. கே . பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.	கணினித்தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு).
4.	பொருநை - ஆற்றங்கரை நாகரீகம் (தொல்லியல் துறை வெளியீடு).
5.	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).

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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.Subaramanian, 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.

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

CHAIRMAN
BOARD OF STUDIES

60 CP 0P3	Applied Physics and Chemistry Laboratory	Category	L	T	P	Credit
		BS	0	0	4	2

Objectives

- To infer the practical knowledge by applying the experimental methods to correlate with the Physics theory.
- To demonstrate an ability to make physical measurements and understand the limits of precision in measurements
- Test the knowledge of theoretical concepts and develop the experimental skills of the learners.
- To facilitate data interpretation and expose the learners to various industrial and environmental applications
- To enhance the students to handle the instruments.

Pre-requisites

Nil

Course Outcomes

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

CO1	Realize the concept of youngs modulus, rigidity modulus and dielectric constant of the given materials	Apply
CO2	Recognize the knowledge of properties of light using laser and ordinary light source	Apply
CO3	Apply the concepts of chemistry and develop analytical skills for applications in engineering.	Apply
CO4	Analyze the pH, electromotive force, conductance by using instrumental methods.	Apply
CO5	Apply the Freundlich's adsorption isotherm and Langmuir's adsorption isotherm using acetic acid on activated charcoal	Analyze

Mapping with Programme Outcomes (FT)

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

3 - Strong; 2 - Medium; 1 – Some

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	10	-	10	10
Understand	30	30	30	30
Apply	40	40	40	40
Analyze	20	30	20	20
Evaluate	-	-	-	-
Create	-	-	-	-
Total	100	100	100	100

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

CHAIRMAN
BOARD OF STUDIES

K. S. Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 CP 0P3- Applied Physics and Chemistry Laboratory								
Semester	Hours/Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	0	0	4	60	2	60	40	100

List of Experiments (Physics):

1.Determination of Young's modulus of a given material - Uniform bending
2.Determination of rigidity modulus of a wire -Torsional pendulum.
3. Determination of dielectric constant.
4. Determination of wavelength of mercury spectral lines – spectrometer grating
5.(a) Laser- Determination of the wave length of the laser using grating.
(b) Optical fibre -Determination of Numerical Aperture and acceptance angle.

* SDG: 4- Quality Education

List of Experiments (Chemistry):

1. Estimation of hardness of water sample by complexometric method.
2. Estimation of HCl by pH meter.
3. Estimation of mixture of acids by conductivity meter.
4. Determination of ferrous ion by Potentiometric titration.
5. Adsorption of acetic acid by Charcoal.

* SDG 6: Improve Clean Water and Sanitation
* SDG 9: Industry, Innovation, and Infrastructure
* SDG 8: Decent Work and Economic Growth

Case studies/Activity report

Prepare a report on hardness of water samples in and around your area and suggest your idea for removal of hardness.
Apply the knowledge of pH determination for health drinks, beverages, soil, effluent and other biological samples and prepare a case study report.

Lab Manual

1.	"Engineering Physics Lab Manual", Department of Physics, KSRCT.
2.	"Chemistry Lab Manual Volume I & II", Department of Chemistry, KSRCT.

Course Designer(s) - Physics
Dr. V. Vasudevan - vasudevanv@ksrct.ac.in
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Dr. P. Suthanthira Kumar - suthanthirakumar@ksrct.ac.in

Course Designer(s) - Physics
Dr.T.A.Sukantha – sukantha@ksrct.ac.in
Dr.B.Srividhya - srividyab@ksrct.ac.in
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Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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60 ME 0P1	Fabrication and Reverse Engineering Laboratory	Category	L	T	P	Credit
		ES	0	0	4	2

Objectives

- To acquire skills in operating hand tools and instruments.
- To provide hands-on training on Carpentry, Sheet metal, Fitting and Welding.
- To provide hands-on training on household wiring and electronic circuits.
- To offer real time activity on plumbing connections in domestic applications.
- To provide hands-on activities on dismantling, and assembling the Home Appliance, Center lathe operations, computer's internal components and peripherals.

Pre-requisites

- NIL

Course Outcomes

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

CO1	Perform power tools operations.	Apply
CO2	Make a wooden model using carpentry process	Apply
CO3	Make a model using sheet metal, filing and joining a MS Plate	Apply
CO4	Repair and Maintenances of water lines for home applications	Apply
CO5	Trouble shoots the electrical and electronic circuits, Electrical machines and realizes the reputation of house wiring, home Appliance, computer internal components and peripherals.	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)	
	Lab	Activity			
Remember	-	-	-	-	-
Understand	25	12	50		50
Apply	25	13	50		50
Analyze	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-
Total	50	25	100	-	100

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech. – Food Technology

60 ME 0P1 -Fabrication and Reverse Engineering Laboratory

Semester	Hours/Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	0	0	4	60	2	60	40	100

Performs of Power Tools*

Drilling in different Walls and Materials Fitting of Hand shower mount, Shirt hanger, Towel hanger and Pipe with clamps.

Carpentry Process*

Design and Development of Wooden Model using the Carpentry Process T / Cross Joint / different joints

Sheet Metal and Filling Process*

Design and Development of Metal Model - Make a Tray Components using Sheet Metal Process and Mating of Square joint in MS Plate using the Filling Process

Welding Process*

Fabrication of Models with MS Plate using Arc Welding- Lap Joint, Butt Joint, T Joint

Plumbing Process*

Repair and Maintenances of Pipe Fitting for Home Applications Study of plumbing tools, assembly of G.I. pipes/ PVC and pipe fittings, cutting of threads in G.I. Pipes by thread cutting dies.

Residential house wiring*

Design and Excusion of Residential house wiring with and without UPS- 1 BHK - 2 BHK. Design and fabrication of domestic LED lamps - Circuit designing (calculation of components)

Electronic Circuit wiring*

PCB fabrication – Soldering - Assembling of Audio Amplifiers- Connecting USB/Bluetooth MP3 player board - Connecting Volume controllers - Connecting bass & treble filter boards - Connecting Surround and sub-woofer filter board

Assembling and dismantling of Electronics Machines*

Iron box, Induction stove, Water heater, Mixer, Table fan, Ceiling fan

Study Exercises

Demonstration of Centre Lathe Operations Facing, Turning, and drilling and its components. Assemble and dismantle of Vacuum Cleaner / Refrigerator and its components

Computer Hardware Study Exercises

Identify internal components of computer - Assemble and dismantle desktop computer systems

List of Experiments:

1. Fitting of Wall mounting Parts using Power Tools

a) Drilling in different Walls and Materials

b) Fitting of Hand shower mount, Shirt hanger, Towel hanger and Pipe with Clamps.

2. Making of Wooden model using the Carpentry Process

a) T / Cross Joint

b) Mortise and Tenon Joint / different joints

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3. Making of Metal Model

a) Making of Components using Sheet Metal Process

b) Mating of Components using the Filling Process

4. Fabrication of Welded model

5. Repair and Maintenance of Pipe Fitting for Home Applications

a) Assembly of GI pipes/PVC and Pipe Fitting

b) Cutting of Threads in GI pipes by thread Cutting Dies

6. Assembling and dismantling of

a) Iron box

b) Induction stove

c) Water heater

d) Mixer

e) Table fan

f) Ceiling fan

7. Design and Execution of Residential house wiring

a) 1 BHK

b) 2 BHK

8. Design and Execution of Residential house wiring with UPS.

a) 1 BHK

b) 2 BHK

9. Design and fabrication of domestic LED lamps

a) Circuit designing (calculation of components)

b) PCB fabrication

c) Soldering

10. Assembling of Audio Amplifiers

a) Connecting USB/Bluetooth MP3 player board

b) Connecting Volume controllers

c) Connecting bass & treble filter boards

d) Connecting Surround and sub-woofer filter board

Study Exercises

1. Demonstration of Centre Lathe and its operations like Facing, Turning, and drilling.
2. Dismantle and Assemble of Vacuum Cleaner / Refrigerator.
3. Study of components of computer. Dismantle and assemble of desktop computer systems

***SDG 9 – Industry Innovation and Infrastructure**

Course Designer(s)

1. Mr.S Sakthivel - sakthivel_s@ksrct.ac.in
2. Dr. D Sri Vidya - srividhya@ksrct.ac.in
3. Mr. K.Raguvaran – raguvaran@ksrct.ac.in

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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BOARD OF STUDIES

K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)
B.E. / B.Tech. Degree Programme
SCHEME OF EXAMINATIONS
(For the candidates admitted in 2023-2024)
SECOND SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1	60 EN 002	Professional English II	2	40	60	100	45	100
2	60 MA 003	Integrals, Partial Differential Equations and Laplace transform	2	40	60	100	45	100
3	60 ME 004	Engineering Mechanics	2	40	60	100	45	100
4	60 CS 001	C Programming	2	40	60	100	45	100
5	60 EE 001	Basic Electrical and Electronics Engineering	2	40	60	100	45	100
6	60 MY 001	Environmental Studies and Climate Change	2	100	-	100	-	-
7.	60 GE 002	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	2	40	60	100	45	100
PRACTICAL								
8	60 CS 0P1	C Programming Laboratory	3	60	40	100	45	100
9	60 EE 0P1	Basic Electrical and Electronics Engineering Laboratory	3	60	40	100	45	100
10	60 CG 0P1	Career Skill Development I	3	60	40	100	45	100

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory End Semester Examination and 40 marks for practical End Semester Examination.

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Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

CHAIRMAN
BOARD OF STUDIES

60 EN 002	Professional English II	Category	L	T	P	Credit
		HS	1	0	2	2

Objectives

- To help learners improve their vocabulary and enable them to use words appropriately in different academic and professional contexts.
- To help learners develop strategies that could be adopted while reading texts.
- To help learners acquire the ability to speak and write effectively in English in real life and career related situations.
- Improve listening, observational skills, and problem-solving capabilities
- Develop message generating and delivery skills

Pre-requisites

Basic knowledge of reading and writing in English and should have completed Professional English I.

Course Outcomes

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

CO1	Compare and contrast products and ideas in technical texts.	Understand
CO2	Illustrate cause and effects in events, industrial processes through technical texts	Understand
CO3	Infer problems in order to arrive at feasible solutions and communicate them orally and in the written format.	Understand
CO4	Relate events and the processes of technical and industrial nature.	Remember
CO5	Demonstrate their opinions in a planned and logical manner, and draft effective résumés in context of job search.	Understand

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	50	50	80	80
Apply	-	-	-	-
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
Total	60	60	100	100

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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BOARD OF STUDIES

K.S.Rangasamy College of Technology–AutonomousR2022

B.Tech. Food Technology

60 EN 002 - Professional English II

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	1	0	2	45	2	40	60	100

Making Comparisons* **Listening:** Evaluative Listening: Advertisements, Product Descriptions, - Audio / video; filling a graphic organiser (choosing a product or service by comparison) **Speaking:** Marketing a product, persuasive speech techniques. **Reading:** Reading advertisements, user manuals and brochures. **Writing:** Professional emails, Email etiquette - compare and contrast essay. **Language Focus:** mixed tenses, prepositional phrases, same words used in different contexts and discourse Markers	**[9]**
Expressing Causal Relations in Speaking and Writing* **Listening:** Listening to longer technical talks and completing– gap filling exercises. Listening technical information from podcasts – Listening to process/event descriptions to identify cause & effects. **Speaking:** Describing and discussing the reasons of accidents or disasters based on news reports. **Reading:** longer technical texts– cause and effect essays, and letters / emails of complaint, **Writing:** Writing responses to complaints **Language Focus:** Active Passive Voice transformations, Infinitive and Gerunds – Word Formation (Noun-Verb-Adj-Adv), Adverbs.	**[9]**
Problem Solving* **Listening:** Listening to / watching movie scenes/ documentaries depicting a technical problem and suggesting solutions. **Speaking:** Group Discussion (based on case studies), - techniques and Strategies. **Reading:** Case Studies, excerpts from literary texts, news reports etc. **Writing:** Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay **Language Focus:** Error correction; If conditional sentences - Compound Words, Sentence Completion.	**[9]**
Reporting of Events and Research* **Listening:** Listening Comprehension based on new report and documentaries **Speaking:** Interviewing, presenting oral reports, Mini presentations on select topics. **Reading:** Newspaper articles. **Writing:** Recommendations, Transcoding, Accident Report, Precis writing and Summarizing **Language Focus:** Reported Speech – Modals - Conjunctions- use of Prepositions	**[9]**
The Ability to put Ideas or Information Coherently* **Listening:** Listening to TED Talks, Presentations, Formal job interviews, (analysis of the interview performance). **Speaking:** Participating in role plays, virtual interviews, making presentations with visual aids **Reading:** excerpts of interview with professionals **Writing:** Job / Internship application – Cover letter & Résumé **Language Focus:** Numerical Adjectives, question types: Wh/ Yes or No/ and Tags; Relative Clauses - Idioms.	**[9]**
Total Hours:	**45**

Text Book(s):

1. *'English for Engineers & Technologists'* Orient Blackswan Private Ltd. Department of English, Anna University, 2020
2. Norman Lewis, *'Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book'*, Penguin Random House India, 2020

Reference(s):

1. Raman. Meenakshi, Sharma. Sangeeta, *'Professional English'*. Oxford university press. New Delhi. 2019
2. Arthur Brookes and Peter Grundy,' *Beginning to Write: Writing Activities for Elementary and Intermediate Learners',* Cambridge University Press, New York, 2003
3. Prof.. Sharma R.C & Krishna Mohan, *'Business Correspondence and Report Writing'*, Tata McGraw Hill & Co. Ltd., New Delhi, 2001
4. Arora V.N. and Laxmi Chandra, *'Improve Your Writing'*, Oxford University Press, New Delhi, 2001

*** SDG- 04- Quality Education**

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Making Comparisons**	
1.1	Evaluative Listening	1
1.2	Product Descriptions and filling a graphic organiser	1
1.3	Marketing a product by using persuasive techniques	2
1.4	Reading advertisements, user manuals and brochures	1
1.5	Writing professional emails	1
1.6	Compare and contrast essay	1
1.7	mixed tenses and prepositional phrases	1
1.8	Same words used in different contexts	1
2.0	**Expressing Causal Relations in Speaking and Writing**	
2.1	Listening to longer technical talks	1
2.2	Listening to process/event descriptions	1
2.3	Describing and discussing the reasons of accidents or disasters	1
2.4	Reading longer technical texts– cause and effect essays	1
2.5	Writing responses to complaints	1
2.6	Active Passive Voice transformations	2
2.7	Infinitive and Gerunds	1
2.8	Word Formation (Noun-Verb-Adj-Adv), Adverbs.	1
3.0	**Problem Solving**	
3.1	Listening to documentaries and suggesting solutions	1
3.2	Group Discussion (based on case studies)	2
3.3	Reading Case Studies, excerpts from literary texts and news reports	1
3.4	Letter to the Editor	1
3.5	Checklists	1
3.6	Problem solution and argumentative essays	1
3.7	Error correction and Sentence Completion	1
3.8	If conditional sentences	1
4.0	**Reporting of Events and Research**	
4.1	Listening Comprehension	1
4.2	Interviewing and presenting oral reports	1
4.3	Mini presentations on select topics	1
4.4	Reading newspaper articles	1
4.5	Recommendations	1
4.6	Transcoding	1
4.7	Precis writing and Summarising	1
4.8	Reported Speech, Modals	1
4.9	Conjunctions	
5.0	**The Ability to put Ideas or Information Coherently**	
5.1	Listening to Formal job interviews	1
5.2	Role plays	2
5.3	Virtual interviews	1
5.4	Reading Company profiles	1
5.5	Writing Statement of Purpose (SoPs)	1
5.6	Writing Résumé	1
5.7	Numerical Adjectives and Relative Clauses - Idioms	1
5.8	question types: Wh/ Yes or No/ and Tags	1

Course Designer(s)

1 Dr.A.Palaniappan - palaniappan@ksrct.ac.in

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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BOARD OF STUDIES

60 MA 003	Integrals, Partial Differential Equations and Laplace Transform	Category	L	T	P	Credit
		BS	3	1	0	4

Objectives

- To acquire the knowledge about multiple integrals.
- To familiarize the basic concepts of vector calculus.
- To get exposed to the fundamentals of analytic functions.
- To solve various types of partial differential equations.
- To familiarize the concepts of Laplace transform.

Pre-requisites

- NIL

Course Outcomes

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

CO1	Interpret the basic concepts of double and triple integrals.	Apply
CO2	Interpret the basic concepts of vector calculus.	Apply
CO3	Construct the analytic functions and evaluate complex integrals.	Apply
CO4	Compute the solution of partial differential equations using different methods.	Apply
CO5	Apply Laplace transform techniques for solving differential equations.	Apply

Mapping with Programme Outcomes

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

3 - Strong; 2 - Medium; 1 – Some

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	10	10	10	10
Understand	10	10	30	30
Apply	40	40	60	60
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
Total	60	60	100	100

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S. Rangasamy College of Technology – Autonomous (R 2022)

B.Tech. Food Technology

60 MA 003 –Integrals, Partial Differential Equations and Laplace Transform

Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	1	0	60	4	40	60	100

Multiple Integrals Double integration – Cartesian and polar co-ordinates – Change of order of integration – Area as double integral – Triple integration in Cartesian co-ordinates – Change of variables - Cartesian to polar co-ordinates and Cartesian to Cylindrical co-ordinates. **Hands - on:** Evaluating double integrals, triple integrals, area as double integrals and volume as triple integrals.	[9]
Vector Calculus* Introduction - Gradient of a scalar point function –Directional derivative – Angle of intersection of two surfaces – Divergence and curl (excluding vector identities) – Solenoidal and irrotational vectors – Application: Green's theorem in the plane – Gauss divergence theorem -Stokes' theorem (statement only). **Hands - on:** Evaluating Gradient, divergence and curls.	[9]
Analytic Functions and Integrals Analytic function – Necessary and Sufficient conditions (statement only)-Properties – Harmonic function – Construction of an analytic function – Cauchy's Integral theorem (statement only) – Cauchy's integral formula – Classification of singularities – Application: Cauchy's residue theorem. **Hands - on:** Plotting and visualizing functions of single variable, two and three variables.	[9]
Partial Differential Equations* Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions – Non-Linear partial differential equations of first order – Lagrange's linear equations – Application: Homogeneous Linear partial differential equations with constant coefficients. **Hands - on:** Calculate homogeneous linear partial differential equations.	[9]
Laplace Transform Conditions for existence – Transforms of elementary functions – Basic properties - Derivatives and integrals of transforms - Initial and final value theorem – Transform of periodic functions. Inverse Laplace transform – Convolution theorem (excluding proof) – Application: Solution of second order ordinary differential equations with constant co-efficients. **Hands - on:** Evaluating laplace, Inverse laplace transforms and solve differential equations.	[9]
Total Hours: 45 + 5(Hands on) + 10(Tutorial)	**60**

Text Book(s):

1. Grewal B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2017.
2. Kreyszig Erwin, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Limited,New Delhi, 2016.

Reference(s):

1. Dass H.K, "Higher Engineering Mathematics", 3rd (Revised) Edition, S.Chand& Company Ltd, New Delhi, 2014.
2. Veerarajan T, "Engineering Mathematics", for Semesters I & II, 1st Edition, Tata McGraw Hill Publishing Co., New Delhi, 2019.
3. Kandasamy P, Thilagavathy K and Gunavathy K, "Engineering Mathematics - I", S.Chand& Company Ltd, New Delhi, 2017
4. Bali N P and Manish Goyal, A text book of Engineering Mathematics",10th Edition, Laxmi Publications(P) Ltd, 2016.

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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BOARD OF STUDIES

Course Contents and Lecture Schedule

S.No	Topic	No.of Hours
1	**MULTIPLE INTEGRALS**	
1.1	Double integration	1
1.2	Cartesian and polar coordinates	1
1.3	Change of order of integration	1
1.4	Area as double integral	1
1.5	Triple integration in Cartesian coordinates	1
1.6	Change of variables	2
1.7	Cartesian to polar coordinates	1
1.8	Cartesian to Cylindrical coordinates	1
1.9	Tutorial	2
1.10	Hands on	1
2	**VECTOR CALCULUS**	
2.1	Introduction: Gradient of a scalar point function	1
2.2	Directional derivative	1
2.3	Angle of intersection of two surfaces	1
2.4	Divergence and curl (excluding vector identities)	1
2.5	Solenoidal and irrotational vectors	1
2.6	Application: Green's theorem in the plane	1
2.7	Gauss divergence theorem	2
2.8	Stokes' theorem (statement only)	1
2.9	Tutorial	2
2.10	Hands on	1
3	**ANALYTIC FUNCTIONS AND INTEGRALS**	
3.1	Analytic function	1
3.2	Necessary and Sufficient conditions (statement only)	1
3.3	Properties	1
3.4	Harmonic function	1
3.5	Construction of an analytic function	1
3.6	Cauchy's Integral theorem (statement only), Cauchy's integral formula	2
3.7	Classification of singularities	1
3.8	Applications : Cauchy's residue theorem.	1
3.9	Tutorial	2
3.10	Hands on	1
4	**PARTIAL DIFFERENTIAL EQUATIONS**	
4.1	Formation of partial differential equations by eliminating arbitrary constants	1
4.2	Formation of partial differential equations by eliminating arbitrary functions	2
4.3	Non- linear partial differential equations of first order	3
4.4	Lagrange's linear equations	1
4.5	Application: Homogeneous Linear partial differential equations with constant coefficients.	2

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4.6	Tutorial	2
4.7	Hands on	1
5	**LAPLACE TRANSFORM**	
5.1	Conditions for existence	1
5.2	Transforms of elementary functions	1
5.3	Basic properties	1
5.5	Derivatives and integrals of transforms, Initial and final value theorem	1
5.6	Transform of periodic functions	1
5.7	Inverse Laplace transform	1
5.8	Convolution theorem (excluding proof)	1
5.9	Application: Solution of second order ordinary differential equation with constant co-efficient.	2
5.10	Tutorial	2
5.11	Hands on	1
	Total	60

Course Designers

1. Dr.C.Chandran - cchandran@ksrct.ac.in

2. Dr.K.Prabakaran -prabakaran@ksrct.ac.in

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60 ME 004	Engineering Mechanics	Category	L	T	P	Credit
		ES	3	1	0	4

Objectives

- To learn a process for analysis of static objects, concepts of force, moment, and mechanical equilibrium in two and three dimensions.
- To learn the equilibrium of rigid bodies such as frames, trusses, beams.
- To identify the properties of surfaces and solids by using different theorem.
- To learn the principle of frictional forces at the contact surfaces and impart basic concept of dynamics of particles.
- To acquire the concept of elements of rigid body dynamics

Pre-requisites

NIL

Course Outcomes

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

CO1	Use scalar and vector analytical techniques for analyzing forces in statically determinate structures.	Apply
CO2	Apply basic knowledge of scientific concepts to solve real-world problems.	Apply
CO3	Calculate the properties of surfaces and solids using various theorems.	Apply
CO4	Determine the effect of frictional forces and the dynamic forces exerted in the particle	Apply
CO5	Analysis of rigid body dynamics and calculation of member forces in the rigid body	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	30	30
Apply	30	30	50	50
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
Total	60	60	100	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech. Food Technology

60 ME 004 – Engineering Mechanics

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	1	0	60	4	40	60	100

Basics and Statics of Particles Introduction -Units and Dimensions-Laws of Mechanics–Principle of transmissibility-Lame's theorem, Parallelogram and triangular Law of forces–Vectors–Vectorial representation of forces and moments. **Vector operations** Addition, subtraction, dot product, cross product-Coplanar Forces–Resolution and Composition of forces– Equilibrium of a particle–Forces in space-Equilibrium of a particle in space-Equivalent systems of forces-Single equivalent force.	[12]
Equilibrium of Rigid Bodies Free body diagram–Types of supports and their reactions–requirements of stable equilibrium–Static determinacy, Moments and Couples–Moment of a force about a point and about an axis–Vectorial representation of moments and couples–Varignon's theorem-Equilibrium of Rigid bodies in two dimensions.	[12]
Properties of Surfaces and Solids Determination of Areas and Volumes-Centroid, Moment of Inertia of plane area (Rectangle, circle, triangle using Integration Method; T section, I section, Angle section, Hollow section using standard formula) - Parallel axis theorem and perpendicular axis theorem- Polar moment of inertia -Mass moment of inertia of thin rectangular section.	[12]
Friction Frictional force–Laws of Coloumb friction–Simple contact friction–Ladder friction-Rolling resistance–Ratio of tension in belt. **Dynamics of Particles** Displacement, Velocity, acceleration and their relationship–Relative motion -Projectile motion in horizontal plane– Newton's law–Work Energy Equation – Impulse and Momentum.	[12]
Elements of Rigid Body Dynamics Translation and Rotation of Rigid Bodies: Velocity and acceleration–General Plane motion: Crank and Connecting rod mechanism.	[12]
Total : 45 + 15 (Tutorial)	**60**

Text Book(s):

1.	Rajasekaran, S., Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., 3rd Edition, 2017.
2.	Beer, F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", Statics and Dynamics, McGraw-Hill International, 11th Edition, 2016.

Reference(s):

1.	Jayakumar, V. and Kumar, M, "Engineering Mechanics", PHI Learning Private Ltd, New Delhi, 2012
2.	Hibbeller, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd.,
3.	Bansal R.K," Engineering Mechanics" Laxmi Publications (P) Ltd, 2011.
4.	Irving H. Shames, Engineering Mechanics: Statics and Dynamics", Pearson Education Asia Pvt. Ltd, 4thEdition, 2003.
5.	James M. Gere and Timoshenko, "Mechanics of Materials", CBS Publisher, New Delhi, 6th Edition, 2012

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**BASICS AND STATICS OF PARTICLES**	
1.1	Introduction, Units and Dimensions, Laws of Mechanics	1
1.2	Principle of transmissibility, Lame's theorem,	1
1.3	Parallelogram and triangular Law of forces	1
1.4	Tutorial	2
1.5	Vectors, Vectorial representation of forces and moments	1
1.6	Vector operations, Coplanar Forces–Resolution and Composition of forces	2
1.7	Equilibrium of a particle, Forces in space	1
1.8	Equivalent systems of forces-Single equivalent force.	1
1.9	Tutorial	2
2.0	**EQUILIBRIUM OF RIGID BODIES**	
2.1	Free body diagram, Types of supports and their reactions	1
2.2	Requirements of stable equilibrium, Static determinacy	1
2.3	Moments and Couples–Moment of a force about a point and about an axis	2
2.4	Vectorial representation of moments and couples	1
2.5	Tutorial	2
2.6	Varignon's theorem	1
2.7	Equilibrium of Rigid bodies in two dimensions	2
2.8	Tutorial	2
3.0	**PROPERTIES OF SURFACES AND SOLIDS**	
3.1	Determination of Areas and Volumes-Centroid	1
3.2	Moment of Inertia of plane area (Rectangle, circle, triangle using Integration Method)	2
3.3	Tutorial	2
3.4	Moment of Inertia of plane area(T section, I section, Angle section)	1
3.5	Moment of Inertia of plane area(Hollow section)	1
3.6	Parallel axis theorem and perpendicular axis theorem	1
3.7	Polar moment of inertia	1
3.8	Mass moment of inertia of thin rectangular section.	1
3.9	Tutorial	2
4.0	**FRICTION &DYNAMICS OF PARTICLES**	
4.1	Frictional force, Laws of Coloumb friction, Simple contact friction	1
4.2	Ladder friction	1
4.3	Rolling resistance–Ratio of tension in belt	1
4.4	Tutorial	2
4.5	Displacement, Velocity, acceleration and their relationship, Relative motion	1
4.6	Projectile motion in horizontal plane	1
4.7	Newton's law	1
4.8	Work Energy Equation	1
4.9	Impulse and Momentum	1
4.10	Tutorial	2
5.0	**ELEMENTS OF RIGID BODY DYNAMICS**	
5.1	Translation and Rotation of Rigid Bodies	1
5.2	Translation and Rotation of Rigid Bodies - Velocity	2
5.3	Translation and Rotation of Rigid Bodies - acceleration	2
5.4	Tutorial	2
5.5	General Plane motion	1
5.6	General Plane motion - Crank and Connecting rod mechanism	2
5.7	Tutorial	2

Course Designer(s)

1. Mr.S.Karthick -skarthick@ksrct.ac.in

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60 CS 001	C Programming	Category	L	T	P	Credit
		ES	3	0	0	3

Objectives

- To learn most fundamental element of the C language and to examine the execution of branching, looping statements,
- To examine the concepts of arrays, its characteristics and types and strings.
- To understand the concept of functions, pointers and the techniques of putting them to use
- To apply the knowledge of structures and unions to solve basic problems in C language
- To enhance the knowledge in file handling functions for storage and retrieval of data

Pre-requisites

NIL

Course Outcomes

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

CO1	Construct the fundamental building blocks of structured Programming in C	Apply
CO2	Implement the different operations on arrays and strings	Apply
CO3	Develop simple real world applications utilizing functions, recursion and pointers.	Apply
CO4	Demonstrate the concepts of structures ,unions ,user defined data types and preprocessor	Apply
CO5	Interpret the file concepts using proper standard library functions for a given application	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	10	10	20	20
Apply	40	40	60	60
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
Total	60	60	100	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech. Food Technology

60 CS 001 – C Programming

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Basics of C, I/O, Branching and Loops Structure of a C Program – Data types – Keywords - Variables – Type Qualifiers - Constants – Operators–expressions and precedence- Console I/O– Unformatted and Formatted Console I/O - Conditional Branching and Loops-Writing and evaluation of conditionals and consequent branching	[8]
Arrays and Strings Arrays: One Dimensional Arrays - Two Dimensional Arrays – Matrix Manipulation - Character arrays – Strings: String Manipulation with and without String Handling Functions.	[7]
Functions and Pointers Functions: Scope of a Function – Library Functions and User defined functions - Function Prototypes – Call by value and Call by reference – Function Categorization- Arguments to main function— Recursion and application - Passing Arrays to Functions– Storage class Specifiers. Introduction to Pointer Variables - The Pointer Operators - Pointer Expressions - Pointers and Arrays - Generating a Pointer to an Array - Indexing Pointers– Function and pointers - Dynamic memory	[11]
Structures, Unions, Enumerations, Typedef and Preprocessors Structures - Introduction to Structures and Initialization - Arrays of Structures- Arrays and Structures, Nested Structures - Passing Structures to Functions - Structure Pointers - Unions – Bit Fields - Enumerations - typedef –The preprocessor and commands.	[9]
File Handling File: Streams –Reading and Writing Characters - Reading and Writing Strings - File System functions – File Manipulation-Sequential access - Random Access Files – Command Line arguments.	[9]
Total Hours:	**45**

Text Book(s):

1. Herbert Schildt, “The Complete Reference C”, Fourth Edition, Tata McGraw Hill Edition, 2010.
2. Byron Gottfried, “Programming with C”, Third Edition, McGraw Hill Education, 2014.

Reference(s):

1. E.Balagurusamy, “Programming in ANSI C”, Seventh Edition, Tata McGraw Hill Edition, New Delhi, 2016.
2. Brian W. Kernighan and Dennis M. Ritchie, “C Programming Language”, Prentice-Hall.
3. ReemaThareja, “Computer Fundamentals and Programming in C”, Second Edition, Oxford Higher Education, 2016.
4. K N King, “C Programming: A Modern Approach”, Second Edition, W.W.Norton, New York, 2008.

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Basics of C, I/O, Branching and Loops**	
1.1	Structure of a C Program, Keywords	1
1.2	Data types, Type Qualifiers	1
1.3	Variables and Constants	1
1.4	Operators–expressions and precedence	1
1.5	Console I/O– Unformatted and Formatted Console I/O	1
1.6	Conditional Branching	1
1.7	Iteration and loops	2
1.8	Writing and evaluation of conditionals and consequent branching	1
2.0	**Arrays and Strings**	
2.1	One Dimensional Array	1
2.2	Two-Dimensional Array and Matrix Manipulation	1
2.3	Character arrays and Strings Basics	1
2.4	String Manipulation without String Handling Functions	2
2.5	String Manipulation with String Handling Functions	2
3.0	**Functions and Pointers**	
3.1	Scope of a Function – Library Functions, User defined functions and Function Prototypes	1
3.2	Function Call by value and Function Call by reference, Function Categorization	2
3.3	Arguments to main function	1
3.4	Recursion and application	1
3.5	Passing Arrays to Functions	1
3.6	Storage class Specifiers	1
3.7	Introduction to Pointer Variables - The Pointer Operators - Pointer Expressions	1
3.8	Pointers and Arrays - Generating a Pointer to an Array – Indexing Pointers	1
3.9	Function and pointers	1
3.10	Dynamic memory allocation	1
4.0	**Structures, Unions, Enumerations, Type def and Preprocessors**	
4.1	Introduction to Structures and Initialization	1
4.2	Arrays and Structures, Arrays of Structures	1
4.3	Structures within Structures, Passing Structures to Functions	2
4.4	Structure Pointers	1
4.5	Unions and Bit Fields.	1
4.6	Enumerations – type def	1
4.7	Preprocessor commands	2
5.0	**File Handling**	
5.1	File Streams –Reading and Writing Characters - Reading and Writing Strings	2
5.2	File System functions and File Manipulation	2
5.3	Sequential access	2
5.4	Random Access Files	2
5.5	Command Line arguments and files	1

Course Designer(s)

1. Dr.P.Kaladevi -kaladevi@ksrct.ac.in

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BOARD OF STUDIES

60 EE 001	Basic Electrical and Electronics Engineering	Category	L	T	P	Credit
		BS	3	0	0	3

Objectives

- To familiarize the basic concept on electrical circuits and its various parameters
- To facilitate the various types of electrical machines and their uses
- To gain knowledge on Electrical safety
- To provide exposure on the functions of various semiconductor devices
- To familiarize the use of various measuring instruments

Pre-requisite

NIL

Course Outcomes

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

CO1	Apply the basic laws of electric circuits to calculate the unknown quantities.	Apply
CO2	Acquire knowledge on different electrical machines and select suitable machines for industrial applications.	Apply
CO3	Express the significance of various components of low voltage electrical installations and create awareness on electrical safety.	Understand
CO4	Demonstrate the operation and characteristics of various semiconductor devices.	Understand
CO5	Interpret the operating principles of measuring instruments and choose suitable instrument for measuring the parameters.	Understand

Mapping with Programme Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	-		-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	2	-	-	-	-	2	-	2	2
CO3	3	3	-	-	-	2		-	-	-	-	2	-	-	-
CO4	2	2	-	-	-	-	2	-	-	2	-	2	-	2	2
CO5	2	3	-	-	-	-	3	-	3	2	-	2	-	1	1
3- Strong; 2-Medium; 1-Low															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	20	20	20	20
Understand	20	40	40	40
Apply	20	-	40	40
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
Total	60	60	100	100

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
B.Tech. Food Technology								
60 EE 001 - Basic Electrical and Electronics Engineering								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Electrical Circuits DC Circuits: Circuit Components: Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws– Simple problems. Introduction to AC Circuits and Parameters: Waveforms, Average value and RMS Value of Sinusoidal Waveform real power, reactive power and apparent power, power factor – Steady state analysis of RLC series circuits- Simple problems. Introduction to three phase AC circuits	[9]
Electrical Machines* Construction and Working principle - Separately and Self excited DC Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phases Alternator, Synchronous motor and Three Phase Induction Motor.	[9]
Electrical Installations* Domestic wiring, types of wires and cables, earthing, protective devices- switch fuse unit- Miniature Circuit Breaker-Moulded Case Circuit Breaker- Earth Leakage Circuit Breaker, Batteries and types, UPS, Safety precautions and First Aid.	[9]
Analog Electronics Introduction to Semiconductor Materials– PN Junction Diodes, Zener Diode –Characteristics and Applications – Bipolar Junction Transistor - Biasing and Configuration (NPN) - **Regulated Power Supply Unit, Switched Mode Power Supply***.	[9]
Measurements and Instrumentation Functional Elements of an Instrument, Standards and Calibration, Operating Principle, Types -Moving Coil and Moving Iron meters, Operating Principles and Types of Wattmeter, Energy Meter, Instrument Transformers-**CT and PT, DSO-** Block Diagram**- Data Acquisition*.**	[9]
Total Hours	**45**

Text Book(s):	
1.	Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020.
2	A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.
Reference(s):	
1.	Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019.
2.	Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017.
3.	Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
4.	H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010.

***SDG 9 – Industry Innovation and Infrastructure**

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**Electrical Circuits**	
1.1	Circuit Components: Resistor, Inductor, Capacitor	1
1.2	Ohm's Law - Kirchhoff's Laws	1
1.3	Ohm's Law - Kirchhoff's Laws - Problems	1
1.4	Introduction to AC Circuits and Parameters: Waveforms, Average value and RMS Value of Sinusoidal Waveform	2
1.5	Real power, reactive power and apparent power, power factor	1
1.6	Steady state analysis of RLC series circuits	1
1.7	RLC series circuits - Problems	1
1.8	Introduction to three phase system	1
2	**Electrical Machines**	
2.1	Construction and Working principle of DC Generator	1
2.2	Types and Applications of Separately and Self excited DC Generators	1
2.3	EMF equation of DC Generator	1
2.4	Working Principle of DC motors	1
2.5	Torque Equation, Types and Applications	1
2.6	Construction, Working principle and Applications of Transformer	1
2.7	Construction, Working principle and Applications of Three phase Alternator	1
2.8	Construction, Working principle and Applications of Synchronous motor	1
2.9	Construction, Working principle and Applications of Three Phase Induction Motor	1
3	**Electrical Installations**	
3.1	Domestic wiring, types of wires and cables	1
3.2	Earthing, protective devices	2
3.3	Switch fuse unit- Miniature Circuit Breaker	1
3.4	Molded Case Circuit Breaker- Earth Leakage Circuit Breaker	1
3.5	Batteries and types	2
3.6	UPS	1
3.7	Safety precautions and First Aid	1
4	**Analog Electronics**	
4.1	Introduction to Semiconductor Materials	1
4.2	Characteristics and Applications of PN Junction Diodes	2
4.3	Characteristics and Applications of Zener Diode	1
4.4	Bipolar Junction Transistor	1
4.5	Biasing & Configuration (NPN)	2
4.6	Regulated power supply unit	1
4.7	Switched mode power supply	1
5	**Measurements and Instrumentation**	
5.1	Functional elements of an instrument	1
5.2	Standards and calibration	1
5.3	Moving Coil meters - Operating Principle, types	1
5.4	Moving Iron meters - Operating Principle, types	1
5.5	Operating principles and Types of Wattmeter	1
5.6	Energy Meter	1
5.7	Instrument Transformers – CT & PT	1
5.9	DSO- Block diagram- Data acquisition	2
	Total	**45**

Course Designer(s)

1. Mr.S.Srinivasan - srinivasan@ksrct.ac.in
2. Ms.R.Radhamani - radhamani@ksrct.ac.in
3. Ms.S.Jaividhya - jaividhya@ksrct.ac.in
4. Dr.S.Gomathi - gomathi@ksrct.ac.in
5. Mr.T.Prabhu - prabhut@ksrct.ac.in

Passed in BoS Meeting held on 23.12.22
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BOARD OF STUDIES

60 MY 001	Environmental Studies and Climate Change	Category	L	T	P	Credit
		MC	2	0	0	0

Objectives

- To understand the impact climate changes in ecosystem and biodiversity.
- To analyze the impacts of pollution, control and legislation.
- To explain the importance of sustainable development practices.
- To explore the significance of organic farming.
- To identify the Geo-spatial tools for resource management.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Interpret the impacts of pollution on climate change	Understand
CO2	Categorize the wastes and its management.	Analyze
CO3	Identify the different types of sustainable practices	Apply
CO4	Classify the organic farming techniques	Apply
CO5	Categorize the Geo-spatial tools for resource management	Analyze

Mapping with Programme Outcomes

COs	POs												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	3	-	-	-	-	2	-	-	-
CO2	3	2	-	-	-	3	3	2	-	-	-	2	-	-	-
CO3	3	2	-	-	-	3	3	2	-	-	-	2	-	-	-
CO4	3	2	-	-	-	2	3	-	-	-	-	2	-	-	-
CO5	3	2	-	-	3	-	2	-	-	-	-	2	-	-	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (30 Marks)		Quiz (20 marks)		Seminar presentation (50 marks)
	Case Study	Activity Report	Quiz 1	Quiz 2	
Remember	10	10	5	5	10
Understand	30	20	10	10	15
Apply	-	30	-	5	15
Analyze	20	-	5	-	10
Evaluate	-	-	-		-
Create	-	-	-		-
Total	**60**	**60**	**20**	**20**	**50**

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 MY 001 – Environmental Studies and Climate Change								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	2	0	0	30	0	100	-	100

Pollution and its Impact on Climate Change* Pollution: Sources and Impacts of Air Pollution – Greenhouse Effect- Global Warming- Climate Change - Ozone Layer Depletion - Acid Rain. Carbon Footprint - Climate Change on Various Sectors – Agriculture, Forestry and Ecosystem – Climate Change Mitigation and Adaptation. Action Plan on Climate Change. IPCC, UNFCCC, Kyoto Protocol, Montreal Protocol on Climatic Changes.	[6]
Integrated Waste Management** Waste - Types and Classification. Principles of Waste Management (5R Approach) - Swachh Bharat Abhiyan – Commercial Waste, Plastic Waste, Domestic Waste, E-Waste - Biomedical Waste - RiskManagement: Collection, Segregation, Treatment and Disposal Methods. Waste Water Treatment- Activate Sludge Process.	[6]
Sustainable Development Practices*** Sustainable Development Goals (Sdgs) **–** Green Computing- Carbon Trading - Green Building – Eco- Friendly Plastic – Alternate Energy: Hydrogen – Bio-Fuels – Solar Energy – Wind – Hydroelectric Power. Water Scarcity- Watershed Management, Ground Water Recharge and Rainwater Harvesting.	[6]
Environment and Agriculture**** Organic Farming – Bio-Pesticides- Composting, Bio Composting, Vermi- Composting, Roof Gardening and Irrigation. Waste Land Reclamation. Climate Resilient Agriculture. Green Auditing	[6]
Geo-Science in Natural Resource Management Data Base Software in Environment Information- Digital Image Processing Applications in Forecasting. GPS - Remote Sensing and Geographical Information System (GIS) - World Wide Web (Www) - Environmental Information System (ENVIS).	[6]
Total Hours:	**30**

Text Book(s):	
1.	Anubha Kaushik , C P Kaushik. Perspectives in Environmental Studies, New Age International publishers;6th Edition 2018.
Reference(s):	
1.	G.Tyler Miller Environmental Science 14th Edition Cengage Publications, Delhi, 2013
2.	Gilbert M.Masters and Wendell P. Ela,"Environmental Engineering And Science", PHI Learning PrivateLimited, 3rd Edition, 2015
3.	Erach Bharucha. Textbook of Environmental Studies for Undergraduate Courses, Universities Press, 2000

*SDG: 13 – Climate Action
**SDG: 4 – Clean Water and Sanitation
***SDG: 6 - Affordable and Clean Energy
****SDG: 3 – Good Health and Well-being

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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Course Contents and Lecture Schedule

S.No	Topic	No. of hours
1.0	**Pollution and its impact on climate change**	
1.1	Pollution: Sources and impacts of air pollution – greenhouse effect- Global warming- climate change - ozone layer depletion - acid rain	2
1.2	Climate change on various sectors: Agriculture, forestry and ecosystem. – climate change mitigation and adaptation	1
1.3	Action plan on climate change - IPCC, UNFCCC, Kyoto Protocol, Montreal Protocol on Climatic Changes	1
2.0	**Integrated Waste Management**	
2.1	Waste - Types and classification. Principles of waste management (5R approach) - Swachh Bharat Abhiyan	1
2.2	Commercial waste, plastic waste, domestic waste, e-waste and biomedical waste	1
2.3	Risk management: Collection, segregation, treatment and disposal methods.	1
3.0	**Sustainable development practices**	
3.1	Sustainable development goals (SDGs) **–** Green computing- Carbon trading - Green building – Eco- friendly plastic	1
3.2	Alternate energy: Hydrogen – Bio-fuels – Solar energy – Wind – Hydroelectric power	2
3.3	Water scarcity- Watershed management, ground water recharge and rainwater harvesting	1
4.0	**Environment and Agriculture**	
4.1	Organic farming – bio-pesticides	1
4.2	Composting, bio composting, vermi-composting	1
4.3	Roof gardening and irrigation	1
4.4	Waste land reclamation. Climate resilient agriculture, Green auditing	1
5.0	**Geo-science in natural resource management**	
5.1	Data base software in environment information, Digital image processing applications in forecasting	2
5.2	GPS, Remote Sensing and Geographical Information System (GIS)	1
5.3	World wide web (www), Environmental information system (ENVIS)	1
	Total	20

Course Designer(s)

1. Dr.T.A.Sukantha - sukantha@ksrct.ac.in
2. Dr.B.Srividhya - srividhya@ksrct.ac.in
3. Dr.S.Meenachi - meenachi@ksrct.ac.in
4. Ms.D.Kirthiga - kiruthiga@ksrct.ac.in

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60 GE 002	Tamils and Technology (Common to all Branches)	Category	L	T	P	Credit
		GE	1	0	0	1[$]

Objectives

- To learn weaving, ceramic and construction technology of Tamils.
- To understand the agriculture, irrigation and manufacturing technology of Tamils.
- To realize the development of scientific Tamil and Tamil computing

Pre-requisites

- Nil

Course Outcomes

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

CO1	Understand the weaving and ceramic technology of ancient Tamil people nature.	Understand
CO2	Comprehend the construction technology, building materials in sangam period and case studies.	Understand
CO3	Infer the metal process, coin and beads manufacturing with relevant archeological evidence.	Understand
CO4	Realize the agriculture methods, irrigation technology and pearl diving.	Understand
CO5	Apply the knowledge of scientific Tamil and Tamil computing.	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment (Marks)	End Sem Examination (Marks)
Remember	20	40
Understand	40	40
Apply	-	20
Analyse	-	-
Evaluate	-	-
Create	-	-
Total	60	100

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B. Tech. Food Technology

60 GE 002- Tamils and Technology

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	1	0	0	15	1*	40	60	100

Weaving and Ceramic Technology* Weaving Industry During Sangam Age – Ceramic Technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.	[3]
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.	[3]
Manufacturing Technology* Art of Ship Building – Metallurgical Studies – Iron Industry – Iron Smelting ,Steel -Copper and Gold coins 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.	[3]
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.	[3]
Scientific Tamil and 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.	[3]
Total Hours:	**15**

Text Book(s):

1.	தமிழக வரலாறு - மக்களும் பண்பாடும் கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.	கணினித்தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு).
4.	பொருநை - ஆற்றங்கரை நாகரீகம் (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.Subaramanian, 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.

*SDG 4 – Quality Education

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60 GE 002	தமிழரும் தொழில்நுட்பமும் (அனைத்து துறைகளுக்கும் பொதுவானது)	Category	L	T	P	Credit
		GE	1	0	0	1[$]

பாடத்தின் நோக்கங்கள்:

நுட்பம் குறித்து அறிதல்.

- தமிழர்களின் சங்ககால வேளாண்மை, நீர்ப்பாசனம் மற்றும் உற்பத்தி முறைகள் குறித்த கற்றல்.
- நவீன அறிவியல் தமிழ் மற்றும் கணித்தமிழ் குறித்த புரிதல்.

முன்கூட்டிய துறைசார் அறிவு:

- தேவை இல்லை

Course Outcomes

பாடத்தை வெற்றிகரமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள்

CO1	சங்ககாலத் தமிழர்களின் நெசவு மற்றும் பானை வனைதல் தொழில்நுட்பம் குறித்த கற்றுணர்தல்	புரிதல்
CO2	சங்ககாலத் தமிழர்களின் கட்டிட தொழில்நுட்பம் கட்டுமானப் பொருட்கள் மற்றும் அவற்றை விளக்கும் தளங்கள் குறித்த அறிவு.	புரிதல்
CO3	சங்ககாலத் தமிழர்களின் உலோகத் தொழில், நாணயங்கள் மற்றும் மணிகள் சார்ந்த தொல்லியல் சான்றுகள் பற்றிய அறிவு.	புரிதல்
CO4	சங்ககாலத் தமிழர்களின் வேளாண்மை, நீர்ப்பாசன முறைகள் மற்றும் முத்து குளித்தல் குறித்த தெளிவு.	புரிதல்
CO5	நவீன அறிவியல் தமிழ் மற்றும் கணித்தமிழ் குறித்த புரிந்துகொள்ளலும் மற்றும் பயன்படுத்துதலும்.	பகுப்பாய்வு

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment (Marks)	End Sem Examination (Marks)
Remember	20	40
Understand	40	40
Apply	-	20
Analyse	-	-
Evaluate	-	-
Create	-	-
Total	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B. Tech. Food Technology

60 GE 002 – தமிழரும் தொழில்நுட்பமும்

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	1	0	0	15	1	40	60	100

நெசவு மற்றும் பானைத் தொழில்நுட்பம்: சங்ககாலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம்-கருப்பு சிவப்புபாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.	[3]
வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில்வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமானப் பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கல் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ -சாரோசெனிக் கட்டிடக் கலை.	[3]
உற்பத்தித்தொழில்நுட்பம்: கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை -இரும்பை உருக்குதல்,எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள்- நாணயங்கள் அச்சடித்தல்- மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள் ,கண்ணாடிமணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	[3]
வேளாண்மை மற்றும் நீர்பாசனத் தொழில் நுட்பம்: அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம்- கால்நடை பராமரிப்பு - கால்நடைகளுக்கான வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டையஅறிவு - அறிவுசார் சமூகம்.	[3]
அறிவியல் தமிழ் மற்றும் கணித்தமிழ் அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்புசெய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.	[3]
Total Hours:	**15**

Text Book(s):

1.	தமிழக வரலாறு-மக்களும் பண்பாடும் கே. கே .பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.	கணினித்தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு).
4.	பொருநை - ஆற்றங்கரை நாகரீகம் (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.Subaramanian, 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:

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	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.

*SDG 4 – Quality Education

60 CS 0P1	C Programming Laboratory	Category	L	T	P	Credit
		ES	0	0	4	2

Objectives

- To enable the students to apply the concepts of C to solve simple problems
- To use selection and iterative statements in C programs
- To apply the knowledge of library functions in C programming
- To implement the concepts of arrays, functions, structures and pointers in C
- To implement the file handling operations through C

Pre-requisites

NIL

Course Outcomes

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

CO1	Implement computational problems using selection and iterative statements	Apply
CO2	Demonstrate C program to manage collection of related data.	Apply
CO3	Design and Implement different ways of passing arguments to functions, Recursion and implement pointers concepts.	Apply
CO4	Develop a C program to manage collection of different data using structures, Union, user-defined data types and preprocessor directives.	Apply
CO5	Demonstrate C program to store and retrieve data using file concepts.	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	12	-	-
Apply	50	13	100	100
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

Passed in BoS Meeting held on 23.12.22
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BOARD OF STUDIES

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 CS 0P1 – C Programming Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	0	0	4	60	2	60	40	100

List of Experiments:

1. Implementation of Simple computational problems using various formulas*.
2. Implementation of Problems involving Selection statements*.
3. Implementation of Iterative problems e.g., sum of series*.
4. Implementation of 1D Array manipulation*.
5. Implementation of 2D Array manipulation*.
6. Implementation of String operations*.
7. Implementation of Simple functions and different ways of passing arguments to functions and Recursive Functions*.
8. Implementation of Pointers*
9. Implementation of structures and Union*.
10. Implementation of Bit Fields, Typedef and Enumeration*.
11. Implementation of Preprocessor directives*.
12. Implementation of File operations*.

*SDG 4 – Quality Education

Course Designer(s)

1. Dr.P.Kaladevi - kaladevi@ksrct.ac.in

Passed in BoS Meeting held on 23.12.22
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60 EE 0P1	Basic Electrical and Electronics Engineering Laboratory	Category	L	T	P	Credit
		ES	0	0	4	2

Objectives

- To acquire knowledge in conducting basic electrical laws
- To gain knowledge on three phase power measurement
- To train the students in conducting load tests on electrical machines
- To gain practical experience in characterizing electronic devices
- To gain practical experience in using measuring devices

Pre-requisites

NIL

Course Outcomes

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

CO1	Practice experimental methods to verify the Ohm's and Kirchhoff's Laws.	Apply
CO2	Perform the three-phase power measurement.	Apply
CO3	Demonstrate the load characteristics of electrical machines.	Apply
CO4	Describe the characteristics of basic electronic devices.	Understand
CO5	Use the appropriate measuring devices to measure the electrical parameters.	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	25	13	50	50
Apply	25	12	50	50
Analyze	-	-	-	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

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K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 EE 0P1 - Basic Electrical and Electronics Engineering Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	0	0	4	60	2	60	40	100

List of Experiments:

1. Verification of Ohm's and Kirchhoff's Laws.
2. Measurement of Three Phase Power.
3. Load test on DC Shunt Motor.
4. Load test on Self Excited DC Generator.
5. Load test on Single phase Transformer.
6. Load test on Induction Motor.
7. Characteristics of PN and Zener Diodes.
8. Characteristics of BJT (CE).
9. Calibration of Single-Phase Energy Meter.*
10. Mini Project.*

***SDG 9 – Industry Innovation and Infrastructure**

Course Designer(s)

1. Mr.S.Srinivasan - srinivasan@ksrct.ac.in
2. Ms.R.Radhamani - radhamani@ksrct.ac.in
3. Ms.S.Jaividhya - jaividhya@ksrct.ac.in
4. Dr.S.Gomathi - gomathi@ksrct.ac.in
5. Mr.T.Prabhu - prabhut@ksrct.ac.in

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60 CG 0P1	Career Skill Development I	Category	L	T	P	Credit
		CG	0	0	2	1*

Objectives

- To help learners improve their vocabulary and to enable them to use words appropriately in different academic and professional contexts
- To help learners develop strategies that could be adopted while reading texts
- To help learners acquire the ability to speak effectively in english in real life and career related situations
- To equip students with effective speaking and listening skills in english
- To facilitate learners to enhance their writing skills with coherence and appropriate format effectively

Pre-requisites

Basic knowledge of reading and writing in English

Course Outcomes

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

CO1	Listen and comprehend complex academic texts	Understand
CO2	Read and infer the denotative and connotative meanings of technical texts	Analyze
CO3	Write definitions, descriptions, narrations, and essays on various topics	Apply
CO4	Speak fluently and accurately in formal and informal communicative contexts	Apply
CO5	Appraise the verbal ability skills in the career development and professional contexts	Analyze

Mapping with Programme Outcomes

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

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech - Food Technology								
60 CG 0P1 - Career Skill Development I								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	0	0	2	30	**1***	100	00	100

Listening * Listening for General Information-Specific Details - Audio / Video (Formal & Informal) - Listen to Podcasts/ TED Talks/ Anecdotes / Stories / Event Narration / Documentaries and Interviews with Celebrities - Listen to a Product	[6]
Speaking * Self-Introduction; Introducing a Friend; Conversation - Politeness Strategies - Narrating Personal Experiences / Events; Interviewing a Celebrity; Reporting / And Summarizing of Documentaries / Podcasts/ Interviews - Picture Description; Giving Instruction to Use the Product; Presenting a Product - Small Talk; Mini Presentations - Group Discussions, Debates & Role Plays.	[6]
Reading * Loud Reading Vs Silent Reading, Skimming & Scanning of Passages, Reading Brochures (Technical Context), Social Media Messages Relevant to Technical Contexts and Emails - Biographies, Travelogues, Newspaper Reports and Travel & Technical Blogs - Advertisements, Gadget Reviews and User	[6]
Writing * Writing Letters – Informal and Formal – Basics and Format Orientation - Paragraph Texting, Short Report on an Event (Field Trip Etc.) - Definitions; Instructions; and Product /Process Description - Note-Making / Note-Taking; Recommendations; Transferring Information From Non-Verbal (Charts,	[6]
Verbal Ability I * Reading Comprehension (Mcqs) – Cloze Test - Sequencing Of Sentences – Summarizing and Paraphrase – Error Detection – Spelling Test – Sentence	[6]
Total Hours:	**30**
Text Book(s):	

Reference(s):

1.	'English for Engineers & Technologists' Orient Blackswan Private Ltd. Department of English, Anna University, 2020
2.	Norman Lewis, 'Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book', Penguin Random House India, 2020
3.	Michael McCarthy and Felicity O Dell, 'English Vocabulary in Use: Upper Intermediate', Cambridge University Press, N.York, 2012
4.	Lakshmi Narayanan, 'A Course Book on Technical English' Scitech Publications (India) Pvt. Ltd. 2020

*** SDG- 04- Quality Education**

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Course Contents and Lecture Schedule

S.No	Topic	No.of Hours
1	**Listening** *	
1.1	Listening for General Information and Specific Details	1
1.2	Listening to Podcasts, Documentaries and Interviews with Celebrities	1
1.3	Narrating Personal Experiences	1
1.4	Reading Relevant to Technical Contexts and Emails	1
1.5	Listen to a Product and Process Descriptions	1
2	**Speaking**	
2.1	Self-Introduction	1
2.2	Summarizing of Documentaries & Picture Narration	1
2.3	Small Talk; Mini Presentations	1
2.4	Group Discussions, Debates & Role Plays.	1
2.5	Group Discussions	1
3	**Reading**	
3.1	Loud Reading Vs Silent Reading, Skimming & Scanning of Passages	1
3.2	Reading Social Media Messages Relevant to Technical Contexts	1
3.3	Reading Newspaper Reports and Travel & Technical Blogs	1
3.4	Reading Advertisements, Gadget Reviews and User Manuals	1
3.5	Reading Newspaper Articles and Journal Reports	1
4	**Writing**	
4.1	Writing Letters – Informal and Formal	1
4.2	Paragraph Texting	1
4.3	Definitions and Instructions	1
4.4	Note-Making / Note-Taking	1
4.5	Essay Texting	1
5	**Verbal Ability**	
5.1	Reading Comprehension (Mcqs) and Cloze Test	1
5.2	Sequencing of Sentences	1
5.3	Paraphrasing and Summarizing	1
5.4	Error Detection and Spelling Test	1
5.5	Prepositions	1
		25

Course Designer

1. Dr.A.Palaniappan - palaniappan@ksrct.ac.in

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K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)
B.E. / B.Tech. Degree Programme
SCHEME OF EXAMINATIONS
(For the candidates admitted in 2023-2024)
THIRD SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1.	60 MA 012	Fourier Transform and Numerical Methods	2	40	60	100	45	100
2.	60 FT 301	Engineering Properties of Food Materials	2	40	60	100	45	100
3.	60 FT 302	Biochemistry for Food Technologist	2	40	60	100	45	100
4.	60 FT 303	Food Microbiology for Food Technologist	2	40	60	100	45	100
5.	60 FT 304	Food Process Calculations	2	40	60	100	45	100
6.	60 FT 305	Food Processing and Preservation	2	40	60	100	45	100
7.	60 MY 002	Universal Human Values	-	100	-	100	-	100
PRACTICAL								
8.	60 FT 3P1	Food Biochemistry Laboratory	3	60	40	100	45	100
9.	60 FT 3P2	Food Microbiology Laboratory	3	60	40	100	45	100
10.	60 CG 0P2	Career Skill Development II	3	60	40	100	45	100
11.	60 CG 0P6	Internship	-	100	-	100	-	100

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory End Semester Examination and 40 marks for practical End Semester Examination.

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60 MA 012	Fourier Transform and Numerical Methods	Category	L	T	P	Credit
		BS	3	1	0	4

Objectives

- To provide exposure and ability to use Fourier series.
- To familiarize the basic concepts of Fourier transform.
- To get exposed to various techniques to solve equations numerically.
- To know the concepts of interpolation and numerical integration.
- To learn the basics concepts of initial value problems.

Pre-requisites

Nil

Course Outcomes

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

CO1	Obtain the Fourier series expansion for the periodic functions.	Apply
CO2	Apply Fourier transform techniques for the continuous functions.	Apply
CO3	Employ various iteration techniques for solving algebraic, transcendental and system of linear equations.	Apply
CO4	Apply different techniques to find the intermediate values and to evaluate single definite integrals.	Apply
CO5	Compute the solution for initial value problems using single and multi-step methods.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	2	-	-	-	-	-	-	-	2	-	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	2	-	-
CO3	3	2	-	-	2	-	-	-	-	-	-	-	2	-	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	2	-	-
CO5	3	2	-	-	2	-	-	-	-	-	-	-	2	-	-
3 – Strong; 2 – Medium;1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	10
Understand	10	10	20
Apply	40	40	70
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0
Total	60	60	100

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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology–Autonomous (R2022)

B.Tech. Food Technology

60 MA 012 – Fourier Transform and Numerical Methods

Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	1	0	60	4	40	60	100

Fourier Series Dirichlet's conditions - Fourier series - Odd and Even functions - Half range Fourier series - Root mean square value of a function - Parseval's identity - Harmonic analysis.	[9]
Fourier Transform Fourier transform pair - Fourier transform of simple functions - Fourier sine and cosine transform - Properties - Convolution theorem - Parseval's identity.	[9]
Solution of Equations and Eigen Value Problem Algebraic and Transcendental equations - Newton Raphson method – Horner's method - Gauss elimination method – Gauss Jordan method – Iterative methods: Gauss Jacobi method – Gauss Seidel method – Eigen value of a matrix by Power method.	[9]
Interpolation and Numerical Integration **Lagrange's and Newton's divided difference interpolations (unequal intervals) - Newton's forward and backward interpolation (equal intervals)*** - Two point and three point Gaussian quadrature – Trapezoidal, Simpson's 1/3 and 3/8 rule (single integral).	**[9]**
Numerical Solution of Ordinary Differential Equations Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods: Milne's predictor and corrector method - Adam's predictor and corrector method.	[9]
Total Hours: 45 + 15 (Tutorial)	**60**

Text Book(s):

1. Grewal B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2018.
2. Faires, J D and Burden R L, "Numerical Methods", Thomson publications, Fourth Edition, New Delhi,2012.

Reference(s):

1. Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons (Asia) Limited,New Delhi, Reprint 2012.
2. Grewal B.S and Grewal J.S, "Numerical Methods in Engineering and Science", 10th Edition, Khanna Publishers, New Delhi, 2012.
3. Veerarajan T, "Transforms and Partial Differential Equations", 3rdEdition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2016.
4. Kandasamy P, Thilagavathy K and Gunavathi K, "Numerical Methods", 3rd Edition, Sultan Chand & Sons, New Delhi, 2010.

****SDG: 4 – Quality Education**

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Course Contents and Lecture Schedule

S.No.	Topic	No. of hours
1.	**Fourier Series**	
1.1	Dirichlet's conditions	1
1.2	Fourier series - Even functions	2
1.3	Fourier series - Odd functions	1
1.4	Half range Fourier series	1
1.5	Tutorial	2
1.6	Electronically Injection System: Function, Layout and Working Principle (MPFi, GDI & CRDi)	1
1.7	Parseval's identity	1
1.8	Harmonic analysis	1
1.9	Tutorial	2
2.	**Fourier Transform**	
2.1	Fourier transform pair	1
2.2	Fourier transform of simple functions	1
2.3	Fourier sine transform	1
2.4	Fourier cosine transform	1
2.5	Tutorial	2
2.6	Properties of Fourier transform	1
2.7	Convolution theorem	2
2.8	Parseval'sidentity	1
2.9	Tutorial	2
3.	**Solution of Equations and Eigen Value Problem**	
3.1	Newton-Raphson method	1
3.2	Horner's method	1
3.3	Gaussian elimination method	1
3.4	Gauss-Jordan method	1
3.5	Tutorial	2
3.6	Gauss-Jacobi method	1
3.7	Gauss-Seidel method	2
3.8	Eigen value of a matrix by Power method	1
3.9	Tutorial	2
4.	**Interpolation and Numerical Integration**	
4.1	Lagrange's divided difference interpolation	2
4.2	Newton's divided difference interpolation	1
4.3	Newton's forward and backward interpolations	2
4.4	Tutorial	2
4.5	Two and three point Gaussian quadrature	1
4.6	Trapezoidal and Simpson's 1/3 and 3/8 rules	2
4.7	Tutorial	2
5.	**Numerical Solution of Ordinary Differential Equations**	
5.1	Taylor series method	2
5.2	Euler's method	1
5.3	Modified Euler's method	1
5.4	Tutorial	2
5.5	Runge-Kutta method	2

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5.6	Milne's predictor and corrector method	1
5.7	Adam's predictor and corrector method	1
5.8	Tutorial	2

List of MATLAB Programs:

1. Generate the Fourier series of f(x) in (- π, π) and (- l, l), plot and visualize.
2. Compute the Fourier transform of f(x), plot and visualize.
3. Determine the solution of Non-linear equations using Iteration methods.
4. Illustrate Gauss-Jacobi and Gauss-Seidal method for system of linear equations.
5. Compute Newton's forward and backward interpolation method.
6. Demonstrate Trapezoidal and Simpson's rule.
7. Determine the solution of first order ODE using Fourth order Runge-kutta method.
8. Compute the solution of ODE using Milne's and Adam's Predictor and Corrector method.

Course Designer(s)

1. Mr.G.Mohan-mohang@ksrct.ac.in
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60 FT 301	Engineering Properties of Food Materials	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To understand the physical properties of food material.
- To impart knowledge on the applications in food processing sector.
- To identify the physical, hydro and aerodynamic properties of food materials
- To know the thermal and Rheological Properties of food materials
- To learn basic principles of optical properties of foods.

Pre-requisites

NIL

Course Outcomes

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

CO1	Apply the various physical properties in food process design	Apply
CO2	Outline the thermal properties of foods and its measurement methods	Understand
CO3	Make use of optical and electromagnetic properties of food materials in food processes	Apply
CO4	Explain various rheological behaviour of solid, liquid and viscoelastic food materials	Understand
CO5	Choose suitable textural and color measurement techniques for food materials	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	**10**
Understand	20	20	30
Apply	30	30	60
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – AutonomousR2022

B.Tech Food Technology

60 FT 301 - Engineering Properties of Food Materials

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Physical Properties: Importance of engineering properties, Physical properties of food materials- size, shape, volume, density, porosity and surface area – definitions and measurements, Frictional properties – coefficient of friction, angle of repose – types and its determination, rolling resistance and angle of internal friction – definition and determination, Aerodynamic properties Drag coefficient, Terminal Velocity and its application.	[9]
Thermal Properties: Definition of specific heat, enthalpy, thermal conductivity, thermal diffusivity, surface heat transfer coefficient. Measurement of specific heat, thermal conductivity – steady state and unsteady state methods, thermal diffusivity – Dickerson's method, Calorific value of food, Bomb calorimeter, Boiling point elevation and freezing point depression - definition, Applications of thermal properties.	[9]
Optical Properties: Refractive index of food items, Abbe's refractometer, Optical activity, Polarimeter, Gloss and glossimeter, color, Translucency – Definitions and applications. Electromagnetic Properties: Electrical properties- electrical conductivity and its measurement, dielectric properties - measurement methods, effect on moisture, temperature and composition, microwave heating and other applications.	[9]
Rheological Properties: Classification of rheology, Stress Strain behaviour of Newtonian and Non- Newtonian fluids- Bingham and Non Bingham. Stress strain relationships in solids, liquids and visco elastic behaviour- stress relaxation test, creep test and dynamic test, stress-strain diagrams, Rheological models – Kelvin and Maxwell model. Viscosity – Types and its definitions, measurement methods -Capillary, Orifice, Falling and Rotational viscometers.	[9]
Textural Properties: Types of food textures, Texture measuring instruments- Compression, Snap Bending, Cutting Shear, Puncture, Penetration and TPA, Properties of food powders. Color: Interaction of object with light, Measurement methods -Spectrophotometer and Colorimeter, Color order systems- Munsel color system, CIE color system, Hunter lab color space, Lovibond system.	[9]
Total Hours:	**45**

Text Book(s):

1.	Serpil Sahin and Servet Gulum Sumnu,"Physical Properties of Foods", 1st Edition, Springer, New York, 2012.
2.	James G. Brennan, "Food Processing Handbook". Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany, 2006.
3.	Rao, M. A. and Rizvi, S. S. H., Ashim K. Datta""Engineering Properties of Food', 3rd edition, Taylor and Francis Gp., CRC press, 2005.

Reference(s):

1.	Rao M.A. and Rizvi S.S.H., "Engineering Properties of Foods", 4thEdition, CRC Press, New York, 2014.
2.	Sahay K.M. and Singh K.K., "Unit Operations of Agricultural Processing", 2nd Edition, Vikas Publishing, New Delhi, 2004.

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1	**Physical Properties**	
1.1	Importance of engineering properties	1
1.2	Physical properties of food materials- size and shape	1
1.3	Physical properties of food materials – volume and density	1
1.4	Physical properties of food materials - porosity and surface area	1
1.5	Frictional properties –coefficient of friction, angle of repose – types and its determination	2
1.6	Rolling resistance and angle of internal friction – definition and determination	1
1.7	Aerodynamic properties Drag coefficient, Terminal Velocity and its application	2
2	**Thermal Properties**	
2.1	Definition of specific heat, enthalpy, thermal conductivity, thermal diffusivity, Surface heat transfer coefficient.	2
2.2	Measurement of specific heat	1
2.3	Thermal conductivity – steady state and unsteady state methods	2
2.4	Thermal diffusivity – Dickerson's method	1
2.5	Calorific value of food - Bomb calorimeter	1
2.6	Boiling point elevation - definition, Applications of thermal properties	1
2.7	Freezing point depression - definition, Applications of thermal properties	1
3	**Optical Properties**	
3.1	Refractive index of food items	1
3.2	Abbe's refractometer	1
3.3	Optical activity	1
3.4	Polarimeter	1
3.5	Gloss and glossimeter, color	1
3.6	Translucency – Definitions and applications	1
3.7	Electrical properties- electrical conductivity and its measurement	1
3.8	Dielectric properties - measurement methods, effect on moisture, temperature and composition	1
3.9	Microwave heating and other applications	1
4	**Rheological Properties**	
4.1	Classification of rheology	1
4.2	Stress Strain behaviour of Newtonian	1
4.3	Non- Newtonian fluids- Bingham and Non Bingham	1
4.4	Stress strain relationships in solids, liquids	1
4.5	Visco elastic behaviour- stress relaxation test, creep test and dynamic test, stress-strain diagrams,	2
4.6	Reological models – Kelvin and Maxwell model	1
4.7	Viscosity – Types and its definitions,	1
4.8	Viscosity – measurement methods - Capillary, Orifice, Falling and Rotational viscometers.	1
5	**Textural Properties**	
5.1	Types of food textures	1
5.2	Texture measuring instruments- Compression, Snap Bending, Cutting Shear, Puncture, Penetration and TPA,	2
5.3	Properties of food powders	1
5.4	Color: Interaction of object with light	1
5.5	Measurement methods -Spectrophotometer	1
5.6	Colorimeter	1
5.7	Color order systems- Munsel color system, CIE color system,	1
5.8	Hunter lab color space, Lovibond system	1

Course Designer(s)

1. Mr. S. Nithishkumar - nithishkumar@ksrct.ac.in

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

CHAIRMAN
BOARD OF STUDIES

60 FT 302	Biochemistry for Food Technologist	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To recall the importance and application of bio molecules.
- To examine the classification and properties fats.
- To learn metabolism of carbohydrate and lipid
- To learn structural functions and properties of proteins and nucleic acids.
- To impart classification and nomenclature of enzymes.

Pre-requisites

Nil

Course Outcomes

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

CO1	Understand types and importance of carbohydrates	Understand
CO2	Categorize the structure, composition and properties of fats	Analyze
CO3	Illustrate the metabolism of carbohydrate and lipid	Apply
CO4	Know the structural functions and properties of proteins and nucleic acid.	Understand
CO5	Describe the nature, function, classification and nomenclature of enzymes.	Understand

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	20	20	20
Apply	20	30	50
Analyze	10	-	10
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology–Autonomous R2022

B.Tech. Food Technology

60 FT 302- Biochemistry for Food Technologist

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Carbohydrates Sources, Classification, function, structure and properties of mono (glucose, Fructose, galactose), di (Sucrose, Maltose · Lactose), oligo (Raffinose) & polysaccharides (Starch & Cellulose). Sugar - properties – sugar Hygroscopicity and solubility, optical rotation, muta rotation, Application of sugar in food industries; sensory properties-sweetness index, Dextrose Equivalent, Degree of polymerisation; Sugar alcohols – Natural and Artificial Sweetener.	[9]
Lipid Classification & nomenclature of lipids- Types of fatty acids –physical and chemical properties of lipids: specific properties - crystal formation, polymorphism, plasticity, isomerization, hydrolytic rancidity and oxidative rancidity. Shortening power of fats, tenderization, emulsification, frying - smoke point, auto-oxidation, inter-esterification and polymerization. Biological role of lipids	[9]
Carbohydrate and Lipid metabolism Matabolic pathways - Types and chemical reactions Glycolysis: Anaerobic path way of glucose metabolism, energy balance sheet and regulation – citric acid cycle: aerobic pathway of glucose metabolism – modification of citric acid cycle, lipid metabolism: fatty acid metabolism, Beta oxidation of saturated and unsaturated fatty acids, energetics of beta oxidation – bio synthesis of lipid and cholesterol.	[9]
Proteins and nucleic acids Structure and classification of amino acids – proteins: primary structure, Secondary structure, Tertiary structure and quaternary structure – central dogma, aggregated proteins, structural importance and function, denaturation and renaturation – Nucleic acids: structure of nucleic acids, structure of DNA, Types of RNA and their structures and its importance.	[9]
Enzymes Introduction, function, classification and nomenclature of enzymes – mechanism of enzyme action - michaelis-menten hypothesis; active site – enzyme models –enzyme activity and modifiers – enzyme inhibititon, factors affecting enzyme activity – application of enzymes in food industries, immobilization methods.	[9]
Total Hours:	**45**

Text Book(s):

1. David L. Nelson and Michael M. Cox. Lehninger Principles of Biochemistry, 6th Ed. Macmillan Learning, NY, USA, 2012.
2. “Murray, Robert K.., Harper Illustrated Biochemistry, 27th Edition. McGraw-Hill, 2006.

Reference(s):

1. Donald Voet and Judith G. Voet. “ Biochemisry” , 4th Ed. John Wiley and Sons, Inc., NY, USA, 2011.
2. Belitz H.D., Grosch W.,.Schieberle P, “Food Chemistry”,Springer,2009.
3. Satyanarayanan, U. “Biochemistry” Books and Allied (P) Ltd., 2005.
4. Rastogi S.C., “Biochemistry”, 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1	**Carbohydrates**	
1.1	Sources, Classification, function, structure and properties of mono (glucose, Fructose, galactose),	2
1.2	Sources, Classification, function, structure and properties of di (Sucrose, Maltose · Lactose),	1
1.3	Sources, Classification, function, structure and properties of oligo (Raffinose)	1
1.4	Sources, Classification, function, structure and properties of poly saccharides(Starch & Cellulose).	2
1.5	Sugar - properties – sugar Hygroscopicity and solubility, optical rotation, mutarotation,	1
1.6	Application of sugar in food industries; sensory properties-sweetness index, Dextrose Equivalent, Degree of polymerisation	1
1.7	Sugar alcohols – Natural and Artificial Sweetener.	1
2	**Lipid**	
2.1	Classification & nomenclature of lipids- Types of fatty acids	1
2.2	Physical properties of lipids.	1
2.3	Chemical properties of lipids:	1
2.4	Specific properties - crystal formation, polymorphism, plasticity, isomerization, hydrolytic rancidity and oxidative rancidity.	2
2.5	Shortening power of fats, tenderization, emulsification, frying - smoke point,	2
2.6	auto-oxidation, inter-esterification and polymerization.	1
2.7	Biological role of lipids	1
3	**Carbohydrate and Lipid metabolism**	
3.1	Metabolic pathways - Types and chemical reactions	1
3.2	Glycolysis: Anaerobic path way of glucose metabolism, energy balance sheet and regulation	1
3.3	citric acid cycle: aerobic pathway of glucose metabolism	1
3.4	modification of citric acid cycle,	1
3.5	lipid metabolism: fatty acid metabolism,	1
3.6	Beta oxidation of saturated fatty acids	1
3.7	unsaturated fatty acids, energetics of beta oxidation	1
3.8	bio synthesis of lipid.	1
3.9	Bio synthesis of cholesterol	1
4	**Proteins and nucleic acids**	
4.1	Structure and classification of amino acids –	1
4.2	proteins :primary structure, Secondary structure, Tertiary structure and quaternary structure	2
4.3	central dogma, aggregated proteins,	1
4.4	structural importance and function, denaturation and renaturation –	1
4.5	Nucleic acids: structure of nucleic acids,	1
4.6	Structure of DNA,	1
4.7	Types of RNA and their structures and its importance.	2
5	**Enzymes**	
5.1	Introduction, function, classification and nomenclature of enzymes –	2
5.2	mechanism of enzyme action - michaelis-menten hypothesis;	1
5.3	active site – enzyme models	1
5.4	enzyme activity and modifiers – enzyme inhibititon,	2
5.5	factors affecting enzyme activity –	1
5.6	application of enzymes in food industries,	1
5.7	immobilization methods.	1

Course Designer(s)

Dr.K.Prabha - prabhak@ksrct.ac.in

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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BOARD OF STUDIES

60 FT 303	Food Microbiology For Food Technologist	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To provide students with a knowledge about Basic knowledge of microorganisms
- To impart detailed knowledge on the Isolation and Identification of Food Pathogens
- To learn staining and Microscopy Techniques.
- To learn about Food spoilage and diseases**.**
- To provide knowledge about microbial spoilage and detection methods

Pre-requisites

Nil

Course Outcomes

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

CO1	Identify the Basic knowledge of microorganism and its classification	Understand
CO2	Recall the method of isolation and Identification of microorganism	Analyze
CO3	Explain the importance of staining and Microscopy techniques	Apply
CO4	Categorize the food spoilage and Diseases	Apply
CO5	Describe the types microbial food spoilage and its detection methods	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember (Rn)	10	10	20
Understand	30	30	40
Apply	10	20	30
Analyze	10	-	10
Evaluate	-	-	-
Create	-	-	-
Total	**60**	**60**	**100**

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech Food Technology

60 FT 303 - Food Microbiology for Food Technologist

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Classification and Structure of Microorganisms Introduction to food microbiology, **classification of microorganisms - prokaryotes and eukaryotes. Types of micro-organisms: bacteria, virus, algae, fungi- structure, reproduction.****	[4]
Isolation, and Identification of Microorganisms Pure culture technique – Serial dilution and plating methods; cultivation, maintenance and preservation of pure cultures. Culture Media – Importance - components of media. Types of media - natural, synthetic, complex, selective, differential, enriched media. Growth curve – batch culture, continuous culture. Physical factors influencing the growth – Temperature, pH, osmotic pressure and salt concentration. Biochemical Identification and Molecular Characterization of Microorganism, Whole Genome Sequencing.	[14]
Microscopy and Staining Techniques Microscope – Instrumentation, Working Principle, Application, Types of Microscope-Light Microscope-Simple, compound , electron microscope basics, dark field and light microscope and phase contrast and Slide preparation. Stains – Auxochrome, chromophores, acidic and basic dyes. Staining techniques – Simple staining, Gram's staining, acid fast staining, endospore staining, capsule staining and flagella staining.	[9]
Microbiology spoilage and Food Borne Diseases Microbial spoilage of different types of foods– **fruits and vegetables, meat, poultry, sea foods, cereals products, bakery products, dairy products, fermented foods and canned foods. Detection and Enumeration of microbes in foods.*** Detection methods for *E. coli*, *Staphylococci, Yersinia*, *B. cereus*, *C. botulinum* and *Salmonella*, *Listeria monocytogenes*, *Norwalk virus*, *Rotavirus, Hepatitis A* virus from food samples.	[9]
Diagnostic Techniques in Food Borne Pathogens **Rapid detection techniques for food borne pathogens and their toxins, pesticides;*** In-vitro evaluation of bacterial toxins by immunological techniques like slide agglutination, tube agglutination, gel diffusion assay; Genetic based diagnostic systems - Polymerase Chain Reaction (PCR). Micro array diagnostic methods.	[9]
Total Hours:	**45**

Text Book(s):

1.	Prescott, L.M., Harley, J.P. and Klein, D.A. "Microbiology", 7th Edition, TATA McGraw-Hill Publications, 2010.
2.	Osman Erkmen, T. Faruk Bozoglu. "Food Microbiology: Principles into Practice",John Wiley & Sons, Ltd, 2016.

Reference(s):

1.	Pelczar, M.J., Chan, E.C.S. and Krieg, N.R., "Microbiology", McGraw-Hill, New York, 2004.
2.	Jay, J.M. "Modern Food Microbiology", 4th Edition. CBS Publishers, 2003.

SDG - *Good health and well-being, **Life on land

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1	**Classification and Structure of Microorganisms**	
1.1	Introduction to food microbiology, classification of microorganisms	1
1.2	Types of micro-organisms: bacteria, virus	1
1.3	Algae, fungi- structure	1
1.4	Reproduction	1
2	**Isolation, and Identification of Microorganisms**	
2.1	Pure culture technique – Serial dilution and plating method	2
2.2	Culture Media – Importance - components of media. synthetic, complex	1
2.3	Types of media - natural, selective, differential, enriched media.	1
2.4	Growth curve – batch culture, continuous culture.	2
2.5	Physical factors influencing the growth – Temperature, pH, osmotic pressure and salt concentration.	2
2.6	Biochemical Identification	2
2.7	Molecular Characterization of Microorganism,	2
2.8	Whole Genome Sequencing.	2
3	**Microscopy and Staining Techniques**	
3.1	Microscope – Instrumentation, Working Principle, Application	1
3.2	Types of Microscope	2
3.3	Dark field and light microscope and phase contrast and Slide preparation.	2
3.4	Stains – Auxochrome, chromophores, acidic and basic dyes.	1
3.5	Simple staining, Gram's staining, acid fast staining,	2
3.6	Endospore staining, capsule staining and flagella staining.	1
4	**Microbiology spoilage and Food Borne Diseases**	
4.1	Microbial spoilage of different types of foods– fruits and vegetables, meat	1
4.2	Poultry, sea foods, cereals products, bakery products	1
4.3	Dairy products, fermented foods and canned foods.	1
4.4	Detection and Enumeration of microbes in foods	1
4.5	Detection methods for *E. coli*, *Staphylococci,*	1
4.6	*Yersinia*, *B. cereus*,	1
4.7	*C. botulinum* and *Salmonella*,	1
4.8	*Listeria monocytogenes*, *Norwalk virus*,	1
4.9	*Rotavirus, Hepatitis A* virus from food samples	1
5	**Diagnostic Techniques in Food Borne Pathogens**	
5.1	Rapid detection techniques for food borne pathogens and their toxins, pesticides;	2
5.3	In-vitro evaluation of bacterial toxins by immunological techniques like slide agglutination,	1
5.4	Tube agglutination, gel diffusion assay	2
5.5	Genetic based diagnostic systems - Polymerase Chain Reaction	2
5.6	Micro array diagnostic methods	2
5.7	Rapid detection techniques for food borne pathogens and their toxins, pesticides;	2

Course Designer(s)

1. Dr.A.S.Ruby Celsia - rubycelsia@ksrct.ac.in

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

CHAIRMAN
BOARD OF STUDIES

60 FT 304	Food Process Calculations	Category	L	T	P	Credit
		PC	2	1	0	3

Objective

- Know the various kinds of processing operations in food industry
- Familiarize with recycle operation in food industry
- To explore knowledge on material balance
- To learn energy balance calculations
- To learn NHV, GHV of the fuels

Pre-requisites

Nil

Course Outcomes

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

CO1	Apply different systems of units and dimensions	Understand
CO2	Learn about the material balance without chemical reaction	Apply
CO3	Apply material balance for recycle operations	Analyze
CO4	Perform energy balance calculations	Analyze
CO5	Know about the combustion of solids, liquid and gas	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	20	20	30
Apply	30	10	30
Analyze	-	20	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology–Autonomous R2022								
B.Tech. Food Technology								
60 FT 304 - Food Process Calculations								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	2	1	0	45	3	40	60	100

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]
Material Balance Stoichiometric principles, material balance without chemical reaction- application of material balance to unit operations like **distillation, evaporation, crystallization, drying and extraction**.*	[9]
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]
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, calculation of standard heat of reaction - Effect of pressure and temperature on heat of reaction - Energy balance for systems without chemical reaction.	[9]
Combustion Combustion of solids, liquid and gas, determination of Net Heat Value (NHV) and Gross Heat Value (GHV). Determination of composition by Orsat analysis - **Calculation of excess air, theoretical oxygen requirement.***	[9]
Total :45+15(Tutorial)Hours	**60**

Text Book(s):	
1.	Gavhane K.A., “Introduction to Process Calculations”, First Edition, Nirali Prakashan Publications, 2016.
2.	Venkataramani V. and Anantharaman N., “Process Calculations”, Second Edition, Prentice Hall of India, 2011.
Reference(s):	
1.	Bhatt B.L. and Vora S.M., “Stoichiometry”, 4th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2004.
2.	Narayanan K.V. and Lakshmi kutty B., “Stoichiometry and Process Calculations”, Prentice Hall of India, New Delhi, 2006.
3.	Himmelblau D.M., “Basic Principles and Calculations in Chemical Engineering, 6th Edition, Prentice Hall of India, New Delhi, 2003.
4.	Albert Ibarz, Gustavo V. Barbosa-Canovas, “Unit Operations in Food Engineering, Food Preservation Technology Series”, CRC Press, 2003.

SDG- *Affordable and clean energy

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1	**Units and Dimensions-Fundamental Calculations**	
1.1	Basic and derived units, unit conversions,	1
1.2	Use of model units in calculations	1
1.3	Methods of expression	1
1.4	Compositions of mixture and solutions.	1
1.5	Ideal and real gas laws – gas constant	1
1.6	Calculations of P, V and T using ideal gas law	1
1.7	Use of partial pressure and pure component volume in gas calculations	1
1.8	Use of partial pressure and pure component volume in gas calculations	1
1.9	Applications of real gas relationship in gas calculation	1
2	**Stoichiometric**	
2.1	Principles of Stoichiometric	1
2.2	Material balance without chemical reaction	1
2.3	Material balance without chemical reaction	1
2.4	Material balance to Unit operation	1
2.5	Application of material balance of distillation	1
2.6	Application of material balance of evaporation	1
2.7	Application of material balance of crystallization	1
2.8	Application of material balance of drying	1
2.9	Application of material balance of extraction	1
3	**Recycle operations**	
3.1	Recycle stream with block diagram	1
3.2	Purging operations with block diagram	1
3.3	Purge ratio, and purge stream	1
3.4	Recycle ratio	1
3.5	Humidity and Saturation concept	1
3.6	Calculation of absolute humidity, molal humidity	1
3.7	Calculation of relative humidity and percentage humidity	1
3.8	Calculation of wet & dry bulb temperature and dew point	1
3.9	Humidity chart usage	1
4	**Energy balance**	
4.1	Heat capacity of solids, liquids, gases and solutions	1
4.2	Use of mean heat capacity in heat calculations	1
4.3	Problems involving sensible heat and latent heats, evaluation of enthalpy.	1
4.4	Problems involving sensible heat and latent heats, evaluation of enthalpy.	1
4.5	Standard heat of reaction of solution and mixing	1
4.6	Standard heats of formation of solution and mixing	1
4.7	Standard heat of combustion of solution and mixing	1
4.8	Calculation of standard heat of reaction - Effect of pressure and temperature On heat of reaction	1
4.9	Energy balance for systems without chemical reaction.	1
5	**Combustion**	
5.1	Combustion of solids, liquid and gas	1
5.2	Determination of Net Heat Value (NHV)	2
5.3	Determination of Gross Heat Value (GHV)	1
5.4	Determination of composition by Orsat analysis	2
5.5	Calculation of excess air requirement	1
5.6	Calculation of theoretical oxygen requirement	2

Course Designer(s)

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Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

CHAIRMAN
BOARD OF STUDIES

60 FT 305	Food Processing and Preservation	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To understand the basic processing techniques
- To identify the suitable processing techniques for food material
- To know novel and advanced methods of food processing.
- To Understand the Basics of food and their spoilage
- To know the methods of food preservation.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Infer the knowledge about food processing technique	Understand
CO2	Recognize the appropriate techniques for food processing	Apply
CO3	Realize the modern and innovative methods of food processing	Apply
CO4	Understand the needs of food and their spoilage	Understand
CO5	Identify the suitable food preservation methods	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	30
Understand	30	30	50
Apply	10	10	20
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech. Food Technology

60 FT 305 - Food Processing and Preservation

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Introduction of food processing Introduction to Food Processing and importance of food processing sectors, Indian trends in industries, **type of food processing – primary processing, secondary processing, tertiary processing.** ** Convenience food – ready to eat and heat & serve food, NOVA food classification, Degree of food processing, different type of food processing sectors.	[9]
Methods of food processing technologies* Thermal treatment: Boiling, Frying, Roasting, Blanching, Autoclave, Canning, Smoking, Pasteurization – Principle, process flow, application, advantages and disadvantages. Non-Thermal and other treatment: Chilling, freezing, freeze drying, fermentation Adjusted environment packing, and Added substance - Principle, process flow, application, advantages and disadvantages.	[9]
Novel Food Processing Technologies* Thermal technologies: Radio frequency heating, Microwave heating, Ohmic heating, Infrared heating, Aseptic processing - Principle, process flow, application, advantages and disadvantages. Nonthermal technologies: High-pressure processing, Pulsed electric field processing, Cold plasma treatment, Ultrasound, Irradiation, UV and pulsed light - Principle, process flow, application, advantages and disadvantages.	[9]
Food Preservation Introduction to food preservation, type of foods – Perishable, semi perishable and shelf stable foods, Classification of food, Food Spoilage, characteristics and types of food spoilage, Cause of food spoilage, food safety for consumers – needs and importance, Principle of Food preservation, Need and scope of Food preservation, importance of food preservation, trends in food processing	[9]
Methods of Food Preservation* Chemical methods – Chemical preservation, water activity (a_w) and pH control, Chemical preservative- types, uses, **FSSAI standards and recommendation****, Physical methods – Preservation by low temperature, Preservation by high temperature, Preservation by drying and Preservation by irradiation, Biological methods – Fermentation, uses and advantages of processed food.	[9]
Total Hours:	**45**

Text Book(s):

1.	Sivasankar, B. Food Processing and Preservation. PHI Learning Pvt. Ltd. 2018
2.	Vikas Nanda and Savita sharma, Novel Food Processing Technologies. NIPA Genx Electronic Resources & Solutions P. LTD. New Delhi.: 2017.
3.	Khetarpaul and Neelam. “Food Processing and Preservation.” Daya Publications, 2005

Reference(s):

1.	Rahman, M. Shafiur. “Handbook of Food Preservation”. Marcel & Dekker, 2006.
2.	Zeuthen, Peter and Bogh-Sarensen, Leif. “Food Preservation Techniques”. CRC / Wood Head Publishing, 2003.

*SDG 9 – Industry Innovation and Infrastructure

**SDG 3 – Good Health and Well Being

Passed in BoS Meeting held on 23.12.22

Approved in Academic Council Meeting held on 07.01.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction of food processing**	
1.1	Introduction to Food processing	1
1.2	Scope and importance of food processing sectors	1
1.3	Indian trends in food processing industries	1
1.4	Type of food processing – primary processing, secondary processing	1
1.5	Tertiary processing.	1
1.6	Convenience food – ready to eat and heat & serve food.	1
1.7	NOVA food classification,	1
1.8	Degree of food processing,	1
1.9	Different type of food processing sectors	1
2.0	**Methods of Food Preservation**	
2.1	Boiling, Frying	1
2.2	Roasting, Blanching	1
2.3	Autoclave, Smoking,	1
2.4	Canning	1
2.5	Pasteurization	1
2.6	Chilling,	1
2.7	Freezing, freeze drying	1
2.8	Fermentation	1
2.9	Adjusted environment packing, and Added substance	1
3.0	**Food Processing**	
3.1	Radio frequency heating	1
3.2	Microwave heating	1
3.3	Ohmic heating, Infrared heating	1
3.4	Aseptic processing	1
3.5	High-pressure processing	1
3.6	Pulsed electric field processing	1
3.7	Cold plasma treatment	1
3.8	Ultrasound, Irradiation	1
3.9	UV and pulsed light	1
4.0	**Methods of food processing technologies**	
4.1	Introduction to food preservation, type of foods	1
4.2	Classification of food	1
4.3	Food Spoilage	1
4.4	Characteristics and types of food spoilage	1
4.5	Cause of food spoilage	1
4.6	Food safety for consumers – needs and importance,	1
4.7	Principle of Food preservation, Need and scope of Food preservation,	1
4.8	Importance of food preservation	1
4.9	Trends in food processing	1
5.0	**Novel Food Processing Technologies**	
5.1	Chemical preservation	1
5.2	water activity (a_w) and pH control	1
5.3	Chemical preservative- types, uses	1
5.4	FSSAI standards and recommendation	1
5.5	Preservation by low temperature	1
5.6	Preservation by high temperature	1
5.7	Preservation by drying	1
5.8	Preservation by irradiation	1
5.9	Biological methods – Fermentation	1

Course Designer(s)

1. Mr. P. Kalai Rajan- kalairajan@ksrct.ac.in

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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60 MY 002	Universal Human Values	Category	L	T	P	Credit
		MC	3	0	0	3#

Objectives

- To identify the essential complementarily between 'values' and 'skills'
- To ensure core aspirations of all human beings.
- To acquire ethical human conduct, trustful and mutually fulfilling human behaviour
- To enrich interaction with Nature
- To achieve holistic perspective towards life and profession

Pre-requisites

Nil

Course Outcomes

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

CO1	Understand the significance of value inputs in formal education and start applying them in their life and profession	Understand
CO2	Evaluate coexistence of the “I” with the body.	Analyze
CO3	Identify and evaluate the role of harmony in family, society and universal order.	Analyze
CO4	Classify and associate the holistic perception of harmony at all levels of existence and Nature	Analyze
CO5	Develop appropriate human conduct and management patterns to create harmony in professional and personal lives.	Create

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom’s Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	No End Semester Examination
Understand	10	10	
Apply	20	20	
Analyze	20	20	
Evaluate	0	0	
Total	60	60	

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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Syllabus

K. S. Rangasamy College of Technology – Autonomous R2022							
B.Tech. Food Technology							
60 MY 002 - Universal Human Values							
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**	
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3#	100	0	100

Introduction to value Education Understanding value Education*-Self exploration as the process for value education-Continuous Happiness and prosperity-the basic human aspirations-right understanding-relationship and physical facility –happiness and prosperity - current scenario – method to fulfill the basic human aspirations	[9]
Harmony in the Human Being 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	[9]
Harmony in the Family and Society Harmony in the Family –the basic unit of human interaction-values in human- to - human relationship –'Trust' the foundation value in relationship –'Respect'- as the right evaluation-understanding harmony in the society –vision for the universal human order.	[9]
Harmony in the Nature/Existence Understanding harmony in the Nature-Interconnectedness, self-regulation and mutual fulfillment among the four orders of nature – realizing existence as co-existence at all levels –the holistic perception of harmony in existence.	[9]
Implications of the Holistic Understanding Natural Acceptance of human values- definitiveness of 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 base life and profession	[9]
Total Hours:	45

Text Book(s):	
1.	A Foundation Course in Human Values and Professional Ethics, Gaur R R, Asthana R, Bagaria G P, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2.	Gaur R R, Asthana R, Teachers' Manual for A Foundation Course in Human Values and Professional Ethics.
Reference(s):	
1.	Jeevan Vidya: Ek Parichaya, Nagaraj A, Jeevan Vidya Prakashan, Amarkantak, 1999.
2.	Human Values, A.N. Tripathi, New Age International. Publishers, New Delhi, 2004.

SDG - * Quality education, ** Gender equality, ***Reduced inequalities

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1	**Introduction to Value Education**	
1.1	Discussion on Present Education System and Skill Based Education	1
1.2	Understanding Value Education	1
1.3	Self-exploration as the process for value education	1
1.4	Basic Human Aspirations – Continuous Happiness and Prosperity	1
1.5	Basic requirements to 44ulfil Human Aspirations – Right understanding, Relationship and Physical facility	1
1.6	Transformation from Animal Consciousness to Human Consciousness	1
1.7	Sources of Happiness and Prosperity – Harmony and Disharmony	1
1.8	Current Scenario and Role of Education	1
1.9	Outcome of Human Education and Method to 44ulfil the basic human aspirations	1
2	**Harmony in the Human Being**	
2.1	Understanding Human being – As Co-Existence of the self and the Body – The Needs of the Self and the Body	1
2.2	Understanding Human being – As Co-Existence of the self and the Body – The Activities and Response of the Self and the Body	2
2.3	The body as an instrument of the self	1
2.4	Understanding harmony in the self	1
2.5	Harmony of the self with the body	2
2.6	Programme to ensure self-regulation and health	1
2.7	My Participation (Value) regarding Self and my Body – Correct Appraisal of our Physical needs	1
3	**Harmony in the Family and Society**	
3.1	Harmony in the Family – Understanding Values in Human Relationships	1
3.2	Family as the basic Unit of Human Interaction	1
3.3	Values in human Relationships	1
3.4	Trust – the foundation value in relationship	1
3.5	Respect as the right evaluation, the Basis for Respect, Assumed Bases for Respect today	1
3.6	Harmony from Family to World Family: Undivided Society	1
3.7	Extending Relationship from family to society , Identification of the Comprehensive Human Goal	1
3.8	Programs needed to achieve the Comprehensive Human Goal: The Five Dimensions of Human Endeavour	1
3.9	Harmony from Family Order to World Family Order – Universal Human Order	1
4	**Harmony in the Nature / Existence**	
4.1	The Four Orders in Nature	1
4.2	Participation of Human Being in Entire Nature	1
4.3	Natural Characteristics – Tendency of Human Living with Animal Consciousness / The Holistic Perception of Harmony in Existence	1
4.4	Present day Problems	1
4.5	Recyclability and self-regulation in Nature	1
4.6	Relationship of Mutual Fulfilment	1
4.7	An Introduction to space, Co-existence of Units in Space	1
4.8	Harmony in Existence – Understanding Existence as Co- Existence	1
4.9	Natural Characteristic of Human Living with Human Consciousness	1
5	**Implications of the Holistic Understanding**	

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5.1	Natural Acceptance of human values	1
5.2	Definitiveness of Ethical Human Conduct – Development of Human Consciousness	1
5.3	Identification of Comprehensive Human Goal	1
5.4	Basis for Humanistic Education and Humanistic Constitution	1
5.5	Ensuring Competence in professional Ethics	1
5.6	Issues in Professional Ethics-The Current Scenario	1
5.7	Holistic Technologies and Production Systems and management models – Typical Case Studies	2
5.8	Strategies for transition towards value based life and profession	1

Course Designer(s)

1. Dr.G.Vennila - vennila@ksrct.ac.in
2. Dr.K.Raja - rajak@ksrct.ac.in

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60 FT 3P1	Food Biochemistry Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

Objectives

- To remember the basics of qualitative analysis.
- To examine the quantitative estimation of carbohydrates.
- To study about determination of protein by appropriate methods.
- To learn the methods for lipids determination.
- To infer suitable methods to identify enzymes in food materials.

Pre-requisites

NIL

Course Outcomes

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

CO1	Recall the process of calibration of glass wares and preparation of regents.	Understand
CO2	Analyze the types of carbohydrate in food materials.	Analyze
CO3	Estimate the protein and lipids in food samples.	Apply
CO4	Determine the iodine, saponification number and minerals content present in the food sample	Apply
CO5	Apply suitable method to analyse the enzyme in the food sources and their effects.	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	20	10	50	50
Apply	20	10	30	30
Analyze	10	5	20	20
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

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Approved in Academic Council Meeting held on 07.01.23

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K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 FT 3P1 – Food Biochemistry Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	0	0	4	60	2	60	40	100

List of Experiments:

1. Calibration of glass wares- pipettes, burettes and volumetric flasks (demonstration) and Preparation of solutions: 1)percentage solutions, 2) molar solutions, 3) normal solutions
2. Qualitative tests for monosaccharide, disaccharide and polysaccharide.
3. Estimation of reducing sugar (Dinitrosalicylic method). *
4. Estimation of Total Carbohydrates in cereals by anthrone method. *
5. Isolation of Protein from milk and egg.*
6. Estimation of Protein by Lowry's method.
7. Estimation of Lipid by Folch's method. *
8. Estimation of cholesterol by Zak's method. *
9. Determination of Iodine number.
10. Determination of Saponification number.
11. Estimation of ash and acid insoluble ash.
12. Estimation of minerals present in food samples by flame photometry.*
13. Determine the dependence of catalase activity on temperature.
14. Identification of enzymes in different sources

Lab Manual

1.	Wilson, Keith and John Walker "Principles and Techniques of Biochemistry and Molecular Biology", 6th Edition. Cambridge University Press, 2006.
2.	Sadasivam, S., and Manickam, A, Biochemical Methods ", 3rd Edition, New Age International, Delhi, 1996.

SDG - *Good health and well-being

Course Designer(s)

Dr. K. Prabha - prabhak@ksrct.ac.in

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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60 FT 3P2	Food Microbiology Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

Objectives

- The students will be familiarize with procedures of isolation of bacteria culturing
- To learn aseptic technique, identification of organisms
- To explore conditions necessary for microbial growth as well as microbial control.
- The students should be able to analyse explicitly the concepts, develop their skills in the preparation
- To identify and quantify microorganisms.

Pre-requisites

NIL

Course Outcomes

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

CO1	Demonstrate the types of sterilization techniques ,cultivation and plating techniques of microorganism	Understand
CO2	Interpret the different types of staining techniques and biochemical analysis of bacteria	Analyze
CO3	Illustrate the biochemical analysis of microorganisms and microbial growth kinetics	Apply
CO4	Examine the load of coliform bacteria ,antimicrobial activity and production of alcoholic beverage	Apply
CO5	Illustrate the effect of pH , temperature and UV on microbial growth and Sauerkraut production	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	20	10	50	50
Apply	20	10	30	30
Analyze	10	5	20	20
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 FT 3P2 – Food Microbiology Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	0	0	4	60	2	60	40	100

List of Experiments:

1. Sterilization techniques, equipment and preparation of culture media –complex, synthetic and selective media.**
2. Isolation of bacteria from rotten food sample
3. Cultivation of microorganisms – agar slant, streak plate and spread plate.
4. Quantitative analysis of food sample by standard plate counting methods.*
5. Simple, Gram and Fungal staining methods.
6. Methylene Blue reduction test for Milk.*
7. Biochemical Analysis of Bacteria – Imvic method.
8. Isolation of probiotic bacteria from food sample using anaerobic chamber.*
9. Microbial Growth Kinetics in Fermentation process.
10. Effect of different sterilization methods on Bacteria.*
11. Antimicrobial activity of Antibiotics and Natural antimicrobial agent.
12. Production and evaluation of Fermented food.*
13. Effect of pH, temperature and UV on microbial growth.

Lab Manual

1.	"Food Microbiology Lab Manual", Department of Food Technology, KSRCT.
2.	Microbiology, Pelczar, Michael J. Chan and E.C.N Krieg Noel R. McGraw Hill Education; 5th edition, New Delhi, 2001.

SDG - *Good health and well-being, **Clean water and sanitation

Course Designer(s)

1. Dr.A.S.Ruby Celsia - rubycelsia@ksrct.ac.in

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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60 CG 0P2	Career Skill Development II	Category	L	T	P	Credit
		CG	0	0	2	1*

Objectives

- To help learners improve their vocabulary and enable them to use words appropriately in different academic and professional contexts.
- To help learners develop strategies that could be adopted while reading texts.
- To help learners acquire the ability to speak and write effectively in English in real life and career related situations.
- Improve listening, observational skills, and problem-solving capabilities
- Develop message generating and delivery skills

Pre-requisites

Basic knowledge of reading and writing in English

Course Outcomes

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

CO1	Compare and contrast products and ideas in technical texts.	Analyze
CO2	Identify cause and effects in events, industrial processes through technical texts	Analyze
CO3	Analyze problems in order to arrive at feasible solutions and communicate them orally and in the written format.	Analyze
CO4	Report events and the processes of technical and industrial nature.	Apply
CO5	Articulate their opinions in a planned and logical manner, and draft effective resumes in context of job search.	Apply

Mapping with Programme Outcomes

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

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technolgy								
60 CG 0P2 - Career Skill Development II								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	0	0	2	30	1*	100	00	100

Listening Evaluative Listening: Advertisements, Product Descriptions - Audio / video; filling a graphic organiser (choosing a product or service by comparison) - Listening to longer technical talks and completing– gap filling exercises. Listening technical information from podcasts – Listening to process/event descriptions to identify cause & effects, documentaries depicting a technical problem and suggesting solutions - Listening to TED Talks	**[6]**
Speaking Marketing a product, persuasive speech techniques - Describing and discussing the reasons of accidents or disasters based on news reports, Group Discussion (based on case studies),presenting oral reports, Mini presentations on select topics with visual aids, participating in role plays, virtual interviews	**[6]**
Reading Reading advertisements, user manuals and brochures - longer technical texts– cause and effect essays, and letters / emails of complaint - Case Studies, excerpts from literary texts,news reports etc. - Company profiles, Statement of Purpose (SoPs)	**[6]**
Writing Professional emails, Email etiquette - compare and contrast essay - Writing responses to complaints Precis writing, Summarizing and Plagiarism- Job / Internship application – Cover letter & Résumé	**[6]**
Verbal Ability II Reading Comprehension (Inferential fillups) – Spotting Errors – Verbal Analogies – Theme Detection – Change of Voice – Change of Speech – One word substitution	**[6]**
Total Hours:	**30**

Reference(s):

1.	*'English for Engineers & Technologists'* Orient Blackswan Private Ltd. Department of English, Anna University, 2020.
2.	Norman Lewis, *'Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book'*, Penguin Random House India, 2020
3.	Raman. Meenakshi, Sharma. Sangeeta, 'Professional English'. Oxford University Press. New Delhi. 2019
4.	Arthur Brookes and Peter Grundy,' Beginning to Write: Writing Activities for Elementary and Intermediate Learners', Cambridge University Press, New York, 2003

*** SDG- 04- Quality Education**

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Listening**	
1.1	Evaluative Listening: Advertisements, Product Descriptions	1
1.2	Listening to longer technical talks and completing– gap filling exercises.	1
1.3	Listening technical information from podcasts	1
1.4	Listening to process/event descriptions to identify cause & effects and documentaries depicting a technical problem and suggesting solutions	1
1.5	Listening to TED Talks	2
2	**Speaking**	
2.1	Marketing a product, persuasive speech techniques	1
2.2	Describing and discussing the reasons of accidents or disasters based on news reports,	1
2.3	Group Discussion (based on case studies)	1
2.4	Presenting oral reports, Mini presentations on select topics with visual aids	1
2.5	participating in role plays and virtual interviews	2
3	**Reading**	
3.1	Reading advertisements, user manuals and brochures	1
3.2	Reading - longer technical texts– cause and effect essays, and letters / emails of complaint	1
3.3	Case Studies, excerpts from literary texts, news reports etc.	1
3.4	Company profiles	1
3.5	Statement of Purpose (SoPs)	2
4	**Writing**	
4.1	Professional emails, Email etiquette	1
4.2	Compare and contrast essay	1
4.3	Writing responses to complaints	1
4.4	Precis writing, Summarizing and Plagiarism	1
4.5	Job / Internship application – Cover letter & Résumé	2
5	**Verbal Ability II**	
5.1	Reading Comprehension (Inferential fillups) and Theme Detection	1
5.2	Spotting Errors	1
5.3	Verbal Analogies	1
5.4	Change of Voice and Change of Speech	1
5.5	One word substitution	2

Course Designer(s)

1. Dr.A.Palaniappan - palaniappan@ksrct.ac.in

Passed in BoS Meeting held on 23.12.22
Approved in Academic Council Meeting held on 07.01.23

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K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE 637215
(An Autonomous Institution affiliated to Anna University)
B.E. / B.Tech. Degree Programme
SCHEME OF EXAMINATIONS
(For the candidates admitted in 2023-2024)
FOURTH SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1	60 MA 021	Probability and Statistics	2	40	60	100	45	100
2	60 FT 401	Fluid Mechanics and Mechanical Operation	2	40	60	100	45	100
3	60 FT 402	Meat, Fish and Poultry Process Technology	2	40	60	100	45	100
4	60 FT 403	Food Chemistry and Nutrition	2	40	60	100	45	100
5	60 FT E1*	Professional Elective – I	2	40	60	100	45	100
6	60 OE L0*	Open Elective – I	2	40	60	100	45	100
PRACTICAL								
7	60 FT 4P1	Food Chemistry and Nutrition Laboratory	3	60	40	100	45	100
8	60 FT 4P2	Unit Operations Laboratory	3	60	40	100	45	100
9	60 CG 0P3	Career Skill Development III	3	60	40	100	45	100
10	60 CG 0P6	Internship	-	-	-	100	-	100

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory End Semester Examination and 40 marks for practical End Semester Examination.

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

60 MA 021	Probability and Statistics	Category	L	T	P	Credit
		BS	3	1	0	4

Objectives

- To get exposed to the basic concepts of probability.
- To familiarize the concepts of correlation and regression.
- To familiarize various methods in hypothesis testing.
- To get exposed to the fundamentals of analysis of variance.
- To learn basics of descriptive statistics and control charts.

Pre-requisites

Nil

Course Outcomes

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

CO1	Understand the basic concepts of probability.	Apply
CO2	Calculate coefficient of correlation and regression.	Apply
CO3	Apply Student's t test, F test and Chi-square test for testing the statistical hypothesis.	Apply
CO4	Apply the concepts of ANOVA to test the equality of means for more than two populations.	Apply
CO5	Compute measures of central tendency and measures of dispersion, and apply the concepts of control charts for decision making.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
3 – Strong; 2 – Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	10	10	20
Apply	40	40	60
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech. Food Technology

60 MA 021 - Probability and Statistics

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	1	0	60	4	40	60	100

Probability and Random Variable Probability - Axioms of probability - Total probability - Conditional probability - Bayes theorem - Random variable - Discrete random variable - Probability mass function - Continuous random variable - Probability density function - Moment generating function.	**[9]**
Two Dimensional Random Variables Joint distribution - Marginal distribution - Conditional distribution - Covariance - Correlation - Rank Correlation - Regression.	**[9]**
Testing of Hypothesis Type I and Type II errors - Test of significance of small samples: **Student's 't' test - Single mean - Difference of means - F- test*** - Chi-square test - Goodness of fit - Independence of attributes.	**[9]**
Design of Experiments Analysis of variance - One way classification - Completely randomized design - **Two way classification*** - Randomized block design - Latin square design.	**[9]**
Statistics and Quality Control **Measures of Central tendency***: Mean, Median, Mode - Measures of Dispersion: Quartile deviation – Standard deviation - Coefficient of variation - Control charts: Mean $(\bar{X})$ chart and Range (R) chart - nP chart - C chart.	**[9]**
Total Hours: 45 + 15 (Tutorial)	**60**

Text Book(s):

1. Gupta S.C and Kapoor V.K., "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand & Sons, New Delhi, 2020.
2. Richard A Johnson, "Miller & Freund's Probability and Statistics for Engineers", 9th Edition, Pearson Education Limited, New Delhi, 2018.

Reference(s):

1. Sheldon Ross, "A first course in Probability", 10th Edition, Pearson Education, New Delhi, 2019.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, New Delhi, 2011.
3. Veerarajan T., "Probability, Statistics and Random Process", 3rd Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
4. Lipschutz, Seymour, Schiller John. J., "Schaum's outlines – Introduction to Probability and Statistics", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 1998.

***SDG: 4 – Quality Education**

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

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BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.	**Probability and Random Variable**	
1.1	Axioms of probability	1
1.2	Total probability	
1.3	Conditional probability	1
1.4	Bayes theorem	2
1.5	Tutorial	2
1.6	Discrete random variable - Probability mass function	2
1.7	Continuous random variable - Probability density function	1
1.8	Moment generating function	1
1.9	Tutorial	2
2.	**Two Dimensional Random Variables**	
2.1	Joint distribution	1
2.2	Marginal distribution	1
2.3	Conditional distribution	1
2.4	Covariance	1
2.5	Tutorial	2
2.6	Correlation	2
2.7	Rank Correlation	1
2.8	Regression	1
2.9	Tutorial	2
3.	**Testing of Hypothesis**	
3.1	Student's 't' test – Single mean	1
3.2	Student's 't' test - Difference of means	2
3.3	F- test	2
3.4	Tutorial	2
3.5	Chi-square test -Goodness of fit	1
3.6	Chi-square test - Independence of attributes	2
3.7	Tutorial	2
4.	**Design of Experiments**	
4.1	Analysis of variance - One way classification	2
4.2	Analysis of variance - Completely randomized design	1
4.3	Analysis of variance - Two way classification	2
4.4	Tutorial	2
4.5	Analysis of variance - Randomized block design	1
4.6	Analysis of variance - Latin square	2
4.7	Tutorial	2
5.	**Statistics and Quality Control**	
5.1	Mean, Median, Mode	2
5.2	Quartile deviation	1
5.3	Standard deviation	1
5.4	Coefficient of variation	1
5.5	Tutorial	2
5.6	Mean □X□ chart and Range (R) chart	1
5.7	nP chart	1
5.8	C chart	1
5.9	Tutorial	2

List of MATLAB Programs:

1. Calculating the probability for one dimensional random variable
2. Computing Coefficient of Correlation
3. Plotting Lines of regression
4. Visualizing data and performing Testing of hypothesis
5. Visualizing data and performing Chi-square test
6. Visualizing data and performing Analysis of Variance
7. Computing Mean, Median and Mode
8. Plotting and visualizing control charts

Course Designer(s)

1. Mr.G.Mohan - mohang@ksrct.ac.in
2. Ms.K.Geetha - geethak@ksrct.ac.in

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

60 FT 401	Fluid Mechanics and Mechanical Operation	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To imply the application of fluid statics and to know the basic dimensional analysis
- To impart concept of the nature of fluids with its properties and types
- To identity and understand the fluid transport through various methods.
- To comprehend the laws of size reduction in equipment such as sieve analysis
- To learn basic principles in mechanical operations in filtration, sedimentation and mixing.

Pre-requisites

NIL

Course Outcomes

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

CO1	Know about the nature of fluids and dimensional analysis	Apply
CO2	Learn about the fluid flow correction and application in pump work	Apply
CO3	Asses the performance of fluid moving machinery and it related concepts	Analyze
CO4	Comprehend the laws of size reduction in equipment	Apply
CO5	Describe the filtration process and sedimentation along with the concept of mixing patterns	Understand

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	30	20	30
Apply	20	20	30
Analyze	-	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology– Autonomous R2022

B.Tech. Food Technology

60 FT 401 - Fluid Mechanics and Mechanical Operation

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	1	0	60	4	40	60	100

Fluid Statics and Dimensional Analysis Nature of fluids, Properties of Fluids, Types of fluids – Newtonian and Non – Newtonian fluids; Compressible and incompressible. Velocity profiles. Fluid static: Hydrostatic equilibrium. Application of fluid statics: manometers, continuous gravity decanter. Basics of dimensional analysis: Rayleigh's method and Buckingham's method.	[9]
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. Friction factor for smooth and rough pipes. Friction loss due to sudden enlargement, contraction. Friction loss in fittings, valves and coils.	[9]
Metering and Transportation of Fluids Variable head meter: Orifice meter, Venturimeter, Pitot tube. Variable area meter: Rota meter. Calibration of flow meters. Valves – Types, applications. Fluid moving machinery. Performance – selection and specification. Positive displacement, centrifugal pump – characteristics-working principle and application. **Fans, blowers and compressors– Selection, types and applications**.*	[9]
Size Reduction Classification, laws of size reduction, equipments: sieve analysis- screening, differential and cumulative sieve analysis; **Problems in power requirement of size reduction equipments and screen effectiveness*:** storage of solids- bins, silo and hopper. Separation of solids based on specific properties: gravity settling, classifier, cyclone, jigging and froth floatation.	[9]
Filtration, sedimentation and Mixing Concept of filtration- Factors affecting rate of filtration-Types of filtration equipments. Concept and principle of sedimentation. **Agitation and mixing of liquids*: Concept of mixing- Types of mixers- construction and flow pattern of impellers-Types of impellers, Flow pattern in agitated vessel.**	[9]
Total Hours: 45 + 15 (Tutorial)	**60**

Text Book(s):

1. McCabe W.L., Smith J.C. and Harriot P., "Unit Operations of Chemical Engineering", 7th Edition, McGraw Hill, New York, 2021.
2. Gavhane K.A., "Unit Operations – I (Fluid Flow and Mechanical Operations)", 8th Edition, Nirali Prakashan Publications, Pune, 2011.

Reference(s):

1. Cengel, Yunus and Cimbala John M., "Fluid Mechanics Fundamentals and Applications", 2nd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2006.
2. Noel de Nevers, "Fluid Mechanics for Chemical Engineer", 4th Edition, McGraw Hill, New York, 2020.
3. Himmelblau D.M., "Basic Principles and Calculations in Chemical Engineering", 6th Edition, Prentice Hall of India, New Delhi, 2003.
4. Albert Ibarz, Gustavo V. Barbosa-Canovas, "Unit Operations in Food Engineering, Food Preservation Technology Series", CRC Press, 2003.

SDG 7 - *Affordable and clean energy

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1	**Fluid Statics and Dimensional Analysis**	
1.1	Introduction and Nature of fluids	1
1.2	Properties of Fluids	1
1.3	Types of fluids – Newtonian and Non – Newtonian fluids	1
1.4	Compressible and incompressible fluids	1
1.5	Fluid static: Hydrostatic equilibrium	1
1.6	Application of fluid statics: manometers	1
1.7	Application of fluid statics: continuous gravity decanter.	1
1.8	Basics of dimensional analysis: Rayleigh's method	1
1.9	Basics of dimensional analysis: Buckingham's method	1
2	**Basic Equations of Fluid Flow**	
2.1	Bernoulli equation	1
2.2	Correction of Bernoulli equation for fluid friction.	1
2.3	Application of Bernoulli equation for pump work	1
2.4	Shear stress in pipes	1
2.5	Skin friction in pipes.	1
2.6	Laminar and turbulent flow of fluids through closed conduits	1
2.7	Friction factor for smooth and rough pipes	1
2.8	Friction loss due to sudden enlargement, contraction	1
2.9	Friction loss in fittings, valves and coils	1
3	**Metering and Transportation of Fluids**	
3.1	Variable head meter: Orifice meter	1
3.2	Variable head meter: Venturimeter, Pitot tube	1
3.3	Variable area meter: Rota meter. Calibration of flow meters.	1
3.4	Valves – Types, applications	1
3.5	Fluid moving machinery	1
3.6	Performance – selection and specification	1
3.7	Positive displacement - working principle and application.	1
3.8	Centrifugal pump – characteristics-working principle and application.	1
3.9	Fans, blowers and compressors –Selection, types and applications	1
4	**Size Reduction**	
4.1	Front Axle - Wheel Geometry - Wheel Alignment and Balancing	1
4.2	laws of size reduction	1
4.3	sieve analysis- screening and differential sieve analysis	1
4.4	sieve analysis- cumulative sieve analysis;	1
4.5	Problems in power requirement of size reduction equipments and screen effectiveness: storage of solids- bins, silo and hopper.	1
4.6	Separation of solids based on specific properties: gravity settling,	1
4.7	Separation of solids based on specific properties: classifier	1
4.8	Separation of solids based on specific properties: jigging	1
4.9	Separation of solids based on specific properties: froth floatation.	1
5	**Filtration, sedimentation and Mixing**	
5.1	Concept of filtration	1
5.2	Factors affecting rate of filtration	1
5.3	Types of filtration equipments	1
5.4	Filtration process	1
5.5	Concept and principle of sedimentation	1
5.6	Agitation and mixing of liquids: Concept of mixing	1
5.7	Types of mixers-construction and flow pattern of impellers	1
5.8	Types of impellers	1
5.9	Flow pattern in agitated vessel	1

Course Designer(s)

1. Dr. P. Shanmugam - shanmugam@ksrct.ac.in

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

60 FT 402	Meat, Fish and Poultry Process Technology	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- Differentiate the types of meat available based on its composition and its structure.
- Students will be able to pronounce carious meat, fish and poultry processing techniques
- Preservation techniques and the post mortem changes that happen in them.
- Study the techniques involved in processing of fishes
- Understand the properties of egg and processing of egg and poultry

Pre-requisites

- Nil

Course Outcomes

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

CO1	Recognize the types of meat available with its structure and composition and illustrate the various steps in processing of meat products.	Apply
CO2	Assess the post-mortem changes of meat and the factors affecting the changes and design modern abattoirs/slaughter house by taking various features into account.	Understand
CO3	Implement various preservation methods for meat for improving shelf life and pronounce and produce different meat products with higher quality.	Understand
CO4	Differentiate different types of fish along with its structure and composition and identify recent trends in fish preservation such as freezing and canning.	Analyze
CO5	Understand the nutritional and functional properties of egg and illustrate different methods of egg processing and preservation	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	20
Understand	30	30	40
Apply	10	10	20
Analyze	-	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B. Tech. Food Technology								
60 FT 402 - Meat, Fish and Poultry Process Technology								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	40	60	100

Meat Recent trends in meat processing. Types of Meat and its sources, composition, structure, of meat and meat products. Introduction to Halal. Ante mortem handling, Slaughtering-pre slaughter care –stunning, methods of stunning – bleeding-skinning of animals, Mechanical deboning, inspection and grading of meat.	[9]
Aging of meat Post-mortem changes of meat. Factors affecting post-mortem changes, properties and shelf-life of meat. Meat tenderization and Meat quality evaluation. Modern abattoirs, slaughter house and its features.	[9]
Meat preservation Meat preservation-Methods of preservation-low temperature, chilling and freezing-Thermal processing-dehydration- curing and smoking-preservation using antibiotics-preservation by irradiation. Meat products – Ham and Beckon, sausage, quality control and standardization of meat.	[9]
Fish processing Types of fish, composition, structure, and spoilage factors of fish. Post-mortem changes in fish. Handling and transportation of fish. Preservation methods –Freezing and Individual Quick Freezing(IQF) – Canning, salting, smoking, drying of fish, pickling. On board preservation – RSW, CSW.	[9]
Egg and poultry processing Structure, composition, nutritive value, calculation of nutritive value and functional properties of eggs, Factor affecting egg quality and measures of egg quality. Preservation of egg by different methods – pasteurization, liquid egg, frozen egg, desugarisation-Egg powder processing. Poultry-Dressing–grading-slaughtering-scalding-Mechanical defeathering eviscerating-preservation-Quality control and standardization of poultry meat.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Panada P.C., —Text book on Egg and Poultry Technology, 1st Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 1996.
2.	Gunter Heinz and Peter Hautzinger, —Meat Processing Technology, 1st Edition, RapPublication, Monteplier, 2007.
Reference(s):	
1.	Ionnis S. Boziaris, —Seafood Handbook: Technology, Quality and Safety, Wiley Blackwell,UK, 2014.
2.	Mead G.C., —Poultry Meat Processing and Quality, 1st Edition, CRC Press, London, 2004.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being
***SDG 7 – Affordable and Clean Energy

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

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BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Meat**	
1.1	Recent trends in meat processing.	1
1.2	Types of Meat and its sources, composition, structure, of meat and meat products.	2
1.3	Introduction to Halal.	1
1.4	Ante mortem handling,	1
1.5	Slaughtering-pre slaughter care –stunning, methods of stunning– bleeding-skinning of animals,	2
1.6	Mechanical deboning, inspection and grading of meat.	2
2.0	**Aging of meat**	
2.1	Post-mortem changes of meat.	2
2.2	Factors affecting post-mortem changes,	1
2.3	Properties and shelf-life of meat.	1
2.4	Meat tenderization and Meat quality evaluation	1
2.5	Modern abattoirs.	1
2.6	Slaughter house and its features	1
3.0	**Meat preservation**	
3.1	Meat preservation-Methods of preservation-low temperature, chilling and freezing	2
3.2	Thermal processing-dehydration	1
3.3	Curing and smoking	1
3.4	preservation using antibiotics	1
3.5	Preservation by irradiation.	1
3.6	Meat products – Ham and Beckon, sausage, quality control and standardization of meat.	3
4.0	**Fish processing**	
4.1	Types of fish, composition, structure, and spoilage factors of fish.	2
4.2	Post-mortem changes in fish.	1
4.3	Handling and transportation of fish.	1
4.4	Preservation methods –Freezing and Individual Quick Freezing(IQF)	1
4.5	Canning	1
4.6	salting, smoking,	1
4.7	drying of fish, pickling.	2
4.8	On board preservation – RSW, CSW.	1
5.0	**Egg and poultry processing**	
5.1	Structure, composition, nutritive value, calculation of nutritive value and functional properties of eggs	2
5.2	Factor affecting egg quality and measures of egg quality.	1
5.3	Preservation of egg by different methods – pasteurization, liquid egg, frozenegg, desugarisation	2
5.4	Egg powder processing	1
5.5	Poultry-Dressing –grading-slaughtering-scalding	1
5.6	Mechanical defeathering eviscerating-preservation	2
5.7	Quality control and standardization of poultry meat	1

Course Designer(s)

1. Dr. J. Philip Robinson –philip@ksrct.ac.in

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

60 FT 403	Food Chemistry and Nutrition	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To understand the composition of food and importance of water
- To recognize the sources, functions and deficiency of minerals and vitamins
- To realize the importance of aroma and phytochemical's in food.
- To get an overview about nutrition.
- To learn basic metabolism, energy, and composition foods and weigh control.

Pre-requisites

Nil

Course Outcomes

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

CO1	Know about the composition of food and importance of water.	Understand
CO2	Learn about the sources, functions and deficiency of minerals and vitamins along with its properties and types.	Understand
CO3	Understand the function of colorants and toxic substance in foods.	Understand
CO4	Comprehend the basics of nutrition and its planning.	Understand
CO5	Describe the metabolic pathway, energy balance and composition of food for health.	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	20
Understand	40	40	40
Apply	-	-	30
Analyze	-	-	10
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology–AutonomousR2022

B. Tech Food Technology

60 FT 403 – Food Chemistry and Nutrition

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	40	60	100

FOOD COMPOSITION AND WATER** Proximate composition of food, water activity in food, water quality for food processing. Water as a nutrient, function, sources, requirement, structure, water balance – effect of deficiency. Moisture in food: Hydrogen bonding, Bound water, Free water, Water activity and Food stability.	[9]
MINERALS AND VITAMINS** Mineral & vitamin content of foods- stability & degradation during food processing. Mineral functions, sources, Bio-availability, and deficiency of following minerals – calcium, Iron, Iodine, Fluorine, sodium, potassium. Vitamins – Classification, units of measurement, sources, functions and deficiency diseases caused by following vitamins: a. Fats soluble vitamins – Vitamin A, D, E and K. Water soluble vitamins – Vitamin C and B-complex.	[9]
AROMA & IMPORTANT PHYTOCHEMICALS IN FOOD*** Naturally occurring colours/pigments in food and impact on antioxidant level, Synthetic food grade Colours, enzymatic browning of food, flavour & aroma components present in herbs, spices, coffee, tea, cocoa, fruits, vegetables & fermented products; and Naturally similar /artificial flavours, Threshold values, off flavours & food taints. Naturally occurring toxic substances, protease inhibitors, bioactive components phytates, polyphenols, saponins.	[9]
AN OVERVIEW OF NUTRITION* Definition, six classes of nutrients, calculating energy values from food, using the RDA, nutritional status, nutritional requirement, malnutrition, nutritional assessment of individuals and populations, dietary recommendations, Balanced diet planning: Diet planning principles, dietary guidelines; food groups, exchange lists, personal diet analysis; Digestion, Absorption and Transport: Anatomy and physiology of the digestive tract, mechanical and chemical digestion, absorption of nutrients.	[9]
METABOLISM, ENERGY BALANCE AND BODY COMPOSITION* Review of catabolic and anabolic pathways of glucose, fats and amino acids; Definition, units, calorific value of foods – bomb calorimeter; energy requirements – basal metabolism, specific dynamic action of foods, energy balance, direct and indirect calorimetry, physiological energy value of foods; Energy Balance and Body Composition: Energy balance; body weight and body composition; health implications; obesity, BMR and BMI calculations; Weight Control: Fat cell development; hunger, satiety and satiation; dangers of weight loss; how to identify unsafe weight loss schemes; treatment of obesity; attitudes and behaviors toward weight control.	[9]
Total Hours:	**45**

Text Book(s):

1. Belitz H.-D, Grosch W and Schieberle P. Food Chemistry, 4th Edition, Springer-Verlag, 2009.
2. Mann, Jim and Stewart Truswell “Essentials of Human Nutrition”. 3rd Edition. Oxford University Press, 2007.

Reference(s):

1. John M. deMan. “Principles of Food Chemistry”. 3rd Edition, Springer, 1999.
2. Chopra, H.K. and P.S. Panesar. “Food Chemistry”. Alpha Science International Limited,2010
3. Gibney, Michael J., et al., “Introduction to Human Nutrition”. 2nd Edition. Blackwell, 2009.
4. Gropper, Sareen S. and Jack L.Smith “Advanced Nutrition and Human Metabolism”. 5th Edition. Wadsworth Publishing, 2008.

***SDG2- Zero hunger**

****SDG3- Good health and well-being**

*****SDG12- Responsible consumption and production**

Passed in BoS Meeting held on 12.05.23

Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1	**FOOD COMPOSITION AND WATER**	
1.1	Proximate composition of food	1
1.2	water activity in food, water quality for food processing	2
1.3	Water as a nutrient, function, sources, requirement	1
1.4	structure, water balance – effect of deficiency	1
1.5	Moisture in food: Hydrogen bonding	1
1.6	Bound water, Free water	1
1.7	Water activity and Food stability	1
2	**MINERALS AND VITAMINS**	
2.1	Mineral & vitamin content of foods	1
2.2	Stability & degradation during food processing	1
2.3	Mineral functions, sources, Bio-availability	1
2.4	deficiency of following minerals – calcium, Iron, Iodine	1
2.5	Fluorine, sodium, potassium	1
2.6	Vitamins – Classification, units of measurement, sources	1
2.7	functions and deficiency diseases caused by vitamins	1
2.8	Fats soluble vitamins – Vitamin A, D, E and K	1
2.9	Water soluble vitamins – Vitamin C and B-complex	1
3.0	**Transmission Systems**	
3.1	Naturally occurring colours/pigments in food and impact on antioxidant level	1
3.2	Synthetic food grade Colours, enzymatic browning of food, flavor	2
3.3	aroma components present in herbs, spices, coffee, tea, cocoa	1
3.4	aroma components present in fruits, vegetables	1
3.5	aroma components present in fermented products	1
3.6	Naturally similar /artificial flavours, Threshold values, off flavours & food taints	1
3.7	Naturally occurring toxic substances, protease inhibitors	1
3.8	bioactive components phytates, polyphenols, saponins	1
4	**AN OVERVIEW OF NUTRITION**	
4.1	Definition, six classes of nutrients	1
4.2	calculating energy values from food, using the RDA	1
4.3	Nutritional status, nutritional requirement, malnutrition, nutritional assessment of individuals and populations	1
4.4	Dietary recommendations, Balanced diet planning	2
4.5	Diet planning principles, dietary guidelines; food groups, exchange lists	1
4.6	Personal diet analysis; Digestion, Absorption and Transport	1
4.7	Anatomy and physiology of the digestive tract	1
4.8	mechanical and chemical digestion, absorption of nutrients	1
5	**METABOLISM, ENERGY BALANCE AND BODY COMPOSITION**	
5.1	Review of catabolic and anabolic pathways of glucose, fats and amino acids	1
5.2	Definition, units, calorific value of foods – bomb calorimeter; energy requirements – basal metabolism	1
5.3	specific dynamic action of foods, energy balance, direct and indirect calorimetry	1
5.4	physiological energy value of foods	1
5.5	Energy Balance and Body Composition: Energy balance; body weight and body composition	1
5.6	health implications; obesity, BMR and BMI calculations	1
5.7	Weight Control: Fat cell development; hunger, satiety and satiation; dangers of weight loss	1
5.8	how to identify unsafe weight loss schemes	1
5.9	Treatment of obesity; attitudes and behaviours toward weight control	1

Course Designer(s)

1. Dr.K.Prabha - prabhak@ksrct.ac.in

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

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BOARD OF STUDIES

60 FT 4P1	Food Chemistry and Nutrition Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

Objectives

- To understand the extraction techniques of food samples.
- To analyze the important vitamins and food spoilage.
- To investigate and comprehend the physical and chemical aspects of foods.
- To become acquainted with the nutritious composition of foods
- To gain knowledge in quantitative methods in assessing nutritional status of individuals and groups.

Pre-requisites

NIL

Course Outcomes

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

CO1	Familiarize the extraction process and analyse the chemical components in the food sample.	Apply
CO2	Identify the vitamins and rancidity in the samples.	Analyze
CO3	Better understanding the physical and chemical properties of food.	Analyze
CO4	Recognizing the various food groups, food components, and energy from food.	Understand
CO5	Exposing to dietary allowances, food components, and nutritional assessments.	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	-	-	-
Apply	25	12	50	50
Analyze	25	13	50	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	**50**	**25**	**100**	**100**

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 FT 4P1 - Food Chemistry and Nutrition Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	0	0	4	60	2	60	40	100

List of Experiments:

1. Estimation of moisture content and crude fiber in the given food sample.
2. Extraction and estimation of chlorophyll for different green leafy vegetables
3. Extraction and Estimation of carotenoid and lycopene in the given sample.
4. Determination of vitamin C in the given food sample.
5. Determination of Solubility, Refractive index and Oxidative rancidity of given fats and oils.
6. Estimation of total polyphenol present in the given food sample.
7. Determination of Total soluble solid, titrable acidity and refractive index of various fruit juice.
8. Iso-electric precipitation of casein, Effect of rennin on milk proteins.
9. Detection of Saccharine in beverages.
10. Determination of α-amylase activity in the given sample by falling number test.
11. Calculation of energy balance of individuals based on 3 day dietary recall.
12. Dietary survey of a group of individuals/community.

Activity

Hospital visit and slide presentation on several nutritional deficiencies problems

Lab Manual

1.	"Food Chemistry and Nutrition Lab Manual", Department of Food Technology, KSRCT.

Course Designer(s)

1. Dr.K.Prabha - prabhak@ksrct.ac.in

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

60 FT 4P2	Unit Operations Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

Objectives

- To provide students with practical knowledge and hands on training in chemical engineering equipment.
- To illustrate principles of viscosity measurement and co-efficient of friction.
- To explore the knowledge on size reduction equipment
- To learn single effect evaporator and diffusivity measurements
- To learn various extraction process

Pre-requisites

NIL

Course Outcomes

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

CO1	Analyse Co-efficient of discharge of venture meter and orifice meter.	Apply
CO2	Estimate the viscosity of non-Newtonian fluids and co-efficient of friction in straight pipelines.	Analyze
CO3	Determination of Jaw/Roll Crusher and Stefan Boltzmann Constant.	Analyze
CO4	Estimate the heat transfer coefficients of the single effect evaporator and principle behind diffusivity measurements.	Understand
CO5	Review the principle of ternary equilibrium in liquid-liquid extraction and leaching process.	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	-	-	-
Apply	25	12	50	50
Analyze	25	13	50	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

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K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 FT 4P2 – Unit Operations Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	0	0	4	60	2	60	40	100

List of Experiments:

1. Determination of Coefficient of Discharge in Venturimeter
2. Determination of Coefficient of Discharge in Orifice meter
3. Estimate the Viscosity measurement for Non – Newtonian fluids
4. Determination of Coefficient of friction in Straight pipes
5. Determination of average particle size of the products from Ball mill
6. Determination of average particle size of the products from Hammer mill
7. Determination of Stefan Boltzmann Constant using radiation methods
8. Determination of heat transfer coefficient using Single effect evaporator
9. Determination of Heat transfer using natural convection
10. Estimate the diffusivity coefficient between the heat transfer objects.
11. Estimate the Ternary equilibrium in liquid – liquid extraction

Activity

Demonstrate the ether-oil and water-oil separation in the decantor.

Lab Manual

1.	McCab W. L. Smith J. C., Unit Operations of Chemical Engineering, Seventh editon, Mc Graw Hill Publications, New York, 2005.
2.	Perry Robert- Perry Chemical Engineering Hand Book eight Edition, Mc Graw Hill Publications, New York, 2007.

Course Designer(s)

1.Dr. P. Shanmugam- shanmugam@ksrct.ac.in

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

60 CG 0P3	Career Skill Development III	Category	L	T	P	Credit
		CG	0	0	2	1*

Objectives

- To help learners improve their logical reasoning skills at different academic and professional contexts.
- To help learners relate basic quantitative problems and solve them.
- To help learners Infer critically the statements with optimal conclusions and assumptions.
- To Solve the quantitative problems pertaining to calculations of averages, ratio and proportions, and profit and loss effectively
- To compute quantitative problems related to time and work, speed and distance, and simple and compound interest

Pre-requisites

Basic knowledge of Arithmetic and Logical Reasoning

Course Outcomes

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

CO1	Deduce the topics in logical reasoning at the preliminary and intermediate level.	Analyze
CO2	Relate basic quantitative problems and solve them effectively at the preliminary level	Apply
CO3	Infer critically the statements with optimal conclusions and assumptions with the data and information given.	Analyze
CO4	Solve the quantitative problems pertaining to calculations of averages,ratio and proportions, and profit and loss effectively at the pre-intermediate level.	Apply
CO5	Compute quantitative problems related to time and work, speed and distance, and simple and compound interest at intermediate level.	Apply

Mapping with Programme Outcomes

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

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 CG 0P3 - Career Skill Development III								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	0	0	2	30	1*	100	00	100

Logical Reasoning Analogies - Alpha and numeric series - Number Series - Coding and Decoding - Blood Relations - Coded Relations - Order and Ranking – odd man out - Direction and distance	**[6]**
Quantitative Aptitude – Part 1 Number system - Squares & cubes - Divisibility - Unit digits - Remainder Theorem - HCF& LCM - Geometric and Arithmetic progression - Surds & indices	**[6]**
Critical Reasoning Syllogism - Statements and Conclusions, Cause and Effect, Statements and Assumptions - identifying Strong Arguments and Weak Arguments – Cause and Action -Data sufficiency	**[6]**
Quantitative Aptitude – Part 2 Average - Ratio and proportion – Ages – Partnership– Percentage - Profit & loss – Discount - Mixture and Allegation	**[6]**
Quantitative Aptitude – Part 3 Time & Work - Pipes and cistern – Time, Speed & distance - Trains - Boats and Streams - Simple interest and Compound interest	**[6]**
Total Hours:	30

Reference(s):

1.	Aggarwal, R.S. 'A Modern Approach to Verbal and Non-verbal Reasoning', Revised Edition 2008, Reprint 2009, S.Chand & Co Ltd., New Delhi. 2009.
2.	Abhijit Guha, *'Quantitative Aptitude'*, McGraw Hill Education, 6th edition, 2016.
3.	Dinesh Khattar, 'Quantitative Aptitude For Competitive Examinations', Pearson Education 2020.
4.	Anne Thomson, 'Critical Reasoning: A Practical Introduction' Lexicon Books, 3rd edition, 2022.

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1	**Logical Reasoning**	
1.1	Analogies - Alpha and numeric series	1
1.2	Number Series - Coding and Decoding	1
1.3	Blood Relations - Coded Relations	1
1.4	Order and Ranking – odd man out	1
1.5	Direction and distance	2
2	**Quantitative Aptitude – Part 1**	
2.1	Number system	1
2.2	Squares & cubes - Divisibility	1
2.3	Unit digits - Remainder Theorem	1
2.4	HCF & LCM- Geometric and Arithmetic progression	1
2.5	Surds & indices	2
3	**Critical Reasoning**	
3.1	Syllogism	1
3.2	Statements and Conclusions, Cause and Effect	1
3.3	Statements and Assumptions	1
3.4	identifying Strong Arguments and Weak Arguments	1
3.5	Cause and Action -Data sufficiency	2
4	**Quantitative Aptitude – Part 2**	
4.1	Average - Ratio and proportion	1
4.2	Ages – Partnership	1
4.3	Percentage	1
4.4	Profit & loss	1
4.5	Discount - Mixture and Allegation	2
5	**Quantitative Aptitude – Part 3**	
5.1	Time & Work	1
5.2	Pipes and cistern	1
5.3	Time, Speed & distance - Trains	1
5.4	Boats and Streams	1
5.5	Simple interest and Compound interest	2

Course Designer(s)

1. R. Poovarasan - poovarasan@ksrct.ac.in

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)
B.E. / B.Tech. Degree Programme
SCHEME OF EXAMINATIONS
(For the candidates admitted in 2023-2024)
FIFTH SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1.	60 FT 501	Dairy Technology	2	40	60	100	45	100
2.	60 FT 502	Food Process Engineering	2	40	60	100	45	100
3.	60 FT 503	Food Safety and Quality Regulation	2	50	50	100	45	100
4.	60 FT 504	Heat and Mass Transfer	2	40	60	100	45	100
5.	60 FT E2*	Professional Elective – II	2	40	60	100	45	100
6.	60 OE L0*	Open Elective – II	2	40	60	100	45	100
7.	60 MY 003	Startups and Entrepreneurship	2	100	-	100	-	100
PRACTICAL								
8.	61 FT 5P1	Dairy Technology Laboratory	3	60	40	100	45	100
9.	60 FT 5P2	Food Process Engineering Laboratory	3	60	40	100	45	100
10.	60 FT 5P3	Design Thinking and Innovation Laboratory	3	60	40	100	45	100
11.	60 CG 0P4	Career Skill Development IV	3	100	-	100	-	100
12.	60 CG 0P6	Internship	-	100	-	100	-	100

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory End Semester Examination, 50 marks for theory cum practical End Semester Examination and 40 marks for practical End Semester Examination.

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
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60 FT 501	Dairy Technology	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To provide knowledge about the various types of milk processing techniques
- To understand about milk, milk processing methodologies
- To provide technical knowledge about the production of milk products
- To provide knowledge on packing equipment in milk processing
- To identify fermented and non-fermented milk products

Pre-requisites

Nil

Course Outcomes

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

CO1	Learn the milk processing equipment's and methods.	Understand
CO2	How to maintain and ensure the quality and safety of dairy products, including hygiene standards and food safety regulations.	Apply
CO3	Knowledge of creating new dairy products and improving existing ones through research and development.	Analyze
CO4	Identify the production process of various fermented and non-fermented milk products	Apply
CO5	Analyse the safety and quality factors that determine the acceptability of the dairy products by consumers.	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	0	20
Understand	40	10	30
Apply	10	40	30
Analyze	-	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B. Tech. Food Technology

60 FT 501 - Dairy Technology

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

Introduction Overview of dairy industry- Historical development of dairy processing, Role of dairy engineers in the industry. Milk - Definition, types of market milk, Composition and factors affecting quality of milk, System of milk pricing, Nutritive value of milk, Physico -chemical properties of milk.	[9]
Collection and inspection of fresh milk Raw milk collection - Cooling and Transportation, Inspection and Quality control of Raw milk, Platform tests of milk, Smell, Appearance, Temperature, Sediment, Acidity, Lactometer Reading, Fat, Solids-Not-Fat, Dye Reduction Test: MBRT test, Resazurian tests, Mastitis test, Neutralizer test and Adulteration test. Microbial inspection of milk.	[9]
Dairy Processing and Equipment's** Milk processing equipment – filtration/clarification – Pasteurization – HTST – LTLT - UHT methods - storage tanks - Cream separating Centrifuges - Homogenization – theory and working principle. Cream separation – principle, theory and separating efficiency of cream separators. Processing techniques of milk powder- types. Advanced novel equipment in dairy processing.	[9]
Packaging, storage and sanitation of dairy industries** Storage and distribution of milk. Principles and working of different packaging types for solid and liquid milk - bottle filters and capping machine, pouch filling machine, aseptic packaging and filling machines for bulk handling of milk products. Description, working, maintenance and factors affecting washing operations. CIP cleaning and designing of system.	[9]
Manufacturing of milk products* Production process of Cream, butter, ghee, ice-cream, infant milk food, khoa, chaana, Rabri, Kulfi. Fermented milk products-Yoghurt, dahi, shrikhand, lassi, buttermilk, kefir, paneer -quality aspects of milk products by advanced technologies.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Tufail Ahmad, "Dairy Plant Engineering and Management", Kitab Mahal Publishers, New Delhi, 2016.
2.	Sukumar De, Outlines of Dairy Technology. Oxford University Press, New Delhi. 2005.
Reference(s):	
1.	Robinson R.K., "Modern Dairy Technology: Advances in Milk Products", Volume 2, Springer London Ltd., 2012.
2.	Hui,Y.H,, "Dairy Science and Technology Handbook: Applications Science, Technology and Engineering, Volume 3, Wiley, New Delhi, 2014. Vol 3 ,2014.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Overview of dairy industry.	1
1.2	Historical development of dairy processing.	1
1.3	Role of dairy engineers in the industry.	1
1.4	Milk – Definition.	1
1.5	Types of market milk.	1
1.6	Composition and factors affecting composition of milk.	1
1.7	System of pricing of milk.	1
1.8	Nutritive value of milk.	1
1.9	Physico -chemical properties of milk.	1
2.0	**Collection and inspection of fresh milk**	
2.1	Raw milk collection - Cooling and Transportation.	1
2.2	Inspection and Quality control of Raw milk.	2
2.3	Platform tests of milk: Smell, Appearance, Temperature, Sediment,	1
2.4	Platform tests of milk: Acidity, Lactometer Reading, Fat, Solids-Not-Fat,	1
2.5	Dye Reduction Test: MBRT test,	1
2.6	Resazurian tests.	1
2.7	Mastitis test,	1
2.8	Neutralizer test.	1
3.0	**Dairy Processing and Equipment's**	
3.1	Milk processing equipment	1
3.2	filtration/clarification	1
3.3	Pasteurization – HTST – LTLT - UHT methods	1
3.4	storage tanks - Cream separating Centrifuges	1
3.5	Homogenization – theory - working principle of homogenizers – homogenization efficiency	2
3.6	cream separation – principles, gravity and centrifugal separation	1
3.7	Centrifugal separator – parts – construction and working principle – separation efficiency.	2
4.0	**Manufacturing of milk products**	
4.1	Production process of Cream, butter, ghee	1
4.2	Production process of ice-cream	1
4.3	Production process of infant milk food	1
4.4	Production process of khoa	1
4.5	Production process of chaana	1
4.6	Production process of Rabri	1
4.7	Production process of Kulfi.	1
4.8	Fermented milk products-Yoghurt, dahi, shrikhand, lassi, buttermilk, kefir, paneer	2
5.0	**Storage and sanitation of dairy equipment**	
5.1	Storage and distribution of milk.	1
5.2	Principles and working of different types of bottle filters and capping machine,	2
5.3	Pouch filling machine for bulk handling of milk products.	1
5.4	Aseptic packaging for bulk handling of milk products.	1
5.5	Filling machines for bulk handling of milk products.	1
5.6	Description, working and maintenance of can washers, bottle washers.	1
5.7	Factors affecting washing operations. CIP cleaning and designing of system.	2

Course Designer(s)

1. Mr.S. Nithishkumar – nithishkumar@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

60 FT 502	Food Process Engineering	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To learn about various food processing operations
- To understand about drying of food samples and the equipment
- To impart the applications of size reduction operations
- To familiarize on mechanical separation in food samples
- To brief on crystallization process performed at food processing industries**.**

Pre-requisites

Nil

Course Outcomes

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

CO1	Analyse the principles and working of equipment used in size reduction of food	Understand
CO2	Elaborate on the concept of sedimentation process, centrifugation, filtration and sieving	Apply
CO3	Adapt specific pre-processing operations of food materials	Analyze
CO4	Analyze the concept and mechanisms of dryers used in food industries	Apply
CO5	Recall the concept and types of equipment employed in crystallization process.	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	-	10
Understand	40	10	30
Apply	10	40	40
Analyze	0	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B. Tech Food Technology

60 FT 502 - Food Process Engineering

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	1	0	60	4	40	60	100

Size reduction in Food processing* Size reduction of Fibrous Food: Cutters - Slicers, Dicers, Pulper, Shredder and Flaker. Size reduction of dry foods: Crushers - Jaw, gyratory and crushing rolls, Grinders - Hammer mills, Fixed head mills, Ball mills, Plate mills and Roller mills. Size reduction in liquids: Emulsification and homogenization, Colloidal mill, Hydro shear homogenizers, High speed mixers, Pressure homogenizers, Ultrasonic homogenizers.	[9]
Mechanical Separation* Sedimentation - Gravitational sedimentation, Sedimentation in liquids, Sedimentation of particles in gas. Floatation. Centrifugal separation - Velocity of particles, Radius of neutral zone. Filtration – Constant rate and Constant pressure filtration, Sieving effectiveness and Applications. Extrusion, Crushing, Milling, shredding and Decantation principle, uses and applications.	[9]
Processing Operations* Types of processing operation: Cleaning - Wet and Dry-cleaning merits and demerits, Screen Cleaners, Air Screen Cleaners. Peeling - Flash steam, Abrasion, Caustic and Flame peeling. Grading and Sorting - Principles, types and equipment. Cutting and chopping, Grinding, Moisture content – free moisture, bound and unbound moisture. Equilibrium moisture content - determination methods, models, Importance and hysteresis effect. Water activity and its importance. Drying-Theory and mechanism of drying - Drying characteristics of materials.	[9]
Drying Equipment* Thin layer and deep bed drying. Various drying equipment: Tunnel Dryer, Belt Dryer, Drum Dryer, Spray Dryer, Fluidized Bed Dryer, Spouted bed dryer, Pneumatic Dryer, Rotary Dryer, Vacuum Drying, Freeze Drying, Heat Pump drying, Di-electric drying and Micro wave drying.	[9]
Crystallization Crystallization Equilibrium – Nucleation – Meta stable region – Seed Crystals. Heat of Crystallization - Rate of crystal growth. Stage equilibrium crystallization. Cooling crystallization, Evaporative crystallization, Batch crystallization, continuous crystallization - Principle and Applications.	[9]
Total Hours: 45 + 15 (Tutorial)	60

Text Book(s):

1.	Fellows P.J. Food Processing Technology: Principles and Practice, 3rd Edition, Wood Head Publishing Limited, New Delhi, 2009.
2.	Sahay K.M. and Singh K. K., —Unit Operations of Agricultural Processing, 2nd Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2012.

Reference(s):

1.	Earle R.L., Unit Operations in Food Processing, Web Edition, Pergamon Press, U.K., 2004.
2.	Paul Singh R. and Dennis R., Introduction to Food Process Engineering, 5th Edition, Academic Press, USA, 2014.
3.	Dennis R. Heldman and R. Paul Singh, Introduction to food engineering, Fourth edition, CRC Press, 2006.

*SDG 9 – Industry, Innovation And Infrastructure

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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Course C ntents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Size reduction**	
1.1	Size reduction of Fibrous Food, Cutters, Slicers, Dicers	1
1.2	Pulper, Shredder and Flaker, Size reduction of dry foods	1
1.3	Crushers - Jaw, gyratory and crushing rolls	1
1.4	Grinders - Hammer mills, Fixed head mills, Ball mills	1
1.5	Plate mills and Roller mills	1
1.6	Size reduction in liquids, Emulsification and homogenization	1
1.7	Colloidal mill, Hydro shear homogenizers	1
2.0	**Mechanical Separation**	
2.1	Gravitational sedimentation, Sedimentation in liquids	1
2.2	Sedimentation of particles in gas.	1
2.3	Floatation	1
2.4	Centrifugal separation	1
2.5	Velocity of particles, Radius of neutral zone	1
2.6	Filtration – Constant rate and Constant pressure filtration	1
2.7	Sieving effectiveness and Applications	1
2.8	Extrusion, Crushing-principle, uses and application	1
2.9	Milling, shredding and Decantation principle, uses and applications	1
3.0	**Processing Operations**	
3.1	Cleaning - Wet and Dry-cleaning merits and demerits	1
3.2	Screen Cleaners, Air Screen Cleaners	1
3.3	Peeling - Flash steam, Abrasion, Caustic and Flame peeling	1
3.4	Grading and Sorting - Principles, types and equipment	1
3.5	Cutting and chopping, Grinding	1
3.6	Moisture content – free moisture, Bound and unbound moisture, Equilibrium moisture content	1
3.7	Determination methods, models, Importance and hysteresis effect	1
3.8	Water activity and its importance.	1
3.9	Theory and mechanism of drying, Drying characteristics of materials	1
4.0	**Drying Equipments**	
4.1	Thin layer and deep bed drying	1
4.2	Tunnel Dryer, Belt Dryer	1
4.3	Drum Dryer	1
4.4	Spray Dryer	1
4.5	Fluidized Bed Dryer, Spouted bed dryer	1
4.6	Pneumatic Dryer, Rotary Dryer	1
4.7	Vacuum Drying, Freeze Drying	1
4.8	Heat Pump drying	1
4.9	Di-electric drying and Microwave drying	1
5.0	**Crystallization**	
5.1	Crystallization Equilibrium	1
5.2	Nucleation	1
5.3	Meta stable region	1
5.4	Seed Crystals	1
5.5	Heat of Crystallization	1
5.6	Rate of crystal growth	1
5.7	Stage equilibrium crystallization	1
5.8	Cooling crystallization, Evaporative crystallization	1
5.9	Batch crystallization, Continuous crystallization	1

Course Designer(s)

1. P. Aarthi – aarthi@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23
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60 FT 503	Food Safety and Quality Regulation	Category	L	T	P	Credit
		PC	2	0	2	3

Objectives

- To understand the basic concept of food safety and quality.
- To familiarize students with national and international regulatory agencies.
- To educate students about relevant food safety laws and regulations, including their scope, key provisions, and enforcement mechanisms.
- To equip students with the skills to detect, analyse, and prevent food adulteration, ensuring the integrity and safety of food products.
- To provide students with an understanding of labelling and packaging regulations.

Pre-requisites

Nil

Course Outcomes

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

CO1	Infer the knowledge about food safety and quality.	Understand
CO2	Understand the national and international regulatory agencies in Food sector.	Understand
CO3	Facilitate the importance of food safety laws and regulations.	Analyze
CO4	Acquire skills in detecting food adulteration, understanding common adulterants, and implementing strategies to prevent adulteration, and ensuring the integrity of Food products.	Apply
CO5	Equip the ability to interpret food labelling and packaging regulations.	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)				Model Examination (Marks)	End Sem Examination (Marks)	
	Test 1		Test 2				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	20	-	10	-	-	20	-
Understand	40	-	30	-	-	40	-
Apply	-	50	10	50	50	20	50
Analyze	-	50	10	50	50	20	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech Food Technology

60 FT 503 - Food Safety and Quality Regulation

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	2	0	2	60	3	50	50	100

Introduction to Food Safety and Quality Overview of Food Safety and Quality Assurance, Quality Assurance vs. Quality Control, Importance of Food Safety in Public Health, Consumer Protection, Historical Development of Food Regulation and Role of Government Agencies in Food Regulation.	[6]
Regulatory Frameworks and Standards National Regulatory Agencies: Functions and Responsibilities, International Organizations: Codex Alimentarius Commission – WHO - FAO, Comparison of Regulatory Frameworks in Different Countries, Harmonization of Food Standards and Regulations, Role of Non- Governmental Organizations (NGOs).	[6]
Food Safety Laws and Regulations* Food Safety and Standards Act, 2006 (India), Regulatory Authorities: Food and Drug Administration (FDA) - European Food Safety Authority (EFSA) - Food Standards Agency (FSA), Key Provisions: Food Safety – Labeling – Additives – Contaminants, Food Safety and Standards (FSS) Regulations (2011), Enforcement Mechanisms and Penalties for Non-Compliance.	[6]
Food Adulteration** Definition and Types of Food Adulteration, Adulterants in Food: Chemical – Biological – Physical, Common Adulterants: Identification of common substances used for food adulteration, Health Risks: foodborne illnesses - allergic reactions - long-term health effects, Methods of Detection and Analysis, Regulatory Measures to Combat Food Adulteration.	[6]
Food Labeling and Packaging Regulations Labelling Requirements: Nutritional Information and Allergen Declaration, Nutrition Labelling and Allergen Labelling, Health and Nutrient Claims, Packaging Standards: Materials -Safety – Preservation, Claims and Declarations: Organic - Non-GMO - Gluten- Free, Regulatory Compliance and Consumer Protection.	[6]
Practical: 1. Collection of food samples from different sources and perform microbial testing using agar plates. 2. Design a survey or conduct interviews to gather data on consumer attitudes towards food safety and quality. 3. Experiment on Measurement of the pH of various food items using a pH meter. Discuss how pH levels affect microbial growth and food stability. 4. Analyze food labels of various products and identify any discrepancies or violations of labelling requirements. 5. Experiment on qualitative tests for food samples to detect the presence of food additives. 6. Execute simple chemical tests to detect adulterants dairy products. Discuss the health risks associated with food adulteration. 7. Implement simple chemical tests to detect adulterants Spices products. Discuss the health risks associated with food adulteration. 8. Perform simple chemical tests to detect adulterants fruit and vegetable products. Discuss the health risks associated with food adulteration. 9. Expose food samples to different packaging materials (plastic, glass, metal) and assess their impact on food quality over time. 10. Design and evaluate food labels for compliance with regulatory standards. 11. Analyze food labels of different products to identify nutritional information, allergen declaration, and health claims.	[30]
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):	
1.	Sivasankar B. Food processing and preservation. PHI Learning Pvt. Ltd.; 2002.
2.	Vikas Nanda and Savita sharma. Novel Food Processing Technologies. NIPA Genx Electronic Resources and Solutions P. LTD. New Delhi.: 2017
3	.Khetarpaul, Neelam. “Food Processing and Preservation.” Daya Publications, 2005
Reference(s):	
1.	Rahman, M. Shafiur. “Handbook of Food Preservation”. Marcel & Dekker, 2006.
2.	Zeuthen, Peter and Bogh-Sarensen, Leif. “Food Preservation Techniques”. CRC / Wood Head Publishing, 2003.

*SDG 12 – Responsible Consumption and Production

**SDG 3 – Good Health and Well Being

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of Hours
1	**Introduction to Food Safety and Quality**	
1.1	Overview of Food Safety and Quality Assurance	1
1.2	Quality Assurance vs. Quality Control	1
1.3	Importance of Food Safety in Public Health	1
1.4	Consumer Protection	1
1.5	Historical Development of Food Regulation	1
1.6	Role of Government Agencies in Food Regulation	1
2	**Regulatory Frameworks and Standards**	
2.1	National Regulatory Agencies: Functions and Responsibilities	1
2.2	International Organizations: Codex Alimentarius Commission – WHO – FAO	2
2.3	Comparison of Regulatory Frameworks in Different Countries	1
2.4	Harmonization of Food Standards and Regulations	1
2.5	Role of Non-Governmental Organizations (NGOs)	1
3	**Food Safety Laws and Regulations**	
3.1	Food Safety and Standards Act, 2006 (India)	1
3.2	Regulatory Authorities: Food and Drug Administration (FDA) - European Food Safety Authority (EFSA) - Food Standards Agency (FSA)	2
3.3	Key Provisions: Food Safety – Labeling – Additives – Contaminants	1
3.4	Food Safety and Standards (FSS) Regulations(2011)	1
3.5	Enforcement Mechanisms and Penalties for Non-Compliance	1
4	**Food Adulteration**	
4.1	Definition and Types of Food Adulteration	1
4.2	Adulterants in Food: Chemical – Biological – Physical	1
4.3	Common Adulterants: Identification of common substances used for food Adulteration	1
4.4	Health Risks: foodborne illnesses - allergic reactions - long-term health effects	1
4.5	Methods of Detection and Analysis	1
4.6	Regulatory Measures to Combat Food Adulteration	1
5	**Food Labeling and Packaging Regulations**	
5.1	Labelling Requirements: Nutritional Information and Allergen Declaration	1
5.2	Nutrition Labelling and Allergen Labelling	1
5.3	Health and Nutrient Claims	1
5.4	Packaging Standards: Materials -Safety – Preservation	1
5.5	Claims and Declarations: Organic - Non-GMO - Gluten-Free	1
5.6	Regulatory Compliance and Consumer Protection	1
Practical:		
1.	Collection of food samples from different sources and perform microbial testing using agar plates	2
2.	Design a survey or conduct interviews to gather data on consumer attitudes towards food safety and quality	4
3.	Experiment on Measurement of the pH of various food items using a pH meter. Discuss how pH levels affect microbial growth and food stability	4
4.	Analyze food labels of various products and identify any discrepancies or violations of labelling requirements	2
5.	Experiment on qualitative tests for food samples to detect the presence of food additives	2
6.	Perform simple chemical tests to detect adulterants dairy products. Discuss the health risks associated with food adulteration	3
7.	Perform simple chemical tests to detect adulterants Spices products. Discuss the health risks associated with food adulteration	4
8.	Perform simple chemical tests to detect adulterants fruit and vegetable products. Discuss the health risks associated with food adulteration	2
9.	Expose food samples to different packaging materials (plastic, glass, metal) and assess their impact on food quality over time.	3
10.	Design and evaluate food labels for compliance with regulatory standards.	2
11.	Analyze food labels of different products to identify nutritional information, allergen declaration, and health claims.	2

Course Designer(s)

1. Mr. S. Nithishkumar- nithishkumar@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

60 FT 504	Heat and Mass Transfer	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To familiarize conduction heat transfer mechanisms
- To demonstrate the phase change heat transfer and determine the performance of heat exchanging devices
- To know principal of mass transfer concepts and its applications
- Choose evaporators and infer its performance.
- To infer diffusion and convective mass transfer

Pre-requisites

Nil

Course Outcomes

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

CO1	Apply the heat conduction equation to compute the rate of heat transfer and determine the heat transfer rate in free and forced convection	Understand
CO2	Make use of equations for calculating convective heat transfer coefficients and to determine the performance of the equipments	Analyze
CO3	Execute mass transfer rate in diffusion mass transfer applications	Apply
CO4	Evaluate convective mass transfer process and apply mass transfer principles in food and bioprocessing	Apply
CO5	Illustrate the principle and operation of leaching equipment's and make use of leaching calculations	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	10	30	20
Apply	20	20	40
Analyze	20	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech Food Technology

60 FT 504 - Heat and Mass Transfer

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	1	0	60	4	40	60	100

Heat Transfer Operations Introduction to Heat transfer Operations: Introduction, Modes of Heat Transfer, role in food processing operations. Conduction: Fourier's law of heat conduction. Natural and forced convection– Application of dimensional analysis for convection - Equations for forced and natural convection under laminar, transition and turbulent conditions. Individual and overall heat transfer coefficients and its relationship. Black body concept - Radiation Properties– Stefan Boltzmann's law, emissivity and absorptivity. Concept of grey body – radiation between non-black surfaces.	[9]
Heat Exchangers Parallel and counter flow heat exchangers - LMTD - Heat exchangers effectiveness; number of transfer unit – use of correction factor charts - Fouling factor. **Types of heat exchanger***- working principles and applications: Single pass, multi pass heat exchangers, shell and tube heat exchanger, plate heat exchangers. Types of evaporators – working principle and applications: Single effect evaporators, **multiple effect evaporators -Feed forward and feed backward operations, Open pan evaporator, horizontal tube evaporator, vertical tube evaporator, long tube evaporator, forced circulation evaporator****	[9]
Mass Transfer Operations and Diffusion Introduction to Mass Transfer Operations: Introduction, Classification and role of mass transfer operations in food processing. Diffusion: Ficks law of diffusion. Steady state molecular and eddy diffusion in gases and liquids. Measurement and prediction of diffusivity of gas and liquids, diffusion in solids. Introduction to unsteady state diffusion. Individual and over all mass transfer coefficients.	[9]
Humidification and Crystallization Humidification and Crystallization: Adiabatic saturation process and theory of wet bulb temperature - Measurement of humidity - **Cooling towers and Spray Chambers***. Principles of crystallization. **Crystallizers - Types – Applications****. Equilibrium in ternary systems - Solvent selection criteria- equilibrium stage wise contact.	[9]
Extraction and Leaching: Single stage extraction- Multi stage cross current and counter current operations. Extractors - working principle and applications: mixer settlers- **packed towers -spray towers- perforated plate towers- rotating disc contactors - pulsed column***. Solid-liquid equilibrium - single stage leaching - **multi stage cross-current and counter-current leaching operations****. Leaching equipment's – working principle and applications: Bollman extractor- Rotocel extractor- Hildebrand Extractor-Kennedy Extractor - Pachuca tank - Dorr agitator.	[9]
Total Hours: 45 + 15 (Tutorial)	**45**

Text Book(s):

1.	Gavhane K.A., "Heat Transfer SI Units", 13th Edition, Nirali Prakashan Publications, Pune, 2012.
2.	Anantharaman N., Meera Sheriffa Begam K.M., **"**Mass Transfer Theory and Practice**",** 1st Edition, PHI Publications, New Delhi, 2011.

Reference(s):

1.	Earle R.L., "Unit Operations in Food Processing", 2nd Edition, The New Zealand Institute of Food Science and Technology, 2008.
2.	Dutta Binay K., **"**Heat Transfer Principles and Applications**",** 1st Edition, Prentice Hall of India, New Delhi, 2015.
3.	Treybal R.E., **"**Mass Transfer Operations**"**, 3rd Edition, McGraw Hill, New York, 2012.
4.	Smith P.G., **"**Introduction to Food Process Engineering", 2nd Edition, Springer, New York, 2011.

*SDG 9 – Industry Innovation and Infrastructure

**SDG 7 – Affordable and Clean Energy

Passed in BoS Meeting held on 22.11.23

Approved in Academic Council Meeting held on 23.12.23

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BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Heat Transfer Operations**	
1.1	Introduction, Modes of Heat Transfer, role in food processing operations	1
1.2	Conduction: Fourier's law of heat conduction	1
1.3	Natural and forced convection	1
1.4	Application of dimensional analysis for convection	1
1.5	Equations for forced and natural convection under laminar, transition and turbulent conditions	1
1.6	Individual and overall heat transfer coefficients and its relationship	1
1.7	Black body concept	1
1.8	Radiation Properties–Stefan Boltzmann's law, emissivity and absorptivity	1
1.9	Concept of grey body – radiation between non-black surfaces	1
2.0	**Heat Exchangers**	
2.1	Parallel and counter flow heat exchangers - LMTD - Heat exchangers effectiveness	1
2.2	number of transfer unit – use of correction factor charts - Fouling factor	1
2.3	Types of heat exchanger- working principles and applications: Single pass, multi pass heat exchangers	1
2.4	Shell and tube heat exchanger, plate heat exchangers	1
2.5	Types of evaporators – working principle and applications: Single effect evaporators, multiple effect evaporators	1
2.6	Feed forward and feed backward operations	1
2.7	Open pan evaporator, horizontal tube evaporator	1
2.8	vertical tube evaporator, long tube evaporator	1
2.9	Forced circulation evaporator	1
3.0	**Mass Transfer Operations and Diffusion**	
3.1	Introduction to Mass Transfer Operations	1
3.2	Classification and role of mass transfer operations in food processing	1
3.3	Classification and role of mass transfer operations in food processing	1
3.4	Diffusion: Ficks law of diffusion	1
3.5	Steady state molecular and eddy diffusion in gases and liquids	1
3.6	Measurement and prediction of diffusivity of gas and liquids	1
3.7	Diffusion in solids	1
3.8	Introduction to unsteady state diffusion	1
3.9	Individual and over all mass transfer coefficients.	1
4.0	**Humidification and Crystallization**	
4.1	Humidification and Crystallization	1
4.2	Adiabatic saturation process and theory of wet bulb temperature	1
4.3	Measurement of humidity	1
4.4	Cooling towers and Spray Chambers	1
4.5	Principles of crystallization	1
4.6	Crystallizers - Types – Applications	1
4.7	Equilibrium in ternary systems	1
4.8	Solvent selection criteria	1
4.9	Equilibrium stage wise contact.	1
5.0	**Extraction and Leaching**	
5.1	Single stage extraction	1
5.2	Multi stage cross current and counter current operations	1
5.3	Extractors - working principle and applications	1
5.4	Mixer settlers- packed towers -spray towers- perforated plate towers- rotating disc contactors - pulsed columns	1
5.5	Solid-liquid equilibrium - single stage leaching	1
5.6	Multi stage cross current and countercurrent leaching operations	1
5.7	Leaching equipment's – working principle and applications	1
5.8	Bollman extractor- Rotocel extractor- Hildebrand Extractor	1
5.9	Kennedy Extractor - Pachuca tank - Dorr agitator	1

Course Designer(s)

1. Dr. J. Balachandra Mohan- balachandramohan@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

60 MY 003	Startups and Entrepreneurship	Category	L	T	P	Credit
		MY	2	0	0	2@

Objectives

- To Learn basic concepts in entrepreneurship, develop mind-set and skills necessary to explore entrepreneurship
- To provide practical proven tools for transforming an idea into a product or service that creates value for others.
- To Comprehend the process of opportunity identification through design thinking, identify market potential and customers while developing a compelling value proposition solution and prototypes
- To create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture ideas & solutions built with domain expertise
- To Prepare and present an investible pitch deck of their practice venture to attract stakeholders

Pre-requisites

- Basic knowledge of reading and writing in English

Course Outcomes

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

CO1	Develop an entrepreneurial mindset and appreciate the concepts of design thinking, entrepreneurship and innovation	Understand
CO2	Apply process of problem -opportunity identification and validation through human centred approach to design thinking in building solutions	Apply
CO3	Understand market types, conduct market estimation, identify customers, create customer persona, develop the skills to create a compelling value proposition and build a Minimum Viable Product	Apply
CO4	Create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture	Apply
CO5	Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders	Create

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Pitch Deck final submission & Via voce
	Milestone 1 (25 Marks)	Milestone 2 & 3 (25 Marks)	
Remember	10	-	50
Understand	05	10	
Apply	10	10	
Analyze	-	-	
Evaluate	-	-	
Create	-	5	
Total	25	25	

Passed in BoS Meeting held on 22.11.23
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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 MY 003 – Startups and Entrepreneurship								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V	2	0	0	30	2@	100	-	100

Introduction to Entrepreneurship & Entrepreneur Meaning and concept of Entrepreneurship, the history of Entrepreneurship development, Myths of Entrepreneurship, role of Entrepreneurship in Economic Development, Agencies in Entrepreneurship Management and Future of Entrepreneurship. The Entrepreneur: Meaning, the skills required to be an entrepreneur, the entrepreneurial decision process, Role models, Mentors and Support system. Innovation and Creativity, types of innovations, Innovations in current scenario	[6]
Problem-Opportunity Identification, Customers Discovery and competitive advantage Understanding the Problem and opportunity, define problem using Design thinking principles and validate problem. Exploring market types and estimating the market size, knowing your customer and consumer, Customer segmentation and creating customer personas. Importance of Value Proposition, Value Proposition Canvas, Developing Problem-solution fit, Competition analysis, Blue ocean strategy, Competitive positioning and understanding unique selling points.	[6]
Business model and build your MVP Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiest assumptions to Business models. Prototyping, building a Minimum viable product, Hypothesis testing and MVP Validation, MVP Iteration-Importance of Build - Measure – Learn approach	[6]
Business Plan, Financial feasibility and Managing growth Business planning: components of Business plan- Sales plan, People plan and financial plan, Preparing a business plan. Financial Planning: Types of costs, preparing the financial plan using financial template, understanding basics of Unit economics and analyzing Growth and the financial performance	[6]
Go To Market Strategies and Funding Introduction to Go to market strategies, start-up branding and its elements, Selecting the Right Channel, creating digital presence, building customer acquisition strategy. Choosing a form of business organization specific to your venture, identifying sources of funds: Debt & Equity, Map the Start-up Lifecycle to Funding Options, Build an Investor ready pitch deck.	[6]
Total Hours:	**30**

Text Book(s):	
1.	Stephen Key, “One Simple Idea for Startups and Entrepreneurs: Live Your Dreams and Create Your Own Profitable Company” 1st Edition, Tata Mc Grawhill Company, New Delhi, 2013.
2.	Charles Bamford and Garry Bruton, “Entrepreneurship: The Art, Science, and Process for Success”, 2nd Edition, Tata Mc Grawhill Company, New Delhi, 2016.
Reference(s):	
1.	Philip Auerswald, “The Coming Prosperity: How Entrepreneurs Are Transforming the Global Economy”, Oxford University Press, 2012.
2.	Janet Kiholm Smith; Richard L. Smith Richard T. Bliss, “Entrepreneurial Finance: Strategy, Valuation and Deal Structure, Stanford Economics and Finance”, 2011.
3.	Edward D. Hess, “Growing an Entrepreneurial Business: Concepts and Cases”, Stanford Business Books, 2011.
4.	Ignite program, wadhwani platform, Entrepreneurship, NPTEL online course By Prof. C Bhaktavatsala Rao | IIT Madras

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Approved in Academic Council Meeting held on 23.12.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Entrepreneurship & Entrepreneur**	
1.1	Meaning and concept of Entrepreneurship and the history of Entrepreneurship Development	1
1.2	The Entrepreneur: Meaning, the skills required to be an entrepreneur, the entrepreneurial decision process,	1
1.3	Myths of Entrepreneurship, How to Become a Successful Entrepreneur - Dr Romesh Wadhwani (Platform on boarding)	1
1.4	Role models, Mentors and Support system- Masterclass on My Story - Joshua Salins	1
1.5	Role of Entrepreneurship in Economic Development, Agencies in Entrepreneurship Management and Future of Entrepreneurship	1
1.6	Innovation and Creativity, types of innovations, Innovations in current scenario, Concepts of Entrepreneurial Thinking, General Enterprising tendency test	1
2.0	**Problem-Opportunity Identification, Customers Discovery and competitive advantage**	
2.1	Understanding the Problem and opportunity, define problem using Design thinking principles and validate problem. Case study and Fireside chat – Desi Hangover	1
2.2	Identifying a problem for practice venture and filling Problem statement canvas (Handout week 1 - class activity)	1
2.3	Customer and markets discovery , knowing your customer and consumer, Customer segmentation and Exploring market types and estimating the market size. Case study and Fireside chat – Verloop	1
2.4	Creating customer personas & Market estimation (Handout week 2 - class activity)	1
2.5	Importance of Value Proposition, Introduce Value Proposition Canvas, Developing Problem-solution fit. Case study and Fireside chat – Honey Twigs	1
2.6	Competition analysis, Blue ocean strategy, Competitive positioning and understanding unique selling points. Case study and Fireside chat on Inzpira Fill Value Proposition Canvas (Handout week 3 - class activity) and Competition analysis framework (Handout week 5 - class activity) **Briefing on Assignment 1 - Milestone 1**	1
3.0	**Business model and Build your MVP**	
3.1	Introduction to Business model and types. Case study and Fireside chat – NUOS	1
3.2	Lean approach, 9 block lean canvas model, riskiest assumptions to Business models	1
3.3	Class Activity- Fill Lean canvas for you idea and understand revenue model (Handout week 6)	1
3.4	Prototyping, Meaning of MLP , Difference between MLP and MVP, How to build an MLP? Different types MLP that you can build. Case study and Fireside chat – KNORISH	1
3.5	Hypothesis testing and MVP Validation, MVP Iteration-Importance of Build - Measure – Learn approach	1
3.6	Class Activity- Fill MVP framework (Handout week 7) and learn validation	1
4.0	**Business Plan, Financial feasibility and Managing growth**	
4.1	Business planning: components of Business plan- Sales plan, People plan and financial plan, Preparing a business plan. Case study and Fireside chat – Bodh Gems	1
4.2	Financial Planning: Types of costs, preparing the financial plan using financial template (Handout week 9)	1
4.3	Class activity - starting up costs, COGS, Sales plan and people plan template.	1
4.4	Class activity - One year P&L projection, Breakeven Analysis, Five year projection	1

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4.5	Understanding basics of Unit economics and analyzing Growth and the financial performance	1
4.6	Class activity - Financial template - Unit economics (Handout week 12)	1
5.0	**Go To Market Strategies and Funding**	
5.1	Introduction to Go to market strategies, start-up branding and its elements, Selecting the Right Channel	1
5.2	Creating digital presence, building customer acquisition strategy.	1
5.3	Class activity: Handout week 10 - create your GTM strategy	1
5.4	Choosing a form of business organization specific to your venture	1
5.5	Identifying sources of funds: Debt & Equity, Map the Start-up Lifecycle to Funding Options	1
5.6	Class activity - Visit relevant GOI websites, other sites to help students explore funding opportunities and **briefing on final submission of the pitch deck** Build an Investor ready pitch deck, What Should You Cover in Your Pitch Deck? Art of pitching and storytelling	1

Course Designer(s)

1. Dr.N.Tiruvenkadam - tiruvenkadam@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23
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CHAIRMAN
BOARD OF STUDIES

61 FT 5P1	Dairy Technology Laboratory	Category	L	T	P	Credit
		PC	0	0	3	1.5

Objectives

- The students will be able to analyze the milk sample and its grading.
- Production process of various types of butter and milk products.
- To provide knowledge on packing equipment in milk processing.
- To impart knowledge on Resazurian testing
- To identify fermented and non-fermented milk products

Pre-requisites

Nil

Course Outcomes

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

CO1	Analyze the physico-chemical properties of milk	Apply
CO2	Apply platform tests for assessing milk quality	Analyze
CO3	Estimate the efficiency of dairy processing equipment	Analyze
CO4	Analyse the process of resazurian testing of milk	Understand
CO5	Estimating the separating efficiency of cream.	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	-	-	-
Apply	25	12	50	50
Analyze	25	13	50	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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BOARD OF STUDIES

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. – Food Technology								
61 FT 5P1 - Dairy Technology Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V	0	0	3	45	1.5	60	40	100

List of Experiments:

1. Studies on Milk sampling, judging and grading of milk
2. Experiment of clot on Boiling test and Alcohol index of milk
3. Detection of adulterants in milk
4. Determination of Fat, SNF and total solids of milk
5. Studies on the regeneration efficiency process of milk.
6. Methylene blue reduction (MBR) test for milk
7. Experiment on Resazurian test of milk to deduct the quality
8. Development of flavored and fortified milk**
9. Development and quality evaluation of Paneer**
10. Determine the separating efficiency of the cream separator*
11. Determination of churning efficiency of butter churner *
12. Experiment on efficiency and Working Principle of Spray Dryer.

Lab Manual	
1.	"Dairy Technology Lab Manual", Department of Food Technology, KSRCT.

*SDG 9 – Industry Innovation and Infrastructure

**SDG 3 – Good Health and Well Being

Course Designer(s)

1. Mr. S. Nithishkumar- nithishkumar@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23

Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

60 FT 5P2	Food Process Engineering Laboratory	Category	L	T	P	Credit
		PC	0	0	3	1.5

Objectives

- To analyse and determine various physical properties of grains
- To analyze efficiency of desheller, dryer and grinders
- To familiarize on mechanical separation in food samples
- To brief on crystallization process performed at food processing industries.
- To impart knowledge on minimal processing of food samples.

Pre-requisites

Thermal Engineering

Course Outcomes

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

CO1	Estimate engineering properties of agricultural produce	Apply
CO2	Evaluate the performance of agro-processing equipment's	Analyze
CO3	Assess the effectiveness of size reduction equipment's	Analyze
CO4	Formulate the and determine the shelling efficiency	Understand
CO5	Analyse the minimal processing of fruits and vegetables	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	-	-	-
Apply	25	12	50	50
Analyze	25	13	50	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

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Approved in Academic Council Meeting held on 23.12.23

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BOARD OF STUDIES

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. – Food Technology								
60 FT 5P2 - Food Process Engineering Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V	0	0	3	45	1.5	60	40	100

List of Experiments:

1. Determination of size, roundness, and sphericity of food products.
2. Determination of bulk density, true density, and porosity of food products.
3. Determination of angle of repose and coefficient of friction of food products.
4. Performance evaluation of twin-screw extruder using Design of Experiments.
5. Experiment on drying of various food samples by fluidized bed dryer*
6. Experiment on drying of various food samples by microwave dryer*
7. Experiments on freezing point determination of given food sample
8. Experiments on dehydration and rehydration characteristics of food samples.
9. Determination of Shelling efficiency of Paddy Dehusker *
10. Determination of fineness module using Hammer and ball mill*

Activity Experiment

Experiment on Minimal processing of fruit and vegetables.

Lab Manual	
1.	"Food Process Engineering", Department of Food Technology, KSRCT.

*SDG 9 – Industry Innovation and Infrastructure

Course Designer(s)

1. P. Aarthi - aarthi@ksrct.ac.in

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BOARD OF STUDIES

60 FT 5P3	Design Thinking and Innovation Laboratory	Category	L	T	P	Credit
		PC	0	0	2	1

Objectives

- Understand the principles of design thinking and their application in engineering innovation
- Identify real-world engineering problems through brainstorming and mind mapping
- Explore problem space using secondary research methods, including the 5Ws and 1H Matrix, and user participant mapping
- Conduct primary research from multiple perspectives to ensure a user-centered approach
- Define and analyze problem areas to develop clear and well-structured problem statements

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Apply design thinking principles to promote innovation.	Apply
CO2	Identify and articulate real-world engineering problems through brainstorming and mind map techniques.	Apply
CO3	Perform secondary research using tools 5Ws and 1H Matrix and user participant mapping to explore problem spaces.	Apply
CO4	Conduct primary research to gather insights from diverse perspectives, ensuring a user- centered approach in problem-solving.	Apply
CO5	Define and analyze problem areas to create precise and actionable problem statements.	Analyse

Mapping with Programme Outcomes

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

Assessment Pattern

Review I (CO1)			Review II (CO2,CO3,CO4)			Review III (CO5)			Total (R1+R2+ R3)	Internal
Identification of Existing Problems and Solutions	Apply design thinking principles	Case study report	Selection of Problem	Secondary and Primary Research on Problem Space	Presentation	Analysis of Problem Space	OIOR	Presentation	Total	
10	10	10	10	30	10	5	10	5	100	60

Report and Presentation (CO1, CO2, CO3, CO4 & CO5)			External
Report	Presentation	Total	
50	50	100	40

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K.S.Rangasamy College of Technology – Autonomous R2022								
B. Tech. – Food Technology								
60 FT 5P3 – Design Thinking and Innovation Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V	0	0	2	30	1	60	40	100

Design Thinking and Innovation Process Introduction to Design Thinking and Innovation - Design, Design Thinking, Innovation - Stages of Design Thinking Process – Case Study: Analysis of Existing Problems and Solutions.	[8]
Selection of Problem Identification and Selection of Problem to Solve, Tools - Brain-storming- Sorting & affinity-Links, Mind-mapping- affinity-Links.	[4]
Secondary research on Problem Space Information Gathering: from past and existing - Secondary Research - Ask questions: Why, who, what, where, when, how, etc, 5Ws and 1H Matrix Table - User Participant Mapping.	[6]
Primary research on Problem Space Understanding your Users environment - Primary research - Observation, Conversations, Questionnaires, Documentation - Conducting Contextual Inquiry.	[6]
Analysis of Problem Space Identify, Classify, Compare, Prioritize, Cross-relate information - Personas Observations, Inference, Opportunities, Recommendations (OIOR) - Redefining the Problem Statement.	[6]
Total Hours:	30

Reference

1.
- NPTEL: Design Thinking and Innovation by Prof. Ravi Poovaiah, IDC School of Design, IIT Bombay. https://onlinecourses.swayam2.ac.in/aic23_ge17/preview, https://dsource.in/dti
- NPTEL: Design, Technology and Innovation by Prof. B. K. Chakravarthy, IDC School of Design, IIT Bombay. https://onlinecourses.nptel.ac.in/noc20_de03/preview
- NPTEL: Innovation by Design by Prof. B. K. Chakravarthy, IDC School of Design, IIT Bombay, https://onlinecourses.swayam2.ac.in/aic19_de02/preview.,
- www.dsource.in , The Resource for Design by e-Kalpa Design Team, IDC, IIT Bombay,DoD, IIT Guwahati & NID, Bengaluru.

*SDG 9 – Industry Innovation and Infrastructure

Course Designer(s)

1. Dr.K.Raja – raja@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
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60 CG 0P4	Career Skill Development IV	Category	L	T	P	Credit
		CG	0	0	2	1*

Objectives

- To help learners improve their vocabulary and enable them to use words appropriately in different academic and professional contexts.
- To help learners develop strategies that could be adopted while reading texts.
- To help learners acquire the ability to speak and write effectively in English in real life and career related situations.
- Improve listening, observational skills, and problem-solving capabilities
- Develop message generating and delivery skills

Pre-requisites

Basic knowledge of Arithmetic and Logical Reasoning

Course Outcomes

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

CO1	Compare and contrast products and ideas in technical texts.	Analyze
CO2	Identify cause and effects in events, industrial processes through technical texts	Analyze
CO3	Analyze problems in order to arrive at feasible solutions and communicate them orally and in the written format.	Analyze
CO4	Report events and the processes of technical and industrial nature.	Apply
CO5	Articulate their opinions in a planned and logical manner, and draft effective résumés in context of job search.	Apply

Mapping with Programme Outcomes

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

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Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech. Food Technology

60 CG 0P4 - Career Skill Development IV

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	0	0	2	30	1*	100	00	100

Verbal & Analytical Reasoning Seating Arrangements – Analytical Reasoning (PUZZELS) – Machin input and output - Coded Inequality – Eligibility Test	**[6]**
Quantitative Aptitude - Part – 4 Permutation and Combination - Probability - Quadratic equation - Geometry – Clock – Calendar – Logarithmic	**[6]**
Non-Verbal Reasoning Series Completion of Figures – Classification – Courting of figure – Figure matrix – Embedded Figure – Complete Figure – Paper Cutting and Folding – Mirror images and Water Images	**[6]**
Quantitative Aptitude - Part – 5 Mensuration of Area, Volume and Surface area in 2D and 3D Shapes – 2D Shapes – Square, Rectangle, Triangle, Circle, etc. - 3D Shapes – Cube, Cuboid , Sphere , Cone , etc.	**[6]**
Data Interpretation and Analysis Data interpretation Based on text - Data interpretation Based on Tabulation , Pie chart , Bar graph, And Line graph – Venn Diagram - Data sufficiency	**[6]**
Total Hours:	**30**

Reference(s):

1.	Aggarwal, R.S. *'A Modern Approach to Verbal and Non-verbal Reasoning'*, Revised Edition 2008,Reprint 2009,S.Chand & Co Ltd., New Delhi.
2.	Abhijit Guha, *'Quantitative Aptitude'*, McGraw Hill Education, 6th edition, 2016
3.	Dinesh Khattar, 'Quantitative Aptitude For Competitive Examinations', Pearson Education (2020)
4.	Anne Thomson, *'Critical Reasoning: A Practical Introduction'* Lexicon Books, 3rd edition, 2022. Warszaw

SDG 4 – Quality Education
SDG 8 – Decent work and Economic growth
SDG 9 – Industry, innovation and Infrastructure

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Verbal & Analytical Reasoning**	
1.1	Seating Arrangements	1
1.2	Analytical Reasoning (PUZZELS)	1
1.3	Machin input and output	1
1.4	Coded Inequality	1
1.5	Eligibility Test	2
2.0	**Quantitative Aptitude - Part – 4**	
2.1	Permutation and Combination	1
2.2	Probability	1
2.3	Quadratic equation - Geometry	1
2.4	Clock – Calendar	1
2.5	Logarithmic	2
3.0	**Non-Verbal Reasoning**	
3.1	Series Completion of Figures – Classification	1
3.2	Courting of figure – Figure matrix	1
3.3	Embedded Figure – Complete Figure	1
3.4	Paper Cutting and Folding	1
3.5	Mirror images and Water Images	2
4.0	**Quantitative Aptitude - Part – 5**	
4.1	Mensuration of Area, Volume	1
4.2	Mensuration of Volume	1
4.3	Surface area in 2D and 3D Shapes	1
4.4	2D Shapes – Square, Rectangle, Triangle, Circle, etc.	1
4.5	3D Shapes – Cube, Cuboid , Sphere , Cone , etc.	2
5.0	**Data Interpretation and Analysis**	
5.1	Data interpretation Based on text	1
5.2	Data interpretation Based on Tabulation, Pie chart	1
5.3	Bar graph , And Line graph	1
5.4	Venn Diagram	1
5.5	Data sufficiency	2

Course Designer(s)

1. R. Poovarasan - poovarasan@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)
B.E. / B.Tech. Degree Programme
SCHEME OF EXAMINATIONS
(For the candidates admitted in 2023-2024)
SIXTH SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1.	60 HS 002	Engineering Economics And Financial Accounting	2	40	60	100	45	100
2.	60 FT 601	Baking and Confectionery Technology	2	40	60	100	45	100
3.	60 FT 602	Food Process plant layout and safety	2	40	60	100	45	100
4.	60 FT 603	Refrigeration and Cold Chain Management	2	40	60	100	45	100
5.	60 FT E3*	Professional Elective – III	2	50	50	100	45	100
6.	60 OE L0*	Open Elective – III	2	40	60	100	45	100
PRACTICAL								
7.	61 FT 6P1	Baking and Confectionary Laboratory	3	60	40	100	45	100
8.	60 FT 6P2	Computational Laboratory for Food Technology	3	60	40	100	45	100
9.	60 FT 6P3	Design Thinking and Product Development Laboratory	3	60	40	100	45	100
10.	60 CG 0P5	Comprehension Test	-	100	-	100	-	100
11.	60 CG 0P6	Internship	-	100	-	100	-	100

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory End Semester Examination, 50 marks for theory cum practical End Semester Examination and 40 marks for practical End Semester Examination.

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BOARD OF STUDIES

60 HS 002	Engineering Economics and Financial Accounting	Category	L	T	P	Credit
		HS	3	0	0	3

Objectives

- To know about the economic principles underlying demand, supply, and market structure
- To understand the concept related to types of business organization and types of banking
- To know about concepts in financial accounting and capital budgeting
- To understand the different methods of pricing and appraisal of projects
- To know the application of break-even analysis in engineering projects

Pre-requisites

NIL

Course Outcomes

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

CO1	Understand the basic concepts of economics, demand, supply, and market structure	Understand
CO2	Understand the forms of business organization and functions of commercial and central bank	Understand
CO3	Understand the basis of financial accounting and capital budgeting techniques	Understand
CO4	Apply different types of pricing strategies and comprehensive project feasibility in diverse business	Apply
CO5	Apply break even analysis in engineering projects and business	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	30	25	35
Understand	30	25	45
Apply	-	10	20
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech. Food Technology

60 HS 002 – Engineering Economics and Financial Accounting

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100

Basic Economics Definition of Economics – Nature and Scope of Economics, Basic Concepts of Economics, Factors of Production - Definition of Demand – Law of Demand, Exception to Law of Demand, Factors Affecting Demand, Elasticity of Demand, Demand Forecasting – Definition of Supply – Factors Affecting Supply, Elasticity of Supply – Market Structure – Perfect Competition, Imperfect Competition – Monopoly, Duopoly, Oligopoly, and Bilateral Monopoly.	[9]
Organization and Business Financing* Forms of Business – Sole Proprietorship, Partnership, Joint Stock Company, Cooperative Organization, State Enterprise - Mixed Economy - Money and Banking – Kinds of Banking, Functions of Commercial Banks and Central Bank – Definition of Monetary Policy and its Types – Types of financing - Short Term Borrowing, Long Term Borrowing - Internal Generation of Funds – External Commercial Borrowings.	[9]
Financial Accounting and Capital Budgeting The Balance Sheet and Related Concepts – The Profit and Loss Statement and Related Concepts – Financial Ratio Analysis – Definition of Working Capital – Types, Factors – Definition of Capital Budgeting - Techniques – Average Rate of Return, Payback Period, Net Present Value, Profitability Index Method and Internal Rate of Return.	[9]
Cost Analysis Types of Costing – Traditional Costing Approach - Activity Based Costing - Fixed Cost – Variable Cost – Marginal Cost – Cost Output Relationship in the Short Run and in Long Run – Pricing Practice – Full Cost Pricing – Marginal Cost Pricing – Going Rate Pricing – Bid Pricing – Pricing for a Rate of Return – Project Appraisal - Appraisal process, - Cost Benefit Analysis – Feasibility Reports –– Technical Feasibility, Economic Feasibility, Financial Feasibility, Managerial Feasibility, Operational Feasibility.	[9]
Break Even Analysis Basic Assumptions –Break-Even Chart – Profit Zone in Break-Even Chart, Loss Zone in Break-Even Chart, Angle of Incidence – Managerial Uses of Break-Even Analysis, Applications of Break-Even Analysis in Engineering Projects.	[9]
Total Hours:	**45**

Text Book(s):

1. Khan M.Y., Jain P.K., "Financial Management ", 8th Edition , McGraw Hill Education, 2018.
2. Maheshwari K.L., Varshney R.L., "Managerial economics", 22nd Edition, S Chand and Co., New Delhi, 2018.

Reference(s):

1. Samuelson P.A., " Economics - An Introductory", 16th Edition, New Age Publications, New Delhi, 2019.
2. Barthwal R.R., " Industrial Economics - An Introductory", 4th Edition, New Age Publications, New Delhi, 2021.
3. Bhattacharyya S. K., John Deardon, "Accounting for Management Text and Cases", 3rd Edition, S Chand Publication, 2018.

*SDG 9 – Increase Industry Innovation and Infrastructure

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1	**Basic Economics**	
1.1	Definition of economics – nature and scope of economics	1
1.2	Basic concepts of economics, factors of production	1
1.3	Definition of demand – law of demand	1
1.4	Exception to law of demand	1
1.5	Factors affecting demand, elasticity of demand	1
1.6	Demand forecasting	1
1.7	Definition of supply – factors affecting supply,	1
1.8	Elasticity of supply	1
1.9	Market structure – perfect competition, imperfect competition	1
2	**Organization and Business Financing**	
2.1	Forms of business – sole proprietorship, partnership	1
2.2	Joint stock company, cooperative organization, state enterprise	1
2.3	Mixed economy - Money and banking	1
2.4	Kinds of banking	1
2.5	Functions of commercial banks and central bank	1
2.6	Definition of monetary policy and its types	1
2.7	Types of financing	1
2.8	Short term borrowing, long term borrowing	1
2.9	Internal generation of funds	1
3	**Financial Accounting and Capital Budgeting**	
3.1	The balance Sheet and related concepts	1
3.2	The profit and loss statement and related concepts	1
3.3	Financial ratio analysis	1
3.4	Definition of Working capital – types	1
3.5	Factors	1
3.6	Definition of Capital budgeting - Techniques	1
3.7	Average rate of return, Payback period	1
3.8	Net present value, Profitability index method	1
3.9	Internal rate of return	1
4	**Cost Analysis**	
4.1	Types of costing - Traditional costing approach - activity based costing	1
4.2	Fixed Cost – variable cost – marginal cost	1
4.3	Cost output relationship in the short run and in long run	1
4.4	Pricing practice – full cost pricing	1
4.5	Marginal cost pricing, going rate pricing	1
4.6	Bid pricing – pricing for a rate of return	1
4.7	Project appraisal - appraisal process - Cost benefit analysis	1
4.8	Feasibility reports -— technical feasibility, economic feasibility	1
4.9	Financial feasibility, managerial feasibility, operational feasibility	1
5	**Break Even Analysis**	
5.1	Basic assumptions – break-even chart	2
5.2	Profit zone in break-even chart, Loss zone in break-even chart	2
5.3	Angle of incidence	2
5.4	Managerial uses of break-even analysis	2
5.5	Applications of break-even analysis in engineering projects	1

Course Designer(s)

1. Mr.V.S.Vijayachander - vijayachander@ksrct.ac.in
2. Dr.E.kalaivani - kalaivanie@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

60 FT 601	Baking and Confectionery Technology	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To give knowledge in Bakery and confectionary technology.
- To provide knowledge on entrepreneurship and development of bakery product.
- To learn production process of cookies, biscuits, cakes and wafers.
- To know about production process of various confectionery products.
- To impart knowledge on quality parameters in a baking industry

Pre-requisites

Nil

Course Outcomes

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

CO1	Recognize the role of ingredients, current status and classification of bakery products	Understand
CO2	Illustrate the types of equipment used in bakery industry.	Apply
CO3	Classify the types of bread making process and chemistry, defects of bread formation	Analyze
CO4	Describe the production process of cookies, biscuits, cakes, wafers and pastry	Apply
CO5	Explicate the current status, ingredients and production process of various confectionery products and their quality parameters	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	10
Understand	40	30	30
Apply	10	10	30
Analyze	-	10	20
Evaluate	-	-	10
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B. Tech Food Technology

60 FT 601 - Bakery and Confectionery Technology

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100

Introduction to Baking and its ingredients Current status of bakery, Classification of bakery products Ingredients used in baking: Types and its functions – flour, sugar, fat, salt, yeast and baking powder; emulsifiers- egg, other ingredients - Coloring agents, flavoring agents, emulsifiers, antioxidants, Conditioners, CBE and CBS and leaving agents in bakery products. FSSAI guidelines.	[9]
Bakery Equipment and Rheology of dough* Types of equipment used in baking process; Bulk handling of ingredients- Types of Dough mixers Spiral and Planetary mixer, Dividing, rounding, sheeting, and laminating- Fermentation enclosures, Types of Ovens and Slicers. Cookies wire cut and dropping machine, Rheology of dough- Viscograph Farinograph, Amylograph, Alveograph and Extensiograph.	[9]
Bread making process Bread making methods - Straight dough/bulk fermentation, Sponge and dough, Activated dough development, Chorleywood bread process, No time process. Chemistry of Dough Development. Characteristics of good bread- Internal and external characteristics. Bread defects/faults and remedies. Microbial spoilage of bread - Causes, detection and prevention, Role of Enzyme in bread making process.	[9]
Bakery products** Production of cookies/biscuits: ingredients and its functions - Types of dough –Developed dough, short dough 's, semi-sweet and enzyme modified dough and batters- importance of the consistency of the dough. Production process of Cake making: Ingredients and its function: Icing and decoration for cakes, Egg less cake, Wafers, puff pastry.	[9]
Confectionery products** Importance of sugar rheology properties, types of sugar glucose and confectionery. Ingredients used in confectionery, Manufacture methods of high boiled sweets: Prevention of recrystallized and stickiness of sugar. Types, Formulation, Processing of confectionery products: Caramel, Toffee and Fudge; Aerated confectionery-Methods of aeration-Manufacturing process- Chemistry of Hydrocolloids -pre-treatment Processes-product quality parameters, faults and corrective measures. Spoilage of confectionery products.	[9]
Total Hours:	**45**

Text Book(s):

1.	Samuel A. Matz, "Bakery Technology and Engineering", 3rd Edition, Chapman and Hall, London, 2005.
2.	Edwards W.P. "Science of bakery products, Published by The Royal Society of Chemistry, UK,2007.

Reference(s):

1.	Geoff Talbot, Science and technology of enrobed and filled chocolate, confectionery and bakery products, Wood head publishing, 2009.
2.	Ferenc A. Mohos, "Confectionery and Chocolate Engineering: Principles and Applications", Wiley Blackwell, UK, 2010.
3.	E.J. Pyler and L.A. Gorton. Baking Science & Technology, Vol. II: Formulation & Production, 4th Ed. Sosland Publishing Company, Kansas City, MO, USA, 2009.

*SDG 9 – Industry Innovation and Infrastructure

**SDG 3 – Good Health and Well Being

Passed in BoS Meeting held on 22.11.23

Approved in Academic Council Meeting held on 23.12.23

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BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Baking and its ingredients**	
1.1	Current status of bakery,	1
1.2	Classification of bakery products Ingredients used in baking.	1
1.3	Types and its functions – flour, sugar, fat, salt.	1
1.4	Types and its functions-yeast and baking powder	1
1.5	Emulsifiers- egg, other ingredients - Coloring agents	1
1.6	Flavoring agents, emulsifiers, antioxidants	1
1.7	Conditioners, CBE and CBS	1
1.8	Leaving agents in bakery products.	1
1.9	FSSAI guidelines	1
2.0	**Bakery Equipment and Rheology of dough**	
2.1	Types of equipment used in baking process	1
2.2	Bulk handling of ingredients	1
2.3	Types of Dough mixers Spiral and Planetary mixer	1
2.4	Dividing, rounding, sheeting	1
2.5	Laminating- Fermentation enclosures	1
2.6	Types of Ovens and Slicers	1
2.7	Cookies wire cut and dropping machine	1
2.8	Rheology of dough- Viscograph Farinograph	1
2.9	Amylograph, Alveograph and Extensiograph	1
3.0	**Making process**	
3.1	Bread making methods - Straight dough/bulk fermentation	1
3.2	Sponge and dough, Activated dough development	1
3.3	Chorleywood bread process, No time process	1
3.4	Chemistry of Dough Development	1
3.5	Characteristics of good bread- Internal and external characteristics	1
3.6	Bread defects/faults and remedies	1
3.7	Microbial spoilage of bread- Causes, detection and prevention	2
3.8	Role of Enzyme in bread making process	1
4.0	**Bakery products**	
4.1	Production of cookies/biscuits: ingredients and its functions	2
4.2	Types of dough - Developed dough, short dough ‘s	1
4.3	Semi-sweet and enzyme modified dough and batters	1
4.4	Importance of the consistency of the dough	1
4.5	Production process of Cake making	1
4.6	Ingredients and its function: Icing and decoration for cakes	1
4.7	Egg less cake, Wafers, puff pastry	2
5.0	**Confectionery products**	
5.1	Importance of sugar rheology properties, types of sugar glucose and confectionery	1
5.2	Ingredients used in confectionery	1
5.3	Manufacture methods of high boiled sweets	1
5.4	Prevention of recrystallized and stickiness of sugar	1
5.5	Types, Formulation Processing of confectionery products- Caramel, Toffee and Fudge	1
5.6	Aerated confectionery, Methods of aeration- Manufacturing process	1
5.7	Chemistry of Hydrocolloids -pre-treatment Processes, Product quality parameters	1
5.8	Faults and corrective measures	1
5.9	Spoilage of confectionery products.	1

Course Designer(s)

1. P. Aarthi – aarthi@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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BOARD OF STUDIES

60 FT 602	Food Process Plant Layout and Safety	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To facilitate the student to understand the importance of location and plant selection.
- Identify and discuss food processing plant utilities
- To enable the student to understand various food process layout.
- To assist the student to understand about industrial accidents.
- Recognise the students to know about health hazards and industrial safety

Pre-requisites

Nil

Course Outcomes

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

CO1	Illustrate the types and characteristic features of location and plant selection.	Understand
CO2	Infer the different types of food plant utilities and symbols used for plant design	Apply
CO3	Analyse the different food factory production layout.	Analyze
CO4	Elucidate the occurrence of industrial accidents and fire accidents in food processing unit.	Apply
CO5	Elaborate the occupational hazards for food handlers, industrial safety and legal aspects.	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	10
Understand	40	30	30
Apply	10	10	30
Analyze	-	10	20
Evaluate	-	-	10
Create	-	-	0
Total	60	60	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech. Food Technology

60 FT 602- Food Process Plant Layout and Safety

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	1	0	60	4	40	60	100

Plant layout Selection of site, process and product government regulations and other legal restrictions, community factors and other factors affecting investment and production costs. Flow chart for plant design, Techniques involved in site selection: Subjective, Qualitative and Semi-Quantitative Techniques – Basics types of plant layout – important and flow pattern, Layout design procedure. Layout of equipment and space determination,	[9]
Overview of Sanitary and Hygienic Design and Layout Hygienic food process design – Principles of Sanitary design - equipment design and specifications Basic outline on FSMS. CIP Sanitary Process design: CIP system components – CIP program control - Criteria for CIP' able Process Equipment Design –Application of CIP for Liquid and Solid Food Processes – Typical Cleaning Protocols and Procedures.	[9]
Various food processing plants layouts* Food building plans and layout design, preparation of machinery layout for various processing sector: fruit and vegetables processing-size reduction machinery, evaporation plant, drying plant. Milk and milk products processing plant Meat processing machinery layout, Heat exchanger plant, refrigeration and air conditioning plant, boiler, packaging plant and ancillary equipment plant. Baking oven and frying plant-types, Oil extraction, cereal, pulses and spices processing plant layout.	[9]
Product Cost and Plant Overheads Manufacturing costs – Direct production costs(including raw materials, human resources, maintenance and repair, operating supplies, power and other utilities, royalties, etc.). – Process Profitability - Application to a Food Processing plant.	[9]
Health hazards, Industrial safety, ISO and Legal Aspects** Classification of occupational hazards for food handlers: Physical, Chemical, Biological, Mechanical, Social. Safe handling and operation of machineries. Safety Appraisal, steps to implement safety procedure, proper selection and replacement of handling equipment, personal protective equipment. ISO of industrial design- Legal Aspects – factories act – labour welfare act – ESI Act – Workmen Compensation Act.	[9]
Total Hours: 45 + 15 (Tutorial)	**60**

Text Book(s):

1. Agarwal G.K., "Plant layout and materials handling", Jain brothers, New Delhi, 2008.
2. Antonio Lopez-Gomez and Gustavo V. Barbosa-Canovas, "Food Plant Design", CRC, London, 2005.

Reference(s):

1. Arora S.P. and Bindra S.P., A Text Book of Building Construction, 5th edition, DhanpatRai publications, New Delhi, 2014.
2. Zacharias B. Maroulis and George D. Saravacos, "Food Process Design" Marcel Dekker, 2003.

*SDG 9 – Industry Innovation and Infrastructure

**SDG 12 – Responsible Consumption and Production

Passed in BoS Meeting held on 22.11.23

Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Plant layout**	
1.1	Selection of site, process and product	1
1.2	Government regulations and other legal restrictions	1
1.3	Community factors and other factors affecting investment and production costs	2
1.4	Flow chart for plant design	1
1.5	Techniques involved in site selection: Subjective, Qualitative and Semi-Quantitative Techniques	1
1.6	Basics types of plant layout – important and flow pattern, Layout design procedure	2
1.7	Layout of equipment and space determination.	1
2.0	**Overview of Sanitary and Hygienic Design and Layout**	
2.1	Hygienic food process design	1
2.2	Principles of Sanitary design equipment design and specifications Basic outline on FSMS.	2
2.3	CIP Sanitary Process design	1
2.4	CIP system components, CIP program control	1
2.5	Criteria for CIP' able Process Equipment Design	1
2.6	Application of CIP for Liquid and Solid Food Processes	2
2.7	Typical Cleaning Protocols and Procedures.	1
3.0	**Various food processing plant layouts**	
3.1	Food building plans and layout design,	1
3.2	Preparation of machinery layout for various processing sectors:	1
3.3	Fruit and vegetables processing-size reduction machinery, evaporation plant, drying plant	1
3.4	Milk and milk products processing plant Meat processing machinery layout, Heat exchanger plant, refrigeration and air conditioning plant, boiler, packaging plant, and ancillary equipment plant	2
3.5	Baking oven plant-types	1
3.6	Frying plant-types	1
3.7	Oil extraction, cereal, pulses, and spices processing plant layout	2
4.0	**Product Cost and Plant Overheads**	
4.1	Manufacturing costs	2
4.2	Direct production costs	1
4.3	Direct production costs (including raw materials, human resources maintenance and repair)	2
4.4	Direct production cost (operating supplies, power and other utilities, royalties, etc.).	2
4.5	Process Profitability	1
4.6	Application to a Food Processing plant	1
5.0	**Health hazards, Industrial safety and Legal Aspects**	
5.1	Classification of occupational hazards for food handlers: Physical, Chemical, Biological, Mechanical, Social	2
5.2	Safe handling and operation of machineries	1
5.3	Safety Appraisal, steps to implement safety procedure	1
5.4	Proper selection and replacement of handling equipment	2
5.5	Personal protective equipment	1
5.6	Legal Aspects – factories act	1
5.7	ESI Act, Workmen Compensation Act	1

Course Designer(s)

1. Mr.S.Nithishkumar – nithishkumar@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

60 FT 603	Refrigeration and Cold Chain Management	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To impart basic knowledge of refrigeration process.
- To impart knowledge on equipment for refrigeration.
- To analyse refrigeration process, their application in processing.
- To know the refrigeration techniques for increasing shelf life of food.
- To learn cold chain design and storage.

Pre-requisites

Nil

Course Outcomes

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

CO1	Analyse the basic concept of refrigeration based on the laws of thermodynamics, carnot systems	Analyze
CO2	Evaluate the application of vapour compression and vapour absorption cycle with P-H and T-S diagrams	Apply
CO3	Recall the types of evaporator and condenser and their applications in food industries.	Analyze
CO4	Design and construct cold storage units with proper precooling, insulation and operation by load calculation.	Apply
CO5	Comprehend the role of cold chain such as refrigeration, distribution and transport.	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	20	20	30
Apply	20	20	40
Analyze	10	10	10
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.11.23
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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech. – Food Technology

60 FT 603- Refrigeration and Cold Chain Management

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	1	0	60	4	40	60	100

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. Ozone depletion potential. Reversed Carnot cycle. Limitations of reversed Carnot systems.	[9]
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, Effect of super heating and sub cooling on vapour compression cycle, Temperature sensors.	[9]
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]
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, freezing in air, Modified Planck's law for calculation of freezing time	[9]
Cold Chain Introduction, Components of cold chain. Refrigerated distribution and transport systems, Cold chain in retail, Traceability Application of RFID and role of packaging. Role of refrigeration in food production - candy manufacture, beverage processing, bakery products, meat products, poultry products, fishery products, fruit /vegetables and dairy products.	[9]
Total Hours: 45 + 15 (Tutorial)	**60**

Text Book(s):

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

Reference(s):

1.	Arora C.P., "Refrigeration and Air Conditioning", 2nd Edition, Tata McGraw-Hill Publishing Company Ltd., Delhi, 2008.
2.	Khurmi R.S. and Gupta J.K., "Textbook of Refrigeration and Air Conditioning", 5th Edition, S. Chand Publishers, New Delhi, 2006.
3.	Roy J. Dossat, Principles of Refrigeration, Pearson Education Asia, 4th edition, 2001.

*SDG 9 – Industry Innovation and Infrastructure

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Introduction to refrigeration	1
1.2	Unit of refrigeration capacity	1
1.3	Review of Second law of thermodynamics and interpretation	1
1.4	Production of low temperatures - principles and process	1
1.5	Production of low temperatures	1
1.6	Refrigerants - classification and thermodynamic properties	1
1.7	Ozone depletion potential	1
1.8	Reversed Carnot cycle	1
1.9	Limitations of reversed Carnot systems	1
2.0	**Refrigeration Systems**	
2.1	Refrigeration cycle – simple vapour compression	1
2.2	Vapour absorption cycle	1
2.3	P-H and T-S diagrams and COP	2
2.4	Energy ratios and Power consumption of a refrigerating machine	1
2.5	Standard rating cycle and effect of operating conditions	1
2.6	Air refrigeration system – reversed Brayton cycle	1
2.7	Effect of super heating and sub cooling on vapour compression cycle	1
2.8	Temperature sensors	1
3.0	**Components of A Refrigeration System**	
3.1	Evaporator- dry and flooded type	2
3.2	Liquid cooling evaporator	1
3.3	Condenser- water cooled, air cooled and evaporative condenser	2
3.4	Compressor - Reciprocating type compressors	2
3.5	Expansion valve - thermostatic expansion valve	2
4.0	**Low Temperature Storage Systems**	
4.1	Pre-cooling systems	1
4.2	Cold storage- construction, insulation and operation	1
4.3	Design of cold storage unit	1
4.4	Calculation of refrigeration load in cold store	2
4.5	Prefabricated systems, walk-in-coolers	1
4.6	Cryogenics – Linde and Claude system for liquefaction of air	1
4.7	Freezing in air, Frozen storage	1
4.8	Modified Planck's law for calculation of freezing time	1
5.0	**Cold Chain**	
5.1	Introduction, Components of cold chain	1
5.2	Refrigerated distribution and transport systems	2
5.3	Cold chain in retail	1
5.4	Traceability Application of RFID in cold chain.	1
5.5	Role of refrigeration in food production - candy manufacture and beverage processing	1
5.6	Role of refrigeration in food production - bakery products and meat products	1
5.7	Role of refrigeration in food production - poultry products and fishery products	1
5.8	Role of refrigeration in food production - fruit /vegetables and dairy products.	1

Course Designer(s)

Dr. P. Shanmugam – shanmugam@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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61 FT 6P1	Baking and Confectionery Laboratory	Category	L	T	P	Credit
		PC	0	0	3	1.5

Objectives

- The students will be able to work in a bakery oven
- To impart various baking equipment in detail.
- The production process of various kinds of bakery products is highlighted.
- To learn the production process of cookies, biscuits, cakes, wafers
- To know about the production process of various confectionery products and their quality parameters

Pre-requisites

NIL

Course Outcomes

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

CO1	Analyze the quality of ingredients used in bakery products	Analyze
CO2	Develop different bakery products	Apply
CO3	Formulate various confectioneries	Analyze
CO4	Analyze various dough characteristics using a farinograph	Analyze
CO5	Develop new dough-based formulations	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	-	-	-
Apply	25	12	50	50
Analyze	25	13	50	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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BOARD OF STUDIES

K.S.Rangasamy College of Technology – Autonomous R2022								
B. Tech Food Technology								
61 FT 6P1 - Baking and Confectionery Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	0	0	3	45	1.5	60	40	100

List of Experiments:

1. Study of ingredients (major and minor): characteristics of flour, yeast, shortening, sugar, egg, and salts.
2. Experiment with the leaving action of baking powder, sodium bicarbonate, and ammonium-bi-carbonate, and yeast
3. Preparation of cakes by all-in-one method.*
4. Estimation of gluten content (Atta, and Maida)
5. Estimation of water absorption powder (Atta, and Maida)
6. Preparation of hard-boiled candies
7. Preparation of pasta and efficiency of rehydration.
8. Production of Marshmallows*
9. Preparation of hard and soft dough biscuits*
10. Preparation of bread-different types *
11. Studies on nutritional allergens of infant babies, Children and adults.
12. Open ended Experiment – Fortification of Baked Products with Functional / Health Ingredients

Lab Manual

1.	Yogambal Ashok Kumar, 'Textbook of Bakery and Confectionery", 2nd Edition, PHI Learning Pvt. Ltd., 2012.

*SDG 3 – Good Health and Well Being

Course Designer(s)

1. Ms. P. Aarthi - aarthi@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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BOARD OF STUDIES

60 FT 6P2	Computational Laboratory for Food Technology	Category	L	T	P	Credit
		PC	0	0	3	1.5

Objectives

- To provide students with practical knowledge and hands on training in chemical engineering equipment.
- To illustrate principles of viscosity measurement and co-efficient of friction.
- To explore the knowledge on size reduction equipment
- To learn single effect evaporator and diffusivity measurements
- To learn various extraction process

Pre-requisites

NIL

Course Outcomes

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

CO1	Estimate the molecular weight, density, enthalpy of the reaction and cell potential using spread sheets	Apply
CO2	Predict the concentration of species and solubility of solute in aqueous solutions using Newton Raphson method	Analyze
CO3	Determine the free energy changes and equilibrium constant for a given reaction	Analyze
CO4	Study the kinetics and rate of a reaction; Estimate heat transfer area using composite curve	Understand
CO5	Apply MATLAB/ C program for design of shell and tube/ double pipe heat exchangers/ evaporators	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	-	-	-
Apply	25	12	50	50
Analyze	25	13	50	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

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Approved in Academic Council Meeting held on 23.12.23

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K.S.Rangasamy College of Technology – Autonomous R2022

B. Tech. Food Technology

60 FT 6P2 – Computational Laboratory for Food Technology

Semester	Hours/Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	0	0	3	45	1.5	60	40	100

List of Experiments:

1. Estimation of the following by using spread sheet
(a) Molecular weight, density, enthalpy of the reaction
(b) Volume of a Van der Waals gas as a function of pressure and temperature
(c)Behavior of ideal gas volume based on temperature and pressure changes
2. Estimation of the following by using spread sheet
(a) Cell potential
(b) H + ion for a given acid by successive approximation
3. Computing the following by using Newton- Raphson technique
(a) Concentrations of all species
(b) Solubility of solute in aqueous solution
4. Computing the free energy changes and equilibrium constant for the given reaction
5. Error calculation for given graphical representation using spread sheet
6. Linearization of given graphical data using spread sheet chart
7. Identification of the kinetics and rate of the given reaction
8. Identification of the total heat transfer area by using composite curve
9. Drawing of PFD and PID using CAD / MS office (Visio)
10. Design of Shell and Tube heat exchanger using MATLAB / C program
11. Design of Double pipe heat exchanger using MATLAB / C program
12. Design of Condenser using MATLAB / C program
13. Design of Single effect evaporator using MATLAB / C program
14. Estimation of WBT and DBT
15. Mass transfer studies using breakthrough curve

Activity

Demonstrate and sketch the Process Flow Diagram and Process Instrumentation diagram in plant design.

Lab Manual

1.	Computational techniques for process simulations and analysis using MATLAB, N. S. Kaisare, CRC Press, 2018.

Course Designer(s)

Dr. P. Shanmugam - shanmugamp@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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BOARD OF STUDIES

60 FT 6P3	Design Thinking and Product Development Laboratory	Category	L	T	P	Credit
		PC	0	0	2	1

Objectives

- Ideate and develop innovative solutions for the given problem statement
- Develop soft prototype and visualize user scenarios for early-stage product validation
- Develop medium and hard prototype, integrating technical, ergonomic, and aesthetic considerations
- Conduct testing, gather user feedback, and apply iterative design processes
- Document, publish and present their solution

Pre-requisites

- Design Thinking and Innovation Laboratory

Course Outcomes

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

CO1	Generate innovative solutions to address specific problem statements.	Apply
CO2	Create and evaluate soft prototype, including paper prototypes and storyboards, to test initial design concepts.	Create
CO3	Create medium and hard prototype using 3D modelling and printing, incorporating human factors and system design.	Create
CO4	Perform usability studies, analyze user feedback, and iterate their designs to finalize user-centered solutions.	Analyse
CO5	Prepare professional documentation, and deliver a comprehensive project report and presentation.	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Review I (CO1)			Review II (CO2,CO3)			Review III (CO4)			(R1+R2+ R3)	Internal Marks
Generating Creative ideas	Concept Maps and Evaluation	Presen tation	Soft Prototyping	Hi-fidelity prototyping	Demonst-ration	User Studies & Feedback	Finalise solution	Presen -tation	Total	
10	10	10	10	20	10	10	10	10	**100**	**60**

Report and Presentation (CO1, CO2, CO3,CO4 & CO5)				External Marks
Report	Presentation	Demonstration	Total	
50	30	20	**100**	**40**

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K.S.Rangasamy College of Technology – Autonomous R 2022								
B. Tech. – Food Technology								
60 FT 6P3 – Design Thinking and Product Development Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	0	0	2	30	1	60	40	100

Ideation Generating Creative ideas - Idea Sketching, Brainstorming for Ideas, SCAMPER, Creativity and Lateral thinking- Concept Maps and Evaluation	[8]
Soft Prototyping Soft Prototyping - Paper Prototype (low-fidelity), Scenarios and Storyboarding, MVP (minimum Viable product).	[4]
Final Prototyping Medium Prototyping - Proof of Concept (PoC), Info Architecture, Experience Design- Human Factors / Ergonomics - Systems Mapping – high prototyping - 3D Modelling & Printing.	[6]
Usability Studies User Studies – Observation – Conversations - Think-aloud protocol – Feedback – Iterate - Finalise solution.	[8]
Publish the solution Publish the ideas: Journal Publication & Intellectual Property Rights–Prepare project report and present the final solution.	[4]
Total Hours:	30

Reference(s):

1.	NPTEL: Design Thinking and Innovation by Prof. Ravi Poovaiah, IDC School of Design, IIT Bombay. https://onlinecourses.swayam2.ac.in/aic23_ge17/preview, https://dsource.in/dti.
2.	NPTEL: Innovation by Design by Prof. B. K. Chakravarthy, IDC School of Design, IIT Bombay, https://onlinecourses.swayam2.ac.in/aic19_de02/preview.
3..	www.dsource.in , The Resource for Design by e-Kalpa Design Team,IDC, IIT Bombay, DoD, IIT Guwahati & NID, Bengaluru

SDG 9 – Industry Innovation and Infrastructure

Course Designer(s)

1. Dr.K.Raja – raja@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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60 CG 0P5	Comprehension Test*	Category	L	T	P	Credit
		CG	0	0	2	1*

Objectives

- To evaluate the knowledge gained in core courses relevant to the programme of study.
- To assess the technical skill in solving complex engineering problems.

Pre-requisites

Fundamental knowledge in all core subjects.

Course Outcomes

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

CO1	Infer knowledge in their respective programme domain.	Apply
CO2	Attend interviews for career progression	Apply
CO3	Exhibit professional standards to solve engineering problems	Apply
CO4	Promote holistic approach to problem solving	Apply
CO5	Examine the competency of graduates in specific programme domain	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

The overall knowledge of the candidate in various courses he/she studied shall be evaluated with multiple choice questions.

***SDG:4- Quality Education**

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)
B.E. / B.Tech. Degree Programme
SCHEME OF EXAMINATIONS
(For the candidates admitted in 2023-2024)
SEVENTH SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1.	60 FT 701	Food Additives, Nutraceutical and Functional Foods	2	40	60	100	45	100
2.	60 FT 702	Food Packaging Technology	2	40	60	100	45	100
3.	60 FT 703	Fermentation Technology	2	40	60	100	45	100
4.	60 FT E4*	Professional Elective – IV	2	40	60	100	45	100
5.	60 AC 001	Research Skill Development	2	100	-	100	-	100
PRACTICAL								
6.	60 FT 7P1	Food Packaging Laboratory	3	60	40	100	45	100
7.	60 FT 7P2	Project Work Phase – I	3	100	-	100	-	100
8.	60 CG 0P6	Internship	-	100	-	100	-	100
9.	60 AB 00*	NCC/NSS/NSO/ YRC/RRC/Fine Arts*	-	50	50	100	-	100

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory End Semester Examination, 50 marks for theory cum practical End Semester Examination and 40 marks for practical End Semester Examination.

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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60 FT 701	Food Additives, Neutraceutical and Functional Foods	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To enable the students to understand types of food additives
- To understand the applications of Food Colors, Emulsifiers and Stabilizers in Food Industry
- To gain knowledge about the basic concept of Neutraceutical
- Impart knowledge on Functional Foods and Dietary supplements
- Familiarize with Safety and Quality Standards

Pre-requisites

Thermal Engineering

Course Outcomes

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

CO1	Overview on food additives and study about role and function of different additives	Understand
CO2	Demonstrate about food colors and emulsifiers and identify different food additives used in food product	Understand
CO3	Study about importance and health benefits of Neutraceuticals and reveal about the technologies to recover Neutraceuticals	Understand
CO4	Illustrate different types of functional foods and identify the need and different forms of dietary supplement	Apply
CO5	Recognise the safety limits and regulation of food additives and explore method of determining toxicity	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	20
Understand	40	30	50
Apply	-	20	30
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 FT 701 Food Additives, Neutraceuticals and Functional Foods								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Food Additives * Overview – Types of food additives-As a preservative-Natural and chemical preservatives; preservatives; Antibiotics-Antioxidants; natural and chemical antioxidants; mechanism of antioxidant function nutritional supplements- Vitamins, Amino acids, minerals	[9]
Food Colors, Flavours, Emulsifiers and Stabilizers * Natural and synthetic colors; certified food dyes. Concept of Flavoring agent- natural flavors; nature identical flavors; artificial flavors. Emulsifiers- functions of permitted emulsifiers and stabilizers in food products; polyols– physical and chemical properties of polyols, application in food industry, permitted polyols in foods. Functional properties and Types of: Sweeteners, Leavening agent, anti-caking agent, Clarifying agent, Gases and propellants	[9]
Neutraceuticals * Importance and health benefits of Neutraceuticals, plant animal and microbial based Neutraceuticals. Types, Extraction and Assessment of various Neutraceuticals - antioxidants, Omega-3 Fatty Acids, phytochemicals, phytosterols, prebiotics, probiotics and synbiotics of Nutraceuticals. Technologies to recover Neutraceuticals compounds: Distillation, ultrahydrostatic pressure treatment, dense carbon-di-oxide treatment, encapsulation of nutraceuticals – materials, mechanical processes and chemical based processes, nano encapsulation. [	[9]
Functional foods** Introduction to dietary supplements and functional food & beverages; Agnuscastus, Aloe vera, Bee products, Chitosan ,Echinacea, Garlic, Ginger, Ginkgo biloba, Ginseng, Guarana, Kelp, Milk thistle, Saw palmetto, Spirulina, Chlorella, Hypericumperforatum, Tea extracts. Dietary supplements – Need for dietary supplements, supplements forms- tablets, capsules, powders, soft gels, gel caps, liquids.	[9]
Safety and Quality Standards* Safety limits and regulation of Food additives; Risk assessment and risk benefit Indices of human exposure, toxicity types, Method of determining toxicity – LD50. FSSAI regulations for preservative, antioxidant, stabilizers, colors and flavors. Health claims, Regulation and Safety issues of nutraceuticals and functional foods.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Belitz, H. D., Grosch, W., Schieberle,P. “Food Chemistry”, Third Edition, Springer-Verley, Berlin, 2004.
2.	John Shi, Chi-Tang Ho and FereidoonShahidi— “Asian Functional Foods”, First Edition, CRC Press, 2005.
Reference(s):	
1.	Wildman, Robert E.C.,” Handbook of Nutraceuticals and Functional Foods”, CRC Press, New York, 2001 M. Hasler ,Regulation of Functional Foods and Nutraceuticals, A Global Perspective, First edition, Blackwell Publisher, 2005.
2.	Lockwood, Brian, and Rapport, Lisa, —Nutraceuticals: A Guide for Healthcare Professionals, Pharmaceutical Press, 2007.
3.	Food safety and standards (food products standards and food additives) regulations, 2011.

*SDG 3 – Good Health and Well Being

**SDG 12 – Responsible Construction & Production

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Passed in BoS Meeting held on 22.05.24

Approved in Academic Council Meeting held on 25.05.24

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Food additives**	
1.1	Overview – types of food additives	1
1.2	As a preservative-natural and chemical preservatives	1
1.3	Preservatives; antibiotics-antioxidants	1
.4	Natural and chemical antioxidants	2
1.5	Mechanism of antioxidant function nutritional supplements	1
1.6	Vitamins	1
1.7	Amino acids	1
1.8	Minerals	1
2.0	**Food colors, flavours, emulsifiers and stabilizers**	
2.1	Natural and synthetic colors; certified food dyes	1
2.2	Concept of flavoring agent	1
2.3	Natural flavors; nature identical flavors; artificial flavors	1
2.4	Emulsifiers- functions of permitted emulsifiers and stabilizers in food products	1
2.5	Polyols– physical and chemical properties of polyols	1
2.6	Application in food industry, permitted polyols in foods	1
2.7	Functional properties and types of: sweeteners, leavening agent	1
2.8	Anti-caking agent, clarifying agent, gases and propellants	2
3.0	**Nutraceuticals**	
3.1	Importance and health benefits of nutraceuticals	1
3.2	Plant animal and microbial based nutraceuticals	1
3.3	Types, extraction and assessment of various nutraceuticals	1
3.4	Antioxidants, omega-3 fatty acids, phytochemicals, phytosterols, prebiotics, Probiotics and synbiotics of nutraceuticals	1
3.5	Technologies to recover nutraceuticals compounds	1
3.6	Distillation, ultra-hydrostatic pressure treatment	1
3.7	Dense carbon-di-oxide treatment, encapsulation of nutraceuticals	1
3.8	Materials, mechanical processes and chemical based processes	1
3.9	Nano encapsulation	1
4.0	**Functional foods**	
4.1	Introduction to dietary supplements and functional food & beverages	1
4.2	Agnuscastus, aloe vera, bee products	1
4.3	Chitosan ,echinacea, garlic, ginger	1
4.4	Ginkgo biloba, ginseng, guaran	1
4.5	Kelp, milk thistle, saw palmetto	1
4.6	Spirulina, chlorella, hypericumperforatum, tea extracts	1
4.7	Dietary supplements – need for dietary supplements	1
4.8	Supplements forms- tablets, capsules, powders, soft gels, gel caps, liquids	2
5.0	**Safety and quality standards**	
5.1	Safety limits and regulation of food additives	1
5.2	Risk assessment and risk benefit indices of human exposure	1
5.3	Toxicity types	1
5.4	Method of determining toxicity – ld50	1
5.5	FSSAI regulations for preservative, antioxidant, stabilizers	2
5.6	FSSAI regulations for colors and flavors.	1
5.7	Health claims, regulation and safety issues of nutraceuticals foods	1
5.8	Health claims, regulation and safety issues of functional foods	1

Course Designer(s)

1. Dr. K. Prabha –prabhak@ksrct.ac.in

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Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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BOARD OF STUDIES

60 FT 702	Food Packaging Technology	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To understand and acquiring the knowledge of packaging technology principles towards protection, communication, and transportation.
- Understand the properties of food packaging materials and their suitability in extending shelf life of food products.
- Impart knowledge on rationale in selecting packaging material for processed food products
- To make the students equipped with understanding of criteria required for designing a successful packaging system for any food product
- To acquire updated knowledge about the new technologies that are developing in packaging industries

Pre-requisites

Nil

Course Outcomes

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

CO1	Infer basic concepts in food packaging	Understand
CO2	Select suitable packaging materials for the extension of shelf life of food products	Analyze
CO3	Select and adapt recent trends in food packaging	Apply
CO4	Analyse the testing and labelling regulatory requirements with respect to food packaging industry	Analyze
CO5	Apply the new innovation in developing advanced food packaging material	Apply

Mapping with Programme Outcomes

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

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	20	20	40
Apply	10	10	20
Analyze	20	20	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

-

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech Food Technology

60 FT 702- Food Packaging Technology

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	1	0	60	4	40	60	100

Basics of Food Packaging History of food packaging technology and methods. Packaging: Concepts and Significance. Developments in packaging industry. Classification of packaging: primary and secondary. Packaging types Primary packaging materials- paper, paper-based, plastic, aluminum foil, tin plate and TFS, glass; Secondary packaging materials- folding carton, corrugated fibre board boxes, wooden boxes; Ancillary packaging materials - printing inks, varnishes, lacquers and varnishes.	[9]
Packaging systems and methods* Bottling, canning, capping, labelling, form-fill-seal and cartonning machineries; vacuum and gas packaging, retort packaging, CAP, MAP, active packaging, shrink packaging, lined cartonning system, PET, Preform, tetrapack. Flash 18 process. Biodegradable and edible packaging, aseptic packaging- need, advantages, process, comparison of conventional & aseptic packaging. system of aseptic packaging and materials used in aseptic packaging machineries used in packing foods, Advances in Packaging Technologies; MAP, CAP, Active packaging, Intelligent Packaging, Nano-Packaging, Irradiated food Packaging	[9]
Food packaging materials** Package materials: classification packages, paper as package material its manufacture, types, advantages, corrugated and paper board boxes etc. Glass as package material, manufacture, advantages, disadvantages, metal as package material-manufacture, advantages, disadvantages, aluminum as package material, its advantages and disadvantages, plastic as package material, classification of polymers, properties, uses and chemistry of each plastic such as polyethylene, polypropylene, polystyrene, polycarbonate, PVC, PVDC, cellulose acetate, nylon etc.	[9]
Testing and labelling of packaging materials Testing of packaging materials (PM) in food industries; Rigid and semi rigid containers; Flexible containers; Sealing equipment; Labeling and symbols used in packaging products; Aseptic and shrink packaging; Secondary and transport packaging. Principles of measuring water vapour transmission rate and gas permeability rate through given flexible film, OUR from food and OTR from film. Testing of packaging materials using – UTM Mullen Bursting strength tester- drop tester- Pouch burst tester- cob tester- gauge tester- torque tester tear tester- gas analyzer-cushioning materials. Labeling, regulation and traceability. Global migration testing and design aspects.	[9]
Advancement in packaging technology* Difference between packing and packaging, Manufacturing of nano packaging, Degradation of plastic materials, Alternate for plastic/glass material, Eco friendly packaging material. Mechanical strength of different packaging materials; Printing of packages; Barcodes & other marking; Interactions between packaging material and foods; Environmental and cost consideration in selecting packaging materials.	[9]
Total Hours: 45 + 15 (Tutorial)	**60**

Text Book(s):

1.	Richard Coles, Derek McDowell, Mark J. Kirwan, "Food Packaging Technology", Blackwell Publishers, 2003.
2.	Gordon L. Robertson, Food Packaging: Principles and Practice, Second Edition (Food Science and Technology), Taylor & Francis, CRC Press, 2005.

Reference(s):

1.	Robertson G.L Food Packaging: Principles and Practice, Third Edition, CRC Press, 2012, ISBN: 9781439862414
2.	Yam K.L. and Lee D.S., Emerging Food Packaging Technologies, Principles and Practice, A volume in Woodhead Publishing series in Food Science, Technology and Nutrition, 2012.
3.	Yam K.L. and Lee D.S., Emerging Food Packaging Technologies, Principles and Practice, A volume in Woodhead Publishing series in Food Science, Technology and Nutrition, 2012.
4.	Richard Coles and Mark J. Kirwan, Food and Beverage Packaging Technology, Second Edition, Wiley & Blackwell, 2011.

*SDG 9 – Industry Innovation and Infrastructure

**SDG 12 – Responsible Consumption and Production

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Passed in BoS Meeting held on 22.05.24

Approved in Academic Council Meeting held on 25.05.24

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Basics of Food Packaging**	
1.1	History of food packaging technology and methods	1
1.2	Packaging: Concepts and Significance	1
1.3	Developments in packaging industry	1
1.4	Classification of packaging: primary and secondary. Packaging types	1
1.5	Primary packaging materials- paper, paper-based, plastic, aluminum	1
1.6	Primary packaging materials- foil, tin plate and TFS, glass	1
1.7	Secondary packaging materials- folding carton, corrugated fibre board boxes,	1
1.8	Secondary packaging materials- wooden boxes	1
1.9	Ancillary packaging materials - printing inks, varnishes, lacquers and varnishes	1
2.0	**Packaging systems and methods**	
2.1	Bottling, canning, capping, labelling, form-fill-seal and cartonning machineries	1
2.2	Vacuum and gas packaging, retort packaging, CAP, MAP, active packaging, shrink packaging, lined cartonning system	1
2.3	PET, Preform, tetrapack. Flash 18 process	1
2.4	Biodegradable and edible packaging	1
2.5	Aseptic packaging-need, advantages, process	1
2.6	Comparison of conventional & aseptic packaging	1
2.7	System of aseptic packaging and materials used in aseptic packaging machineries used in packing foods	1
2.8	Advances in Packaging Technologies; MAP, CAP, Active packaging	1
2.9	Advances in Packaging Technologies; Intelligent Packaging, Nano-Packaging, Irradiated food Packaging	1
3.0	**Food packaging materials**	
3.1	Package materials: classification packages, paper as package material	1
3.2	its manufacture, types, advantages, corrugated and paper board boxes etc.	1
3.3	Glass as package material, manufacture, advantages, disadvantages	1
3.4	metal as package material-manufacture, advantages, disadvantages	1
3.5	aluminum as package material, its advantages and disadvantages	1
3.6	plastic as package material	1
3.7	classification of polymers, properties, uses	1
3.8	chemistry of each plastic such as polyethylene, polypropylene	1
3.9	polystyrene, polycarbonate, PVC, PVDC, cellulose acetate, nylon etc.	1
4.0	**Testing and labelling of packaging materials**	
4.1	Testing of packaging materials (PM) in food industries; Rigid and semi rigid containers	1
4.2	Flexible containers; Sealing equipment; Labeling and symbols used in packaging products	1
4.3	Aseptic and shrink packaging; Secondary and transport packaging.	1
4.4	Principles of measuring water vapour transmission rate and gas permeability rate through given flexible film	1
4.5	OUR from food and OTR from film	1

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4.6	Testing of packaging materials using – UTM Mullen Bursting strength tester-drop tester-	1
4.7	Pouch burst tester- cob tester- gauge tester- torque tester tear tester	1
4.8	Gas analyzer-cushioning materials.	1
4.9	Labeling, regulation and traceability. Global migration testing and design aspects.	1
5.0	**Advancement in packaging technology**	
5.1	Difference between packing and packaging,	1
5.2	Manufacturing of nano packaging	1
5.3	Degradation of plastic materials	1
5.4	Alternate for plastic/glass material	1
5.5	Eco friendly packaging material.	1
5.6	Mechanical strength of different packaging materials	1
5.7	Printing of packages; Barcodes & other marking;	1
5.8	Interactions between packaging material and foods;	1
5.9	Environmental and cost consideration in selecting packaging materials.	1

Course Designer(s)

1. Dr. J.Balachandra Mohan - balachandramohan@ksrct.ac.in

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CHAIRMAN
BOARD OF STUDIES

60 FT 703	Fermentation Technology	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To analyse the basic concept of food fermentation
- To learn the process and product obtained through fermentation process
- To impart the knowledge of soy based fermented product.
- To familiarize with different fermentor types and method
- To analyse the concept in production of secondary metabolites

Pre-requisites

Nil

Course Outcomes

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

CO1	Recall the importance of food fermentation process and fermentative microbes	Understand
CO2	Identify the basics of fermentation techniques	Understand
CO3	Illustrate the production process of dairy, alcoholic and soy based fermented product.	Analyze
CO4	Assess the fermentation process of cereal, vegetables and sausage.	Apply
CO5	Analyse the basic concept in production of secondary metabolites	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	30	10	20
Understand	30	20	30
Apply	-	20	30
Analyze	-	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B. Tech. Food Technology								
60 FT 703 - Fermentation Technology								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Introduction to Fermentation process Fermentation –Basic, Types, Benefits, Importance. –. Media for industrial fermentation - characteristics of an ideal raw material – industrial sterilization of media and fermentor. Basic function of fermentor - **Fermentor design***, parts –types. Recovery and purifications of food products.	[9]
Fermentated Food Products –I** Dairy fermentations - Alcoholic beverages- Vegetable fermentation- Leafy vegetable fermentation -Mould fermentations – soy based fermented foods – miso, tempeh, soy sauces. Lactic acid bacteria - Brewers and Bakers yeasts - Moulds used in food fermentations	[9]
Fermented food products II** Bread Making-Idli batter- processes. Fermented meat products. Preservation of marine products using fermentation process. Manufacture of different types of sausages. Storage and shelf life of fermented foods. Medicinal and nutritional supplement production using fermentation.	[9]
Other products from fermentation Fermentation production of acids – citric acid, acetic acid; Production of flavours, colours using microbes. Enzymes – amylase, proteases. Amino acids – Lysine, glutamic acid, Vitamins – C, B12, SCP – bacterial, fungal, Actinomycetes, algal protein. Antibiotics – penicillin, Streptomycin.	[9]
Non-Food Applications of Fermentation Bioremediation - fermentation can be used to clean up oil spills - Bacterial bioremediation of hazardous substances - Energy Production- Biofuels - Industrial Fermentation- Primary tool in bio-production of a variety of substances. Industry food waste utilization, Toxicology of fermented food products.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Ray, Ramesh C., and Didier Montet. Fermented Foods. CRC Press, 2021.
2.	Hutkin Robert W. Microbiology and Technology of Fermented Foods. Wiley Blackwell, 2019.
Reference(s):	
1.	Bamforth, C.W. and Cook, D.J. Food, fermentation and micro-organisms. Hoboken: Wiley Blackwell. 2019
2.	Puniya, Anil Kumar. Fermented Milk and Dairy Products. CRC Press, 2016.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Fermentation Process**	
1.1	Fermentation –Basic Types, Benefitits, Importance	2
1.2	Media for industrial fermentation	2
1.3	Characteristics of an ideal raw material	1
1.4	Industrial sterilization of media and fermentor.	1
1.5	Basic function of fermentor - Fermentor design, parts –types	1
1.6	Recovery and purifications of food products.	2
2.0	**Fermentated Food Products –I**	
2.1	Dairy fermentations	1
2.2	Alcoholic beverages	1
2.3	Vegetable fermentation	1
2.4	Leafy vegetable fermentation	1
2.5	Mould fermentations – soy based fermented foods – miso, tempeh, soy sauces.	2
2.6	Lactic acid bacteria	1
2.7	Brewers and Bakers yeasts	1
2.8	Moulds used in food fermentations	1
3.0	**Fermented food products II**	
3.1	Bread Making-Idli batter- processes.	1
3.2	Fermented meat products.	2
3.3	Preservation of marine products using fermentation process.	1
3.4	Manufacture of different types of sausages.	2
3.5	Storage and shelf life of fermented foods.	1
3.6	Medicinal and nutritional supplement production using fermentation	2
4.0	**Other products from fermentation**	
4.1	Fermentation production of acids – citric acid, acetic acid;	1
4.2	Production of flavours, colours using microbes.	1
4.3	Enzymes – amylase, proteases	1
4.4	Amino acids – Lysine, glutamic acid,	1
4.5	Vitamins – C, B12,	1
4.6	SCP – bacterial, fungal, Actinomycetes, algal protein.	2
4.7	Antibiotics – penicillin, Streptomycin.	2
5.0	**Non-Food Applications of Fermentation**	
5.1	Bioremediation - fermentation can be used to clean up oil spills	1
5.2	Bacterial bioremediation of hazardous substances	1
5.3	Energy Production	1
5.4	Biofuels	1
5.5	Industrial Fermentation	1
5.6	Primary tool in bio-production of a variety of substances	1
5.7	Industry food waste utilization	1
5.8	Toxicology of fermented food products.	2

Course Designer(s)

Dr.A.S.Ruby Celsia – rubycelsia@ksrct.ac.in

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Passed in BoS Meeting held on 22.05.24
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BOARD OF STUDIES

60 AC 001	Research Skill Development	Category	L	T	P	Credit
		AC	1	0	0	0

Objectives

- To identify research problems, formulate hypotheses, collect data and test hypotheses
- To prepare and submit quality manuscripts and understand peer review process
- To utilize software tools for effective manuscript preparation and visualization of research data
- To familiarize different journal metrics and author-level quality indicators
- To protect creative works, inventions, and branding elements using IPR

Pre-requisites

Nil

Course Outcomes

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

CO1	Develop structured scientific approach to plan and execute research work	Apply
CO2	Understand the journal requirements to publish research findings effectively	Understand
CO3	Apply various software tools during the manuscript preparation	Apply
CO4	Select suitable journals to publish the work using different publication metrics	Analyze
CO5	Apply the appropriate form of IP protection to a specific invention or creation	Apply

Mapping with Programme Outcomes

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

3 - Strong; 2 - Medium; 1 – Some

Assessment Pattern

One review at end of the semester	
Parameters	**Weightage (Marks)**
Research Problem Identification (Research gap, SDG, Objectives)	10
Literature Review preparation (Clarity, Number and quality of sources)	20
Patent Draft/ Manuscript Preparation (Structure, Content)	20
Use of software tools (Plagiarism, Reference Management, etc.,)	10
Journal Identification (Aim & scope of the journal, journal metrics)	10
Presentation & Viva voce	30
Total	**100**

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 AC 001 – Research Skill Development								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	1	0	0	15	0	100	-	100

Research - Scientific Approach* Types of Research - Identification and Clarification of the problem – Problem analysis - Formulating hypothesis, Selection of sample and tools of data collection - Testing the hypothesis - Conclusion	[3]
Manuscript Preparation* Structure of a manuscript - Types of manuscript - Graphical abstract - Highlights - Literature Review - Citation - Reference style - Plagiarism – Journal selection - Peer review process	[3]
Research Toolkit* Software Tools for Writing enhancement - Literature review - Reference management - Data analysis and visualization - Drawing - Plagiarism	[3]
Research Publication Metrics* Journal Index: Scopus - Web of Science - SCI - UGC Care - Q Journal; Journal Metrics: Impact Factor, Cite Score; Quality Indicators: h-index - i-10 index - citations	[3]
Intellectual Property Rights* Patents - Industrial Designs - Copyright - Trademarks - Geographical Indications - Trade Secrets	[3]
Total Hours:	**15**

Reference(s):

1.	Kothari, C.R. and Gaurav Garg, “Research Methodology: Methods and Techniques”, New Age International Publishers, 2023
2.	Chawla H S., “Introduction to Intellectual Property Rights”, CBS Publishers and Distributors Private Limited, 2019

***SDG 9 – Industry Innovation and Infrastructure**

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1	**Research - Scientific Approach**	
1.1	Types of Research - Identification and Clarification of the problem – Problem analysis - Formulating hypothesis	2
1.2	Selection of sample and tools of data collection - Testing the hypothesis - Conclusion	1
2	**Manuscript Preparation**	
2.1	Structure of a manuscript - Types of manuscript - Graphical abstract - Highlights	1
2.2	Literature Review	1
2.3	Citation - Reference style – Plagiarism, Journal selection - Peer review process	1
3	**Research Toolkit**	
3.1	Software Tools for Writing enhancement	1
3.2	Literature review, Reference management	1
3.3	Data analysis and visualization – Drawing, Plagiarism	1
4	**Research Publication Metrics**	
4.1	Journal Index: Scopus - Web of Science - SCI - UGC Care - Q Journal;	1
4.2	Journal Metrics: Impact Factor, Cite	1
4.3	Score Quality Indicators: h-index - i-10 index - citations	1
5	**Intellectual Property Rights**	
5.1	Patents	1
5.2	Industrial Designs - Copyright	1
5.3	Trademarks - Geographical Indications - Trade Secrets	1
	Total	15

Course Designer

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BOARD OF STUDIES

60 FT 7P1	Food Packaging Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

Objectives

- To understand and acquiring the knowledge of packaging technology principles towards protection, communication, and transportation
- Understand the properties of food packaging materials and their suitability in extending shelf life of food products
- Impart practical knowledge and skills related to food packaging technology
- Understanding of flexible packaging materials for food packaging technology
- To analyse and interpret the technical requirements for food packaging

Pre-requisites

NIL

Course Outcomes

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

CO1	Understand the basic knowledge on packaging materials properties in terms of technical requirements for food packaging	Understand
CO2	Analysis and experimentation of packaging materials for water absorption, tearing, bursting, and compression properties	Analyze
CO3	Assess the concept of drop testing of food packages.	Analyze
CO4	Review the advancements in packaging technologies	Analyze
CO5	Outline of the food packaging materials using different equipment's.	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	-	-	-
Apply	25	12	50	50
Analyze	25	13	50	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 FT 7P1- Food Packaging Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	0	0	4	60	2	60	40	100

List of Experiments:

1. Estimation of water absorption capacity of paper based packaging materials using cobb tester.
2. Determination of tear resistance of packaging materials.
3. Determination compressive strength of carton boxes.
4. Estimation of bursting strength of packaging materials.
5. Estimation of water vapour permeability of different packaging materials
6. Measuring thickness of various types of paper based packaging materials.
7. Measuring GSM of various paper and flexible film based packaging materials.*
8. Determination drop strength of packaged food material using drop tester.
9. Experiment on bottling of foods samples using crown corking machine and sealing of packaging materials using hand operated sealing machine.**
10. Testing of Thermal Shock resistance of glass materials
11. Vacuum packaging of foods and shelf life studies
12. Determination of greeze resistance of papers used in food industry – butter paper and toffee wrap.
13. Determination of adhesiveness test of tapes

Lab Manual

1.	Yam K.L. and Lee D.S., “Emerging Food Packaging Technologies, Principles and Practice, A volume in Wood head Publishing series in Food Science, Technology and Nutrition”, 2012.

*SDG 7 – Affordable and Clean Energy

** SDG 9 – Industrial Innovation and Infrastructure

Course Designer(s)

1. Dr. J.Balachandra Mohan- balachandramohan@ksrct.ac.in

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60 FT 7P2	**Project Work Phase – I**	**Category**	**L**	**T**	**P**	**Credit**
		PC	**0**	**0**	**4**	**2**

Objectives

- To prepare the students to adapt to the research environment
- To understand how projects are executed in a research laboratory
- To learn practical aspects of research on their domain
- To train students in the art of data interpretation
- To practice the students to analyze the results and thesis writing

Pre-requisites

NIL

Course Outcomes

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

CO1	Identify the problem and select a topic of the research.	Apply
CO2	Competence in research design and planning.	Apply
CO3	Create, analyse and critically evaluate different technical solutions.	Apply
CO4	Interpret the obtained research data and conclude the experiment.	Analyze
CO5	Develop skills of project management, report writing, problem solving, communication and interpersonal.	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Review I (R1)			**Review II (R2)**		**Review III (R3)**			**Total (R1+R2+R3)**	**Internal**
Literature Survey	Topic Identification & Justification	Work Plan	Approach	Conclusion	Demo-Existing System	Presentation	Report	Total	
10	10	10	20	20	10	10	10	100	100

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Approved in Academic Council Meeting held on 25.05.24

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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B. Tech. Food Technology								
60 FT 7P2 – Project Work Phase – I								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	0	0	4	60	2	100	00	100

Methodology:

Three reviews have to be conducted by the committee that constitutes minimum of three members one of which should be guide.

Research problem should be selected.

Students have to collect and bound about 50 research papers related to their work.

Objectives and title of the work has to be finalized at the end of the Project Work - Phase I.

Preliminary Implementation can be done if possible.

Report has to be prepared as per the format and submitted by the students

Internal evaluation has to be done for 100 marks

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60 CG 0P6	Internship	Category	L	T	P	Credit
		CG	0	0	0	1\2\3$

Objectives

- To promote hands on experience to students in food research institute and food processing industries.
- Students has to undergo practical training in any Food industries or food research institute with the approval from the institution.
- Students will have options while undergoing training either one slot (four weeks) of training in a single industry or else two slot (two weeks in individual industry) of training in two different industries of same discipline.
- At the end of the training student need to submit a report as per the prescribed format to the department.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Identify the underlying causes and approach to problem-solving	Understand
CO2	Develop the experiment based on a review of the literature.	Create
CO3	Implement and debug using a pilot study	Apply
CO4	Evaluate the calculated and unprocessed data to solve the problem	Apply
CO5	Compiling the reports and recording the information for print	Apply

Mapping with Programme Outcomes

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

Assessment process

- This course is mandatory and the student has to pass the course to become eligible for the award of degree.
- Students are allowed to undergone internship from IV to VII semester
- The student performance will be assessed by the Industry mentor through Student intern performance review/employer assessment intern form.
- The student need to make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made.
- Marks will be awarded out of 100 and appropriate grades assigned as per the regulations.

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

60 AB 001	National Cadet Corps - Air Wing	Category	L	T	P	Credit
		HS	2	0	2	3€

Objectives

- To design
- d especially for NCC Cadets
- To develop character, camaraderie, discipline, secular outlook
- To inculcate spirit of adventure, sportsman spirit
- To teach selfless service amongst cadets by working in teams
- To learning military subjects including weapon training and motivate them to join in tri-services

Pre-requisites

- Nil

Course Outcomes

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

CO1	Display sense of patriotism, secular values and shall be transformed into motivated youth who will carry out nation building through national unity and social cohesion.	Remember
CO2	Demonstrate the sense of discipline with smartness and have basic knowledge of weapons and their use and handling.	Remember
CO3	Illustrate various forces and moments acting on aircraft.	Understand
CO4	Outline the concepts of aircraft engine and rocket propulsion.	Understand
CO5	Design, build and fly chuck gliders/model airplanes and display static models.	Create

Mapping with Programme Outcomes

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

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 AB 001- National Cadet Corps - Air Wing								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	2	0	2	60	3€	50	50	100

NCC Organisation and National Integration * NCC Organization – History of NCC- NCC Organization- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honors' and Awards – Incentives for NCC cadets by central and state govt. History and Organization of IAF- Indo-Pak War-1971- Operation Safed Sagar. National Integration- Unity in diversity- Contribution of youth in nation building- National integration council- Images and Slogans on National Integration.	[12]
Drill and Weapon Training* Basic physical Training- Various exercises for fitness (with Demonstration)- Food- Hygiene and Cleanliness. Drill- Words of commands- Position and commands- Sizing and forming- Saluting- Marching- Turning on the march and wheeling- Saluting on the march- Side pace, Pace forward and to the rear- Marking time- Drill with arms- Ceremonial drill- Guard mounting (WITH DEMONSTRATION).	[12]
Principles of Flight * Laws of motion- Forces acting on aircraft- Bernoulli's theorem- Stalling-Primary control surfaces-Secondary control surfaces- Aircraft recognition.	[12]
Aero Engines * Introduction of Aero engine- Types of engine- Piston engine- Jet engines- Turboprop engines- Basic Flight Instruments- Modern trends.	[12]
Aero Modeling * History of Aero modeling- Materials used in Aero modeling- Types of Aero models – Static Models- Gliders- Control line models- Radio Control Models- Building and Flying of Aero models.	[12]
Total Hours:	**60**

Text Book(s):	
1.	"National Cadet Corps- A Concise handbook of NCC Cadets", Ramesh Publishing House, New Delhi, 2014.
Reference(s):	
1.	"Cadets Handbook – Common Subjects SD/SW", published by DG NCC, New Delhi.
2.	"Cadets Handbook- Specialized Subjects SD/SW", published by DG NCC, New Delhi
3.	"NCC OTA Precise", published by DG NCC, New Delhi

*SDG 4 – Quality Education

Course Designer(s)

1. Flt Lt V.R.SADASIVAM - sadasivam@ksrct.ac.in

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

60 AB 002	National Cadet Corps - Army Wing	Category	L	T	P	Credit
		HS	2	0	2	3€

Objectives

- Develop character, camaraderie
- Inculcate discipline, secular outlook
- Enrich the spirit of adventure, sportsman spirit
- Ideals of selfless service amongst cadets by working in teams
- Improve qualities such as self-discipline, self-confidence, self-reliance and dignity of labour in the cadets

Pre-requisites

- NIL

Course Outcomes

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

CO1	Display sense of patriotism, secular values and shall be transformed into motivated youth who will carry out nation building through national unity and social cohesion.	Understand
CO2	Demonstrate Health Exercises, the sense of discipline, improve bearing, smartness, turn out, develop the quality of immediate and implicit obedience of orders.	Apply
CO3	Basic knowledge of weapons and their use and handling.	Understand
CO4	Aware about social evils and shall inculcate sense of whistle blowing against such evils and ways to eradicate such evils	Analyze
CO5	Acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles	Apply

Mapping with Programme Outcomes

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

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 AB 002 - National Cadet Corps - Army Wing								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	**2**	**0**	**2**	**60**	**3€**	**50**	**50**	**100**

NCC Organization & National Integration* NCC Organization – History of NCC- NCC Organization- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and Advantages of NCC Training- NCC Badges of Rank- Honors' and Awards – Incentives for NCC Cadets by Central and State govt. National Integration - Unity in Diversity- Contribution of Youth in Nation Building- National Integration Council- Images and Slogans on National Integration.	[12]
Basic Physical Training & Drill Basic Physical Training – Various Exercises for Fitness (with Demonstration) -Food – Hygiene and Cleanliness .Drill- Words of Commands- Position and Commands- Sizing and Forming- Saluting- Marching- Turning on the March and Wheeling- Saluting on the March- Side Pace, Pace Forward and to the Rear- Marking Time- Drill with Arms- Ceremonial Drill- Guard Mounting.(WITH DEMONSTRATION)	[12]
Weapon Training Main Parts of a Rifle Characteristics of .303 Rifle- Characteristics of .22 Rifle- Loading and Unloading – Position and Holding, Safety Precautions – Range Procedure- MPI and Elevation- Group and Snap Shooting- Long/Short Range Firing(WITH PRACTICE SESSION) - Characteristics of 5.56mm Rifle- Characteristics of 7.62mm SLR- LMG- Carbine Machine Gun – Pistol.	[12]
Social Awareness and Community Development Aims of Social Service-Various Means and Ways of Social Services- Family Planning – HIV and AIDS- Cancer its Cause and Preventive Measures- NGO and their Activities- Drug Trafficking- Rural Development Program - MGNREGA-SGSYJGSY-NSAP-PMGSY-Terrorism and Counter Terrorism- Corruption – Female Foeticide -Dowry –Child Abuse-RTI Act- RTE Act- Protection of Children from Sexual Offences Act- Civic Sense and Responsibility	[12]
Specialized Subject (Army) Basic Structure of Armed Forces- Military History – War Heroes- Battles of Indo-Pak War- Param Vir Chakra- Career in The Defence Forces- Service Tests and Interviews.	[12]
Total Hours	60

Text Book(s):	
1.	"National Cadet Corps- A Concise handbook of NCC Cadets", Ramesh Publishing House, New Delhi, 2014.
Reference(s):	
1.	"Cadets Handbook – Common Subjects SD/SW", published by DG NCC, New Delhi.
2.	"Cadets Handbook- Specialized Subjects SD/SW", published by DG NCC, New Delhi.
3.	"NCC OTA Precise", published by DG NCC, New Delhi.

***SDG 9 – Industry Innovation and Infrastructure**

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**NCC Organization & National Integration**	
1.1	NCC Organization	1
1.2	History of NCC and NCC Organization	1
1.3	NCC Training and NCC Uniform	1
1.4	Promotion of NCC cadet, Aim and Advantages of NCC Training	1
1.5	NCC badges of Rank, Honors' and Awards, Incentives for NCC Cadets by Central and State govt	1
1.6	National Integration, Unity in Diversity	1
1.7	Contribution of Youth in Nation Building	1
1.8	National Integration Council	1
1.9	Images and Slogans on National Integration	1
2.0	**Basic Physical Training & Drill**	
2.1	Basic Physical Training – Various Exercises for Fitness (with Demonstration)	1
2.2	Drill- Words of Commands.	1
2.3	Position and Commands- Sizing and Forming-	1
2.4	Saluting- Marching- Turning on the March and Wheeling-	2
2.5	Saluting on the March- Side Pace, Pace Forward and to The Rear- Marking Time-	2
2.6	Drill with Arms- Ceremonial Drill- Guard Mounting.(WITH DEMONSTRATION)	2
3.0	**Weapon Training Main Parts ofa Rifle**	
3.1	Characteristics of .303 Rifle	1
3.2	Characteristics of .22 Rifle	1
3.3	Loading and Unloading, Position and Holding Safety Precautions	2
3.4	Range Procedure, MPI and Elevation-	1
3.5	Group and Snap Shooting Long/Short Range Firing (WITH PRACTICE SESSION)	2
3.6	Characteristics of 5.56 Mm Rifle	1
3.7	Characteristics of 7.62mm	1
4.0	**Social Awareness and Community Development**	
4.1	Aims of Social Service, Various Means and Ways of Social Services	1
4.2	Family Planning , HIV and AIDS	1
4.3	Cancer its Cause and Preventive Measures	1
4.4	NGO and their Activities, Drug Trafficking	1
4.5	Rural Development Programmes MGNREGA, SGSY, JGSY, NSAP, PMGSY	1
4.6	Terrorism and Counter Terrorism, Corruption	1
4.7	Female Foeticide, Dowry, Child Abuse, RTI Act, RTE Act	1
4.8	Protection of Children from Sexual Offences Act	1
4.9	Civic Sense and Responsibility	1
5.0	**Specialized Subject (Army)**	
5.1	Basic Structure of Armed Forces	1
5.2	Military History, War Heroes	1
5.3	Battles of Indo - Pak War	1
5.4	Param Vir Chakra,	1
5.5	Career in The Defence Forces	2
5.6	Service Tests and Interviews.	2

Course Designer(s)

1. Lt.E.Chandra Kumar - chandrakumar@ksrct.ac.in

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Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)
B.E. / B.Tech. Degree Programme
SCHEME OF EXAMINATIONS
(For the candidates admitted in 2023-2024)
EIGHTH SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1	60 FT E5*	Professional Elective – V	2	40	60	100	45	100
PRACTICAL								
2	60 FT 8P1	Project Work Phase – II	3	60	40	100	45	100
3	60 CG 0P6	Internship	-	100	-	100	-	100

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory End Semester Examination and 40 marks for project End Semester Examination.

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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BOARD OF STUDIES

60 FT 8P1	Project Work Phase – II	Category	L	T	P	Credit
		PC	0	0	16	8

Objectives

- To prepare the students to adapt to the research environment
- To understand how projects are executed in a research laboratory
- To learn practical aspects of research on their domain
- To train students in the art of data interpretation
- To practice the students to analyze the results and thesis writing

Pre-requisites

NIL

Course Outcomes

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

CO1	Identify the problem and select a topic of the research.	Apply
CO2	Competence in research design and planning.	Apply
CO3	Create, analyse and critically evaluate different technical solutions.	Apply
CO4	Interpret the obtained research data and conclude the experiment.	Analyze
CO5	Develop skills of project management, report writing, problem solving, communication and interpersonal.	Apply

Mapping with Programme Outcomes

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

Assessment process

Internal Assessment: 60 Mark + End Semester Examination: 40 Mark

Internal Assessment (60)					End Semester (40)
Items	Review 1	Review 2	Review 3	Publication*	
Marks	5	10	15	30	40
	Total internal mark 60				

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B. Tech. Food Technology

60 FT 8P1 – Project Work Phase – II

Semester	Hours/Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	0	0	16	240	8	60	40	100

Methodology:

Three reviews have to be conducted by the committee that constitutes minimum of three members one of which should be guide.
Research problem should be selected.
Students have to collect and bound about 50 research papers related to their work.
Objectives and title of the work has to be finalized at the end of the Project Work - Phase I.
Preliminary Implementation can be done if possible.
Report has to be prepared as per the format and submitted by the students
Internal evaluation has to be done for 100 marks

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

60 CG 0P6	Internship	Category	L	T	P	Credit
		CG	0	0	0	1\2\3$

Objectives

- To promote hands on experience to students in food research institute and food processing industries.
- Students has to undergo practical training in any Food industries or food research institute with the approval from the institution.
- Students will have options while undergoing training either one slot (four weeks) of training in a single industry or else two slot (two weeks in individual industry) of training in two different industries of same discipline.
- At the end of the training student need to submit a report as per the prescribed format to the department.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Identify the underlying causes and approach to problem-solving	Understand
CO2	Develop the experiment based on a review of the literature.	Create
CO3	Implement and debug using a pilot study	Apply
CO4	Evaluate the calculated and unprocessed data to solve the problem	Apply
CO5	Compiling the reports and recording the information for print	Apply

Mapping with Programme Outcomes

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

3 - Strong; 2 - Medium; 1 - Some

Assessment process

- This course is mandatory and the student has to pass the course to become eligible for the award of degree.
- Students are allowed to undergone internship from IV to VII semester
- The student performance will be assessed by the Industry mentor through Student intern performance review/employer assessment intern form.
- The student need to make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made.
- Marks will be awarded out of 100 and appropriate grades assigned as per the regulations.

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

PROFESSIONAL ELECTIVE - I

60 FT E11	Introduction to Food Biotechnology	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- Comprehend the various basic concepts of biotechnology in Food.
- Understand the various Genetically modified foods and its regulations.
- Identify the techniques used for fortification of foods
- Relate the various food quality regulations related to commercial food products.
- Explore the various applications of food biotechnology

Pre-requisites

Nil

Course Outcomes

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

CO1	Summarize the applications of food biotechnology and integrate the various microbiological analysis for food and water	Apply
CO2	Define the different types of GM Foods along with its ethical issues and correlate the respective regulation and rules for GM Foods	Analyze
CO3	Select the various techniques used for food fortification and compare the various biological barriers for its application	Understand
CO4	Examine various food quality regulations and link the regulations with the international standards	Analyze
CO5	Deduce the applications of food biotechnology in packaging and validate the application of biosensors in food	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	20	20
Understand	10	10	40
Apply	20	20	10
Analyze	20	10	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B. Tech. Food Technology								
60 FT E11 - Introduction to Food Biotechnology								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	40	60	100

Introduction to Food Biotechnology Food Biotechnology: Introduction & Applications; Methods for the microbiological examination of water and foods; Control of Microbiological quality and safety; Food borne illnesses and diseases; Microbial cultures for food fermentation, their maintenance, strain development	[9]
Genetically Modified Food Introduction and controversies related to GMOs. Ethical issues concerning **GM foods****; testing for GMOs; labelling and traceability; trade related aspects; biosafety; risk assessment and risk management. Public perception of GM foods. IPR. GMO Act–2004. New products and processes in various food commodities including plant and animal products.	[9]
Food Functionalization* Functional food. Nutraceutical, Delivery systems-Nano-scale delivery systems; Overcoming biological barriers; Liposomes, Nano-cochleates, Hydrogels-based nanoparticles, Micellar systems, Dendrimers, Polymeric nanoparticles, Nano emulsions.	[9]
Food Quality Regulations*** Analysis of food, major ingredients present in different product, Food additives color, flavor, vitamins, Microbial safety of food products, Chemical safety of food products, heavy metal, fungal toxins, pesticide and herbicide contamination, Food safety standards: WHO, FPO, MMPO, HACCP, GMP, FSSAI.	[9]
Applications of Food Biotechnology Starter cultures, designing and development, micro encapsulation and packaging; **Development and formulation of novel products such as probiotic foods.**** Nutrigenomics, working, significance and relevance. Biosensors and novel tools and their application in food science & Technology.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Srilakshmi B., Food science, New Age Publishers,2002
2.	Lee, B. H. Fundamentals of Food Biotechnology. VCH. 2006
Reference(s):	
1.	Lopez G.F.G. & Canovas G.V.B., Food Science and Food Biotechnology (2003), CRC Press, Florida, USA
2.	James M. Jay, Modern Food Micro-Biology, (2000), 6th edition, An Aspen publication, Maryland, USA.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being
***SDG 12 – Responsible Consumption and Production

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Food Biotechnology: Introduction & Applications	1
1.2	Methods for the microbiological examination of water and foods	2
1.3	Control of Microbiological quality and safety	2
1.4	Food borne illnesses and diseases	1
1.5	Microbial cultures for food fermentation	1
1.6	Culture maintenance	1
1.7	Strain development	1
2.0	**Genetically Modified Foods**	
2.1	Introduction and controversies related to GMOs	2
2.2	Ethical issues concerning GM foods	1
2.3	Testing for GMOs and its labelling, traceability	1
2.4	Trade related aspects	1
2.5	Biosafety; risk assessment and risk management	1
2.6	Public perception of GM foods	1
2.7	IPR. GMO Act–2004	1
2.8	New products and processes in various food commodities including plant and animal products	1
3.0	**Food Functionalization**	
3.1	Functional food	1
3.2	Nutraceutical	1
3.3	Delivery systems	1
3.4	Nano-scale delivery systems	1
3.5	Overcoming biological barriers	1
3.6	Liposomes, Nano-cochleates	1
3.7	Hydrogels-based nanoparticles, Micellar systems, Dendrimers	2
3.8	Polymeric nanoparticles, Nano emulsions	1
4.0	**Food Quality Regulations**	
4.1	Analysis of food	1
4.2	Major ingredients present in different product	1
4.3	Food additives color, flavor, vitamins	2
4.4	Microbial safety of food products	1
4.5	Chemical safety of food products	2
4.6	Heavy metal, fungal toxins, pesticide and herbicide contamination	1
4.7	Food safety standards: WHO, FPO, MMPO, HACCP, GMP, FSSAI	1
5.0	**Applications of Food Biotechnology**	
5.1	Starter cultures designing and development	2
5.2	Micro encapsulation and packaging	1
5.3	Development and formulation of novel products such as probiotic foods	2
5.4	Nutrigenomics, working, significance and relevance	2
5.5	Biosensors and novel tools and their application	2

Course Designer(s)

1. Mr. G. Bharath– bharathg@ksrct.ac.in

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

60 FT E12	Therapeutics and Nutrition	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand causative factors and metabolic changes in various disease/disorders
- To gain knowledge of the principles of diet therapy
- To understand the fundamentals of therapeutic diet and their formulation
- To understand the necessity of Dietary management in CVD
- To highlight about dietary counselling and medical nutrition therapy

Pre-requisites

Nil

Course Outcomes

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

CO1	Recall the fundamentals of Nutritional Assessment and Diet Nutrient and Drug Interaction.	Understand
CO2	Infer the Dietary management in critically ill patients.	Understand
CO3	Identify the Medical Nutrition Therapy, dietary counselling of Weight management & diabetes management.	Apply
CO4	Recall the concept of diagnosis, complications and dietary counselling of cardiovascular disorders and GI tract disorders.	Apply
CO5	Review the dietary management of degenerative disorders and surgery.	Understand

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	30	10	20
Understand	30	30	50
Apply	-	20	30
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B. Tech. Food Technology								
60 FT E12 – Therapeutic and Nutrition								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	40	60	100

Nutritional Assessment and Care of Patients Introduction to Therapeutic Nutrition, Major food groups - classification, Factors influencing food intake and food habits. Good nutrition - a multidisciplinary effort **-** Balanced diets, Recommended Dietary Allowances (RDA) for all age groups. BMR and BMI calculations. Nutritional screening and assessment of patients – out patient & hospitalized. Nutrition care plan and implementation, Dietary Counselling, Importance and modification of normal diet to therapeutic diets.	[9]
Dietary management in critically ill patients Dietary Counselling, Diet Nutrient and Drug Interaction: Effect of drugs on ingestion, Digestion, Absorption, and metabolism of nutrients. Nutritional status assessment of the critically ill patients. Recent advances in techniques and feeding substrates. Enteral Nutrition support and Parenteral Nutrition. Dietary treatment for - Typhoid, Malaria, Tuberculosis, Hypertension and Cardiovascular disease.	[9]
Weight management & diabetes management Etiopathophysiology, metabolic & clinical aberrations, diagnosis, complications, treatment, Medical Nutrition Therapy, Dietary treatment and dietary counseling, and recent advance for Weight imbalance disorders in: Overweight and Underweight, Diabetes Mellitus – Type 1, Type 2, and Gestational diabetes.	[9]
Cardiovascular disorders & GI tract disorders* Etiopatho physiology, metabolic & clinical aberrations, diagnosis, complications, treatment, Medical Nutrition Therapy, dietary counseling, and recent advance in Cardiovascular Diseases – hypertension, hyperlipidemia, metabolic syndrome, peripheral and cerebro vascular disease and Gastrointestinal tract Disorders – Gastroesophageal reflux disease, peptic ulcer, diarrhoea, lactose intolerance, celiac disease.	[9]
Overview of some degenerative disorders and surgery Cancer therapy and its complications - Chemotherapy, Radiation therapy and Surgery. Dietary treatment and management to cancer patients. Alzheimer's disease and Parkinson's disease, HIV-AIDS. Dietary management in Surgery- Nutrition in wound healing, Stage of Convalescence, Dietary management for pre- and post- surgical diets.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Shils, M.E., Shike, M, Ross, A.C., Caballero B and Cousins RJ, Modern Nutrition in Health and Disease. 10th ed. Lipincott, William and Wilkins. 2005.
2.	Mahan, L. K. and Escott Stump. S., Krause's Food & Nutrition Therapy 12th ed. Saunders-Elsevier, 2008.
Reference(s):	
1.	Antia F.P. And Philip Abraham, Clinical Nutrition and Dietetics, Oxford Publishing Company, 2001.
2.	Mahan L.K., Sylvia Escott-Stump: Krause"s Food Nutrition and Diet Therapy 10th Edition, W.B. Saunders Company London. 2000.
3.	Roth, R. A.. *Nutrition & diet therapy*. Cengage Learning. 2013.
4.	Stanfield, P., Stanfield, P. S., and Hui, Y. H. Nutrition and diet therapy: self-instructional modules. Jones & Bartlett Learning.2003.

*SDG 3 – Good Health and Well Being

Passed in BoS Meeting held on 22/05/2024
Approved in Academic Council Meeting held on 25/05/2024

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BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Nutritional Assessment and Care of Patients**	
1.1	Introduction to Therapeutic and Nutrition	1
1.2	Major food groups - classification, Factors influencing food intake and food habits	1
1.3	Good nutrition - a multidisciplinary effort - Balanced diets,	1
1.4	Recommended Dietary Allowances (RDA) for all age groups.	1
1.5	BMR and BMI calculations	1
1.6	Nutritional screening and assessment of patients – out patient & hospitalized	1
1.7	Nutrition care plan and implementation	1
1.8	Dietary Counselling, Importance and modification of normal diet to therapeutic diets	2
2.0	**Dietary management in critically ill patients**	
2.1	Dietary Counselling, Diet Nutrient and Drug Interaction	1
2.2	Effect of drugs on ingestion, Digestion, Absorption, and metabolism of nutrients	2
2.3	Nutritional status assessment of the critically ill patients	1
2.4	Recent advances in techniques and feeding substrates	1
2.5	Enteral Nutrition support and Parenteral Nutrition	1
2.6	Dietary treatment for - Typhoid, Malaria	1
2.7	Dietary treatment for - Tuberculosis, Hypertension and Cardiovascular disease	2
3.0	**Weight management & diabetes management**	
3.1	Etiopathophysiology, metabolic & clinical aberrations	1
3.2	diagnosis, complications, treatment, Medical Nutrition Therapy	2
3.3	Dietary treatment and dietary counseling	1
3.4	Recent advance for Weight imbalance disorders in: Overweight	1
3.5	Recent advance for Weight imbalance disorders in: Underweight	1
3.6	Diabetes Mellitus – Type 1, Type 2, and Gestational diabetes	1
3.7	Diabetes Mellitus –Type 2, and Gestational diabetes	1
3.8	Diabetes Mellitus –Gestational diabetes	1
4.0	**Cardiovascular disorders & GI tract disorders**	
4.1	Etiopathophysiology, metabolic & clinical aberrations	1
4.2	diagnosis, complications, treatment	1
4.3	Medical Nutrition Therapy, dietary counseling	1
4.4	Recent advance in Cardiovascular Diseases – hypertension, hyperlipidemia, metabolic syndrome	2
4.5	Peripheral and cerebro vascular disease	1
4.6	Gastrointestinal tract Disorders – Gastroesophageal reflux disease, peptic ulcer	2
4.7	Diarrhoea, lactose intolerance, celiac disease.	1
5.0	**Overview of some degenerative disorders and surgery**	
5.1	Cancer therapy and its complications	1
5.2	Chemotherapy, Radiation therapy and Surgery.	2
5.3	Dietary treatment and management to cancer patients.	1
5.4	Alzheimer's disease and Parkinson's disease	1
5.5	HIV-AIDS. Dietary management in Surgery	1
5.6	Nutrition in wound healing, Stage of Convalescence, Dietary management for pre - surgical diets	2
5.7	Dietary management for post- surgical diets	1

Course Designer(s)

1. Dr. K.Prabha - prabhak@ksrct.ac.in

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

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60 FT E13	Technology of Fruit and Vegetable Processing	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- Apply tailored methods for soil prep, planting, irrigation, and fertilization in crops.
- Apply proper sorting, grading, and cleaning techniques to prepare fruits and vegetables efficiently.
- Utilize freezing technologies to maintain quality, flavor, and nutrition of surplus produce.
- Apply pasteurization and sterilization methods to enhance fruit and vegetable product safety.
- Design and implement production processes for jams, sauces, pickles, and value-added products.

Pre-requisites

- **Nil**

Course Outcomes

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

CO1	Analyze the fundamental agricultural practices related to fruits and vegetables.	Analyze
CO2	Demonstrate the techniques used in the processing of fruits and vegetables.	Apply
CO3	Implement freezing and dehydration technologies to preserve surplus produce.	Apply
CO4	Utilize thermal processing methods in the technology of fruits and vegetables.	Apply
CO5	Execute the production processes for manufacturing fruit and vegetable products.	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	30
Understand	20	30	40
Apply	10	10	20
Analyze	10	-	10
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. – Food Technology								
60 FT E13 - Technology of Fruit and Vegetable Processing								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
IV	**3**	**0**	**0**	**45**	**3**	**40**	**60**	**100**

BASIC AGRICULTURAL ASPECTS OF VEGETABLES AND FRUITS Ability to identify all commercially important fruits and vegetables with their names in important Indian languages, important regions, season, Production and processing scenario of fruits and vegetable India and World. Scope of Fruit and Vegetable Preservation Industry in India. Present status, constraints and prospectus. Problem solving in post-harvest quality of fruits and vegetables	**9**
FRESH FRUITS AND VEGETABLES Physical, Textural characteristics, structure and composition. Maturity standards; Importance, methods of Maturity determinations maturity indices for selected fruits and vegetables. Harvesting of important fruits and vegetables. Fruit ripening- chemical changes,regulations, methods. Calculation of respiration rates, Spoilage of fruits, vegetable and their processed products.	**9**
PRESERVATION OF FRUITS AND VEGETABLES Preservation by fermentation- Definition, Advantages, disadvantages, Types of fermentation, equipments; Fruit wine. Irradiation applications for fruits and Vegetable. Minimally processed fruits and vegetables, solving problems with respect to natural resistance of fruit, General pre processing, drying and freezing of fruits and vegetables* - problems associated with specific fruits and vegetables, problem solving in Post- cutting treatments to extend the shelf-life of fresh-cut products.	**9**
CANNING, PUREES AND JUICES Canning- General pre-processing, specific or salient points in fruits and vegetables like – Blanching, exhausting, processing conditions; Indian Food Regulation and Quality assurance Fruit Juice / pulp/ Nectar/Drinks, concentrates – General and specific processing, different packing including aseptic. Indian Food Regulation and Quality assurance Vegetable Purees/pastes - General and specific processing, different packing including aseptic. Technology for juice pressing, juice extraction and clarification, methods of bottling, enzymatic clarification and debittering of juices, fruit juice powders- preparation and packaging	**9**
FRUIT AND VEGETABLE PRODUCTS*** Ready to eat fruit and vegetable products, Jams/Marmalades, Squashes/cordials, Ketchup/sauces, Chutneys, Fruit Bar, Soup powders, Candied Fruits, Natural colors, Fruit and Vegetable Fibres- General and specific processing, different packing including aseptic, Dried Onion, Powder. Garlic Dried Garlic, Powder, Oil. Potato Wafer; starch, Papad, Carrot Preserve, candy, Pickle, Jam. Vegetable- Dried vegetable , Sauerkraut, Pickle Leafy vegetables; Dried Leafy Vegetables.	**9**
Total Hours	**45**

Text Book(s):	
1.	Fellows, P J. "Food Processing Technology Principles and Practice". 3rd Edition, Woodhead, 2009.
2.	Sivasankar, B. "Food Processing & Preservation", Prentice Hall of India, 2002.
Reference(s):	
1.	Salunke,D . K and S. S Kadam "Hand Book of Fruit Science and Technology Production, Composition, Storage and Processing". Marcel Dekker, 2005.

***SDG 9 – Industry Innovation and Infrastructure**

*****SDG 7 – Affordable and Clean Energy**

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

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BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Basic Agricultural Aspects of Vegetables and Fruits**	
1.1	Ability to identify all commercially important fruits with their names	1
1.2	Fruit Names in important Indian languages, important regions, season,	1
1.3	Ability to identify all commercially important vegetables with their names	1
1.4	Vegetable Names in important Indian languages, important regions, season,	1
1.5	Production and processing scenario of fruits and vegetable India and World	2
1.6	Scope of Fruit and Vegetable Preservation Industry in India	1
1.7	Present status, constraints and prospectus	1
1.8	Problem solving in post-harvest quality of fruits and vegetables	1
2.0	**Fresh Fruits and Vegetables**	
2.1	Physical, Textural characteristics, structure and composition	1
2.2	Maturity standards; Importance, methods of Maturity determinations maturity indices for selected fruits	2
2.3	Maturity standards; Importance, methods of Maturity determinations maturity indices for selected vegetables	2
2.4	Harvesting of important fruits and vegetables	1
2.5	Fruit ripening- chemical changes, regulations, methods	1
2.6	Calculation of respiration rates	1
2.7	Spoilage of fruits, vegetable and their processed products.	1
3.0	**PRESERVATION OF FRUITS AND VEGETABLES**	
3.1	Preservation by fermentation- Definition, Advantages, disadvantages	2
3.2	Types of fermentation, equipment; Fruit wine	1
3.3	Irradiation applications for fruits and Vegetable. Minimally processed fruits and vegetables	2
3.4	solving problems with respect to natural resistance of fruit	1
3.5	General pre-processing, drying and freezing of fruits and vegetables	1
3.6	problems associated with specific fruits and vegetables	1
3.7	problem solving in Post- cutting treatments to extend the shelf-life of fresh-cut products.	1
4.0	**Canning, Purees and Juices**	
4.1	Canning- General pre-processing	1
4.2	specific or salient points in fruits and vegetables like -Blanching, exhausting, processing conditions	1
4.3	Indian Food Regulation and Quality assurance Fruit Juice / pulp/ Nectar/Drinks, concentrates	1
4.4	General and specific processing, different packing including aseptic.	1
4.5	Indian Food Regulation and Quality assurance Vegetable Purees/pastes	1
4.6	General and specific processing, different packing including aseptic	1
4.7	Technology for juice pressing, juice extraction and clarification, methods of bottling, enzymatic clarification and debittering of juices, fruit juice powders	2
4.8	preparation and packaging	1
5.0	**Fruit and Vegetable Products**	
5.1	Ready to eat fruit and vegetable products, Jams/Marmalades, Squashes / cordials, Ketchup/sauces	2
5.2	Chutneys, Fruit Bar, Soup powders, Candied Fruits, Natural colors, Fruit and Vegetable Fibres	2
5.3	General and specific processing, different packing including aseptic	1
5.4	Dried Onion, Powder, Garlic Dried Garlic, Powder, Oil	1
5.5	Potato Wafer; starch, Papad,	1
5.6	Carrot Preserve, candy, Pickle, Jam.	1
5.7	Vegetable-Dried vegetable, Sauerkraut, Pickle Leafy vegetables; Dried Leafy Vegetables.	1

Course Designer(s)

Dr. J. Philip Robinson - philip@ksrct.ac.in

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

60 FT E14	Instrumental Techniques in Food Analysis	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To learnt about the various instruments based on electromagnetic radiation.
- To learn about advanced analytical methods used in the analysis of food.
- To impart knowledge on food quality.
- To evaluate the principles of chromatographic techniques.
- To learn characterization techniques

Pre-requisites

Nil

Course Outcomes

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

CO1	Analyze different food materials using spectrometry techniques	Understand
CO2	Analyze the components and morphology of food products using various instrumental methods.	Understand
CO3	Discriminate the physical basis of electrophoresis and its development.	Remember
CO4	Evaluate the principle, types and applications of different chromatographic techniques for separation.	Understand
CO5	Acquire knowledge about charecterization techniques.	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	30	30
Understand	40	30	50
Apply	-	-	20
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B. Tech. Food Technology								
60 FT E14 – Instrumental Techniques in Food Analysis								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	40	60	100

Spectrometry The Electromagnetic spectrum – Interaction of photons with matter, absorbance and transmittance – classification of instrumental methods, Derivation from Beer's law, – Visible spectrometry and calorimetry- Theory, instrumentation and application. Ultra violet spectroscopy – Theory instrumentation and application. Infrared spectroscopy: Theory Fundamental vibrations – Instrumentation – application – Finger print region.	[9]
X-Ray and thermal studies X- Ray diffraction, Mosley's law- instrumentation and applications. Flame photometer, Polarimetry and Refractometry – Principle and instrumentation – Analysis of sugar. Thermogravimetry – Differential. Thermal analysis, Differential scanning calorimetry applications. Morphology analysis – SEM, TEM, epifluorescence microscopy and Laser diffraction for particle analysis.	[9]
Conductometry and Potential Measurement Conductance measurements - applications. Conductometry titrations Types, advantages, and disadvantages. Potential measurement - pH, pO_2, pCO_2, $pHCO_3$, determination. Basic Principle of electrophoresis, application of paper, starch gel, agarose, native and denaturing PAGE. 2D electrophoresis and its advantages.	[9]
Chromatographic Methods* Classification of chromatographic methods: Column, Thin Layer, Paper, Gas; High Performance Liquid Chromatography (HPLC), (Principle, mode of separation technique and types of detectors) HPTLC, GC-MS, LC-MS and GC-FTIR. Solid – phase extraction System. Recent Rapid Techniques – e-nose techniques, e-tongue.	[9]
AAS, NMR Spectroscopy* Atomic Absorption Spectrophotometer: Principle, instrumentation and applications. Nuclear Magnetic Resonance: Introduction to NMR; Principle and instrumentation (proton NMR only) chemical shift - applications. Mass spectroscopy – Theory, instrumentations – Ion fragmentation- applications.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Semih Ötles. Handbook of Food Analysis Instruments. CRC Press, Boca Raton, FL, USA, 2009.
2.	Suzanne Nieisen. 2010. Food Analysis Laboratory Manual, 2nd Ed. Springer, NY, USA. 2010.
Reference(s):	
1.	Chatwal, Gurdeep R and Anand, Sham K., "Instrumentation Methods of Chemical Analysis", Himalaya Publications, Bombay, 2003.
2.	Liptak B.G, "Process Measurement and Analysis", Chilton Book Company, Radnor, Pennsylvania, 2010.
3.	Otles, Semih. "Methods of Analysis of Food Components and Additives", CRC Press, 2005
4.	Nollet, Leo M.L."Hand Book of Food Analysis" Rev. Edition. Vol. I, II & III, Marcel & Dekker, 2004.

*SDG 9 – Industry Innovation and Infrastructure

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Spectrometry**	
1.1	The Electromagnetic spectrum – Interaction of photons with matter	1
1.2	Absorbance and transmittance	1
1.3	classification of instrumental methods,	1
1.4	Derivation from Beer's law, – Visible spectrometry - Theory, instrumentation and application	1
1.5	Calorimetry - Theory, instrumentation and application.	1
1.6	Ultra violet spectroscopy – Theory instrumentation and application	2
1.7	Infrared spectroscopy: Theory Fundamental vibrations – Instrumentation – application – Finger print region	2
2.0	**X-Ray and thermal studies**	
2.1	X- Ray diffraction, mosley's law	1
2.2	Instrumentation and applications.	1
2.3	Flame photometer, Polarimetry principle and instrumentation.	1
2.4	Refractrometry – Principle and instrumentation – Analysis of sugar	1
2.5	Thermogravimetry – Differential. Thermal analysis	1
2.6	Differential scanning calorimetry applications	1
2.7	Morphology analysis – SEM	1
2.8	Morphology analysis - TEM	1
2.9	Epifluorescence microscopy and Laser diffraction for particle analysis.	1
3.0	**Conductometry and Potential Measurement**	
3.1	Conductance measurements - applications.	1
3.2	Conductometry titrations Types, advantages, and disadvantages.	1
3.3	Potential measurement - pH, pO2, pCO2, pHCO3, determination.	2
3.4	Basic Principle of electrophoresis,	1
3.5	Application of paper, starch gel, agarose, and 2D electrophoresis.	2
3.6	Native and denaturing PAGE.	1
3.7	2D electrophoresis and its advantages	1
4.0	**Chromatographic Methods**	
4.1	Classification of chromatographic methods	1
4.2	Column, Thin Layer chromatography	1
4.3	Paper, Gas chromatography	1
4.4	High Performance Liquid Chromatography (HPLC), (Principle, mode of separation technique and types of detectors)	1
4.5	HPLC	1
4.6	GC-MS	1
4.7	LC-MS and GC-FTIR.	1
4.8	Solid – phase extraction System	1
4.9	Recent Rapid Techniques – e-nose techniques, e-tongue	1
5.0	**AAS, NMR Spectroscopy**	
5.1	Atomic Absorption Spectrophotometer: Principle, instrumentation and applications	2
5.2	Nuclear Magnetic Resonance: Introduction to NMR	1
5.3	Principle and instrumentation (proton NMR only)	2
5.4	Chemical shift - applications	1
5.5	Mass spectroscopy – Theory, instrumentations	1
5.6	Ion fragmentation- applications	2

Course Designer(s)

1. Dr.K.Prabha- prabhak@ksrct.ac.in

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

60 FT E15	Food Safety and Quality Auditing	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To study the Standard Operating Procedures.
- To prepare HACCP based SOP.
- To understand the GMP, Sanitation and Hygiene practice.
- To implement HACCP program to any food industry.
- To conduct quality auditing in the food industries

Pre-requisites

Nil

Course Outcomes

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

CO1	Understand the basic techniques of Standard Operating Procedures used in food processing industries	Understand
CO2	Define the needs of HACCP and SOP during the food audits	Remember
CO3	Examine the Good Manufacturing Practice along with Sanitation and Hygiene practice used in the food industries	Understand
CO4	Summarize the whole process of HACCP in the food processing sectors.	Analyze
CO5	Deduce the improvements of HACCP while undergoing the food auditing	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	30	20	30
Understand	30	20	30
Apply	-	10	30
Analyze	-	10	10
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B. Tech. Food Technology								
60 FT E15 - Food Safety and Quality Auditing								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	40	60	100

Standard Operating Procedures Preparing scope, quality policy and quality objectives of food processing company, Defining Standard operating procedure – purpose- Format - developing and implementing, effective writing. SOP for purchasing raw materials, receiving raw materials, storage, cleaning, holding, cooling, freezing, thawing, reheating, personal hygiene, facility and equipment. Systems in laboratory accreditation	[9]
Audit Check List Preparation of HACCP based SOP checklist - personal hygiene, food preparation, hot holding, cold holding, refrigerator, freezer and milk cooler, food storage and dry storage, cleaning and sanitizing, utensils and equipment, large equipment, garbage storage and disposal and pest control.	[9]
Pre-requisite Program Good Manufacturing Practices - Personal hygiene – occupational health and safety specification, Food Plant Sanitation Management - Plant facilities construction and maintenance - exterior of the building- interior of the building- equipment. Storage, transportation, traceability, recalling procedures, training.	[9]
HACCP principle* Conduct a hazard analysis, CCP identification, establish critical limits for each CCP, establish CCP monitoring procedures, establish corrective actions procedures, establish procedures for HACCP verification and validation, documenting the HACCP Program .	[9]
Implementation of HACCP and conducting audit* HACCP for jam, biscuit, bread, dairy, meat, fish and egg industries. Conducting of open meeting and close meeting in auditing, preparation of audit reports for different department-audit exercise	[9]
Total Hours:	**45**

Text Book(s):	
1.	Andres Vasconcellos J. Quality Assurance for the Food industry - A practical approach. CRC press, London, UK. 2005.
2.	Inteaz Alli., Food quality assurance - Principles & practices. CRC Press. New York. 2004
Reference(s):	
1.	Sara Mortimore and Carol Wallace. HACCP - A practical approach. Third edition. Chapman and Hall, London, 2013.
2.	Roday, S. Food Hygiene and Sanitation, Tata McGraw-Hill Education, 1998.

*SDG 12 – Responsible Consumption and Production

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Standard Operating Procedures**	
1.1	Preparing scope	1
1.2	quality policy and quality objectives of food processing company	1
1.3	Defining Standard operating procedure – purpose	1
1.4	Format - developing and implementing, effective writing	1
1.5	SOP for purchasing raw materials, receiving raw materials, storage	1
1.6	cleaning, holding, cooling, freezing	1
1.7	thawing, reheating, personal hygiene	1
1.8	facility and equipment	1
1.9	Systems in laboratory accreditation	1
2.0	**Audit Check List**	
2.1	Preparation of HACCP based SOP checklist	1
2.2	Personal hygiene, food preparation	1
2.3	Hot holding, cold holding	1
2.4	Refrigerator, freezer and milk cooler	1
2.5	Food storage and dry storage	1
2.6	Cleaning and sanitizing	1
2.7	Utensils and equipments, large equipments	1
2.8	garbage storage and disposal and pest control	2
3.0	**Pre-requisite Program**	
3.1	Good Manufacturing Practices	1
3.2	Personal hygiene.	1
3.3	occupational health and safety specification	1
3.4	Food Plant Sanitation Management - Plant facilities construction and Maintenance	1
3.5	Food Plant Sanitation Management - exterior of the building- interior of the Building	2
3.6	Food Plant Sanitation Management - equipments. Storage, transportation	2
3.7	Food Plant Sanitation Management - traceability, recalling procedures, training	1
4.0	**HACCP principle**	
4.1	Conduct a hazard analysis	1
4.2	CCP identification	2
4.3	Establish critical limits for each CCP	1
4.4	Establish CCP monitoring procedures	1
4.5	Establish corrective actions procedures	1
4.6	Establish procedures for HACCP verification and validation,	2
4.7	Documenting the HACCP Program.	1
5.0	**Implementation of HACCP and conducting audit**	
5.1	HACCP for jam, biscuit, bread	2
5.2	HACCP for dairy	1
5.3	HACCP for meat, fish and egg industries	2
5.4	Conducting of open meeting and close meeting in auditing	2
5.5	preparation of audit reports for different department- audit exercise	2

Course Designer(s)

1. Mr. P. Kalai Rajan– kalairajan@ksrct.ac.in

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

60 FT E16	Flour Chemistry and Rheology	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- Understand the composition and role of gluten in bread making and baking.
- Learn the dry milling process of wheat and the characteristics of flour produced.
- Learn how to test for gluten quantity and dough raising capacity.
- Study the effects of bakery ingredients (e.g., water, yeast, sugar) on dough rheology.
- Learn the effects of mechanical work, mixing time, and temperature on dough properties.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Demonstrate knowledge of gluten's function in bread and baked products.	Understand
CO2	Analyse the chemistry of wheat proteins and their effects on flour quality.	Analyze
CO3	Assess gluten quantity and quality using appropriate testing methods.	Apply
CO4	Assess how different ingredients affect dough's rheological properties and gas retention during bread making.	Apply
CO5	Perform rheological tests to measure dough extensibility and mixing tolerance.	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	30	30	40
Apply	10	20	20
Analyze	10	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 FT E16 - Flour Chemistry and Rheology								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	40	60	100

FLOUR Flour: Refined, composition, nature of gluten and its functions in bread making and baking. Simple tests for flour quality, colour, gluten and water absorption. Blended flours and their suitability for use in different types of baked products. Flour improvers.	**[9]**
WHEAT FLOUR Wheat grain structure and composition, classification and grading, dry milling of wheat, flour characteristics, optimization, chemistry & biochemistry – wheat proteins, adverse reactions to wheat proteins, polysaccharides, interaction within components and interaction with other components.	**[9]**
PHYSIOCHEMICAL TESTS & FUNCTIONAL TESTS Principles and methods of estimation of moisture, protein, ash, minerals, fats, diastatic activity, starch damage content, maltose value, flour colour grade value and flour particle size distribution. Principles and methods of estimation of gluten quantity, SDS - Sedimentation volume, falling number, dough raising capacity and alkaline water retention test.	**[9]**
BASIC APPROACHES TO DOUGH RHEOLOGY Dough structure and basics of rheology. Creep and recovery, viscometry, stress relaxation, oscillatory measurements. Empirical and fundamental testing. Rheological behavior of dough and gluten. Importance of dough and gluten viscoelasticity in gas retention and bread making. **Bakery ingredients and dough rheology: Effects of water, yeast, oxidation and compounds with disulfide and thiol groups, sugar and emulsifiers on rheological properties of dough.***	**[9]**
RHEOLOGICAL TESTS Flour constituents, processing parameters and dough rheology: Influence of proteins, gluten, starch and enzymes on rheological properties of dough. Effects of mechanical work, mixing time and temperature on dough rheology. Determination of Extensio-graph characteristics of the dough. **Application of visco-amylograph in dough testing.***	**[9]**
Total Hours:	**45**

Text Book(s):	
1.	Hui.Y.H. - Bakery products, Science and Technology, Blackwell, 2006
2.	Zhou - Bakery products, Science and Technology, Second edition, 2014
Reference(s):	
1.	Matz, Samuel A., —Bakery Technology and Engineering, 1992, 3rd Edition, Chapman & Hall, London
2.	Edwards W.P. — Science of bakery products, RSC, UK, 2007

***SDG 9 – Industry Innovation and Infrastructure**

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Flour**	
1.1	Types of Flour	1
1.2	Composition of flour	1
1.3	Nature of gluten and its functions	1
1.4	Functions in bread making and baking	1
1.5	Simple tests for flour quality	1
1.6	Colour, gluten and water absorption	2
1.7	Blended flours and their suitability for use in different types of baked products	1
1.8	Flour improvers	1
2.0	**Wheat flour**	
2.1	Wheat grain structure and composition	2
2.2	Classification and grading	2
2.3	Dry milling of wheat	1
2.4	Flour characteristics, optimization, chemistry & biochemistry – wheat proteins	1
2.5	Adverse reactions to wheat proteins, polysaccharides	1
2.6	Interaction within components and interaction with other components	2
3.0	**Physiochemical tests & functional tests**	
3.1	Principles and methods of estimation of moisture, protein, ash	1
3.2	Principles and methods of estimation of minerals, fats	1
3.3	Principles and methods of estimation of diastatic activity	1
3.4	starch damage content, maltose value	1
3.5	flour colour grade value and flour particle size distribution	1
3.6	Principles and methods of estimation of gluten quantity	1
3.7	SDS -Sedimentation volume, falling number	1
3.8	dough raising capacity	1
3.9	alkaline water retention test	1
4.0	**Basic approaches to dough rheology**	
4.1	Dough structure and basics of rheology	1
4.2	Creep and recovery, viscometry	1
4.3	stress relaxation, oscillatory measurements	1
4.4	Empirical and fundamental testing.	1
4.5	Rheological behavior of dough and gluten.	1
4.6	Importance of dough and gluten viscoelasticity in gas retention and bread making.	1
4.7	Bakery ingredients and dough rheology: Effects of water, yeast, oxidation and compounds with disulfide and thiol groups,	1
4.8	Bakery ingredients and dough rheology: Effects of water, yeast, oxidation and compounds with disulfide and thiol groups,	1
4.9	sugar and emulsifiers on rheological properties of dough.	1
5.0	**Rheological Tests**	
5.1	Flour constituents, processing parameters	1
5.2	dough rheology: Influence of proteins, gluten,	2
5.3	dough rheology: starch and enzymes on rheological properties of dough.	2
5.4	Effects of mechanical work, mixing time and temperature on dough rheology.	1
5.5	Determination of Extensio-graph characteristics of the dough	1
5.6	Application of visco-amylograph in dough testing	2

Course Designer(s)

1. Mr. S. Nithishkumar - nithishkumar@ksrct.ac.in

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

60 FT E17	Drying Technology	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- Infer the mechanism and quality changes during drying.
- Select suitable dryers for food products based on requirement.
- Identify appropriate low cost drying methods.
- Choose suitable dryers for solid food materials.
- Recommend appropriate dryers for liquid food materials.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Study and understand the knowledge of the basic mechanism of drying and the changes occurs during drying of food material.	Understand
CO2	Define the different types of drying technologies with its principle, procedure and application in food sectors	Apply
CO3	Examine the different types of low-cost methods used in drying with its ethical values and applications	Analyze
CO4	Elucidate the technologies and methodologies used in drying of solids materials with its limitations	Analyze
CO5	Deduce the various techniques which were used to dry the liquid and slurry food products along with its advantages and disadvantages	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	3	3	-	-	-	-	-	-	-	2
CO2	3	3	2	-	-	3	3	3	-	-	-	-	-	-	2
CO3	3	3	2	-	-	2	2	-	-	-	-	-	-	-	2
CO4	3	3	2	-	-	2	2	3	-	-	-	-	-	-	2
CO5	3	3	2	-	-	2	2	-	-	-	-	-	-	-	2
3 - Strong; 2 - Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	30
Understand	20	30	30
Apply	20	10	20
Analyze	-	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 FT E17 - Drying Technology								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	40	60	100

Fundamentals of Drying** Drying and dehydration – Basics and principles. Mechanism of drying – Drying curves, Drying rate periods -constant and falling rate periods. Drying and Food Quality – Post-drying problems and In-drying problems. Effect of drying on Water activity, EMC, Sorption isotherms. Moisture diffusivities in food. Quality changes in food - Browning, color loss, shrinkage, solubility, texture and rehydration.	[9]
Types of Dryers* Classification of dryers – Based on mode of operation, mode of heat transfer – conduction, convection and radiation. Based on feed properties. Selection of dryers - energy costs, safety, and environmental factors. Conventional versus innovative drying techniques. Tray dryer – principle operational aspects and design.	[9]
Low Cost Drying methods Solar drying. Types of solar dryers – Direct, Indirect and mixed mode. Green house solar dryers. Osmotic dehydration – Principal. Osmotic agents, Factors affecting osmotic dehydration. Effect of water activity. Osmo convective drying. Applications, Advantages and Limitations.	[9]
Drying of Solids*** Rotary dryer – Principle, Types, Applications. Freeze drying – Phase diagram of water, Principle – Freezing, Primary and Secondary drying stage. Fluidized bed drying - Principles of fluidization, Types of fluidized bed dryers. Pneumatic drying – Principle, Working mechanism, Applications.	[9]
Drying of Liquids and Slurries Drum drying – principle. Types of drum driers – Single and double drum driers. Types of Feeding system. Foam mat drying – Principles, Foaming agents, Foaming Properties, Continuous foam mat dryer. Spray drying – Principle. Components of spray dryer - Atomizer types. Single stage and double stage spray dryer. Design aspects. Advantages and limitations.	[9]
Total Hours	**45**

Text Book(s):	
1.	Mujumdar A.S., —Handbook of Industrial dryingǁ, 3rd Edition, CRC press, Taylor and Francis group, UK, 2007.
2.	Xiao Dong Chen and Mujumdar A.S, —Drying Technologies in Food Processing, 1st Edition, Wiley- Blackwel, 2008.
Reference(s):	
1.	Jangam S.V., Chung Lim Law and Mujumdar A.S., —Drying of Foods, Vegetables and Fruits, Volume 1, Electronic Version, 2010.
2.	Hii, C.L., Jangam S.V., Sze Pheng Ong and Mujumdar, A.S., —Solar Drying: Fundamentals, Applications and Innovations, Electronic Version, 2012.
3.	Toledo R.T., —Fundamentals of Food Process Engineering, Springer, 2007.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being
***SDG 7 – Affordable and Clean Energy

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Fundamentals of Drying**	
1.1	Drying and dehydration – Basics and principles	1
1.2	Mechanism of drying – Drying curves, Drying rate periods - constant and falling rate periods	2
1.3	Drying and Food Quality – Post-drying problems and In-drying problems	1
1.4	Effect of drying on Water activity, EMC, Sorption isotherms	1
1.5	Moisture diffusivities in food	1
1.6	Quality changes in food - Browning, color loss	1
1.7	Quality changes in food - shrinkage, solubility	1
1.8	Quality changes in food - texture and rehydration	1
2.0	**Types of Dryers**	
2.1	Classification of dryers – Based on mode of operation	1
2.2	Mode of heat transfer – conduction, convection and radiation	1
2.3	Based on feed properties	1
2.4	Selection of dryers - energy costs, safety, and environmental factors	2
2.5	Conventional versus innovative drying techniques	2
2.6	Tray dryer – principle operational aspects and design	2
3.0	**Low Cost Drying methods**	
3.1	Solar drying	1
3.2	Types of solar dryers – Direct, Indirect and mixed mode	2
3.3	Green house solar dryers	1
3.4	Osmotic dehydration – Principal. Osmotic agents	1
3.5	Factors affecting osmotic dehydration	1
3.6	Effect of water activity	1
3.7	Osmo convective drying. Applications, Advantages and Limitations	2
4.0	**Drying of Solids**	
4.1	Rotary dryer – Principle, Types, Applications	2
4.2	Freeze drying – Phase diagram of water	1
4.3	Principle – Freezing	1
4.4	Primary and Secondary drying stage	1
4.5	Fluidized bed drying - Principles of fluidization	1
4.6	Types of fluidized bed dryers	1
4.7	Pneumatic drying – Principle, Working mechanism, Applications	2
5.0	**Drying of Liquids and Slurries**	
5.1	Drum drying – principle	1
5.2	Types of drum driers – Single and double drum driers	1
5.3	Types of Feeding system	1
5.4	Foam mat drying – Principles, Foaming agents, Foaming Properties Continuous foam mat dryer	2
5.5	Spray drying – Principle, Components of spray dryer –Atomizer types	2
5.6	Single stage and double stage spray dryer. Design aspects. Advantages and limitations	2

Course Designer(s)

1. Mr. S. Nithishkumar – nithishkumar@ksrct.ac.in

Passed in BoS Meeting held on 12.05.23
Approved in Academic Council Meeting held on 03.06.23

CHAIRMAN
BOARD OF STUDIES

PROFESSIONAL ELECTIVE – II

60 FT E21	Process Control and Instrumentation	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- Make use of Laplace transformation for first order systems.
- Apply Laplace Transformation for second order systems and determine its dynamic behavior,
- Interpret the concepts of feedback controller and determine its dynamic response and stability.
- Summarize the concept of computer-based controls in automation.
- Select temperature, pressure and level measuring instruments

Pre-requisites

Nil

Course Outcomes

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

CO1	Make use of Laplace transformation for first order systems	Understand
CO2	Apply Laplace Transformation for second order systems and determine its dynamic behaviour.	Analyze
CO3	Interpret the concepts of feedback controller and determine its dynamic response and stability.	Apply
CO4	Summarize the concept of computer-based controls in automation.	Apply
CO5	Select temperature, pressure and level measuring instruments	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	10	20	30
Apply	20	20	30
Analyze	10	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 FT E21 - Process Control and Instrumentation								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

Laplace Transform and First Order System 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]
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]
Controllers, Dynamic Response and its Stability 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. Stability for linear systems, Routh stability criterion and its limitations. Introduction to control system design by frequency, Bode diagram.	[9]
Automation* Control components of SCADA, working of SCADA, comparison of SCADA with DCS, comparison of PLC with RTU, Application and advantages of SCADA, Sensors and its classification.	[9]
Process Instruments* Principles of measurements - Static and dynamic response of instruments, Temperature measurements – Expansion Thermometer, filled system thermometers, thermocouple, optical pyrometers, radiation pyrometers. Pressure measurements - Manometers, bourdon gauge and bellows gauge, pressure measurement by vacuum. – Mccleod gauge, Pirani Gauge. Level measurement – sight glass level indicator, float and tape liquid level gauge.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Vyas, R.P, "Process Control and Instrumentation", 8th Edition, Dennet & Co, India, 2015.
Reference(s):	
1.	Stephanopoulos, S.G., "Chemical Process Control: An Introduction to Theory and Practice", 1st Edition, Prentice Hall of India, New Delhi, 2011.
2.	Donald R. Cough anowr and Steven E. LeBlanc, "Process Systems Analysis and Control", 3rd Edition, Tata McGraw Hill Company Ltd., New Delhi, 2013.

*SDG 9 – Industry Innovation and Infrastructure

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Laplace Transform and First Order System**	
1.1	Laplace transformation	1
1.2	application	1
1.3	Open-loop systems	2
1.4	first order systems	1
1.5	their transient response for standard input functions	2
1.6	Linearization and its application in process control.	2
2.0	**Second Order System**	
2.1	Second order systems	1
2.2	Interacting system and non-interacting system	2
2.3	manometer, damped oscillator	1
2.4	dynamic response of second order system	1
2.5	Closed loop control systems	1
2.6	development of block diagram for feed-back control systems	2
2.7	servo and regulator problems	1
3.0	**Controllers, Dynamic Response and its Stability**	
3.1	Controllers - Proportional, Proportional Integral,	2
3.2	Proportional Derivative and Proportional Integral Derivative (PID)	2
3.3	Dynamic behavior of feedback-controlled processes	1
3.4	Effect of proportional, Integral, Derivative	1
3.5	Effect of composite control actions on the response of controlled processes	1
3.6	Stability for linear systems, Routh stability criterion and its limitations	1
3.7	Introduction to control system design by frequency, Bode diagram	1
4.0	**Automation**	
4.1	Control components of SCADA	2
4.2	working of SCADA	1
4.3	comparison of SCADA with DCS	2
4.4	comparison of PLC with RTU	1
4.5	Application and advantages of SCADA	2
4.6	Sensors and its classification	1
5.0	**Process Instruments**	
5.1	Principles of measurements	1
5.2	Static and dynamic response of instruments	1
5.3	Temperature measurements, Expansion Thermometer, filled system thermometers	1
5.4	thermocouple, optical pyrometers, radiation pyrometers. Pressure measurements	2
5.5	Manometers, bourdon gauge and bellows gauge, pressure measurement by vacuum	1
5.6	Mccleod gauge, Pirani Gauge	1
5.7	Level measurement – sight glass level indicator	1
5.8	float and tape liquid level gauge	1

Course Designer(s)

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Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

60 FT E22	Community Nutrition	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To provide knowledge on components of health and fitness.
- To impart knowledge on importance of nutrients and its assimilation,
- Determination of Energy Balance in human nutrition and nutrition during life cycle.
- Develop and prepare different types of visual aids suitable to community nutrition programs.

Pre-requisites

Nil

Course Outcomes

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

CO1	To understand the basic concepts of nutrition, different nutritional demands and dietary requirements	Understand
CO2	Gain practical experience in imparting the knowledge of nutrition to the community	Analyze
CO3	To enhance societal awareness in improving the nutritional and functional properties of food.	Apply
CO4	Understand the importance and roles of energy levels in the regulation of human metabolism and nutrition.	Apply
CO5	Comprehend the physiological changes during pregnancy and lactation and the importance of nutrition during these stages.	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	30	30	40
Apply	10	20	20
Analyze	10	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 FT E22 - Community Nutrition								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

Introduction to Food and Nutrition Definition, six classes of nutrients, RDA-General Principles of Deriving RDA, Reference Body Weights of Indians, Reference Person, Recommended Dietary Allowances for Indians, Uses and limitations of RDA. Nutritional status and its assessment, Malnutrition – over nutrition and under nutrition, deficiency disease. Functions of food, Functions of Nutrients, Balanced diet	[9]
Nutrition during life cycle* Factors to be considered in meal/menu planning. Pregnancy -Nutritional requirements and modification of existing diet and supplementation, Lactation - nutritional requirements, breast feeding, infant formula, Infancy - nutritional requirements. Introduction of supplementary foods. Nutritional needs of toddlers, preschool, school going children- and adolescents – Dietary management. Geriatic Nutrition - Factors affecting food intake and nutrients use, nutrient needs.	[9]
Health and functional foods* Concept of the functional foods, types of functional foods, development of functional foods, infant and baby foods, adolescent/ teen age foods, foods for pregnant ladies and nursing mothers, geriatric foods. Social, Economic and psychological aspects of ageing, Food selection patterns, Nutrition and drug interactions	[9]
Energy in Human nutrition Energy and its unit, Energy Balance, Assessment of Energy Requirements—deficiency and excess, Determination of Energy in food, BMR. and its regulation, specific dynamic action of foods, Obesity and BMI calculations, Preparation of balance diets, evaluation of energy value and techno economic feasibility, Common nutritional problems, prevalence, etiology, management and implications. Undernutrition – PEM, underweight, stunting, wasting, SAM. Overnutrition – Childhood obesity	[9]
Maternal and Child Nutrition Intergenerational cycle of malnutrition. Growth and development in adolescent girls. Pre-conceptual and Peri-conceptual Nutrition. Pregnancy and Lactation: Pregnancy, Nutritional requirements, Structural and functional differentiation during fetal period. Metabolism and use of nutrients, Lactation: Physiology of lactation, Nutritional requirements, Lactation management.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Swaminathan,M. “Handbook of Food and Nutrition”, 1st Edition, The Bangalore Press, 2018
2.	Mike Lean and E.Combet, Barasi’s Human Nutrition – A Health Perspective, Second Edition CRC Press, London, 2015
Reference(s):	
1.	Sumanti R. Mudambi, Rajagopal, M.V., “Fundamentals of Food, Nutrition and Diet Therapy”, 6th Edition, New Age International Publishers, New Delhi, 2018
2.	Srilakshmi B., “Nutrition Science”, 6th Edition, New Age International Publishers, New Delhi,2018
3.	Sarah H. (1981). Maternal, Infant and Child Nutrition. Health Sciences Consortium, the University of California.

*SDG 3 – Good Health and Well Being

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Food and Nutrition**	
1.1	Definition, six classes of nutrients	1
1.2	RDA-General Principles of Deriving RDA	1
1.3	Reference Body Weights of Indians, Reference person	1
1.4	Recommended Dietary Allowances for Indians	1
1.5	Uses and limitations of RDA	1
1.6	Nutritional status and its assessment	1
1.7	Malnutrition – over nutrition and under nutrition	1
1.8	Deficiency disease. Functions of food	1
1.9	Functions of Nutrients, Balanced diet	1
2.0	**Nutrition during life cycle**	
2.1	Factors to be considered in meal/menu planning	1
2.2	Pregnancy -Nutritional requirements and modification of existing diet and supplementation	1
2.3	Lactation - nutritional requirements	1
2.4	Breast feeding, infant formula	1
2.5	Infancy - nutritional requirements	1
2.6	Introduction of supplementary foods	1
2.7	Nutritional needs of toddlers, preschool, school going children- and adolescents	1
2.8	Dietary management. Geriatric Nutrition	1
2.9	Factors affecting food intake and nutrients use, nutrient needs	1
3.0	**Health and functional foods**	
3.1	Concept of the functional foods	1
3.2	Types of functional foods	1
3.3	Development of functional foods	1
3.4	Infant and baby foods, adolescent/ teen age foods	1
3.5	foods for pregnant ladies and nursing mothers	1
3.6	Geriatric foods	1
3.7	Social, Economic and psychological aspects of ageing	1
3.8	Food selection patterns	1
3.9	Nutrition and drug interactions	1
4.0	**Energy in Human nutrition**	
4.1	Energy and its unit, Energy Balance	1
4.2	Assessment of Energy Requirements—deficiency and excess	1
4.3	Determination of Energy in food	1
4.4	BMR and its regulation	1
4.5	Specific dynamic action of foods	1
4.6	Obesity and BMI calculations	1
4.7	Preparation of balance diets, evaluation of energy value and techno economic feasibility	1
4.8	Common nutritional problems, prevalence, etiology, management and implications	1
4.9	Undernutrition – PEM, underweight, stunting, wasting, SAM. Overnutrition – Childhood obesity	1
5.0	**Maternal and Child Nutrition**	
5.1	Intergenerational cycle of malnutrition	1
5.2	Growth and development in adolescent girls	1
5.3	Pre-conceptual and Peri-conceptual Nutrition	1
5.4	Pregnancy and Lactation: Pregnancy, Nutritional requirements	1
5.5	Structural and functional differentiation during fetal period	1
5.6	Metabolism and use of nutrients	1
5.7	Lactation: Physiology of lactation	1
5.8	Nutritional requirements	1
5.9	Lactation management	1

Course Designer(s)

1. Dr. J.Balachandra Mohan- balachandramohan@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23

Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
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60 FT E23	Fruits and Vegetables as Nutraceuticals	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- Design and implement production processes for jams, sauces, pickles, and value-added products.
- Identify and describe the major physiological processes in fruits and vegetables.
- Define nutraceuticals and distinguish them from pharmaceuticals and functional foods.
- Compare and contrast different methods used for the extraction and isolation of nutraceuticals.
- Assess the role of nutraceuticals and functional foods in preventing specific diseases.

Pre-requisites

Nil

Course Outcomes

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

CO1	Comprehend the physiological characteristics of fruits and vegetables.	Understand
CO2	Explain the foundational concepts of nutraceuticals and their impact on health and disease.	Understand
CO3	Analyze the chemical properties of nutraceuticals and the techniques used for their extraction.	Analyze
CO4	Assess the significance of nutraceuticals and functional foods in promoting health and preventing disease.	Analyze
CO5	Analyze the role of nutraceuticals and functional foods in preventing specific diseases.	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	30	20	30
Understand	30	20	30
Apply	-	10	20
Analyze	-	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech. – Food Technology

60 FT E23 - Fruits and Vegetables as Nutraceuticals

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

Bioactive Compounds in Fruits and Vegetables Introduction to major class of bioactives in fruits and vegetables, present scenario of nutraceutical market, food and nutrient intake behavior in Indians, classification of plant derived bioactives, interaction of functional food with medicine, Vitamins and Minerals of fruits and Vegetables, Flavonoid, Isoflavone, and Carotenoid Contents in Raw fruits and Vegetables, Fibre – dietary fibre, plant tissue and type of cell walls, cell wall polysaccharide, effects of cooking or processing on cell wall composition, health benefits	9
Pharmacological and Nutritional Properties of Fruits and Vegetables Pharmacological properties of fruits and vegetables; nutritional indicators and health aspects of fruits and vegetable consumption in adults; diabetes, diabetic complication and flavonoids; curcumin – epigenetic therapy; Nutraceuticals as therapeutic agent for inflammation – flavonoids, anthocyanin; diet and nutrition in prostate health, Antioxidants in fruits & vegetables – factors that affect antioxidant response to ingestion of fruit - health properties.	9
Nutrients in Fruits and Vegetables for Health and Specialized Foods Role of fruit and vegetable nutrients in Cancer and immune system enhancer, utilization in functional foods, phytosterol, phytoestrogens, glucosinolates, organosulphur compounds, flavonoids, carotenoids, etc. Sports foods – ingredients, components in sports foods, sports drinks, design consideration, ergogenic aids in sports nutrition. Formulations for meeting normal and special needs of infants, current status of infant foods, additives for infant foods. Foods for aged persons, design consideration, ingredients for geriatric foods	9
Development of Health Foods from Fruits and Vegetables Concept of new health food product development from fruits and vegetables. Safety; marketing strategy and consumer response; economic analysis and costing of novel foods from fruits and vegetables, Prebiotic substances from fruits and vegetables and their utilization in functional foods, symbiotic foods, technological aspects and recent development in probiotics, prebiotics and symbiotic	9
Nutraceuticals and Bioactive Compound Utilization Nutraceutical delivery vehicles, Role of bioactives from fruit and vegetables for human health – plant parts and chemistry, mechanism of action - case studies, recovery of valuable bioactives from residues of fruit and vegetable processing industry, stability and bioaccessibility of fruit and vegetables bioactives in food – food component interaction and matrix effect.	9
Total Hours:	**45**

Text Book(s):

1. Anumala, V., Phurailatpam, A., Sarma, P., Anumala, V., Phurailatpam, A., Sarma, P. (2021). Fruits and Vegetables as Nutraceutical: Nature's Medicine. United States: Taylor & Francis.
2. Functional Foods, Nutraceuticals, and Degenerative Disease Prevention. (2011). Germany: Wiley.

Reference(s):

1. Li, T. S. C., Li, T. S. C. (2008). Vegetables and Fruits: Nutritional and Therapeutic Values. United States: CRC Press.
2. Nutritional Composition and Antioxidant Properties of Fruits and Vegetables. (2020). Netherlands: Elsevier Science.

**SDG 3 – Good Health and Well Being

***SDG 7 – Affordable and Clean Energy

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Bioactive Compounds in Fruits and Vegetables**	
1.1	Introduction to major class of bioactives in fruits and vegetables	1
1.2	present scenario of nutraceutical market, food and nutrient intake behavior in Indians	2
1.3	classification of plant derived bioactives, interaction of functional food with medicine	2
1.4	Vitamins and Minerals of fruits and Vegetables, Flavonoid,	1
1.5	Isoflavone, and Carotenoid Contents in Raw fruits and Vegetables	1
1.6	Fibre – dietary fibre, plant tissue and type of cell walls, cell wall polysaccharide	1
1.7	effects of cooking or processing on cell wall composition, health benefits	1
2.0	**Pharmacological and Nutritional Properties of Fruits and Vegetables**	
2.1	Pharmacological properties of fruits and vegetables	1
2.2	nutritional indicators and health aspects of fruits and vegetable consumption in adults	2
2.3	diabetes, diabetic complication and flavonoids;	1
2.4	curcumin – epigenetic therapy	1
2.5	Nutraceuticals as therapeutic agent for inflammation – flavonoids, anthocyanin	1
2.6	diet and nutrition in prostate health	1
2.7	Antioxidants in fruits & vegetables	1
2.8	factors that affect antioxidant response to ingestion of fruit - health properties	1
3.0	**Nutrients in Fruits and Vegetables for Health and Specialized Foods**	
3.1	Role of fruit and vegetable nutrients in Cancer and immune system enhancer	1
3.2	utilization in functional foods, phytosterol, phytoestrogens	1
3.3	glucosinolates, organosulphur compounds, flavonoids, carotenoids, etc.	1
3.4	Sports foods – ingredients, components in sports foods,	1
3.5	sports drinks, design consideration, ergogenic aids in sports nutrition.	1
3.6	Formulations for meeting normal and special needs of infants,	1
3.7	current status of infant foods, additives for infant foods.	1
3.8	Foods for aged persons, design consideration, ingredients for geriatric foods	2
4.0	**Development of Health Foods from Fruits and Vegetables**	
4.1	Concept of new health food product development from fruits	1
4.2	Concept of new health food product development from vegetables	1
4.3	Safety; marketing strategy and consumer response;	2
4.4	economic analysis and costing of novel foods from fruits	1
4.5	economic analysis and costing of novel foods from vegetables	1
4.6	Prebiotic substances from fruits and vegetables and their utilization in functional foods,	1
4.7	symbiotic foods, technological aspects and recent development in probiotics, prebiotics and symbiotic	2
5.0	**Nutraceuticals and Bioactive Compound Utilization**	
5.1	Nutraceutical delivery vehicles	2
5.2	Role of bioactives from fruit and vegetables for human health	2
5.3	plant parts and chemistry, mechanism of action	1
5.4	case studies, recovery of valuable bioactives from residues of fruit and vegetable processing industry,	2
5.5	stability and bioaccessibility of fruit and vegetables bioactives in food	1
5.6	food component interaction and matrix effect.	1

Course Designer(s)

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Passed in BoS Meeting held on 22.11.23

Approved in Academic Council Meeting held on 23.12.23

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BOARD OF STUDIES

60 FT E24	Modelling, Simulation and Soft Tools for Food Technology	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- Understand the importance for computerization and usage of SCADA in food industries.
- Relate the concept of macros and its applications in spreadsheets.
- Equip knowledge on the usage of MATLAB in food industries.
- Identify the various applications of CFD in beverage industries.
- Facilitate the learners on the usage of LabVIEW software.

Pre-requisites

Nil

Course Outcomes

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

CO1	Describe the computerization in food industries and discuss about the SCADA and its functions in industrial process control.	Understand
CO2	Recall the concept of implementing of macros in spreadsheets and infer the various multimedia tools and online process control systems	Understand
CO3	Illustrate the basics of MATLAB programming and compare the various plotting techniques	Analyze
CO4	Deduce the boundary conditions used in CFD and evaluate the discretization and application of CFD in beverage industries	Analyze
CO5	Correlate the basics of LabVIEW software interface and asses the data flow programming and debugging techniques	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	30	-	10
Understand	30	20	30
Apply	-	20	30
Analyze	-	20	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B. Tech. Food Technology								
60 FT E24 - Modelling, Simulation and Soft Tools for Food Technology								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

Introduction Importance of computerization in food industry, operating environments and information systems for various types of food industries. Supervisory control and data acquisition (SCADA); SCADA systems hardware, firmware, software and protocols, landlines, local area network systems, modems.	[9]
Spread sheets and Macros Spreadsheet applications: Data interpretation and solving problems, preparation of charts, use of macros to solve engineering problems, use of add-ins, use of solver; Web hosting and webpage design; file transfer protocol (FTP), on-line food process control from centralized server system in processing plant.	[9]
MATLAB* Use of MATLAB in food industry; computing with MATLAB, user defined functions, programming using MATLAB; debugging MATLAB programs, applications to simulations; Plotting and model building in MATLAB, X-Y plotting functions, subplots and overlay plots, special plot types, interactive plotting in MATLAB.	[9]
Computational Fluid Dynamics* Introduction to CFD software, GAMBIT and FLUENT software Models of flow, substantial derivative, divergence of velocity, continuity, momentum and energy equations; Physical boundary conditions, discretization; Applications of CFD in food and beverage industry.	[9]
LabVIEW LabVIEW – LabVIEW environment: Getting data into computer, data acquisition devices, NI-DAQ, simulated data acquisition, sound card, front panel/block diagram, toolbar/tools palette; Components of a LabVIEW application: Creating a VI, data Flow execution, debugging techniques.	[9]
Total Hours:	**45**

Text Book(s):	
1.	R. Paul Singh.. Computer Applications in Food Technology: Use of Spreadsheets in Graphical, Statistical and Process Analysis. Academic Press, London. 2014.
2.	William J. Palm III.. Introduction to MATLAB for Engineers, 3rd Ed. McGraw-Hill Companies, Inc., NY, USA. 2011.
Reference(s):	
1.	Da-Wen Sun.. Computational Fluid Dynamics in Food Processing. CRC Press, Boca Raton, FL, USA. 2007.
2.	National Instruments Corporation.. Introduction to LabVIEW: 3-Hour Hands-On. NI, Austin, Texas. 2005.

*SDG 9 – Industry Innovation and Infrastructure

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Importance of computerization in food industry.	2
1.2	Operating environments and information systems for various types of food industries.	1
1.3	Supervisory control and data acquisition (SCADA)	1
1.4	SCADA systems hardware	1
1.5	SCADA systems software and protocols	1
1.6	SCADA system firmware	1
1.7	Landlines, local area network systems, modems.	2
2.0	**Spread sheets and Macros**	
2.1	Spreadsheet applications: Data interpretation and solving problems	1
2.2	preparation of charts, use of macros	1
2.3	solve engineering problems, use of add-ins, use of solver	1
2.4	Web hosting and webpage design;	2
2.5	File transfer protocol (FTP)	2
2.6	On-line food process control from centralized server system in processing plant.	2
3.0	**MATLAB**	
3.1	Use of MATLAB in food industry	1
3.2	Computing with MATLAB	1
3.3	User defined functions, programming using MATLAB	2
3.4	Debugging MATLAB programs, applications to simulations	2
3.5	Plotting and model building in MATLAB	1
3.6	X-Y plotting functions, subplots and overlay plots, special plot types, interactive plotting in MATLAB.	2
4.0	**Computational Fluid Dynamics**	
4.1	Introduction to CFD software	1
4.2	GAMBIT and FLUENT software	2
4.3	Models of flow, substantial derivative, divergence of velocity, continuity, momentum and energy equations	3
4.4	Physical boundary conditions, discretization	2
4.5	Applications of CFD in food and beverage industry.	1
5.0	**LabVIEW**	
5.1	LabVIEW – LabVIEW environment: Getting data into computer, data acquisition devices	2
5.2	NI-DAQ, simulated data acquisition, sound card	2
5.3	Front panel/block diagram, toolbar/tools palette	2
5.4	Components of a LabVIEW application: Creating a VI, data Flow execution, debugging techniques.	3

Course Designer(s)

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Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

60 FT E25	Food Storage and Cold Chain Management	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- Understand the basics of food storage concepts and measurement.
- Equip knowledge on cold storage units and its functioning.
- Describe the requirements for cold storage and cold chain.
- Comprehend various control points in the cold chain system.
- Correlate the cold chain traceability concepts with risk management techniques.

Pre-requisites

Nil

Course Outcomes

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

CO1	List the various dimensions used for the measurements of foods and discuss the various psychometric tests and the FSSAI standards for food storage.	Understand
CO2	Identify the various equipment used in a cold storage unit and explain the designing and instrumentation for a cold storage unit	Apply
CO3	Define the scope and importance of cold chain along with its components and describe the temperature and humidity requirement for cold chain products.	Understand
CO4	Indicate the various control points in cold storage systems with temperature recording devices and choose the flexible systems of transportation for retail and supermarkets.	Apply
CO5	Prepare mitigation strategies for the challenges in cold chain management along with the role of packaging in cold chain and outline the various risk mitigation strategies and cost benefit studies	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	20	30
Understand	40	30	30
Apply	10	10	30
Analyze	0	0	10
Evaluate	0	0	0
Create	0	0	0
Total	60	60	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B. Tech Food Technology								
60 FT E25 - Food Storage and Cold Chain Management								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

tion to Food Storage Grain dimensions, bulk density, true density, porosity, coefficient of friction, thermal conductivity. Psychrometry: humidity, relative humidity, humid heat, deterioration index, wet bulb temperature test, use of psychrometric charts, FSSAI standard in food storage.	[9]
Equipment for Cold Food Storage* Cold storage - Moist air and applied psychrometry, Estimation of cooling load, Air conditioning systems, Evaporators, Compressors, Condensers, Expansion devices, Cooling towers, Different types of refrigerants, Transmission and distribution system of cool air, Thermal and vapor insulation materials, Design of small capacity cold storage, Instrumentation and climate control systems.	[9]
Cold chain requirements Scope and importance of cold chain in food processing industry and retail chain, components of cold chain and integration. Products going in cold chain, their temperature and humidity requirements, packaging needs and their compatibility in cold chain.	[9]
Cold storage control points Stages and points of control in cold storages and structures, Temperature recording devices and its functions in cold storages, pallet layout and stacking options, flexibility storage systems cold chain transportation in land and export, retail & supermarket cold chain and display systems	[9]
Risk management in Cold chain Challenges in implementing and managing cold storage, Role of Packaging in food cold chain, Risk management and problem diagnosis, Risk Mitigation strategies and documentations, cost benefit analysis for cold chain transport, loading and unloading, storage duration.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Rao, Chandra Gopala. “Engineering for storage of fruits and vegetables: cold storage, controlled atmosphere storage, modified atmosphere storage”,1st edition. BS Publications, 2014.
2.	Burg, Stanley. “Hypobaric storage in food industry: advances in application and theory”, Academic Press, ISBN-10: 0124199623, ISBN-13: 978-0124199620, 2014.
Reference(s):	
1.	Ahvenainen, Raija, “Novel food packaging techniques”, 1st edition, Woodhead Publishing,2003.
2.	Robertson G.L., “Food packaging: Principles and practice”, Taylor & Francis/CRC Press,2006.

*SDG 9 – Industry Innovation and Infrastructure

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Food Storage**	
1.1	Grain dimensions	1
1.2	Bulk density, true density, porosity	1
1.3	Coefficient of friction	1
1.4	Thermal conductivity and aerodynamic properties	1
1.5	Psychrometry: humidity, relative humidity	1
1.6	Humid heat	1
1.7	Deterioration index, Wet bulb temperature test	1
1.8	Use of psychrometric charts	1
1.9	FSSAI standard in food storage.	1
2.0	**Equipment for Cold Storage**	
2.1	Cold storage Moist air and applied psychrometry	1
2.2	Air conditioning systems	1
2.3	Evaporators, Compressors, Condensers.	1
2.4	Expansion devices, Cooling towers.	2
2.5	Different types of refrigerants	1
2.6	Transmission and distribution system of cool air	1
2.7	Thermal and vapor insulation materials	1
2.8	Design of small capacity cold storage, Instrumentation and climate control	1
3.0	**Cold chain requirements**	
3.1	Scope and importance of cold chain	1
3.2	Cold chain in food processing industry and retail chain	2
3.3	Components of cold chain and integration	1
3.4	Products going in cold chain	1
3.5	Temperature and Humidity requirements	1
3.6	Packaging Needs	1
3.7	Compatibility in cold chain.	2
4.0	**Cold storage control points**	
4.1	Stages and points of control in cold storages and structures	1
4.2	Temperature recording devices and its functions in cold storages	2
4.3	Pallet layout and stacking options	2
4.4	Flexibility storage systems	1
4.5	Cold chain transportation in land and export	2
4.6	Retail & supermarket cold chain	1
4.7	Display systems	1
5.0	**Risk management in Cold Chain**	
5.1	Challenges in implementing and managing Cold storage	1
5.2	Role of packaging in food cold chain	1
5.3	Risk management and problem diagnosis	2
5.4	Risk Mitigation strategies and documentations	2
5.5	Cost benefit analysis for cold chain transport	2
5.6	Loading and unloading, storage duration	1

Course Designer(s)

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Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
BOARD OF STUDIES

60 FT E26	Confectionery Products	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To Understand the types and importance of sugar confectionery
- To Learn the formulations and processing for tablets and lozenges
- To Apply the formulation and processing of hard candy
- To impact the manufacturing processes for fondants and creams
- To recall the ingredients and processing techniques for caramel and toffee

Pre-requisites

- **Nil**

Course Outcomes

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

CO1	Learn the ingredient optimization and spoilage prevention methods	Understand
CO2	Apply troubleshooting methods for production problems effectively	Apply
CO3	Analyze chemical changes and stability in hard candy	Analyze
CO4	Apply solutions to common issues in fondant production	Apply
CO5	Analyze emulsification and cooking methods for confectionery	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	20
Understand	30	30	40
Apply	10	10	20
Analyze	-	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 FT E26 - Confectionery Products								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
IV	**3**	**0**	**0**	**45**	**3**	**40**	**60**	**100**

CONFECTIONERY Definition, importance of sugar confectionery. Types of confectioneries-classification-basic technical consideration of confectionery-TSS-pH-Acidity-Raw materials-types of sugar-role of sugar-alternative bulk sweetners –syrup production-enzymes used, additives used. quality parameters, faults and corrective measures. Spoilage of confectionery products. Optimization of ingredients for different types of bread, toffees and sugar boiled confectionary.	**[9]**
COMPRESSED TABLETS AND LOZENGES Introduction, formulations and ingredients – Base, binder, lubricant, disintegrant, acids, flavours, colors, actives. Processing – Lozenges / wafers, tablets. Product characteristics, Problems and trouble shooting. Role of Particle Size and Granulation in Tablet Formation. Impact of Environmental Factors on Tablet and Lozenge Stability*	**[9]**
HARD CANDY Introduction, formulations and ingredients, processing – typical process steps, other hard candy technologies. Product characteristics – chemical changes, microstructure, stability / shelf life. Hard Candy Packaging Technology for Shelf Life Enhancement. Challenges in Sugar-Free Hard Candy Production***	**[9]**
FONDANTS AND CREAMS Introduction, formulation and ingredients, manufacturing – fondant, powdered fondant, creams. Product characteristics, potential problems and trouble shooting. Role of Enzymes in Fondant Texture Modification. Alternative Sweeteners in Fondants and Creams. Innovative Flavor and Texture Combinations in Fondants***	**[9]**
CARAMEL, FUDGE AND TOFFEE** Introduction, formulations and ingredients – sweeteners, dairy ingredients, fats, emulsifiers, hydrocolloids, salts, flavors, colors. Processing – Mixing & Emulsification, Cooking and browning, Cooling and forming. Product characteristics, Trouble shooting.	**[9]**
Total Hours	**45**

Text Book(s):	
1.	Minifie , “Chocolate, Cocoa and Confectionery: Science and Technology”, Third edition, 2012.
2.	Weller, “Confectionery and Chocolate Engineering: Principles and Applications”, First edition, 2010.
Reference(s):	
1.	Beckett, “Industrial Chocolate Manufacture and Use”, Fifth edition, 2017.
2.	Edwards, “The Science of Sugar Confectionery”, Second edition, 2018.
3.	Jackson, “Sugar Confectionery and Chocolate Manufacture”, Third edition, 2021.
4.	Hartel, “Confectionery Science and Technology”, First edition, 2018.

***SDG 9 – Industry Innovation and Infrastructure**
****SDG 12 – Responsible Consumption and Production**
***** SDG3- Good Health and well-being**

Passed in BoS Meeting held on 22.11.23
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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Confectionery**	
1.1	Definition, importance of sugar confectionery	1
1.2	Types of confectioneries-classification	1
1.3	basic technical consideration of confectionery-TSS-pH-Acidity	1
1.4	Raw materials-types of sugar-role of sugar-alternative bulk sweetners	1
1.5	syrup production-enzymes used, additives used	1
1.6	quality parameters, faults and corrective measures	1
1.7	Spoilage of confectionery products	1
1.8	Optimization of ingredients for different types of bread, toffees and sugar boiled confectionary	2
2.0	**Compressed Tablets and Lozenges**	
2.1	Introduction, formulations and ingredients	1
2.2	Base, binder, lubricant	1
2.3	disintegrant, acids,	1
2.4	flavours, colors, actives	1
2.5	Processing – Lozenges / wafers, tablets.	1
2.6	Product characteristics, Problems and trouble shooting	1
2.7	Role of Particle Size and Granulation in Tablet Formation	1
2.8	Impact of Environmental Factors on Tablet and Lozenge Stability	2
3.0	**Hard Candy**	
3.1	Introduction, formulations and ingredients, processing	2
3.2	Typical process steps, other hard candy technologies	2
3.3	Product characteristics	1
3.4	chemical changes, microstructure, stability / shelf life.	1
3.5	Hard Candy Packaging Technology for Shelf Life Enhancement.	2
3.6	Challenges in Sugar-Free Hard Candy Production	1
4.0	**Fondants and Creams**	
4.1	Introduction, formulation and ingredients, manufacturing	2
4.2	fondant, powdered fondant, creams	2
4.3	Product characteristics	1
4.4	potential problems and trouble shooting	1
4.5	Role of Enzymes in Fondant Texture Modification	1
4.6	Alternative Sweeteners in Fondants and Creams	1
4.7	Innovative Flavor and Texture Combinations in Fondants	1
5.0	**Caramel, Fudge and Toffee**	
5.1	Introduction, formulations and ingredients	1
5.2	sweeteners, dairy ingredients, fats	1
5.3	emulsifiers, hydrocolloids, salts, flavors, colors	2
5.4	Processing – Mixing & Emulsification	2
5.5	Cooking and browning, Cooling and forming	2
5.6	Product characteristics, Trouble shooting	1

Course Designer(s)

1. **Mr.T.G.N. Nagarjun - nagarjun@ksrct.ac.in**

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60 FT E27	Flavouring Technology	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- Facilitate the learners on the classification and types of falvours.
- Relate the various techniques for production of flavours.
- Equip the analysis techniques used for detecting flavours.
- Identify the quality control procedures with the limits of falvour usage.
- Demonstrate the applications of flavours in various food products and industries.

Pre-requisites

- **Nil**

Course Outcomes

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

CO1	Describe the classification of falvours and its forms and discuss the artificial flavours and compounds.	Understand
CO2	Recall the techniques used for producing flavours and infer the various extraction methods of the flavours produced	Understand
CO3	Illustrate the sample preparation techniques for flavour isolation and compare the various analysis results.	Analyze
CO4	Deduce the chemical properties, structure and stability of flavours and evaluate the falvours based on FSSAI standards.	Analyze
CO5	Correlate the application of falvours in culinary products and asses the role of falvours in dairy and baking industry.	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	30	20	20
Understand	30	20	30
Apply	-	10	20
Analyze	-	10	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022							
B. Tech. Food Technology							
60 FT E27 - Flavouring Technology							
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**	
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
V	**3**	**0**	**0**	**45**	**3**	**40**	**60**	**100**

Food flavours Introduction Classification - Natural and artificial flavors, flavor forms: water soluble liquid flavours – oil soluble liquid flavours, emulsion-based flavours, dispersed flavours, spray dried flavours. Artificial flavours- Diacetyl, Ethyl decadienoate, Ethyl maltol, Ethyl propionate, Ethylvanillin, Eucalyptol.	[9]
Flavour production technology Classification - Alliaceous flavours - Bittering agents, Coffee and Cocoa, Fruit flavours. Effect of roasting, cooking frying on flavour developments - Essential oils and oleoresins - Extraction - Super critical fluid extraction. Solvent Extraction, Sorptive Extraction, Distillation Methods, Liquid and dry flavour production - Staling of flavours. Microbial and cell suspensions in the synthesis of flavours.	[9]
Analysis of flavours* Introduction, Aroma Compounds - Sample Selection/Preparation, Principles of Aroma Isolation – Solubility, Sorptive Extraction, Volatility, Methods of Aroma Isolation - Static Headspace, Headspace Concentration Methods (Dynamic Headspace), Concentration for Analysis.	[9]
Quality control of flavours Definitions, Chemical Properties, Structure, Stability, Sensory Properties- Influence on Taste, Influence on Aroma. Synergism, Mode of Action Flavour, Potentiators in Foods, Toxicity, Commercial and Other Potentiators. FSSAI flavour standards - list of permitted synthetic flavour and limits, solvents, carrier, diluents used in flavorings.	[9]
Flavour technology applications Flavours in culinary Products - Soups and Stocks, Sauces, Seasonings, and Marinades. Application of flavours in Bakery Products, Snack Foods, Confectionery Products, Dairy Products - Flavored Milks, Flavored Yogurts, Flavored Dairy Desserts. Soft Drinks - Carbonated Beverages	[9]
Total Hours	**45**

Text Book(s):	
1.	Andrew J. Taylor, Roberts S. T. Linforth, “Food Flavouring Technology”. Wiley, 2010.
2.	Parker J.K., Elmore J.S. and L. Methven, “Flavour Development, Analysis and Perception in Food and Beverages”, Woodhead Publishing, 2015.
Reference(s):	
1.	Fellows, P.J., Food processing Technology: Principles and practice, second edition, Wood head publishing limited, Cambridge, 2009.
2.	Otles, Semih. “Methods of Analysis of Food Components and Additives”, CRC Press, 2005.

***SDG 9 – Industry Innovation and Infrastructure**

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Food flavours**	
1.1	Introduction and Classification - Natural and artificial flavors	2
1.2	Flavor forms: water soluble liquid flavours	1
1.3	Flavor forms: oil soluble liquid flavours	1
1.4	Flavor forms: emulsion-based flavours	1
1.5	Flavor forms: dispersed flavours, spray dried flavours	1
1.6	Artificial flavours - Diacetyl, Ethyl decadienoate, Ethyl maltol	1
1.7	Artificial flavours - Ethyl propionate, Ethylvanillin, Eucalyptol	2
2.0	**Flavour production technology**	
2.1	Classification of flavours - Bittering agents, Coffee and Cocoa	1
2.2	Fruit flavours	1
2.3	Effect of roasting, cooking frying on flavour development	1
2.4	Essential oils and oleoresins	1
2.5	Extraction - Super critical fluid extraction	1
2.6	Solvent Extraction, Sorptive Extraction	1
2.7	Extraction - Distillation Methods	1
2.8	Liquid and dry flavour production - Staling of flavours	1
2.9	Microbial and cell suspensions in the synthesis of flavour	1
3.0	**Analysis of flavours**	
3.1	Introduction to Aroma Compounds – Volatility	1
3.2	Sample Selection/Preparation, Principles of Aroma Isolation	1
3.3	Solubility, Sorptive Extraction	2
3.4	Aroma Isolation - Static Headspace	2
3.5	Aroma Isolation - Headspace Concentration Methods (Dynamic Headspace)	2
3.6	Methods of Concentration for Analysis.	1
4.0	**Quality control of flavours**	
4.1	Definitions, Chemical Properties, Structure and Stability	1
4.2	Sensory Properties - Influence on Taste	2
4.3	Sensory Properties - Influence on Aroma	1
4.4	Synergism, Mode of Action Flavour	1
4.5	Potentiators in Foods, toxicity	1
4.6	Commercial and Other Potentiators	1
4.7	FSSAI flavour standards - list of permitted synthetic flavour and limits	1
4.8	FSSAI flavour standards - solvents, carrier, diluents used in flavorings	1
5.0	**Flavour technology applications**	
5.1	Flavours in culinary Products - Soups and Stocks, Sauces, Seasonings, and Marinades,	2
5.2	Application of flavours in Bakery Products, Snack Foods, Confectionery Products	2
5.3	Dairy Products - Flavored Milks, Flavored Yogurts, Flavored Dairy Desserts	2
5.4	Soft Drinks - Carbonated Beverages	3

Course Designer(s)

1. G. Bharath – bharathg@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23
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PROFESSIONAL ELECTIVE – III

60 FT E31	Bioprocess Engineering	Category	L	T	P	Credit
		PE	2	0	2	3

Objectives

- To learn the historical development in bioprocess technology of production and recovery process.
- To design a bioreactors and the strategy of scale up reactor for commercial prospects.
- To develop and predict the construction of ancillaries for fermentor system.
- To enable the knowledge of fluid behavior and analyze the biodynamic property.
- To understand the important concepts of software's in monitoring and validation of Bioprocess Technology

Pre-requisites

Nil

Course Outcomes

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

CO1	Enumerate the historical development, types of fermentation process and bio product recovery	Understand
CO2	Design a kinetic parameters of cell growth of structured and unstructured model	Analyze
CO3	Illustrate the concept of design and construction of reactor with its controlling strategies	Apply
CO4	Determine the scale up of the bioreactors with respect to mixing and power consumption	Analyze
CO5	Simulate and validate the protocol of bioprocess technology through soft wares.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	3	-	-	-	-	2	-	-	-	3	3	2
CO2	3	2	3	3	-	-	-	-	2	-	-	-	3	3	2
CO3	3	2	3	3	-	-	-	-	2	-	-	-	2	3	3
CO4	3	2	3	3	-	-	-	-	2	-	-	-	3	3	3
CO5	3	2	3	3	3	-	-	-	2	-	-	-	3	3	3
3 - Strong; 2 - Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)				Model Examination (Marks)	End Sem Examination (Marks)	
	Test 1		Test 2				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	20	-	20	-	-	20	-
Understand	30	-	20	-	-	30	-
Apply	10	50	10	50	50	30	50
Analyze	-	50	10	50	50	20	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech Food Technology

60 FT E31 - Bioprocess Engineering

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100

Introduction to Bioprocess Technology Introduction to Bioprocessing: Historical development of Bioprocess technology, General requirements and types of fermentation processes, Designing of media for fermentation process, aerobic and anaerobic fermentation process.	[6]
Fermentation Processes Medium requirements for fermentation processes, batch growth, balanced growth, effect of substrate concentration. Monod model. Determining cell kinetic parameters from batch data.	[6]
Process Design And Control of Bioreactors* Bioreactor design and construction - Reactor Engineering in perspective. Types of Reactors (Batch, Fed Batch and Continuous). Design of Stirrers and impellers. Bioprocess design for Plant and Animal cell reactor	[6]
Rheology and Scale up of Fermentation Newtonian and Non Newtonian fluids, Effect of scale on oxygenation, mixing, sterilization, nutrient availability and supply. Scale-up criteria for bioreactors based on oxygen transfer	[6]
Simulation and Validation in Bioprocess Technology Simulation techniques (Software): Reactor design (Autocad, ANSYS Fluent,) and evaluation of Design of experiments (DOE), Dynamic simulation of the bioreactor.	[6]
Practical: 1. Design a packed bed reactor system for a catalytic chemical reaction using AutoCAD. 2. Create a computational model of a fluidized bed reactor using ANSYS Fluent. 3. Perform sensitivity analysis to identify key operating parameters affecting reactor performance using CFD 4. Design a screening experiment using a fractional factorial design or other DOE approach to identify the most significant factors influencing the bioprocess and their interactions. 5. Evaluate the significance of each factor using analysis of variance (ANOVA) or other appropriate statistical tests. 6. Generate response surface plots or contour plots to visualize the relationship between the selected factors and the bioprocess output. 7. Design an experiment to investigate the mass balance of a bioreactor using FLOWTRAN. Choose a specific microbial culture and substrate, and vary parameters such as flow rate, substrate concentration, and inoculum size. Measure the input and output concentrations of biomass, substrate, and by-products to validate the steady-state mass balance assumptions. 8. Develop a MATLAB script to simulate the behavior of a CSTR operating in continuous mode for the production of a microbial product. The script should include: Input parameters such as reactor volume, feed flow rate, inlet substrate concentration, and reaction kinetics. a. Differential equations representing the mass balances for substrate and product concentrations in the reactor. b. Integration method to solve the differential equations numerically. c. Visualization of substrate and product concentration profiles over time. d. Analysis of steady-state conditions and sensitivity analysis for key parameters. 9. Using Design Expert, design an experiment to optimize the concentrations of different media components (such as carbon source, nitrogen source, vitamins, etc.) for maximizing the production of a specific metabolite by a microbial strain in a bioprocess.	[30]

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10. Design a robustness testing experiment using Design Expert to evaluate the robustness of a bioprocess to variations in key parameters (such as raw material quality, operating conditions) and identify critical factors affecting process performance.		
Total Hours: (Lecture - 30; Practical - 30)		**60**
Text Book(s):		
1.	Rao, D.G., "Introduction to Biochemical Engineering", Second Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, India, 2010.	
2.	Ashok Kumar verma, Process Modelling and Simulation in Chemical, Biochemical and Environmental Engineering, CRC Publication press. 2014.	
Reference(s):		
1.	Shuler,M.L. and Kargi, F.," Bioprocess Engineering Basic Concepts", Prentice Hall of India, Pvt. Ltd., New Delhi, India, 2003.	
2.	Chien Wei Ooi, Pau Loke Show, Tau Chuan Ling, "Bioprocess Engineering Downstream Processing", CRC Press, 2019.	

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No.	Topics	No. of Hours
1	**Introduction to Bioprocess Technology**	
1.1	Introduction to Bioprocessing	1
1.2	Historical development of Bioprocess technology	1
1.3	General requirements and types of fermentation processes	1
1.4	Designing of media for fermentation process	1
1.5	Aerobic fermentation process.	1
1.6	Anaerobic fermentation process.	1
2	**Fermentation processes**	
2.1	Medium requirements for fermentation processes	1
2.2	Batch growth	1
2.3	Balanced growth	1
2.4	Effect of substrate concentration	1
2.5	Monod model	1
2.6	Determining cell kinetic parameters from batch data	1
3	**Process Design And Control of Bioreactors**	
3.1	Bioreactor design and construction	1
3.2	Reactor Engineering in perspective	1
3.3	Types of Reactors (Batch, Fed Batch and Continuous)	1
3.4	Design of Stirrers and impellers	1
3.5	Bioprocess design for Plant cell reactor	1
3.6	Bioprocess design for Animal cell reactor	1
4	**Rheology and Scale up of Fermentation**	
4.1	Newtonian fluids	1
4.2	Non Newtonian fluids	1
4.3	Effect of scale on oxygenation	1

4.4	Mixing sterilization	1
4.5	Nutrient availability and supply	1
4.6	Scale-up criteria for bioreactors based on oxygen transfer	1
5	**Simulation and Validation in Bioprocess Technology**	
5.1	Simulation techniques (Software): Reactor design (Autocad)	1
5.2	Simulation techniques (Software): Reactor design (ANSYS)	1
5.3	Simulation techniques (Software): Reactor design (Fluent)	1
5.4	Evaluation of Design of experiments (DOE)	1
5.5	Dynamic simulation of the bioreactor	2
Practical:		
1	Design a packed bed reactor system for a catalytic chemical reaction using AutoCAD.	3
2	Create a computational model of a fluidized bed reactor using ANSYS Fluent.	3
3	Perform sensitivity analysis to identify key operating parameters affecting reactor performance using CFD	3
4	Design a screening experiment using a fractional factorial design or other DOE approach to identify the most significant factors influencing the bioprocess and their interactions.	3
5	Evaluate the significance of each factor using analysis of variance (ANOVA) or other appropriate statistical tests.	3
6	Generate response surface plots or contour plots to visualize the relationship between the selected factors and the bioprocess output.	3
7	Design an experiment to investigate the mass balance of a bioreactor using FLOWTRAN. Choose a specific microbial culture and substrate, and vary parameters such as flow rate, substrate concentration, and inoculum size. Measure the input and output concentrations of biomass, substrate, and by-products to validate the steady-state mass balance assumptions.	3
8	Develop a MATLAB script to simulate the behavior of a CSTR operating in continuous mode for the production of a microbial product. The script should include: Input parameters such as reactor volume, feed flow rate, inlet substrate concentration, and reaction kinetics. e. Differential equations representing the mass balances for substrate and product concentrations in the reactor. f. Integration method to solve the differential equations numerically. g. Visualization of substrate and product concentration profiles over time. Analysis of steady-state conditions and sensitivity analysis for key parameters.	3
9	Using Design Expert, design an experiment to optimize the concentrations of different media components (such as carbon source, nitrogen source, vitamins, etc.) for maximizing the production of a specific metabolite by a microbial strain in a bioprocess.	3
10	Design a robustness testing experiment using Design Expert to evaluate the robustness of a bioprocess to variations in key parameters (such as raw material quality, operating conditions) and identify critical factors affecting process performance.	3

Course Designer(s)

1. Dr. A.S. Ruby Celsia -rubycelsia@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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BOARD OF STUDIES

60 FT E32	Traditional Foods	Category	L	T	P	Credit
		PE	2	0	2	3

Objectives

- To understand the historical and traditional perspective of foods and food habits
- To identify the suitable Methods and Production of Traditional foods.
- To understand the wide diversity and common features of traditional Indian foods and meal patterns
- To understand the wide diversity and common features of traditional Indian foods and meal patterns.
- To understand the wide diversity and common features of traditional Indian foods and meal patterns

Pre-requisites

Nil

Course Outcomes

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

CO1	Recall about cultural perspectives and basic ingredient for food preparation and impact of Traditional food	Understand
CO2	Exemplify knowledge in Methods and Production of Traditional food	Analyze
CO3	Assess the concept of packed Traditional food and food preservation	Analyze
CO4	Learn about health aspects of Traditional food and food patterns	Understand
CO5	Assess the Traditional foods used for specific ailments /illnesses.	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)				Model Examination (Marks)	End Sem Examination (Marks)	
	Test 1		Test 2				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	20	-	20	-	-	30	-
Understand	30	-	30	-	-	40	-
Apply	10	50	10	50	50	30	50
Analyze	-	50	-	50	50	-	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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BOARD OF STUDIES

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech Food Technology								
60 FT E32 – Traditional Foods								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100

Historical and Cultural Perspectives Importance of food in understanding human culture - variability, diversity, from basic ingredients to food preparation; impact of customs and traditions on food habits, festive occasions, specific religious festivals, mourning; Kosher, Halal foods. Tradition and modern method comparisons- energy costs, efficiency, yield, shelf life and nutrient content.	[6]
Traditional Methods of Food Processing* Traditional methods of milling grains – rice, wheat and corn – equipment and processes as compared to modern methods. Equipment and processes for edible oil extraction, paneer, butter and ghee manufacture – comparison of traditional and modern methods. Traditional methods of food preservation – sun-drying, osmotic drying, brining, pickling- vegetables, fish and meat, smoking- dry fish, Temp, soya sauce and vegetable fermented products.	[6]
Traditional Food Patterns Typical breakfast, meal and snack foods of different regions of India. Regional foods that have gone Pan Indian / Global. Popular regional foods; Traditional fermented foods, pickles and preserves, beverages, snacks, desserts and sweets, street foods; IPR issues in traditional foods.	[6]
Commercial Production of Traditional Foods** 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	[6]
Health Aspects of Traditional Foods 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.	[6]
Practical: 1. Perform experiment on Food Preservation and preparation by Smoking methods. 2. Carryout experiment on traditional drying methods for Preserving for Pulses and grains 3. Measure the pH levels of various traditional pickled vegetables to determine their acidity levels and assess their quality. 4. Identify the effects of different cooking methods on the sensory attributes of traditional foods. 5. Investigate the fermentation process of traditional fermented foods like idli and dosa batters. 6. Experiments on controlling browning reaction in fruits and vegetables. 7. Determination and comparison on rate of drying using Sun drying and shadow drying. 8. Preservation of fruits through osmotic dehydration. 9. Curing of vegetables and production of Pickles. 10.Experiment on canning of fruits and vegetable.	[30]
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):	
1.	Mohammed Al-Khusaibi, Nasser Al-Habsi, Mohammad Shafiur Rahman Traditional Foods: History, Preparation, Processing and Safety, Edition 1, SpringerCham, 2020.
2.	Davidar, Ruth N. “Indian Food Science: A Health and Nutrition Guide to Traditional Recipes: East West Books, 2001.
3.	Sen, Colleen Taylor “Food Culture in India” Greenwood Press, 2005.
Reference(s):	
1.	Aneja. R.P, Mathur.BN, R.C. Chandan,and Banerjee.A.K. Technology of Indian Milk Products. Dairy India Year Book, 2009.
2.	Steinkrus.K.H. Handbook of Indigenous Fermented Foods, CRC press, 1995.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being

Passed in BoS Meeting held on 22.11.23
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Course Contents and Lecture Schedule

S. No.	Topics	No. of Hours
1	**Historical and Cultural Perspectives**	
1.1	Importance of food in understanding human culture	1
1.2	Learn the impact of customs and traditions on food habits	1
1.3	Festive occasions and specific religious festivals foods	1
1.4	Comparisons of Tradition and modern method	1
1.5	Tradition method - energy costs, efficiency, yield,	1
1.6	Tradition method - shelf life and nutrient content.	1
2	**Traditional Methods of Food Processing**	
2.1	Traditional methods of milling grains	1
2.2	Equipment and processes for edible oil extraction, paneer, butter and ghee	1
2.3	Comparison of traditional and modern methods in food Processing.	1
2.4	Traditional methods of food preservation	1
2.5	Learn about sun-drying, osmotic drying, brining, pickling.	1
2.6	Smoking process of dry fish, Temp, soya sauce and vegetable fermented products.	1
3	**Traditional Food Patterns**	
3.1	Typical breakfast, meal and snack foods of different regions of India.	1
3.2	Regional foods that have gone Pan Indian / Global.	1
3.3	Popular regional foods;	1
3.4	Traditional fermented foods, pickles and preserves,	1
3.5	Beverages, snacks, desserts and sweets with street foods	1
3.6	IPR issues in traditional foods	1
4	**Commercial Production of Traditional Foods**	
4.1	Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes,	1
4.2	Frozen foods – types marketed	2
4.3	Turnover; role of SHGs, SMES industries, national and multinational companies	1
4.4	Commercial production and packaging of traditional beverages	1
4.5	Commercial production of intermediate foods	1
5	**Health Aspects of Traditional Foods**	
5.1	Comparison of traditional foods with typical fast foods / junk foods	1
5.2	Cost of the Traditional foods	1
5.3	Food safety for the Traditional foods	1
5.4	nutrient composition and bioactive components	1
5.5	Energy and environmental costs of traditional foods	1
5.6	Traditional foods used for specific ailments /illnesses	1
Practical:		
1.	Perform experiment on Food Preservation and preparation by Smoking methods	3
2.	Carryout experiment on traditional drying methods for Preserving for Pulses and grains	3
3.	Measure the pH levels of various traditional pickled vegetables to determine their acidity levels and assess their quality.	3
4.	Identify the effects of different cooking methods on the sensory attributes of traditional foods.	3
5.	Investigate the fermentation process of traditional fermented foods like idli and dosa batters.	3
6.	Experiments on controlling browning reaction in fruits and vegetables.	3
7.	Determination and comparison on rate of drying using Sun drying and shadow drying	3
8.	Preservation of fruits through osmotic dehydration.	3
9.	Curing of vegetables and production of Pickles.	3
10.	Experiment on canning of fruits and vegetable.	3

Course Designer(s)

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60 FT E33	Advances in Fruit and Vegetable Processing Technologies	Category	L	T	P	Credit
		PE	2	0	2	3

Objectives

- Familiarize students with advanced fruit and vegetable processing techniques and its applications
- Understand the effect of Novel non thermal methods on quality and safety of fruit and vegetable products.
- Learn the evaluation techniques to analyse the quality of fruit and vegetable products.
- Understand the quality of fruit and vegetable products on the impact of novel non-thermal methods.
- Understand the importance of sensory evaluation and drying technology.

Pre-requisites

Nil

Course Outcomes

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

CO1	Analyze various non-thermal food processing techniques and their applications in fruit and vegetable processing.	Analyze
CO2	Evaluate novel non-thermal sterilization methods for fruits and Vegetables	Analyze
CO3	Assess the quality of fruit and vegetable products using different evaluation techniques.	Apply
CO4	Examine the impact of novel non-thermal methods on the quality and safety of fruit and vegetable products	Analyze
CO5	Assess the quality of fruit and vegetable products using sensory evaluation.	Analyze

Mapping with Programme Outcomes

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	2	-	-	2	3	3	3
CO2	3	3	3	-	-	-	-	-	2	-	-	2	3	3	3
CO3	3	3	3	-	-	-	-	-	2	-	-	2	3	3	3
CO4	3	3	3	-	-	-	-	-	2	-	-	2	3	2	2
CO5	3	3	3	-	-	-	-	-	2	-	-	2	3	2	3
3 - Strong; 2 - Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)				Model Examination (Marks)	End Sem Examination (Marks)	
	Test 1		Test 2				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	10	-	10	-	-	30	-
Understand	30	-	30	-	-	40	-
Apply	10	50	10	50	50	20	50
Analyze	10	50	10	50	50	10	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech Food Technology

60 FT E33 - Advances in Fruit And Vegetable Processing Technologies

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100

Non-Thermal Processing Technologies for Fruits And Vegetables Ultraviolet light for processing of fruit and vegetable products, high pressure processing of fruit and vegetable, ultrasound application of fruit and vegetable products, minimal processing	[6]
Innovative Technologies in Fruit and Vegetable Processing Membrane application in fruit and vegetable processing technologies, high intensity pulsed electric field applications, applications of ozone in fruit and vegetable processing, irradiation application in fresh fruit and vegetable produce processing	[6]
Processing Techniques for Enhanced Fruit and Vegetable Quality* Enzyme maceration, fruit and vegetable juices as vehicle for probiotic microorganism and prebiotics oligosaccharides, vacuum frying of fruit and vegetable application in processing, role of canning in preservation of fruits and vegetables	[6]
Preservation Techniques and Shelf-Life Extension in Fruits and Vegetables** Freeze concentration applications in fruit and vegetable processing, refrigeration and cold chain effects on fruit and vegetable product shelf life, edible coatings.	[6]
Thermal Processing in Fruits and Vegetables Thermal treatment effects in fruit and vegetable juices, effect of fruit and vegetable processing on product aroma, sensory evaluation in fruit and vegetable product development, ohmic heating, microwave dielectric heating recent trends in drying	[6]
Practical: 1. Apply UV light to fresh fruits and compare microbial load before and after treatment. 2. Use ultrasound (via ultrasonic bath or cleaner) to treat vegetable juice and measure yield improvement and clarity. 3. Compare the effects of blanching versus no blanching on color and texture retention in vegetables like carrots or broccoli. 4. Use a basic filtration setup (e.g., cloth or filter paper) to clarify fruit juices and compare clarity and flavor retention. 5. Use commercial enzymes like pectinase on fruits (e.g., apples) to break down the cell structure and observe the consistency of the puree. 6. Add probiotic cultures to fresh fruit juice and observe microbial growth and changes in acidity over time. 7. Can fruits (e.g., peaches) in syrup using basic canning techniques and evaluate taste, texture, and color after preservation. 8. Store fruits and vegetables at different temperatures (room temperature, refrigerator, freezer) and observe changes in shelf life, texture, and appearance. 9. Prepare edible coatings using natural ingredients (e.g., starch or gelatin) and apply them to fruits; compare spoilage rates and texture over time. 10. Freeze fruit juice and allow it to thaw partially; collect and analyze the concentrated liquid for sugar content and flavor.	[30]
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):	
1.	Rodrigues, S., & Fernandes, F. A. N. “Advances in Fruit Processing Technologies.” CRC Press, 2016.
2.	Hodson de Jaramillo, E. G. “Sustainable Production of Fruits and Vegetables: Sustainable Processing Technologies for the Fruit and Vegetable Industry.” Springer, 2017.
Reference(s):	
1.	**Martin-Belloso, O., & Soliva-Fortuny, R.** "Advances in Fresh-Cut Fruits and Vegetables Processing." CRC Press, 2016.

*SDG 9 – Industry Innovation and Infrastructure

**SDG 3 – Good Health and Well Being

Passed in BoS Meeting held on 22.11.23
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Course Contents and Lecture Schedule

S. No.	Topics	No. of Hours
1	**Non-Thermal Processing Technologies for Fruits And Vegetables**	
1.1	Ultraviolet light for processing of fruit and vegetable products	2
1.2	high pressure processing of fruit and vegetable	1
1.3	ultrasound application of fruit and vegetable products	2
1.4	minimal processing	1
2	**Innovative Technologies in Fruit and Vegetable Processing**	
2.1	Membrane application in fruit and vegetable processing technologies	2
2.2	high intensity pulsed electric field applications	1
2.3	applications of ozone in fruit and vegetable processing	1
2.4	irradiation application in fresh fruit and vegetable produce processing	2
3	**Processing Techniques for Enhanced Fruit and Vegetable Quality**	
3.1	Enzyme maceration,	1
3.2	fruit and vegetable juices as vehicle for probiotic microorganism and prebiotics oligosaccharides,	2
3.3	vacuum frying of fruit and vegetable application in processing,	2
3.4	role of canning in preservation of fruits and vegetables	1
4	**Preservation Techniques and Shelf-Life Extension in Fruits And Vegetables**	
4.1	Freeze concentration applications in fruit processing	1
4.2	Freeze concentration applications in vegetable processing	2
4.3	Refrigeration and cold chain effects on fruit product shelf life	1
4.4	Refrigeration and cold chain effects on vegetable product shelf life	1
4.5	edible coatings	1
5	**Thermal Processing in Fruits and Vegetables**	
5.1	Thermal treatment effects in fruit and vegetable juices,	1
5.2	effect of fruit and vegetable processing on product aroma,	1
5.3	sensory evaluation in fruit and vegetable product development,	2
5.4	ohmic heating,	1
5.5	microwave dielectric heating recent trends in drying	1
Practical:		
1.	Apply UV light to fresh fruits and compare microbial load before and after treatment.	3
2.	Use ultrasound (via ultrasonic bath or cleaner) to treat vegetable juice and measure yield improvement and clarity.	3
3.	Compare the effects of blanching versus no blanching on color and texture retention in vegetables like carrots or broccoli.	3
4.	Use a basic filtration setup (e.g., cloth or filter paper) to clarify fruit juices and compare clarity and flavor retention.	3
5.	Use commercial enzymes like pectinase on fruits (e.g., apples) to break down the cell structure and observe the consistency of the puree.	3
6.	Add probiotic cultures to fresh fruit juice and observe microbial growth and changes in acidity over time.	3
7.	Can fruits (e.g., peaches) in syrup using basic canning techniques and evaluate taste, texture, and color after preservation.	3
8.	Store fruits and vegetables at different temperatures (room temperature, refrigerator, freezer) and observe changes in shelf life, texture, and appearance.	3
9.	Prepare edible coatings using natural ingredients (e.g., starch or gelatin) and apply them to fruits; compare spoilage rates and texture over time.	3
10.	Freeze fruit juice and allow it to thaw partially; collect and analyze the concentrated liquid for sugar content and flavor.	3

Course Designer(s)

1. Dr.K. Prabha - prabhak@ksrct.ac.in

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60 FT E34	Modern Technology in Cereals, Pulses and Spices	Category	L	T	P	Credit
		PE	2	0	2	3

Objectives

- To Understand the processing of Cereal pulses and spices
- To Analyze the cereal pulses and spices based on its properties
- To analyze various aspects of milling of pulses
- To develop value added products from pulses
- To recognize the milling techniques of cereals and pulses

Pre-requisites

Nil

Course Outcomes

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

CO1	Understand the processing of Cereal pulses and spices	Understand
CO2	Evaluate the basic composition and structural parts of food grains.	Analyze
CO3	Practice the various methods on drying of grains	Analyze
CO4	Prepare value added products from the by-products obtained during milling.	Understand
CO5	Demonstrate the equipment involved in the milling of pulses.	Apply

Mapping with Programme Outcomes

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	3	-	-	-	3	2	-	3	-	2	3	3	2
CO2	3	-	3	-	-	-	3	2	-	3	-	2	3	3	2
CO3	3	-	3	-	-	-	3	2	-	3	-	2	2	3	3
CO4	3	-	3	-	-	-	3	2	-	3	-	2	3	3	3
CO5	3	-	3	-	-	-	3	2	-	3	-	2	3	3	3
3 - Strong; 2 - Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)				Model Examination (Marks)	End Sem Examination (Marks)	
	Test 1		Test 2				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	20	-	20	-	-	30	-
Understand	30	-	30	-	-	40	-
Apply	10	50	10	50	50	30	50
Analyze	-	50	-	50	50	-	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech Food Technology

60 FT E34 - Modern Technology in Cereals, Pulses and Spices

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100

Introduction to Cereal, Pulses, and Spices Overview of Cereal Grains- Wheat, rice, maize, millets. Pulses- Chickpeas, lentils, beans, peas. Spices- Pepper, turmeric, cumin, cardamom. Importance in global food systems: Nutrition, economic significance, cultural aspects. Historical significance: Role in human diet, trade, and cultural heritage. Current challenges: Production, processing, distribution, and consumption.	[6]
Cereal Processing Technology* Pre-processing operations: Cleaning, grading, and sorting techniques. Milling techniques: Dry milling, wet milling, roller milling, and stone milling. Flour quality and characteristics: Protein content, gluten formation, starch properties. Packaging and storage.	[6]
Pulse Processing Technology* Cleaning and dehulling methods: Mechanical, pneumatic, water-based techniques. Splitting and fractionation processes: Milling, splitting, sieving, grading. Quality assessment and assurance: Moisture content, protein content, particle size, microbial safety. Emerging technologies: High-pressure processing, pulsed electric field processing, microwave drying.	[6]
Spice Processing Technology* Drying methods: Sun drying, hot air drying and freeze drying. Extraction methods: Steam distillation, solvent extraction, supercritical fluid extraction. Quality control measures: Purity, moisture content, volatile oil content, microbial load.	[6]
Innovations and Future Trends Nano encapsulation, nano-sensors for quality monitoring. Waste utilization, energy-efficient technologies, water recycling. Organic, non-GMO, clean label, functional foods.	[6]
Practical: 1. Microwave pulses to enhance the sprouting process in legumes like chickpeas or lentils, improving digestibility and nutrient availability. 2. To determine the spice essential oil extraction via supercritical CO2. 3. Utilize cryogenic technology to grind spices like cinnamon or cloves, preserving their volatile compounds and enhancing flavour. 4. Demonstrate the spice flavour enhancement through enzymatic hydrolysis. 5. Determine the nano encapsulation to encapsulate volatile compounds from spices like turmeric or ginger, ensuring prolonged shelf life and controlled release in food products. 6. To determine cereal pulse texturization with extrusion processing. 7. Examine the ultrasound technology to extract bioactive compounds from spices such as black pepper or cardamom, enhancing their antioxidant properties. 8. Employ high-pressure processing to extend the shelf life of cooked cereal and pulse products, preserving freshness and nutrients without the need for additives. 9. Utilize hydrothermal treatment to modify the texture of pulses like beans or chickpeas, improving their mouthfeel and reducing cooking time. 10. Employ molecular distillation to extract essential oils from aromatic spices like cloves or cinnamon, producing highly concentrated flavor extracts for use in food products.	[30]
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):	
1.	Tiwari, B. K., & Gowen, A. (Eds.) Pulse Foods: Processing, Quality, and Nutraceutical Applications. Academic Press. 2012.
2.	Peter, K. V. (Ed.).. Handbook of Herbs and Spices. Woodhead Publishing Series in Food Science, Technology and Nutrition. 2012
3.	Smith, J. S., & Circle, S. J.. Spice: Flavors of the Eastern Mediterranean. HarperCollins,2016.
Reference(s):	
1.	Leo M. L. Nollet, “Handbook of Meat, Poultry and Seafood Quality”, Blackwell Publishing, 2007
2.	Sahay K.M. & Singh K. K., "Unit Operations of Agricultural Processing", 2nd Edition, Vikas Publishing House Pvt. Ltd, New Delhi, 2012.

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Course Contents and Lecture Schedule

S. No.	Topics	No. of Hours
1	**Introduction to Cereal, Pulses, and Spices**	
1.1	Overview of Cereal Grains- Wheat, rice, maize, millets	1
1.2	Overview of pulses- Chickpeas, lentils, beans, peas	1
1.3	Overview of spices- Pepper, turmeric, cumin, cardamom	1
1.4	Importance in global food systems: Nutrition, economic significance, cultural aspects.	1
1.5	Historical significance: Role in human diet, trade, and cultural heritage.	1
1.6	Current challenges: Production, processing, distribution, and consumption.	1
2	**Cereal Processing Technology**	
2.1	Pre-processing operations: Cleaning, grading, and sorting techniques.	1
2.2	Milling techniques: Dry milling, wet milling.	1
2.3	Milling techniques: Roller milling, stone milling	1
2.4	Flour quality and characteristics: Protein content, gluten formation	1
2.5	Flour quality and characteristics: Starch properties	1
2.6	Packaging and storage	1
3	**Pulse Processing Technology**	
3.1	Cleaning and dehulling methods: Mechanical, pneumatic.	1
3.2	Cleaning and dehulling methods: Water-based techniques	1
3.3	Splitting and fractionation processes: Milling, splitting	1
3.4	Splitting and fractionation processes: Sieving, grading	1
3.5	Quality assessment and assurance	1
3.6	Emerging technologies	1
4	**Spice Processing Technology**	
4.1	Drying methods: Sun drying, hot air drying	1
4.2	Drying methods: Freeze drying	1
4.3	Extraction methods: Steam distillation, solvent extraction	1
4.4	Extraction methods: Supercritical fluid extraction	1
4.5	Quality control measures: Purity, moisture content	1
4.6	Quality control measures: Volatile oil content, microbial load.	1
5	**Innovations and Future Trends**	
5.1	Electric Vehicles: Function, Types, Layout, Components, Working Principle and challenges	1
5.2	Fuel Cell Vehicle: Function, Types, Layout, Components and Working Principle	1
5.3	Hybrid Vehicle: Function, Types, Layout, Components and Working Principle	1
5.4	Autonomous Vehicles: Levels of Autonomous Vehicles, Layout, Components, Working Principle and Challenges	1
5.5	Advanced Driver-Assistance Systems (ADAS): Function, Layout, Components and Working Principle	1
5.6	Connected Vehicle: Function, Types of Vehicle Connectivity, Components, Working Principle and Challenges	1
Practical:		
1.	Microwave pulses to enhance the sprouting process in legumes like chickpeas or lentils, improving digestibility and nutrient availability.	3
2.	To determine the spice essential oil extraction via supercritical CO2.	3
3.	Utilize cryogenic technology to grind spices like cinnamon or cloves, preserving their volatile compounds and enhancing flavour.	3
4.	Demonstrate the spice flavour enhancement through enzymatic hydrolysis	3

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5.	Determine the nano encapsulation to encapsulate volatile compounds from spices like turmeric or ginger, ensuring prolonged shelf life and controlled release in food products.	3
6.	To determine cereal pulse texturization with extrusion processing	3
7.	Examine the ultrasound technology to extract bioactive compounds from spices such as black pepper or cardamom, enhancing their antioxidant properties.	3
8.	Employ high-pressure processing to extend the shelf life of cooked cereal and pulse products, preserving freshness and nutrients without the need for additives.	3
9.	Utilize hydrothermal treatment to modify the texture of pulses like beans or chickpeas, improving their mouthfeel and reducing cooking time.	3
10.	Employ molecular distillation to extract essential oils from aromatic spices like cloves or cinnamon, producing highly concentrated flavor extracts for use in food products.	3

Course Designer(s)

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60 FT E35	Food Industry Waste Management	Category	L	T	P	Credit
		PE	2	0	2	3

Objectives

- To study the standards and acts in industrial waste management.
- To learn by products and its utilisation for various purposes.
- To study the characterisation of food industry effluents
- To explain the biological oxidation process
- To study the advanced waste management systems

Pre-requisites

NIL

Course Outcomes

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

CO1	Recognize the various acts and standards implemented for waste Disposal	Remember
CO2	Analyse the various by-product from food waste and its utilisation	Analyze
CO3	Analyse the various characterisation methods of food industry effluent methods.	Analyze
CO4	Illustrate the biological oxidation process and the methods employed in industries.	Apply
CO5	Discuss the advance waste management systems employed for treating food industry effluents	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	2	2	-	-	3	3	2
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	3	-	-	-	-	-	2	2	-	-	2	3	3
CO4	3	3	3	-	-	-	-	-			-	-	3	3	3
CO5	3	3	3	-	-	-	-	-	2	2		2	3	3	3
3 - Strong; 2 - Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)				Model Examination (Marks)	End Sem Examination (Marks)	
	Test 1		Test 2				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	20	-	20	-	-	30	-
Understand	30	-	20	-	-	40	-
Apply	-	50	10	50	50	20	50
Analyze	-	50	10	50	50	10	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech. Food Technology

60 FT E35 – Food Industry Waste Management

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100

Standards and Acts Food industry wastes, Food waste treatment, ISO 14001 standards, Standards for emission or discharge of environmental pollutants from food processing Industries as per Environment (Protection) Act, 1986. Elements of importance in the efficient management of food processing.	[6]
By Products and their Utilization* Characterization and utilization of by-products from cereal, pulses, oilseeds, fruits and vegetables, plantation products, fermented foods, milk, fish, meat, egg and poultry processing industries.	[6]
Characterization of Food Industry Effluents** Physical and chemical parameters, Oxygen demands and their inter relationship, Residues (solids), Fats, Oils and grease, Forms of Nitrogen, Sulphur and Phosphorus, Anions and cations, Surfactants, Colour, Odour, Taste.	[6]
Biological Oxidation Objectives, Organisms, Reactions, Oxygen requirements, Aeration devices Systems: Lagoons, Activated sludge process, Oxidation ditches, Rotating biological contactors and their Variations and advanced modifications	[6]
Advanced Waste Water Management Advanced waste water management systems: Physical separations- Micro-strainers, Filters, Ultra filtration and reverse osmosis, Physico-chemical separations: activated carbon adsorption, Ion-exchange electro-dialysis and magnetic separation.	[6]
Practical: 1. Determination of Physical parameters of Waste water Temperature, Colour, Odour, pH 2. Determination of total Solids, Volatile solids and Fixed solids of waste water 3. Determination of total phosphorous from waste water 4. Determination of electrical conductivity and turbidity of waste water 5. Determination of chlorides and sulphates of wastewater 6. Determination of acidity and alkalinity of waste water 7. Determination of biological oxygen demand (BOD) of wastewater 8. Determination of Chemical oxygen demand (COD) of wastewater 9. Determination of faecal Contamination of water 10. Determination of dissolved oxygen from waste water	[30]
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):	
1.	Monika Thakur, V.K. Modi, Renu Khedkar, Karuna Singh, "Sustainable Food Waste Management", Springer 2020.
2.	Elina Narvanen, Nina Mesiranta, Malla Mattila, Anna Heikkinen. "Food Waste Management" Springer,2020.
Reference(s):	
1.	Wang L.K., Hung Y.T. and Yapijakis C., " Waste Treatment in the Food Processing Industry", CRC press, Taylor and Francis Group, 2006.
2.	Arvanitoyannis I S., and. Jogdhand S.N., "Waste Management for the Food Industries", Academic press, 2008.

*SDG 9 – Industry Innovation and Infrastructure

**SDG 7 – Affordable and Clean Energy

Passed in BoS Meeting held on 22.11.23

Approved in Academic Council Meeting held on 23.12.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of Hours
1	**Standards and Acts**	
1.1	Food industry wastes	1
1.2	Food waste treatment	1
1.3	ISO 14001 standards	2
1.4	Standards for emission or discharge of environmental pollutants from food processing Industries as per Environment (Protection) Act, 1986	1
1.5	Elements of importance in the efficient management of food processing	1
2	**By Products and their Utilization**	
2.1	Characterization and utilization of by-products from cereal, pulses, oilseeds	1
2.2	Characterization and utilization of by-products: oilseeds, fruits and vegetables	1
2.3	Characterization and utilization of by-products: plantation products	1
2.4	Characterization and utilization of by-products: fermented foods, milk	1
2.5	Characterization and utilization of by-products: fish, meat, egg	1
2.6	Characterization and utilization of by-products: poultry processing industries.	1
3	**Characterization of Food Industry Effluents**	
3.1	Physical and chemical parameters,	1
3.2	Oxygen demands and their inter relationship	1
3.3	Residues (solids), Fats, Oils and grease	1
3.4	Forms of Nitrogen, Sulphur and Phosphorus	1
3.5	Anions and cations	1
3.6	Surfactants, Colour, Odour, Taste	1
4	**Biological Oxidation**	
4.1	Objectives, Organisms, Reactions, Oxygen requirements,	1
4.2	Aeration devices	1
4.3	Systems: Lagoons	1
4.4	Systems: Activated sludge process	1
4.5	Systems: Oxidation ditches	1
4.6	Systems: Rotating biological contactors and their Variations and advanced modifications	1
5	**Advanced Waste Water Management**	
5.1	Advanced waste water management systems	1
5.2	Physical separations- Micro-strainers,	1
5.3	Filters, Ultra filtration and reverse osmosis,	1
5.4	Physico-chemical separations: activated carbon adsorption	1
5.5	Physico-chemical separations: Ion-exchange	1
5.6	Physico-chemical separations: electro-dialysis and magnetic separation	1
Practical:		
1.	Determination of Physical parameters of Waste water Temperature, Colour, Odour, pH	2
2.	Determination of total Solids, Volatile solids and Fixed solids of waste water	4
3.	Determination of total phosphorous from waste water.	4
4.	Determination of electrical conductivity and turbidity of waste.	2
5.	Determination of chlorides and sulphates of waste water	2
6.	Determination of acidity and alkalinity of waste.	4
7.	Determination of biological oxygen demand (BOD) of waste water	4
8.	Determination of Chemical oxygen demand (COD) of waste water	2
9.	Determination of faecal Contamination of water	4
10.	Determination of dissolved oxygen from waste.	2

Course Designer(s)

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Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

CHAIRMAN
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60 FT E36	Industrial Production of Cookies and Biscuits	Category	L	T	P	Credit
		PE	2	0	2	3

Objectives

- Understand hard and soft dough biscuit processing methods.
- Explain operation and role of different biscuit-making machines.
- Understand cookie production and impact of automation and efficiency.
- Describe construction and operation of cookie-making machines.
- Understand cracker, wafer, and pretzel production technologies.

Pre-requisites

Nil

Course Outcomes

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

CO1	Learn ingredient effects on dough spread during baking.	Understand
CO2	Analyse the machine performance to ensure product quality.	Analyze
CO3	Design energy-efficient, automated cookie production processes.	Analyze
CO4	Apply advanced techniques for hygienic, customizable cookie production.	Apply
CO5	Apply innovative cracker products using modern techniques and packaging.	Apply

Mapping with Programme Outcomes

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	-	-	-	-	-	-	2	2	2	2
CO2	3	3	2	2	-	-	-	-	-	-	-	2	2	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
3 - Strong; 2 - Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)				Model Examination (Marks)	End Sem Examination (Marks)	
	Test 1		Test 2				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	20	-	20	-	-	20	-
Understand	40	-	20	-	-	40	-
Apply	-	50	10	50	50	30	50
Analyze	-	50	10	50	50	10	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech. Food Technology

60 FT E36 - Industrial Production of Cookies and Biscuits

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100

Classification and processing technology of biscuits* Hard dough biscuits - ingredients and formulations, dough mixing, forming, baking, flavoring, cooling and packaging, Soft dough biscuits - ingredients and formulations, dough mixing, forming, baking, flavoring, cooling and packaging.	[6]
Biscuit Making Machines* Sheeting machines, sheeters, gauge rolls, laminators, Reciprocating cutters – construction, shaping principle, crosshead drive, transmission. Rotary cutters – Construction, shaping principle, transmission.	[6]
Classification And Processing Technology Of Cookies Characteristic features of ingredients of cookies, Quality assessment of raw ingredients used in cookies. Types of cookies, general process of cookies production - mixing, dough sheeting, baking, cooling and packaging.	[6]
Cookie Making Machines* Rotary moulders – introduction, Construction, moulding principle, transmission system, operation. Extruder & depositor – Construction – Dough feed assembly, Die assembly, Shaping principle, Transmission system & operation.	[6]
Crackers And Miscellaneous Biscuit Like Products** Classification of crackers - cream, soda and snack crackers. Manufacturing technology of crackers. Wafers and pretzels biscuits. Fermentation in Cracker Production. Innovations in Wafer Technology. Sustainability in Cracker Packaging.	[6]
Practical: 1. Prepare multiple batches of hard dough biscuits using varying proportions of flour, fat, and sugar. Compare the texture, crispness, and flavor. 2. Compare manual and mechanical mixing methods for hard dough. Measure dough consistency, elasticity, and baking results. 3. Bake hard dough biscuits at different temperatures and times, observing changes in color, texture, and moisture content. 4. Experiment with different flavoring agents (e.g., vanilla, cocoa, fruit extracts) on Soft Dough Biscuits and assess their impact on taste and consumer preference. 5. Package biscuits using different materials (e.g., plastic wrap, aluminum foil) and observe shelf life by monitoring moisture content and texture changes over time. 6. Use manual sheeting and cutting techniques to form biscuits. Observe the impact of dough thickness and shape on final product texture and uniformity. 7. Use different grades of raw materials (flour, sugar, fat) and evaluate the cookies based on texture, spread, and flavor. 8. Test different mixing times for cookie dough and analyze the impact on dough consistency, spread during baking, and overall cookie texture. 9. Ferment cracker dough for different times and compare the effect on texture, rise, and flavor profile. 10. Prepare wafers of different thicknesses and compare the impact on texture, crispness, and baking times.	[30]
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):

1.	Manley, Duncan, "Technology of Biscuits, Crackers, and Cookies", Fourth Edition, 2011.
2.	Pareyt, Bram et al., "Engineering Aspects of Baking", First Edition, 2020.

Reference(s):

1.	Manley, Duncan, "Biscuit, Cookie, and Cracker Manufacturing Manuals: Volume 1 - Ingredients", First Edition, 1998.
2.	Manley, Duncan, "Biscuit, Cookie, and Cracker Manufacturing Manuals: Volume 2 - Biscuit Doughs", First Edition, 1998.

*SDG 9 – Industry Innovation and Infrastructure

**SDG 12 – Responsible Consumption and Production

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of Hours
1	**Classification and Processing Technology of Biscuits**	
1.1	Hard dough biscuits - ingredients and formulations, dough mixing	1
1.2	Hard dough biscuits - forming, baking, flavoring	1
1.3	Hard dough biscuits cooling and packaging	1
1.4	Soft dough biscuits - ingredients and formulations, dough mixing	1
1.5	Soft dough biscuits - forming, baking, flavoring	1
1.6	Soft dough biscuits - cooling and packaging	1
2	**Biscuit Making Machines**	
2.1	Sheeting machines	2
2.2	Sheeters	1
2.3	Gauge rolls	1
2.4	Laminators	2
2.5	Reciprocating cutters – construction, shaping principle, crosshead drive, transmission	
2.6	Rotary cutters – Construction, shaping principle, transmission	
3	**Classification and Processing Technology of Cookies**	
3.1	Characteristic features of ingredients of cookies,	1
3.2	Quality assessment of raw ingredients used in cookies.	1
3.3	Types of cookies,	1
3.4	General process of cookies production - mixing, dough sheeting, baking, cooling and packaging.	3
4	**Cookie Making Machines**	
4.1	Rotary moulders – introduction, Construction	1
4.2	moulding principle, transmission system, operation.	1
4.3	Extruder & depositor – Construction – Dough feed assembly,	2
4.4	Die assembly, Shaping principle,	1
4.5	Transmission system & operation.	1
5	**Crackers and Miscellaneous Biscuit like Products**	
5.1	Classification of crackers - cream, soda and snack crackers	1
5.2	Manufacturing technology of crackers	1
5.3	Wafers and pretzels biscuits	1
5.4	Fermentation in Cracker Production	1
5.5	Innovations in Wafer Technology	1
5.6	Sustainability in Cracker Packaging	1
Practical:		
1.	Prepare multiple batches of hard dough biscuits using varying proportions of flour, fat, and sugar. Compare the texture, crispness, and flavor.	3
2.	Compare manual and mechanical mixing methods for hard dough. Measure dough consistency, elasticity, and baking results.	3
3.	Bake hard dough biscuits at different temperatures and times, observing changes in color, texture, and moisture content.	3
4.	Experiment with different flavoring agents (e.g., vanilla, cocoa, fruit extracts) on Soft Dough Biscuits and assess their impact on taste and consumer preference.	3
5.	Package biscuits using different materials (e.g., plastic wrap, aluminum foil) and observe shelf life by monitoring moisture content and texture changes over time.	3

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6.	Use manual sheeting and cutting techniques to form biscuits. Observe the impact of dough thickness and shape on final product texture and uniformity.	3
7.	Use different grades of raw materials (flour, sugar, fat) and evaluate the cookies based on texture, spread, and flavor.	3
8.	est different mixing times for cookie dough and analyze the impact on dough consistency, spread during baking, and overall cookie texture.	3
9.	Ferment cracker dough for different times and compare the effect on texture, rise, and flavor profile.	3
10.	Prepare wafers of different thicknesses and compare the impact on texture, crispness, and baking times.	3

Course Designer(s)

1. Mr.P. Kalai Rajan - kalairajan@ksrct.ac.in

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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60 FT E37	Technology of Fats and Oils	Category	L	T	P	Credit
		PE	2	0	2	3

Objectives

- To learn about sources and quality analysis of oils and fats.
- To study the pre-treatment techniques and its uses.
- To understand the refining process and modification in edible oils.
- To know the preparation and processing of Plant and Animal products.
- To realize the importance and application of by products from Oils and Fats.

Pre-requisites

- **Nil**

Course Outcomes

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

CO1	Explain the various sources and quality parameters of Oils and Fats	Understand
CO2	Details on novel techniques of oil extraction.	Analyze
CO3	Elucidate the suitable refining and modification process for Oils and Fats.	Analyze
CO4	Summarize the technology applied for preparation and processing of plant and animal products.	Apply
CO5	Emphasis the importance of by product and its utilization.	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	2	-	2	2	-	2	3	3	2
CO2	3	3	2	-	-	-	2	-	2	2	-	2	3	3	2
CO3	3	3	3	-	-	-	2	-	2	2	-	2	2	3	3
CO4	3	3	3	-	-	-	2	-	2	2	-	3	3	3	3
CO5	3	3	2	-	-	-	2	-	2	2	-	3	3	3	3
3 - Strong; 2 - Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)				Model Examination (Marks)	End Sem Examination (Marks)	
	Test 1		Test 2				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	20	-	20	-	-	20	-
Understand	30	-	30	-	-	40	-
Apply	10	50	10	50	50	20	50
Analyze	-	50	-	50	50	20	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B. Tech Food Technology

60 FT E37 - Technology of Fats and Oils

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100

Sources of oils and fats and quality analysis Natural sources of oils and fats (plant and animal), current status, issues and challenges: Consumption- nutritional and healthy values- chemical composition of fat and oil- types of fatty acid - Antioxidants in edible oil. Quality parameters and international and regional regulations.	**[6]**
Pre-treatment techniques of oil extraction* Primary process: thermal, enzymatic and novel pre-treatment process. Physical methods of oil extraction- principles and mechanism-factors affecting extraction process – solvent extraction technology- meal desolventization and novel techniques of oil extraction.	**[6]**
Edible oil refining and modification Principle – Refining - Filtration, degumming, neutralisation, bleaching, deodorization and physical refining. Membrane technology; Modification - fractionation, winterization - Margarine Edible oil blending and fortification - edible oil packaging and its regulations.	**[6]**
Preparation and Processing of plant oil and animal fats* Nutritive value-manufacturing process – packaging materials and methods, storage and industrial application of plant oil (seed oil, fruits and nuts, rice bran oil) and animal fats (fish, dairy cream ,ghee, lard). Oil powder - processing and its application.	**[6]**
By product utilization of oils and fats** Properties and utilization of major by-products of oil mill industry. Other products - Protein powder – edible films – TVP – animal feed – extraction of bioactive compounds – lecithin production and application - Biodiesel, ethanol and glycerol production.	**[6]**
Practical: 1. Qualitative test to identify the presence of oils and fats in the given sample. 2. Determination of Iodine number of fried fats and oils. 3. Determination of Saponification number of fried oils and fats. 4. Investigate the temperature affects the melting points of various fats and oils, and to understand the implications of these properties in culinary and industrial applications. 5. Evaluation of quantify the free fatty acid content in different fats and oils, which is an indicator of their quality and shelf life. 6. Investigate the emulsification properties of various fats and oils and their suitability for use in food emulsions. 7. Evaluation of the oxidative stability of fats and oils under accelerated aging conditions, mimicking storage and processing. 8. Determination of Free Fatty Acids analysis in Oils and Fats by suitable method. 9. Separation of glycerin, a valuable byproduct from the transesterification process used to produce biodiesel from vegetable oils. 10. Assess the nutritional value of oil cake derived from oilseed processing and evaluate its suitability as a component of animal feed.	**[30]**
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):

1.	Richard D. O'Brien, "Fats and Oils: Formulating and Processing for Applications", 3rd Edition, CRC Press, London, 2010.
2.	A. Chakraverty. Post-Harvest Technology of Cereals, Pulses and Oilseeds, 3rd Ed. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.2008.

Reference(s):

1.	Gunstone, F. (Ed.). Vegetable oils in food technology: composition, properties and uses. John Wiley & Sons.2011.
2.	Talbot, G. (Ed.). Specialty oils and fats in food and nutrition: properties, processing and applications. Woodhead publishing. 2015

***SDG 9 – Industry Innovation and Infrastructure **SDG 3 – Good Health and Well Being**

Passed in BoS Meeting held on 22.11.23
Approved in Academic Council Meeting held on 23.12.23

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Course Contents and Lecture Schedule

S. No.	Topics	No. of Hours
1	**Sources of oils and fats and quality analysis**	
1.1	Natural sources of oils and fats (plant and animal)	1
1.2	Current status, issues and challenges	1
1.3	Consumption-nutritional and healthy values	1
1.4	Chemical composition of fat and oil	1
1.5	Types of fatty acid, Antioxidants in edible oil	1
1.6	Quality parameters - International and regional regulations	1
2	**Pre-treatment techniques of oil extraction**	
2.1	Primary process - thermal, enzymatic process,	1
2.2	Novel pre-treatment process	1
2.3	Physical methods of oil extraction , principles and mechanism	1
2.4	Factors affecting extraction process	1
2.5	Solvent extraction technology	1
2.6	Meal desolventization - novel techniques of oil extraction	1
3	**Edible oil refining and modification**	
3.1	Principle – Refining - Filtration, degumming,	1
3.2	Neutralisation, bleaching	1
3.3	Deodorization and physical refining	1
3.4	Modification - fractionation, winterization - Margarine	1
3.5	Edible oil blending and fortification	1
3.6	Edible oil packaging and its regulations	1
4	**Preparation and Processing of plant oil and animal fats**	
4.1	Nutritive value-manufacturing process of plant oil	1
4.2	Packaging materials and methods, storage of plant oil	1
4.3	Industrial application of plant oil, Nutritive value-manufacturing process of animal fat	1
4.4	Packaging materials and methods, storage of animal fat	1
4.5	Industrial application of animal fat	1
4.6	Oil powder - processing and its application.	1
5	**By product utilization of oils and fats**	
5.1	Properties and utilization of major by-products of oil mill industry	1
5.2	Other products - protein powder – edible films	1
5.3	TVP – animal feed – extraction of bioactive compounds	1
5.4	Lecithin production and application	1
5.5	Biodiesel production	1
5.6	Ethanol and glycerol production	1
Practical:		
1	Qualitative test to identify the presence of oils and fats in the given sample.	[3]
2	Determination of Iodine number of fried fats and oils.	[3]
3	Determination of Saponification number of fried oils and fats.	[3]
4	Investigate the temperature affects the melting points of various fats and oils, and to understand the implications of these properties in culinary and industrial applications.	[3]
5	Evaluation of quantify the free fatty acid content in different fats and oils, which is an indicator of their quality and shelf life.	[3]
6	Investigate the emulsification properties of various fats and oils and their suitability for use in food emulsions.	[3]

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7	Evaluation of the oxidative stability of fats and oils under accelerated aging conditions, mimicking storage and processing.	[3]
8	Determination of Free Fatty Acids analysis in Oils and Fats by suitable method.	[3]
9	Separation of glycerine, a valuable by-product from the transesterification process used to produce biodiesel from vegetable oils.	[3]
10	Assess the nutritional value of oil cake derived from oilseed processing and evaluate its suitability as a component of animal feed.	[3]

Course Designer(s)

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Approved in Academic Council Meeting held on 23.12.23

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PROFESSIONAL ELECTIVE - IV

60 FT E41	Downstream Processing of Bioproducts	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To learn various unit operations and their applications in downstream processing of bio products.
- To emphasis ~~the~~ need for separation techniques in downstream processing
- To acquire knowledge in recovery, purification and formulation of bio products of commercial interest.
- To provide knowledge on downstream processing economics
- To introduce sequential stages of downstream processing

Pre-requisites

Thermal Engineering

Course Outcomes

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

CO1	Review cost cutting strategies and bio-product release kinetics	Understand
CO2	Interpret the design and principle of filtration and centrifugation	Analyze
CO3	Identify suitable unit operation for product recovery and concentration	Apply
CO4	Demonstrate the principles and operation of chromatographic Techniques	Apply
CO5	Discuss the operational requirements of industrial crystallizers and Lyophilizer	Analyze

Mapping with Programme Outcomes

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	3	-	-	-	-	-	-	-	-	-	2	3	3
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	3	3
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	3	3
3 - Strong; 2 - Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	10	30	30
Apply	20	20	30
Analyze	10	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech Food Technology								
60 FT E41 - Downstream Processing of Bioproducts								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Introduction to downstream and intracellular product release Introduction to downstream processing - characteristics of biomolecules - economics of downstream processing - cost cutting strategy - physico chemical basis of bioseparation - location of products and product release kinetics - cell disruption methods: mechanical, chemical and enzymatic process; pretreatment and stabilization of bioproducts.	[9]
Primary separation and isolation Principle of batch filtration - pretreatment of fermentation broth, design of industrial filters: plate and frame filter press, leaf filter, continuous filtration: rotary drum filter - calculations in batch and continuous filtration - centrifugation: principle, design and types of industrial centrifuges - scale up of centrifugation- Calculations in settling velocity, sigma factor and number of discs in centrifugation with the application of simple MATLAB programming.	[9]
Product recovery and concentration Adsorption: Isotherms, batch, continuous operations- problems in adsorption isotherms and break point time in fixed bed adsorption - principle of cloud point, aqueous two phase and supercritical fluid extraction - membrane separation processes: microfiltration, ultrafiltration, reverse osmosis and dialysis, precipitation of proteins by different methods.	[9]
Product purification by chromatography* Principle and practice, ion exchange, size exclusion, bioaffinity, hydrophobic interaction, reverse phase, pseudo affinity chromatography, high performance liquid chromatography, flash chromatography and gas chromatographic techniques.	[9]
Final product purification and polishing* Crystallization: nucleation, crystal growth, crystal size distribution, kinetics of crystallization, population density, industrial crystallizers, recrystallization, MATLAB programming for the kinetic studies; drying - drying terminologies, drying curve, industrial dryers, freeze drying principles and applications.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Nooralabettu Krishna Prasad, “Downstream Process Technology - A New Horizon In Biotechnology”, PHI Learning Private Limited, New Delhi, 2012.
2.	Sivasankar B., “Bioseparations - Principles and Techniques”, Prentice Hall of India Private Limited, New Delhi, 2006.
Reference(s):	
1.	Harrison, R.G., Todd, P., Rudge, S.R., and Petrides, D.P.. Bioseparations Science and Engineering. 2 nd Edition. Oxford University Press. 2015.
2.	Roger.G, Harrison, Paul Todd, Scott R.Rudge and Demetri P.Petrides, “Bioseperation Science and Engineering” Oxford University Press, Newyork , 2003.

*SDG 9 – Industry Innovation and Infrastructure

Passed in BoS Meeting held on 22.05.24
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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to downstream and intracellular product release**	
1.1	Introduction to downstream processing	1
1.2	characteristics of biomolecules	1
1.3	economics of downstream processing	1
1.4	cost cutting strategy	1
1.5	physico chemical basis of bioseparation	1
1.6	location of products and product release kinetics	1
1.7	cell disruption methods: mechanical, chemical	1
1.8	cell disruption methods: enzymatic process	1
1.9	pre-treatment and stabilization of bioproducts.	1
2.0	**Primary separation and isolation**	
2.1	Principle of batch filtration	1
2.2	pre-treatment of fermentation broth	1
2.3	design of industrial filters:	1
2.4	plate and frame filter press, leaf filter, continuous filtration	1
2.5	rotary drum filter	1
2.6	calculations in batch and continuous filtration	1
2.7	centrifugation: principle, design and types of industrial centrifuges	1
2.8	scale up of centrifugation	1
2.9	Calculations in settling velocity, sigma factor and number of discs in centrifugation with the application of simple MATLAB programming.	1
3.0	**Product recovery and concentration**	
3.1	Adsorption: Isotherms, batch, continuous operations	2
3.2	problems in adsorption isotherms	1
3.3	break point time in fixed bed adsorption	1
3.4	principle of cloud point	1
3.5	aqueous two phase and supercritical fluid extraction	1
3.6	membrane separation processes: microfiltration, ultrafiltration	1
3.7	membrane separation processes: reverse osmosis and dialysis,	1
3.8	Precipitation of proteins by different methods.	1
4.0	**Product purification by chromatography**	
4.1	Principle and practice, ion exchange, size exclusion,	1
4.2	bioaffinity, hydrophobic interaction,	1
4.3	reverse phase, pseudo affinity chromatography,	1
4.4	high performance liquid chromatography,	2
4.5	flash chromatography	2
4.6	gas chromatographic techniques	2
5.0	**Final product purification and polishing**	
5.1	Crystallization: nucleation, crystal growth, crystal size distribution,	2
5.2	kinetics of crystallization, population density,	2
5.3	industrial crystallizers, recrystallization,	1
5.4	MATLAB programming for the kinetic studies;	2
5.5	drying - drying terminologies, drying curve, industrial dryers,	1
5.6	freeze drying principles and applications.	1

Course Designer(s)

1. Dr. P. Shanmugam – shanmugam@ksrct.ac.in

Passed in BoS Meeting held on 22.05.24

Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

60 FT E42	Food Product Development	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand the fundamentals of food product development and its significance in the food industry.
- To study the functionality of ingredients and their application in food product formulations.
- To understand the principles of product design and scaling production processes.
- To learn the regulatory and quality assurance aspects of food product development.
- To explore the commercialization and marketing strategies for food products.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Explain key factors influencing new product development and identify stages of the NPD process.	Understand
CO2	Analyze ingredient roles in food formulation and create product prototypes.	Analyze
CO3	Develop effective product designs and understand scaling-up of production processes.	Apply
CO4	Understand food regulations and apply quality assurance protocols in product development.	Understand
CO5	Apply marketing strategies and assess the commercial viability of new food products.	Apply

Mapping with Programme Outcomes

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	-	3	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
3 - Strong; 2 - Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	20	30	40
Apply	20	20	30
Analyze	10	-	10
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B. Tech. Food Technology								
60 FT E42 - Food Product Development								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Introduction to Food Product Development Definition and Importance of Food Product Development, Historical evolution and current trends in food products, The role of innovation in the food industry, Factors influencing food product development: Consumer preferences, market needs, competition, Stages of new product development (NPD) process, Idea generation and concept development, Screening and feasibility studies.	[9]
Ingredient Functionality and Formulation** Role of ingredients in food product development, Functionality of proteins, carbohydrates, fats, and emulsifiers, Use of natural and artificial additives: preservatives, colorants, and flavors, Balancing nutrition, taste, and shelf life in formulations, Product formulation techniques and prototype development, Product cost analysis and scale-up challenges.	[9]
Product Design and Process Development Designing food products for sensory appeal, nutrition, and safety, Equipment selection and process design for product manufacturing, Scaling up from pilot to full production, Packaging considerations for different types of food products, Sensory evaluation: Techniques and importance in product development, Process optimization and yield improvement.	[9]
Food Regulations and Quality Assurance** Food laws and regulations (FDA, FSSAI, Codex Alimentarius),Labeling requirements and nutritional claims, Hazard Analysis and Critical Control Points (HACCP), Good Manufacturing Practices (GMP) and food safety standards, Quality assurance methods in product development. Shelf-life testing and microbiological analysis. Product recall and risk management strategies.	[9]
Commercialization and Marketing of Food Products* Market research and consumer testing, Marketing strategies and positioning of food products. Branding and packaging design for consumer appeal, Pricing strategies and competitive analysis. Distribution channels and logistics. Launching a new product: Planning and execution. Evaluating product performance post-launch: Metrics and improvements.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Fuller, G.W., "New Food Product Development: From Concept to Marketplace", Third Edition, 2011.
2.	Gorton, Laurie, "Bakery Product Development", First Edition, 2010.
Reference(s):	
1.	Earle, M.D., Earle, R.L., and Anderson, A., "Food Product Development", First Edition, 2001.
2.	Brody, A.L., and Lord, J.B., "Developing New Food Products for a Changing Marketplace", Second Edition, 2008.
3.	Crosby, N.T., "Food Packaging: Principles and Practice", First Edition, 2001.
4.	Side, C., and Long, T., "The Fundamentals of Food Product Development", First Edition, 2005.

*SDG 12 – Responsible Consumption and Production

**SDG 3 – Good Health and Well Being

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Food Product Development**	
1.1	Definition and Importance of Food Product Development,	1
1.2	Historical evolution and current trends in food products,	1
1.3	The role of innovation in the food industry,	1
1.4	Factors influencing food product development: Consumer preferences, market needs, competition	2
1.5	Stages of new product development (NPD) process	2
1.6	Idea generation and concept development	1
1.7	Screening and feasibility studies	1
2.0	**Ingredient Functionality and Formulation**	
2.1	Role of ingredients in food product development	1
2.2	Functionality of proteins, carbohydrates, fats, and emulsifiers	2
2.3	Use of natural and artificial additives: preservatives, colorants, and flavors	2
2.4	Balancing nutrition, taste, and shelf life in formulations,	1
2.5	Product formulation techniques and prototype development	2
2.6	Product cost analysis and scale-up challenges.	1
3.0	**Product Design and Process Development**	
3.1	Designing food products for sensory appeal, nutrition, and safety	2
3.2	Equipment selection and process design for product manufacturing	2
3.3	Scaling up from pilot to full production	1
3.4	Packaging considerations for different types of food products	1
3.5	Sensory evaluation: Techniques and importance in product development,	2
3.6	Process optimization and yield improvement.	1
4.0	**Food Regulations and Quality Assurance**	
4.1	Food laws and regulations (FDA, FSSAI, Codex Alimentarius)	2
4.2	Labeling requirements and nutritional claims	1
4.3	Hazard Analysis and Critical Control Points (HACCP)	1
4.4	Good Manufacturing Practices (GMP) and food safety standards	1
4.5	Quality assurance methods in product development.	1
4.6	Shelf-life testing and microbiological analysis.	1
4.7	Product recall and risk management strategies	2
5.0	**Commercialization and Marketing of Food Products**	
5.1	Market research and consumer testing	2
5.2	Marketing strategies and positioning of food products	1
5.3	Branding and packaging design for consumer appeal	1
5.4	Pricing strategies and competitive analysis	1
5.5	Distribution channels and logistics.	1
5.6	Launching a new product: Planning and execution.	1
5.7	Evaluating product performance post-launch: Metrics and improvements.	2

Course Designer(s)

1. Mr. P. Kalai Rajan– kalairajan@ksrct.ac.in

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

60 FT E43	Fruits and Vegetable Storage	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand the basic processing Harvesting techniques.
- To identify the safe storage of food materials.
- To know novel and advanced methods of food Transportation.
- To Understand the Basics of food temperature conditions.
- To know design of storage Structures and handling for various categories of food product

Pre-requisites

- Nil

Course Outcomes

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

CO1	Understand trends and development storage technologies aiming at assuring the safety and quality of fruits and vegetables.	Understand
CO2	Explain the design, construction, operation, control and maintenance of commercial refrigeration systems and cold storages for fruits and vegetables	Apply
CO3	Assess basic in storage of fruits and vegetables	Apply
CO4	Examine the design of storage Structures for various categories of food product	Understand
CO5	Analyse storage Structures and handling for various categories of food product	Apply

Mapping with Programme Outcomes

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	-	3	3	3	3	3
CO2	3	3	3	-	-	-	-	-	-	-	3	3	3	3	3
CO3	3	3	3	-	-	-	-	-	-	-	3	3	3	3	3
CO4	3	3	3	-	-	-	-	-	-	-	3	3	3	2	2
CO5	3	3	3	-	-	-	-	-	-	-	3	3	3	2	3
3 - Strong; 2 - Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	30
Understand	30	30	50
Apply	10	10	20
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 FT E43 - Fruits and Vegetable Storage								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Harvesting and Storage Operations Introduction – storage operation, harvest and pre-harvest factors, traditional and modern storge methods, changes during storage, factors influencing storage, genetic effects on storage, humidity and temperature – measurement and control technology, store design and methods, pre-storage treatments	[9]
Cooling of fruits and Vegetables Pre-cooling of fruits and vegetables – methods, estimation of cooling time, ventilation & forced system, combined forced and extraction system, low cost cold room, storehouse – layout of floor duct, air distribution, packaging icing, cooling load calculations, vacuum cooling – principle, process, mechanism, equipment, advantages, limitations, Commercial forced air cooling methods, product moisture loss and produce cooling pattern with forced air cooling; heat load; hydrocooling of fruits and vegetables – hydrocooling rate, methods; evaporative cooling (EC) – thermodynamics and psychrometric of EC process, types of EC system, limitations, maintenance and design.	[9]
Transportation of Food products Hypobaric storage – mode of action, transport, effect on fruits and vegetables, case studies on raw horticultural commodities and processed products, vacuum infiltration and cooling, hyperbaric storage – mode of action, effect on fruits and vegetables, case studies on raw horticultural commodities and processed products	[9]
Controlled Atmospheric Conditions** Controlled atmosphere (CA) – changes during storage, biochemical considerations, gas exchange mechanism, equipment for producing and regulation CA, design, construction and operation - on raw horticultural commodities and processed products, gas measurement and control technology, effect of gas atmosphere and interactions, MAP – techniques, polymeric film properties, gas and vapour applied to MA process operation, effect on shelf life of fruits and vegetables, MAP design with O2 modeling, chilling injury, control of temperature, absorbers.	[9]
Handling and Storage of food products** Handling of common fruits and vegetables – recommended storage conditions for variousfruits and vegetables, storage and transportation of fruits - citrus, sub-tropical, pears, grapes, plums, cherries, peaches, apricot and berries. Vegetables – artichokes, asparagus, corn, cucumber, eggplant, garlic, lettuce, melon, mushroom, okra, onion, parsnip, parsley, peas, pepper, potato, spinach, canned foods, transport. – sea, CA, hypobaric, MA – case studies.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Thompson, A. K., Thompson, A. K. (2015). Fruit and Vegetable Storage: Hypobaric, Hyperbaric and Controlled Atmosphere. Germany: Springer International Publishing.
2.	Puttongsiri, T., Prange, R. K., Thompson, A. K., Bancroft, R. D., Puttongsiri, T., Prange, R. K., Thompson, A. K., Bancroft, R. D. (2018). Controlled Atmosphere Storage of Fruit andVegetables. United Kingdom: CABI.
Reference(s):	
1.	Packaging and Storage of Fruits and Vegetables: Emerging Trends. (2021). (n.p.): Apple Academic Press.
2.	Rao, C. G., Rao, C. G. (2015). Engineering for Storage of Fruits and Vegetables: Cold Storage, Controlled Atmosphere Storage, Modified Atmosphere Storage. India: Elsevier Science.

**SDG 3 – Good Health and Well Being

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Harvesting and Storage Operations**	
1.1	Introduction	1
1.2	Storage operation, harvest and pre-harvest factors	1
1.3	Traditional and modern storge methods	1
1.4	Changes during storage	1
1.5	Factors influencing storage & genetic effects on storage	1
1.6	Humidity and temperature – measurement and control technology	2
1.7	Store design and methods	1
1.8	Pre-storage treatments	1
2.0	**Cooling of fruits and Vegetables**	
2.1	Pre-cooling methods, estimation of cooling time, ventilation & forced system	2
2.2	Combined forced and extraction system, low-cost cold room, storehouse – layout of floor duct, air distribution, packaging icing, cooling load calculations	2
2.3	vacuum cooling – principle, process, mechanism, equipment, advantages, limitations	1
2.4	Commercial forced air-cooling methods, product moisture loss and producecooling pattern with forced air cooling	1
2.5	heat load; hydrocooling of fruits and vegetables – hydrocooling rate, methods; evaporative cooling (EC)	1
2.6	thermodynamics and psychrometric of EC process, types of EC system, limitations, maintenance and design	2
3.0	**Transportation of Food products**	
3.1	Hypobaric storage	1
3.2	Mode of action, transport	1
3.3	Effect on fruits and vegetables	1
3.4	Case studies on raw horticultural commodities and processed products	2
3.5	Vacuum infiltration and cooling, hyperbaric storage	1
3.6	Case studies on raw horticultural commodities and processed products	1
4.0	**Controlled Atmospheric Conditions**	
4.1	Controlled atmosphere (CA) – changes during storage	1
4.2	Biochemical considerations, gas exchange mechanism	1
4.3	Equipment for producing and regulation CA	1
4.4	Design, construction and operation on raw horticultural commodities and processed products	1
4.5	Gas measurement and control technology	1
4.6	Effect of gas atmosphere and interactions	1
4.7	MAP – techniques, polymeric film properties, gas and vapour applied to MA process operation	1
4.8	Effect on shelf life of fruits and vegetables	2
4.9	MAP design with O2 modeling, chilling injury, control of temperature, absorbers	1
5.0	**Handling and Storage of food products**	
5.1	Handling of common fruits and vegetables	1
5.2	Recommended storage conditions for various fruits	1
5.3	Recommended storage conditions for various vegetables	1
5.4	Storage and transportation of fruits - citrus, sub-tropical, pears, grapes,plums, cherries, peaches, apricot and berries	2
5.5	Vegetables – artichokes, asparagus, corn, cucumber, eggplant, garlic, lettuce	1
5.6	Vegetables - melon, mushroom, okra, onion, parsnip, parsley, peas, pepper,potato, spinach, canned foods	2
5.7	Transport. – sea, CA, hypobaric, MA – case studies	1

Course Designer(s)

Dr.K. Balasubramani - balasubramanik@ksrct.ac.in

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

60 FT E44	Technology of Snacks and Extruded Products	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand the scope and types of snack products in India
- To learn the different types and flavouring the method of Pop-corn
- To study the production and quality parameters of Potato and Rice based snacks
- To explain the types and importance of Extruder products.
- To study the pasta making process and its importance in Food industry

Pre-requisites

Nil

Course Outcomes

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

CO1	Understand the Importance of Snack industry and the different methods snacks in Indian scenario.	Understand
CO2	Summarize the process of dry and oil popping and flavouring process in popcorn.	Remember
CO3	Illustrate the process and Production of Potato and rice-based snack products.	Apply
CO4	Exemplify the Process and production of second and third generation extruder snack products.	Apply
CO5	Illustrate the Types and Production of Pasta along with its formulations.	Analyze

Mapping with Programme Outcomes

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	-	-	3	3	-	2	2	-	3	3	3	2
CO2	2	2	3	-	-	3	3	-	-	-	-	3	3	3	2
CO3	1	3	3	-	-	3	3	-	2	2	-	3	3	3	2
CO4	2	3	3	-	-	3	3	-	-	-	-	3	3	3	2
CO5	3	3	3	-	-	3	3	-	2	2	-	3	3	3	2
3 - Strong; 2 - Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	30	20	30
Understand	30	20	30
Apply	-	20	20
Analyze	-	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 FT E44 - Technology of Snacks and Extruded Products								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Introduction Current status of snack food industry in India. Types of snack food- Raw Vegetable Snack, Formed dough products from potato and maize derivatives, 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 flavoring substances.	[9]
Corn Based Snacks** Popcorn – Popping methods, oil popping and dry popping. Commercial and industrial popcorn process. Flavorings and Applicators. Tortilla chip processing – Corn soaking, steeping, milling, Sheeting and Cutting, Baking and Frying, cooling, addition of flavor. Corn puff – production process.	[9]
Potato and Rice based Snacks** Potato chips production process: 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 – Puffed rice, flaked rice, papad production, Products using flours.	[9]
Extrusion Technology* Extruder components – Single and Twin screw, Single and Multiple die extruders. Functions and advantages of extruded Technology, Second generation and Third generation snacks, Co extruded snacks, Masala based snack	[9]
Pasta and other Products** Overview of pasta making process, Types of Pasta products, Production process of Spaghetti, noodles and macaroni. Pretzel – Types – Formulation and Processing - mixing, extrusion, proofing, cooking, surface salting, baking and drying, Flat and crisp bread.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Edmund W. Lusas and Lloyd W. Rooney, “Snack Food Processing”, 1st Edition, CRC Press, Florida, 2001.
2.	Robin Guy, “Extrusion cooking: Technologies and Applications”, 1st Edition, CRC Press, Florida, 2001
Reference(s):	
1.	Panda H.,”The Complete Technology Book on Snack Foods”, National Institute of Industrial Research, New Delhi, 2003.
2.	Sergio O. Serna- Saldivar, “Industrial Manufacture of Snack Food”, Woodhead Publishing, New Delhi, 2008.
3.	Jean Marie Bouvier Osvaldo H. Campanella. “Extrusion Processing Technology: Food and Non Food Biomaterials”,John Wiley & Sons, Ltd. 2014.
4.	Fast R.B. and Caldwell E.F. “Breakfast Cereals and How they are made. American Association of Cereal Chemists”, St. Paul, Minnesota, 2000 .

*SDG 9 – Industry Innovation and Infrastructure

**SDG 3 – Good Health and Well Being

Passed in BoS Meeting held on 22.05.24

Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction:**	
1.1	Current status of snack food industry in india	1
1.2	Types of snack food- raw vegetable snack, formed dough products from Potato and maize derivatives,	2
1.3	Directly expanded extruded snack, puffed snacks and other.	2
1.4	Types and functions of ingredients – structure forming materials,	1
1.5	Dispersed phase/filling materials, plasticizers/lubricants,	1
1.6	Soluble solids, nucleating substances,.	1
1.7	Colouring and flavouring substances	1
2.0	**Corn Based Snacks:**	
2.1	Popcorn – Popping methods, oil popping and dry popping.	2
2.2	Commercial and industrial popcorn process.	2
2.3	Flavorings and Applicators.	1
2.4	Tortilla chip processing – Corn soaking, steeping,	1
2.5	Milling, Sheeting and Cutting,	1
2.6	Baking and Frying, cooling, addition of flavor.	1
2.7	Corn puff – production process.	1
3.0	**Potato and Rice based Snacks:**	
3.1	Potato chips production process: Pre cleaning and peeling, slicing,	2
3.2	Drying/frying, salting and seasoning, quality control.	1
3.3	Fabricated potato snacks – potato flak3es, potato granules	1
3.4	Potato starch, ground and crushed dehydrated potato.	1
3.5	Rice based Snacks	1
3.6	Products using whole grains – Puffed rice,	1
3.7	Flaked rice, papad production,	1
3.8	Products using flours.	1
4.0	**Extrusion Technology:**	
4.1	Extruder components – Single and Twin screw,	2
4.2	Single and Multiple die extruders.	2
4.3	Functions and advantages of extruded Technology,	2
4.4	Second generation and Third generation snacks,	1
4.5	Co extruded snacks,	1
4.6	Masa based snack	1
5.0	**Pasta and other Products:**	
5.1	Overview of pasta making process,	1
5.2	Types of Pasta products,	1
5.3	Production process of Spaghetti, noodles and macaroni.	2
5.4	Pretzel – Types – Formulation and Processing - mixing, extrusion,	2
5.5	proofing, cooking, surface salting, baking and drying,	2
5.6	Flat and crisp bread.	1

Course Designer(s)

Dr. J. Philip Robinson -hodft@ksrct.ac.in

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

60 FT E45	Food Quality Assurance and Quality Control	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To give students a thorough understanding of food quality assurance and control in the food industry.
- To introduce the key concepts of quality assurance in food production, including Total Quality Management (TQM), Hazard Analysis and Critical Control Points (HACCP), and Good Manufacturing Practices (GMP).
- To provide students with the knowledge and skills to carry out food quality control methods, such as sampling, analytical techniques, and microbiological testing.
- To give students a basic understanding of statistical methods in food quality assurance, including statistical process control (SPC), control charts, and data analysis for improvement.
- To help students become familiar with food quality management systems (like TQM and Six Sigma) and auditing processes for meeting quality standards and gaining certification.

Pre-requisites

NIL

Course Outcomes

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

CO1	Explain the role of food quality assurance and control in maintaining food safety and meeting consumer expectations.	Understand
CO2	Apply principles of TQM, HACCP, and GMP to ensure food safety and quality during production.	Apply
CO3	Demonstrate proficiency in sampling techniques, analytical methods, and microbiological testing to assess food quality.	Apply
CO4	Use statistical methods like statistical process control (SPC) and control charts to monitor and enhance food quality processes.	Apply
CO5	Identify and implement continuous improvement strategies within food quality management systems to boost product quality and compliance.	Analyze

Mapping with Programme Outcomes

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	-	-	-	-	-	-	2	2	-	-	-	-	2
CO2	3	-	-	-	-	-	-	-			-	-	-	-	2
CO3	3	-	-	-	-	-	-	-	2	2	-	-	-	-	2
CO4	3	-	-	-	-	-	-	-			-	-	-	-	2
CO5	3	-	-	-	-	-	-	-	2	2	-	2	-	-	2
3 - Strong; 2 - Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	20
Understand	30	30	40
Apply	10	10	30
Analyze	-	-	10
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B. Tech Food Technology

60 FT E45 - Food Quality Assurance and Quality Control

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Introduction to Food Quality Assurance and Quality Control Overview of food quality assurance and quality control, Importance of quality assurance and quality control in the food industry, Historical perspective and evolution of food quality management systems, Objectives and goals of food quality assurance and quality control, Regulatory frameworks and standards governing food safety and quality	[9]
Principles of Food Quality Assurance* Principles and concepts of quality assurance in food production, Principles of Total Quality Management (TQM) in the food industry, Hazard Analysis and Critical Control Points (HACCP) principles and implementation, Good Manufacturing Practices (GMP) and their role in ensuring food safety and quality, Quality management systems: ISO 9000 series standards and their application in the food industry	[9]
Food Quality Control Methods and Techniques* Sampling techniques and sample preparation in food quality control, Analytical methods for assessing food quality parameters: Analytical methods for assessing physical quality parameters (texture, color), Chemical analysis methods for evaluating composition (moisture content, fat content, nutritional compound), Microbiological testing methods for assessing microbial safety and quality, Instrumentation and equipment used in food quality control laboratories.	[9]
Statistical Methods in Food Quality Assurance Basic statistical concepts and their application in quality assurance, Statistical process control (SPC) techniques for monitoring and controlling food production processes, Control charts for monitoring process variation (X-bar and R charts, control limits), Sampling plans and acceptance sampling techniques (attribute sampling, variable sampling), Data analysis and interpretation for continuous improvement in food quality management, Application of statistical methods in food quality assurance and control decision-making.	[9]
Food Quality Management Systems and Auditing Overview of food quality management systems (Total Quality Management, Six Sigma), Internal auditing procedures for assessing compliance with quality standards, External auditing processes for achieving certification (e.g., ISO 22000, HACCP); Food safety audits: GFSI-approved schemes (BRC, SQF, FSSC 22000), Corrective and preventive actions (CAPA) and root cause analysis in response to quality deviations; Continuous improvement strategies for enhancing food quality management systems	[9]
Total Hours:	**45**

Text Book(s):

1. Hubbard, M. R. *Statistical quality control for the food industry*. Springer Science & Business Media. 2012.
2. Alli, I. *Food quality assurance: principles and practices*. CRC Press. 2003.

Reference(s):

1. Motarjemi, Y., & Lelieveld, H. *Food Safety Management: A Practical Guide for the Food Industry*. Elsevier. 2014
2. Nielsen, S. S. (Ed.). *Food analysis* (Vol. 86). Gaithersburg: Aspen Publishers. 1998.

* SDG 12 – Responsiple Consumption and Production

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Food Quality Assurance and Quality Control**	
1.1	Overview of food quality assurance	1
1.2	Overview of food quality control	1
1.3	Importance of quality assurance in the food industry	1
1.4	Importance of quality control in the food industry,	1
1.5	Historical perspective and evolution of food quality management systems	2
1.6	Objectives and goals of food quality assurance	1
1.7	Objectives and goals of quality control.	1
1.8	Regulatory frameworks and standards governing food safety and quality	1
2.0	**Principles of Food Quality Assurance**	
2.1	Principles and concepts of quality assurance in food production	1
2.2	Principles of Total Quality Management (TQM) in the food industry	2
2.3	Hazard Analysis and Critical Control Points (HACCP) principles and Implementation	2
2.4	Good Manufacturing Practices (GMP) and their role in ensuring food safety and quality	2
2.5	Quality management systems: ISO 9000 series standards and their application in the food industry	2
3.0	**Food Quality Control Methods and Techniques**	
3.1	Sampling techniques and sample preparation in food quality control	1
3.2	Analytical methods for assessing food quality parameters: Analytical methodsfor assessing physical quality parameters (texture, color)	2
3.3	Chemical analysis methods for evaluating composition (moisture content, fat content, nutritional compound)	2
3.4	Microbiological testing methods for assessing microbial safety and quality	2
3.5	Instrumentation and equipment used in food quality control laboratories	2
4.0	**Statistical Methods in Food Quality Assurance**	
4.1	Basic statistical concepts and their application in quality assurance	1
4.2	Statistical process control (SPC) techniques for monitoring and controlling food production processes	2
4.3	Control charts for monitoring process variation (X-bar and R charts, control limits)	2
4.4	Sampling plans and acceptance sampling techniques (attribute sampling, variable sampling)	2
4.5	Data analysis and interpretation for continuous improvement in food quality Management	1
4.6	Application of statistical methods in food quality assurance and control decision-making.	1
5.0	**Food Quality Management Systems and Auditing**	
5.1	Overview of food quality management systems (Total Quality Management, Six Sigma)	2
5.2	Internal auditing procedures for assessing compliance with quality standards	1
5.3	External auditing processes for achieving certification (e.g., ISO 22000, HACCP)	1
5.4	Food safety audits: GFSI-approved schemes (BRC, SQF, FSSC 22000)	2
5.5	Corrective and preventive actions (CAPA) and root cause analysis inresponse to quality deviations	2
5.6	Continuous improvement strategies for enhancing food quality management Systems	1

Course Designer(s)

1. Dr. P. Shanmugam – shanmugam@ksrct.ac.in

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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60 FT E46	Industrial Production of Bun, Bread, Cakes and Pastries	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand the complete process of industrial bread making
- To learn the role of ingredients and machines in bread making.
- To understand cake formulation and baking techniques
- To study various cake mixing methods and process technologies
- To explore various types of pastry and their preparation methods

Pre-requisites

Nil

Course Outcomes

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

CO1	Identify key stages like mixing, fermentation, baking.	Understand
CO2	Recognize importance of additives and key machinery in production.	Understand
CO3	Identify ingredients' roles and analyze common cake faults	Apply
CO4	Distinguish different cake types and appropriate mixing methods	Analyze
CO5	Identify types of pastries and understand key preparation techniques	Understand

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	20
Understand	40	30	40
Apply	-	10	20
Analyze	-	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech Food Technology

60 FT E46 - Industrial Production of Bun, Bread, Cakes and Pastries

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Bread Making Process Status of bakery industry. Bread formulation, basic bread making procedure - mixing Fermentation, proofing and baking. Raw material receiving – quality check- batch making (addition of ingredients with respective proposition) – kneading – molding – panning - Proofing – baking – cooling – slicing – packing. Advantages and limitations of various bread processes.	**[9]**
Ingredients & Bread Making Machines* Role of ingredients, additives and improvers in bread making. Chemical leavening agents- baking powder, sodium bicarbonate, ammonium bicarbonate cream of tartar. Different types of bread - methods of bread preparation - quality aspects of bread and standards. Dividers – Construction, dividing principle and operation. Rounders - Construction, rounding principle and operation.	**[9]**
Baking of Cakes Role of ingredients - flours, oils and fats, eggs, sugar, dried fruits and nuts- types of cakes - methods of mixing - preparation of fancy cakes and techniques - quality - cake faults and remedies. Heat transfer in the oven, mixing and delivery of batter – batch & continuous mixers, depositing the batter, baking ovens- band, tunnel & reel ovens*	**[9]**
Mixing Methods and Processing Technology of Cakes Shortening style cakes, creaming method, flour batter method, single stage, emulsion, continuous batter mixing, foam style cakes – angel food, sponge, chiffon, genoise cake. Types of cakes, formula balance in cake, production of cakes and pastry - mixing, baking, cooling and packaging. Cakes faults - shape, structure, texture, crust and colour faults. Remedies of cake faults.	**[9]**
Pastry Basic formulation - different types - flaky, puff and danish pastry- bakery products that combines flour and fat. Pie - types and methods. Preparation methods of danish pasties and the role of ingredients used. Cold and hot pastries	**[9]**
Total Hours:	**45**

Text Book(s):	
1.	Cauvain, Stanley P., and Young, Linda S., "Technology of Bread making", Third Edition, 2015.
2.	Zhou, Weibiao, and Hui, Y. H., "Bakery Products Science and Technology", Second Edition, 2014.
Reference(s):	
1.	Pyler, E.J., and Gorton, Laurie, "Baking Science and Technology: Volume 1 – Fundamentals & Ingredients", Fourth Edition, 2008.
2.	Campbell, Grant M., et al., "Bread: The Chemistry of Bread Making", First Edition, 2007.
3.	Cauvain, Stanley P., "Bread Making: Improving Quality", Second Edition, 2012.

***SDG 9 – Industry Innovation and Infrastructure**

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Bread Making Process**	
1.1	Status of bakery industry	1
1.2	Bread formulation, basic bread making procedure	1
1.3	mixing Fermentation, proofing and baking	1
1.4	Raw material receiving – quality check	2
1.5	batch making (addition of ingredients with respective proposition)	1
1.6	kneading – molding – panning	1
1.7	Proofing – baking – cooling – slicing – packing	1
1.8	Advantages and limitations of various bread processes	1
2.0	**Ingredients & Bread Making Machines**	
2.1	Role of ingredients, additives and improvers in bread making	2
2.2	Chemical leavening agents- baking powder	1
2.3	sodium bicarbonate	1
2.4	ammonium bicarbonate cream of tartar	1
2.5	Different types of bread - methods of bread preparation	1
2.6	quality aspects of bread and standards	1
2.7	Dividers – Construction, dividing principle and operation	1
2.8	Rounders - Construction, rounding principle and operation	1
3.0	**Baking of Cakes**	
3.1	Role of ingredients – flours, oils and fats, eggs, sugar, dried fruits and nuts	2
3.2	types of cakes – methods of mixing	1
3.3	preparation of fancy cakes and techniques	1
3.4	Cake quality	1
3.5	cake faults and remedies	1
3.6	Heat transfer in the oven, mixing and delivery of batter	1
3.7	batch & continuous mixers, depositing the batter	1
3.8	baking ovens- band, tunnel & reel ovens	1
4.0	**Mixing Methods and Processing Technology of Cakes**	
4.1	Shortening style cakes, creaming method	1
4.2	flour batter method, single stage	1
4.3	emulsion, continuous batter mixing	1
4.4	foam style cakes – angel food, sponge, chiffon, genoise cake	1
4.5	Types of cakes, formula balance in cake	1
4.6	production of cakes and pastry - mixing, baking, cooling and packaging	2
4.7	Cakes faults - shape, structure, texture, crust and colour faults	1
4.8	Remedies of cake faults	1
5.0	**Pastry**	
5.1	Basic formulation - different types	1
5.2	flaky, puff and danish pastry	1
5.3	bakery products that combines flour and fat	1
5.4	Pie - types and methods	2
5.5	Preparation methods of danish pasties and the role of ingredients used	2
5.6	Cold and hot pastries	2

Course Designer(s)

1. Ms. T. Swathy - swathyt@ksrct.ac.in

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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60 FT E47	Cane Sugar Technology	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To know about an outline of sugar industry
- To gain knowledge on machinery and process involved in sugarcane technology
- To identify sugar cane constituents and apply pre-processing operations
- To recommend suitable cane juice extraction and processing method
- To apply the acquired knowledge for manufacturing of cane sugar by-products

Pre-requisites

- **Nil**

Course Outcomes

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

CO1	Study about the overview of sugar industry and identify different methods for harvesting	Remember
CO2	Recognize the extraction and clarification methods of cane juice	Understand
CO3	Discuss about the different method of filtration and concentration process	Analyze
CO4	Exemplify the crystallization methods and refining factors in sugar production	Apply
CO5	Study about the by-product management and manufacture of jaggery and gur	Understand

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	20
Understand	40	20	40
Apply	-	20	30
Analyze	-	10	10
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech. Food Technology

60 FT E47 - Cane Sugar Technology

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Introduction Overview of Sugar industry: Sugarcane, Constituents, Type of Sugar cane: Harvesting indices. Cane cutting: Manual, Mechanical. Transportation: loading, unloading. Cane conveyor: Washing, Shredders, Types.	[9]
Juice Extraction and Clarification Crushing: Types of Crushers, Crushing efficiency, Extraction of juice: methods, accumulators: types, Maceration, Theory of cane diffusivity: Types of diffuser, weighing of juice, Maxwell Boulogne Scale and Magnetic Flow meter. Clarification; methods, clarifying agents and its importance. Bleaching agents. lime; specification, storage. Milk of lime, rotary lime slacker, hydrated lime powder.	[9]
Juice Filtration and Concentration Filtration of mud - Filter types - filter press, rotary vacuum filter,Rapi – Floc process. Filter cake washing. 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]
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]
By-products and processing of unrefined sugars* By-products: Drying and uses of Bagasse, Back strap Molasses, Characteristics of Molasses. Direct Utilization of Molasses, Distilling Industries, Applications in animal feed, Biogas, Bio fertilizers production, Inverted syrup. Jaggery and Gur production: Extraction of Juice, Clarification of Gur, Concentration of Juice, Drying and grading of Gur, Storage of Gur, Production of sugar from palm and coconut.	[9]
Total Hours	**45**

Text Book(s):

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.

Reference(s):

1.	Chung Chi Chou, —"Handbook of Sugar Refining: A Manual for the Design and Operation of Sugar RefiningFacilities", John Wiley and Sons, 2000.
2.	Jenkins, George Horner. "Introduction to cane sugar technology". Elsevier, 2013
3.	Paturau J.M., —"By-Products of the Cane Sugar Industry", 2nd Edition, Elsevier Publishing Company, New York, 1989.
4.	Baikow V.E., —"Manufacturing and Refining of Raw Cane Sugar", 2nd Edition, Volume - I and II, Elsevier Publishing Company, New York, 1967.

***SDG 3 – Good Health and Well Being**

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Overview of Sugar industry: Sugarcane, Constituents	2
1.2	Type of Sugar cane	1
1.3	Harvesting indices	1
1.4	Cane cutting: Manual, Mechanical.	2
1.5	Transportation: loading, unloading.	1
1.6	Cane conveyor: Washing, Shredders, Types.	2
2.0	**Juice Extraction and Clarification**	
2.1	Crushing: Types of Crushers, Crushing efficiency	2
2.2	Extraction of juice: methods, accumulators: types, Maceration	2
2.3	Theory of cane diffusivity: Types of diffuser, weighing of juice	1
2.4	Maxwell Boulogne Scale and Magnetic Flow meter.	1
2.5	Clarification; methods, clarifying agents and its importance.	1
2.6	Bleaching agents. lime; specification, storage.	1
2.7	Milk of lime, rotary lime slacker, hydrated lime powder.	1
3.0	**Juice Filtration and Concentration**	
3.1	Filtration of mud - Filter types - filter press	2
3.2	rotary vacuum filter, Rapi – Floc process	1
3.3	Filter cake washing. Concentration	1
3.4	Importance: types of heaters, construction and working of tubular heater,	1
3.5	Direct Contact Heater (DCH),	1
3.6	Plate Heater (PHE),	1
3.7	Advantages and disadvantages	1
3.8	Evaporator, types, performance measures	1
4.0	**Crystallization and Refining**	
4.1	Sugar boiling, Nucleation and crystal growth,	1
4.2	super saturation and meta stable stage,	1
4.3	Seeding, shock seeding, true seeding.	1
4.4	Crystallizers. Refining, Brown sugar, importance of refining,	1
4.5	Affination, clarification,	1
4.6	carbonation, sulphitation,	1
4.7	phosphitation, decolorization,	1
4.8	Centrifugation, dewatering of sugar.	1
4.9	Drying, Bagging and storage. Factors affecting sugar refining process.	1
5.0	**By-products and processing of unrefined sugars**	
5.1	By-products: Drying and uses of Bagasse,	1
5.2	Back strap Molasses, Characteristics of Molasses.	1
5.3	Direct Utilization of Molasses, Distilling Industries,	1
5.4	Applications in animal feed, Biogas, Bio fertilizers production, Inverted syrup.	2
5.5	Jaggery and Gur production: Extraction of Juice,	1
5.6	Clarification of Gur, Concentration of Juice,	1
5.7	Drying and grading of Gur, Storage of Gur,	1
5.8	Production of sugar from palm and coconut.	1

Course Designer(s)

1. Ms. P. Aarthi -aarthi@ksrct.ac.in

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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PROFESSIONAL ELECTIVE - V

60 FT E51	Food Allergy and Toxicology	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To know the basics concept of food allergens and toxicology and their mechanism.
- To recognize the allergic reaction and their symptoms and disorder
- To familiarize the concept, types and factors responsible for toxicity.
- To understand the types of toxicants produced from food processing.
- To realize the foundational understanding of assessment of toxicants in food samples.

Pre-requisites

Nil

Course Outcomes

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

CO1	To explain the importance of food allergens and toxicants and their mechanism of action in immune resources,	Understand
CO2	To identify and analyze the types allergic reaction and their symptoms of disease caused by allergens.	Understand
CO3	To demonstrate the basics and factors affecting toxicity ant to analyze how it is stored and excrete from blood and brain barrier.	Understand
CO4	To identify and assess the types of toxicants formed in processing of foods and able to analyze case studies about possible toxic effects.	Apply
CO5	Emphasis the importance of toxicants assessments by various methods and its risk, standard regulation for toxicants.	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	30
Understand	40	30	40
Apply	-	20	30
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B. Tech. Food Technology

60 FT E51 - Food Allergy and Toxicology

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100

Introduction about allergens and toxicology Definition and need for understanding food allergens and toxicology; Hazards - Microbiological, nutritional and environmental. Basics of immune resources - humoral and cell mediated resources. Allergen and mechanism of allergic resources. FDA approved common allergy food products.	[9]
Food Allergy and Sensitivity Natural sources and Chemistry of food allergens. Types of food sensitivities – Anaphylactoid reaction, Metabolic food disorders, Idiosyncratic reactions. Food disorders associated with metabolism, Lactose intolerance, Celiac disease, and asthma. Food allergy due to food additives: MSG, Sulfites. Typical symptoms related to food allergy.	[9]
Concept of Toxicology Principles of toxicology, classification of toxic agents - toxins of plant and animal origin-microbial toxins, Natural food toxicants - toxicity of pulses, mushroom alkaloids, seafood, vegetables and fruits. Biological factors that influence toxicity, toxin absorption in the G.I.track, storage and excretion of toxins and the components protects the toxins in Industrial microflora, blood, brain barrier.	[9]
Toxicants formed during Food Processing* Intentional direct additives - food preservatives, nitrate, nitrite, and N- nitroso compound flavour enhancers, food colours. 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 - possible toxic effects.	[9]
Assessment of Toxicants in Food Sampling Quantitative and qualitative analysis of toxicants in foods; Biological determination of toxicants Instrumental analysis of toxicants – ELISA and AAS. Assessment of food safety – Risk assessment and risk benefit indices of human exposure, acute toxicity, reproductive and developmental toxicity, neurotoxicity and behavioural effect, immunotoxicity, Standards and regulation related totoxins.	[9]
Total Hours:	**45**

Text Book(s):

1. Helferich, William and Carl K.Winter “Food Toxicology” CRC Press, 2001.
2. Alluwalia, Vikas “Food Hygiene and Toxicology” Paragon International Publishers, 2007

Reference(s):

1. Shibamoto, Taka yuki and Leonard F.Bjeldanzes “Introduction to Food Toxicology” 2ndEdition. Academic Press,
2. Maleki, Soheila J. A.Wesley Burks, and Ricki M.Helm, “Food Allergy”, ASM Press, 2006.
3. Cliver, Dean O. and Hans P.Riemann, “Food Borne Diseases”, 2nd Edition, Academic Press/Elsevier, 2002
4. Duffus, J.H., and Worth, H.G. J. “Fundamental Toxicology”, The Royal Society of Chemistry. 2006.

*SDG 3 – Good Health and Well Being

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction about allergens and toxicology**	
1.1	Definition and need for understanding - food allergens	1
1.2	Definition and need for understanding – Food toxicology	1
1.3	Hazards - Microbiological, nutritional	1
1.4	Hazards – environmental	1
1.5	Basics of immune resources - humoral resources	1
1.6	Basics of immune resources - cell mediated resources	1
1.7	Allergen and mechanism of allergic resources	1
1.8	FDA approved common allergy food products	2
2.0	**Food Allergy and Sensitivity**	
2.1	Natural sources and Chemistry of food allergens	2
2.2	Types of food sensitivities – Anaphylactoid reaction	1
2.3	Metabolic food disorders, Idiosyncratic reactions	1
2.4	Food disorders associated with metabolism, Lactose intolerance	2
2.5	Celiac disease, and asthma	1
2.6	Food allergy due to food additives: MSG, Sulfites	1
2.7	Typical symptoms related to food allergy	1
3.0	**Concept of Toxicology**	
3.1	Principles of toxicology, classification of toxic agents	1
3.2	toxins of plant and animal origin- microbial toxins	1
3.3	Natural food toxicants - toxicity of pulses, mushroom alkaloids	1
3.4	Toxicity of seafood, vegetables and fruits	1
3.5	Biological factors that influence toxicity	1
3.6	toxin absorption in the G.I.track	1
3.7	storage and excretion of toxins	1
3.8	components protect the toxins in Industrial microflora, blood, brain barrier	2
4.0	**Toxicants formed during Food Processing**	
4.1	Intentional direct additives - food preservatives, nitrate, nitrite, effects	2
4.2	N- nitroso compound flavour enhancers, food colours	1
4.3	Indirect additives - residues and contaminants, heavy metals	1
4.4	other organic residues and packaging materials	1
4.5	Toxicity of heated and processed foods	1
4.6	food carcinogens and mutagens – Polycyclic aromatic hydrocarbons	1
4.7	N – nitrosamines and their mode of action - possible toxic effects	1
4.8	Acrylamide and their mode of action - possible toxic effects	1
5.0	**Assessment of Toxicants in Food Sampling**	
5.1	Quantitative and qualitative analysis of toxicants in foods	1
5.2	Biological determination of toxicants Instrumental analysis of toxicants – ELISA and AAS	3
5.3	Assessment of food safety – Risk assessment	1
5.4	Risk benefit indices of human exposure, acute toxicity	1
5.5	reproductive and developmental toxicity	1
5.6	neurotoxicity and behavioural effect, immunotoxicity	1
5.7	Standards and regulation related totoxins	1

Course Designer(s)

1. Dr.K.Prabha- prabhak@ksrct.ac.in

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

60 FT E52	Food Processing Equipment Design	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To provide students with a basic knowledge about materials of construction, design
- To impart knowledge in pressure vessel design.
- To provide student the knowledge about design of sterilization equipment.
- To impart knowledge about design of heat exchangers.
- To provide student knowledge about dryers, mixers.

Pre-requisites

Nil

Course Outcomes

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

CO1	Know the importance of materials and mechanical properties in equipment design.	Understand
CO2	Analyse the process parameters and design of pressure vessels.	Analyze
CO3	Illustrate, analyse the process and design of sterilization equipment.	Analyze
CO4	Identify and comprehend the design of heat exchangers, evaporators.	Apply
CO5	Recognize different types and design of dryers and mixers.	Understand

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	30	30	40
Apply	10	10	60
Analyze	10	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech – Food Technology								
60 FT E52 - Food Processing Equipment Design								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100

Basic design considerations and materials of construction* Basic considerations in process equipment design. Materials of construction – mechanical properties and materials. Design considerations - stresses created due to static and dynamic loads. Process flow diagrams (PFD) – symbols used in PFD.Selection and importance of different food equipment.	[9]
Design of pressure vessels* Design conditions and stresses – design stress, design criteria, corrosion allowance. Design of a shell and its components – cylindrical and spherical shells, head, nozzles and flange thickness. Vessels subjected to internal pressure and combined loading – cylindrical shell and spherical shell, stresses induced in vessel. Vessels subjected to external pressure. Optimum proportions of a vessel and optimum vessel size.	[9]
Design of heat exchangers and evaporators* Types of heat exchangers – double pipe heat exchangers, shell and tube heat exchangers, and special types of heat exchangers. Design of shell and tube heat exchanger. Design of single effect, multiple effect evaporators.	[9]
Design of Dryers and mixers* Dryers: Types, General considerations, Design of Rotary Dryer, Tray dryer, Cabinet dryer, fluidized bed dryer, heat pump dryer, foam mat dryer, freeze dryer, Spray dryer: Equipment Ancillaries – Piping system – Flow control devices. Mixing devices, Types of agitators. Power requirements for agitation. Design of agitation system components – shaft design and agitator design.	[9]
Design of food extruders, sterilization equipment* Selection and importance of extruders in food industry, Design of food extruders - singleand twin-screw extruders. Over view of sterilization, Design of batch sterilization processes - Calculation of the Del factor during heating and cooling, Calculation of the holding time atconstant temperature - Richards' rapid method for the design of sterilization cycles, The scale up of batch sterilization processes.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Mahajani V.V and Umarji S.B. “Joshi’s process equipment design”. Trinity Press. New Delhi, 2014.
2.	Shrikant D Dawande. “Process design of equipments”. Central Techno Publications, Nagpur, 2005.
Reference(s):	
1.	Singh &Heldman.”Introduction to Food Engineering”. Academic Press – Elsevier India Private Ltd. New Delhi, 2013.
2.	Jasim Ahmed, Mohammad Shafuir Rahman “Handbook of Food Process Design, 2 volume Set” Wiley-Blackwell, April 2012.
3.	Doran P. M., Bioprocess Engineering Principles, Academic Press, 1995.
4.	Maroulis Z.B. and Saravacos G.D. “Food Process Design”, Marcel Dekker Inc. 2003.

*SDG 9 – Industry Innovation and Infrastructure

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Basic design considerations and materials of construction**	
1.1	Basic considerations in process equipment design	2
1.2	Materials of construction – mechanical properties	1
1.3	Materials of construction – materials	1
1.4	Design considerations - stresses created due to static loads.	1
1.5	Design considerations - stresses created due to dynamic loads.	1
1.6	Process flow diagrams (PFD)	1
1.7	symbols used in PFD	1
1.8	Selection and importance of different food equipment	1
2.0	**Design of pressure vessels**	
2.1	Design conditions and stresses – design stress	1
2.2	Design conditions and stresses – design criteria	1
2.3	Design conditions and stresses – corrosion allowance	1
2.4	Design of a shell and its components – cylindrical and spherical shells	1
2.5	Design of a shell and its components –head, nozzles and flange thickness	1
2.6	Vessels subjected to internal pressure and combined loading	1
2.7	stresses induced in vessel	1
2.8	Vessels subjected to external pressure	1
2.9	Optimum proportions of a vessel and optimum vessel size	
3.0	**Design of heat exchangers and evaporators**	
3.1	Types of heat exchangers – double pipe heat exchangers	1
3.2	Types of heat exchangers – shell and tube heat exchangers	1
3.3	Types of heat exchangers – special types of heat exchangers	1
3.4	Design of shell and tube heat exchanger	2
3.5	Design of single effect	2
3.6	multiple effect evaporators	2
4.0	**Design of Dryers and mixers**	
4.1	Dryers: Types, General considerations	1
4.2	Rotary Dryer, Tray dryer	1
4.3	foam mat dryer, Cabinet dryer	1
4.4	fluidized bed dryer	1
4.5	heat pump dryer	1
4.6	freeze dryer	1
4.7	Spray dryer: Equipment Ancillaries – Piping system – Flow control devices	1
4.8	Types of agitators. Power requirements for agitation	1
4.9	Design of agitation system components – shaft design and agitator design	1
5.0	**Design of food extruders, sterilization equipment**	
5.1	Selection and importance of extruders in food industry	1
5.2	Design of food extruders - single and twin-screw extruders.	2
5.3	Overview of sterilization	1
5.4	Design of batch sterilization processes	1
5.5	Calculation of the Del factor during heating and cooling	1
5.6	Calculation of the holding time at constant temperature	2
5.7	Richards' rapid method for the design of sterilization cycles	1

Course Designer(s)

1. Dr.A.S.Ruby Celsia – rubycelsia@ksrct.ac.in

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

60 FT E53	Fruit and Vegetable Industry Safety and Laws	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand the various food laws
- To identify functions of food safety management systems
- To know on food laws and safety in food processing
- To Understand the Basics of food and their spoilage
- To know the Importance of food Safety.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Identify the Agency responsible for legislation & implementation when facing a problem concerning fruits and vegetables	Understand
CO2	Elaborate on the relevant legislation/standard for a fruits and vegetables based product	Apply
CO3	Assess the meaning of what is written in the relevant legislation when facing a problem concerning fruits and vegetables	Apply
CO4	Propose to pertinent Authorities amendments to existing legislation/standard whenever it seems justifiable	Understand
CO5	Assess the importance of food safety.	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination(Marks)
	1	2	
Remember	20	20	30
Understand	30	30	50
Apply	10	10	20
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech. Food technology

60 FT E53 - Fruit and Vegetable Industry Safety and Laws

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100

Necessity of Law in Fruit and Vegetable Processing Industry 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. PFA; 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; 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]
Food Safety in Processing Fruit and vegetable processing industry - Building and equipment design; microbiological quality of fruit and vegetable products, air; Safety in food procurement, storage, handling and manufacture; Food safety in retail fruit and vegetable product businesses; international food service operators, institutional food service operators; application of the principals of modern hygiene; Food handlers, habits, clothes, illness	[9]
Key Safety Principles Fruit and vegetable processing industry - Training & Education for safe methods of handling fruits and vegetables; 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]
Food Safety Management System** Fruit and vegetable processing industry - Physical, chemical and Microbial hazards and their control in food industry; Quality systems standards including ISO; - ISO 9000; total quality management (TQM); hazard analysis of critical control points (HACCP); good manufacturing practices (GMP)	[9]
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. Concepts and trends in food legislation, Information-Domination in the European Food Industry, Agriculture, Ethics and Law, WHO in Global Food Safety Governance, The Right to Food in International Law with Case Studies. Intellectual Property and Food Labelling: Trademarks and Geographical Indications, Agricultural Innovation: Patenting and Plant Variety Rights Protection, Cross-Contamination, Genetic Drift, and GMO Co-existence with Non-GM Crops, Legal Barriers to International Food Trade, food policies.	[9]
Total Hours:	**45**

Text Book(s):

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

Reference(s):

1. Mehta, Rajesh and J. George —Food Safety Regulations, Concerns and Trade: The Developing Country Perspective□, Macmillan, 2005.
2. The Prevention of Food Adulteration Act, 1954□, Commercial Law Publishers India) Pvt. Ltd.

**SDG 3 – Good Health and Well Being

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

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BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	Necessity of law in fruit and vegetable processing industry	
1.1	Establishment of US Pure Food Law in early 1900s and of Food & Drug Administration to enforce safety of food products	1
1.2	Urbanisation of population and necessity of processed and preserved foods and the necessity of ensuring quality of food to prevent adulteration	1
1.3	PFA; Various aspects of defining adulteration	1
1.4	Taking samples of food for analysis by public analyst, prosecution for adulteration and punishment	1
1.5	Standards of various food products; FPO; Use of permitted additives like colours, preservatives, emulsifiers, stabilisers, antioxidants etc.	1
1.6	Food Safety & Standards Act 2006	2
1.7	The provisions therein Act; Integrated Food Law	1
1.8	Multi departmental, multilevel to single window control system, consumer protection Act.	1
2.0	Food safety in processing	
2.1	Fruit and vegetable processing industry	2
2.2	Building and equipment design; microbiological quality of fruit and vegetable product	2
2.3	Safety in food procurement, storage, handling and manufacture	1
2.4	Food safety in retail fruit and vegetable product businesses; international food service operators	1
2.5	Institutional food service operators	1
2.6	Application of the principals of modern hygiene; Food handlers, habits, clothes, illness	2
3.0	Key safety principles	
3.1	Fruit and vegetable processing industry - Training	1
3.2	Education for safe methods of handling fruits and vegetables	1
3.3	Cleaning and sanitization of processing plants	1
3.4	Principles of cleaning and sterilization	2
3.5	Sterilization & disinfection- different methods used-detergents, heat, chemicals; selecting and installing equipment	1
3.6	Cleaning of equipment and premises	1
3.7	Safety limits of sanitizers	1
3.8	pest control; management and disposal of waste	1
4.0	Food safety management system	
4.1	Fruit and vegetable processing industry	1
4.2	Physical hazards	1
4.3	Chemical hazards	1
4.4	Microbial hazards	1
4.5	Control in food industry	1
4.6	Quality systems standards	1
4.7	ISO 9000	1
4.8	Total quality management (TQM)	2
4.9	Hazard analysis of critical control points (HACCP); good manufacturing practices (GMP)	1
5.0	Management	
5.1	Good Manufacturing Practice and HACCP, Surveillance networks	1
5.2	Consumer and food service operator education; GM Foods, safety and labelling.	1
5.3	International Food Standards ISO 9000 and related standards; Impact of food safety on global trade	1
5.4	Concepts and trends in food legislation, Information-Domination in the European Food Industry, Agriculture, Ethics and Law, WHO in Global Food Safety Governance, The Right to Food in International Law with Case Studies	2
5.5	Intellectual Property and Food Labelling: Trademarks and Geographical Indications, Agricultural Innovation	1
5.6	Patenting and Plant Variety Rights Protection, Cross-Contamination, Genetic Drift, and GMO Co-existence with Non-GM Crops	2
5.7	Legal Barriers to International Food Trade, food policies	1

Course Designer(s)

Mr.G. Bharath - bharathg@ksrct.ac.in

Passed in BoS Meeting held on 22.05.24

Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

60 FT E54	Energy Management in Modern Food Process Industries	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- Develop a comprehensive understanding of various energy sources and their classifications, with a specific emphasis on renewable energy alternatives
- To introduce students to the principles and applications of renewable energy sources
- Gain insight into energy units, perspectives, and norms, and their significance in energy management practices, enabling students to evaluate and optimize energy usage effectively
- To Learn about energy accounting methods and the design of energy management systems to enhance overall energy performance in various industrial settings
- To Acquire knowledge of energy and water conservation technologies applicable to food processing industries

Pre-requisites

Nil

Course Outcomes

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

CO1	Understanding of different energy sources and their classifications, focusing on renewable energy alternatives.	Understand
CO2	Introduced to the principles and applications of renewable energy sources, with a focus on biomass.	Remember
CO3	Understanding of energy units, perspectives, and norms, and their role in energy management.	Understand
CO4	Learn about energy accounting methods and the design of energy management systems.	Apply
CO5	Equipped with knowledge of energy and water conservation technologies applicable to food processing facilities.	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	20
Understand	40	30	40
Apply	-	10	20
Analyze	-	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 FT E54 - Energy Management in Modern Food Process Industries								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100

Classification of Energy Sources Classification of energy sources; Introduction to renewable energy sources; characterization of biomass; types, construction, working principle, usages and safety environmental aspects of different renewable energy devices like gasifiers, biogas plants	[9]
Introduction to Renewable Energy Sources* Solar passive heating devices, photovoltaic cells and arrays, Phase Changing Materials; Brief Introduction to wind energy, hydroelectric energy, ocean energy, briquetting and baling of biomass, biomass combustion, biodiesel preparation and energy conservation in agriculture	[9]
Energy Forms and Units; Energy Perspective and Norms Energy forms and units, energy perspective, norms and scenario; energy audit and management in agro-processing units, data collection and analysis for energy conservation in food processing industries. Non-conventional energy sources in agro-processing industries	[9]
Energy Accounting and Management Systems Rescue and calculation of used steam, hot water, chimney gases and cascading of energy sources, Energy accounting methods, measurements of energy, design of computer-based energy management systems, economics of energy use.	[9]
Energy and Water Conservation Technologies in Food Processing Facilities* Energy and Water Conservation Technologies Applied to Food Processing Facilities: Conservation in steam generation and consumption system, energy conservation in heat exchangers, conservation in compressed air system, conservation in power and electrical systems, waste-heat recovery and thermal energy storage in food processing facilities, building envelop audit, energy consumption and saving opportunities.	[9]
Total Hours:	**45**

Text Book(s):	
1.	A. Hosier,"Energy Management in the Food Industry" Woodhead Publishing, 2009
2.	Connelly R. J., "Energy Efficiency and Management in Food Processing Facilities", CRC Press 2018.
Reference(s):	
1.	Haghighat F., Singal J. K., Abou-Ziyan M., "Handbook of Energy Efficiency in Buildings: A Life Cycle Approach" CRC Press 2018.
2.	Zeki Berk, "Food Process Engineering and Technology" Academic Press, 2018.
3.	Turner W. C.,. Doty S. D, "Energy Management Handbook" The Fairmont Press, 2012.

*SDG 7 – Affordable and Clean Energy

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Classification of Energy Sources**	
1.1	Clasification of energy sources;	2
1.2	Introduction to renewable energy sources;	1
1.3	Charecterization of biomass;	1
1.4	Types, construction, working principle,	2
1.5	Usaes and safety environmental aspects of different renewable energy Devices like gasifiers, biogas plants	3
2.0	**Introduction to Renewable Energy Sources**	
2.1	Solar passive heating devices,	2
2.2	Photovoltic cells and arrays, Phase Changing Materials;	1
2.3	Brief Introduction to wind energy,	1
2.4	Hydroelectric energy, ocean energy,	2
2.5	Briquetting and baling of biomass,	1
2.6	Biomass combustion,	1
2.7	Biodiesel preparation and energy conservation in agriculture	1
3.0	**Energy Forms and Units; Energy Perspective and Norms**	
3.1	Energy forms and units,	1
3.2	Enenrgy perspective,	1
3.3	Norms and scenario;	1
3.4	Energy audit and mangement in agro-processing units,	2
3.5	Data collection and analysis for energy conservation in food processing Industries.	2
3.6	Non-conventional energy sources in agro-processing industries	2
4.0	**Energy Accounting and Management Systems**	
4.1	Rescue and calculation of used steam, hot water,	2
4.2	Chimney gases and cascading of energy sources,	2
4.3	Enenrgy accounting methods,	1
4.4	Measurements of enenrgy,	2
4.5	Design of computer-based enenrgy management systems,	1
4.6	Economics of energy use.	1
5.0	**Energy and Water Conservation Technologies in Food Processing Facilities**	
5.1	Conservation in steam generation and consumption system	1
5.2	Energy conservation in heat exchangers	2
5.3	Conservation in compressed air system	1
5.4	Conservation in power and electrical systems	1
5.5	Waste-heat recovery and thermal energy storage in food processing facilities	1
5.6	Building envelop audit	1
5.7	Energy consumption and saving opportunities	2

Course Designer(s)

1. Dr. J. Philip Robinson- philip@ksrct.ac.in

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

60 FT E55	Food Laws – Indian and International	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To provide a comprehensive understanding of national and international food laws.
- To familiarize students with legal frameworks on food safety and labeling.
- To analyze roles of regulatory authorities and industry stakeholders.
- To explore emerging issues in food regulation and global trade.
- To develop critical thinking skills in applying food law principles.

Pre-requisites

NIL

Course Outcomes

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

CO1	Demonstrate understanding of the Food Safety and Standards Act.	Understand
CO2	Compare regulatory frameworks in India, EU, and USA.	Apply
CO3	Identify roles of FSSAI and international regulatory agencies.	Apply
CO4	Evaluate food regulatory systems using case studies.	Apply
CO5	Develop strategies for compliance with food regulations.	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	20
Understand	30	30	40
Apply	10	10	20
Analyze	-	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B. Tech. Food Technology								
60 FT E55 - Food Laws – Indian and International								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100

Introduction to Food Laws and Regulatory Frameworks Overview of food laws and regulations at national and international levels, Historical development and evolution of food regulatory systems, Role of government agencies and international organizations in food regulation, Comparison of regulatory frameworks in India and key international jurisdictions.	[9]
Indian Food Laws and Regulations* Food safety and standards regulations in India: FSSAI Act, 2006 and Food Safety and Standards (FSS) Regulations, 2011, Regulatory authorities and their roles: Food Safety and Standards Authority of India (FSSAI), Ministry of Health and Family Welfare, Key provisions related to food safety, labeling, additives, contaminants, and packaging. Enforcement mechanisms and penalties for non-compliance with food regulations.	[9]
International Food Laws and Standards* Overview of international food standards-setting bodies: Codex Alimentarius Commission, World Health Organization (WHO), Food and Agriculture Organization (FAO), International agreements and treaties related to food safety and trade: Sanitary and Phytosanitary (SPS) Agreement, Technical Barriers to Trade (TBT) Agreement, Harmonization of food standards and regulations: Importance, challenges, and implications for global trade. Comparison of international food standards: Codex Alimentarius, EU Food Law, US FDA regulations.	[9]
Food Safety Management Systems and Certification* Introduction to food safety management systems (FSMS): ISO 22000, Hazard Analysis and Critical Control Points (HACCP), Certification schemes and accreditation bodies: BRC (British Retail Consortium), SQF (Safe Quality Food), IFS (International Featured Standards). Process of certification and audit requirements for food businesses, Benefits of implementing FSMS and obtaining certification for food safety and quality assurance.	[9]
Emerging Issues and Future Trends in Food Regulation Current challenges and emerging issues in food regulation: Novel foods, biotechnology, nanotechnology, food fraud. Regulatory responses to emerging risks and technologies: Risk assessment, risk management, risk communication. Future trends in food regulation: Transparency, traceability, blockchain technology, sustainable food systems.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Proshanta Guha & Basudeb Guha. (2022) Fundamentals of Indian Food Laws: University Book House Pvt. Ltd.
2.	Gabriela Steier & Kiran K. Patel. (2017) International Food Law And Policy: Springer
Reference(s):	
1.	Seth & Capoor. (2023) Commentary on the Food Safety and Standards Act, 2006:Delhi Law House
2.	Bhatnagar 8th Edition (2024), Commentary on Food Safety Law: Whytes and Co.

*SDG 12 – Responsible Consumption and Production

Passed in BoS Meeting held on 22/05/2024
Approved in Academic Council Meeting held on 25/05/2024

CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Food Laws and Regulatory Frameworks**	
1.1	Overview of food laws	1
1.2	Regulations at national and international levels	2
1.3	Historical development and evolution of food regulatory systems	1
1.4	Role of government agencies	1
1.5	Role of international organizations in food regulation	2
1.6	Comparison of regulatory frameworks in India	1
1.7	Key international jurisdictions	1
2.0	**Indian Food Laws and Regulations**	
2.1	Food safety and standards regulations in India	1
2.2	Fssai act, 2006	1
2.3	Food Safety and Standards (FSS) Regulations, 2011	1
2.4	Food Safety and Standards Authority of India (FSSAI)	1
2.5	Ministry of Health and Family Welfare	1
2.6	Key provisions related to food safety, labeling, additives, contaminants, and Packaging.	2
2.7	Enforcement mechanisms and penalties for non-compliance with food regulations.	1
3.0	**International Food Laws and Standards**	
3.1	Codex alimentarius commission	1
3.2	World health organization (who)	1
3.3	Food and Agriculture Organization (FAO)	1
3.4	Sanitary and Phytosanitary (SPS) Agreement	1
3.5	Technical Barriers to Trade (TBT) Agreement	1
3.6	Harmonization of food standards and regulations: Importance, challenges, And implications for global trade	1
3.7	Codex alimentarius, eu food law	1
3.8	US FDA regulations	1
4.0	**Food Safety Management Systems and Certification**	
4.1	Introduction to food safety management systems (FSMS)	1
4.2	ISO 22000	1
4.3	Hazard Analysis and Critical Control Points (HACCP)	2
4.4	BRC (british retail consortium)	1
4.5	SQF (safe quality food)	1
4.6	IFS (international featured standards)	1
4.7	Process of certification and audit requirements for food businesses.	1
4.8	Benefits of implementing FSMS and obtaining certification for food safety and Quality assurance	1
5.0	**Emerging Issues and Future Trends in Food Regulation**	
5.1	Current challenges and emerging issues in food regulation: Novel foods & Biotechnology	2
5.2	Current challenges and emerging issues in food regulation: nanotechnology & Food fraud.	2
5.3	Regulatory responses to emerging risks and technologies: Risk assessment, Risk management, risk communication.	2
5.4	Future trends in food regulation: Transparency.	1
5.5	Future trends in food regulation: Traceability, blockchain technology	1
5.6	Future trends in food regulation: Sustainable food systems.	1

Course Designer(s)

1. Mr. P. Kalai Rajan - kalairajan@ksrct.ac.in

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
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60 FT E56	Packaging of Bakery and Confectionery Products	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand the fundamentals and significance of food packaging.
- To explore the packaging methods and regulations for bread.
- To learn about packaging methods and materials for biscuits.
- To examine packaging materials and techniques for confectionery.
- To investigate advancements in packaging technologies and materials.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Identify packaging materials and their functional properties effectively.	Understand
CO2	Analyze storage options and packaging techniques for bread.	Analyze
CO3	Differentiate between various biscuit packaging techniques and functions.	Apply
CO4	Identify types of containers and sealing methods for confectionery.	Understand
CO5	Assess new packaging methods and their benefits for shelf life.	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	30	30	40
Apply	10	20	20
Analyze	10	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech Food Technology								
60 FT E56 - Packaging of Bakery and Confectionery Products								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100

Introduction Introduction, History, Importance and functions of Food packaging. Properties of packaging material in relation to these functions, package design. Tests for flexible packaging materials. Materials used in packaging- rigid, semi rigid and flexible. Types of containers- primary & secondary, flexible & rigid, hermetic & non hermetic.	[9]
Bread Packaging Storage of bread, packaging specifications, characteristics of packaging material, types of packaging – fundamental classification, different packaging materials. Packaging Regulations and Compliance for Bread. Packaging - Modified Atmosphere Packaging (MAP), Vacuum Packaging of Bread.	[9]
Biscuit Packaging Types of Biscuit Packaging, Packaging Functions, Packaging Materials , Modified Atmosphere Packaging, Vertical Form Fill Seal Packaging, On Edge Flowpack, Biscuits in Trays, Pile Packs, Cartons, Biscuit Tins	[9]
Packaging of Confectionery Products The container, metal cans, paper and associated materials, types of paper, metal foil, transparent films, metallized films, shrink and stretch films, laminates, the type of wrap, wrapping materials in display and advertising, mechanical sealing methods, dessicant pouches.	[9]
Packaging Advances Advance in packaging, different packaging materials, methods and machineries involved (primary, secondary and tertiary) in packaging. Selection of packaging materials and standards for baked products. Recent packaging techniques to extend the shelf life of the product. Technologies-MAP, hermetic packaging, convenient intelligent and smart packaging.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Sakharam, Patil D, "Packaging of Food Materials", First Edition, 2015
2.	Han, Jung H., "Innovations in Food Packaging", Second Edition, 2013.
Reference(s):	
1.	Robertson, Gordon L., "Food Packaging: Principles and Practice", Third Edition, 2013.
2.	Coles, Richard, "Food Packaging Technology", First Edition, 2003.
3.	Yam, Kit L., "The Wiley Encyclopedia of Packaging Technology", Third Edition, 2009.
4.	Mathlouthi, M., "Food Packaging and Preservation", First Edition, 1999.

*SDG 9 – Industry Innovation and Infrastructure

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Introduction, History, Importance and functions of Food packaging	1
1.2	Properties of packaging material in relation to these functions	1
1.3	package design	1
1.4	Tests for flexible packaging materials	1
1.5	Materials used in packaging- rigid	1
1.6	semi rigid and flexible	1
1.7	Types of containers-primary & secondary	1
1.8	flexible & rigid	1
1.9	hermetic & non hermetic	1
2.0	**Bread Packaging**	
2.1	Storage of bread, packaging specifications	2
2.2	characteristics of packaging material	1
2.3	Types of packaging – fundamental classification	2
2.4	different packaging materials	1
2.5	Packaging Regulations and Compliance for Bread	1
2.6	Packaging - Modified Atmosphere Packaging (MAP)	1
2.7	Vacuum Packaging of Bread.	1
3.0	**Biscuit Packaging**	
3.1	Types of Biscuit Packaging	1
3.2	Packaging Functions, Packaging Materials	2
3.3	Modified Atmosphere Packaging	1
3.4	Vertical Form Fill Seal Packaging	1
3.5	On Edge Flowpack, Biscuits in Trays	2
3.6	Pile Packs	1
3.7	Cartons, Biscuit Tins	1
4.0	**Packaging of Confectionery Products**	
4.1	The container, metal cans, paper and associated materials	2
4.2	types of paper, metal foil, transparent films	2
4.3	metallized films, shrink and stretch films	1
4.4	laminates, the type of wrap	1
4.5	wrapping materials in display and advertising	1
4.6	mechanical sealing methods	1
4.7	Desiccant pouches	1
5.0	**Packaging Advances**	
5.1	Advance in packaging	1
5.2	different packaging materials	1
5.3	methods and machineries involved (primary, secondary and tertiary) in packaging..	2
5.4	Selection of packaging materials and standards for baked products	2
5.5	Recent packaging techniques to extend the shelf life of the product	1
5.6	Technologies-MAP, hermetic packaging	1
5.7	Convenient intelligent and smart packaging.	1

Course Designer(s)

1. Dr. J. Philip Robinson - philip@ksrct.ac.in

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

60 FT E57	Waste Management and By-product Development in Food Industries	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To classify food waste and explain the strategies for waste minimization
- To utilize the wastes from cereal industries for developing byproducts
- To make use of wastes from oilseeds and tuber processing industries for developing byproducts
- To utilize the animal processing industries waste for developing byproducts
- To apply the concept of waste utilization of fruit and vegetable, sugar and packaging industries

Pre-requisites

- **Nil**

Course Outcomes

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

CO1	Classify food waste and explain the strategies for waste minimization	Understand
CO2	Utilize the wastes from cereal industries for developing byproducts	Apply
CO3	Make use of wastes from oilseeds and tuber processing industries for Developing byproducts	Apply
CO4	Utilize the animal processing industries waste for developing byproducts	Apply
CO5	Apply the concept of waste utilization of fruit and vegetable, sugar and Packaging industries	Apply

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	30
Understand	30	20	40
Apply	10	20	30
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.Tech – Food Technology

60 FT E57 - Waste Management and By-product Development in Food Industries

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100

Introduction on Waste and disposal strategies Introduction : Different Sources of waste from Food Industries and their availability in India, nature of different waste, potentials and prospects of developing by products in India. Characteristics of Industrial Waste and disposal strategies : 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]
Waste utilization in Cereal Food Industries Waste utilization in Cereal Food Industries: Waste utilization from rice mill – thermal and biotechnological uses of rice husk- pyrolysis and gasification of rice husk- cement preparation and different thermal applications- utilization of rice bran- stabilization – defatted bran utilization.	[9]
By Products from Oil Seed and Tuber Processing Industries * 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]
By Products from Animal Product based Industries 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 form animal hair, bone meal, meat meal, chondroitinsulfate, squalene, fish oil, micro nutrients- vitamins and minerals, pigments.	[9]
Utilization of Fruits, Vegetables and Food Packaging Waste Utilization of Fruits and Vegetables waste: processes for waste utilization from fruits and vegetable industries –Pectin, essential oils, antioxidants, and organic acids. Distillation for production of alcohol, SCP production, by products of sugar industry. Handling of Food Packaging Waste: Handling and treatment, far waste, incineration of solid food waste and its disposal	[9]
Total Hours	**45**

Text Book(s):

1.	Vasso Oreopoulou & Winfried Russ, "Utilization of By-Products and Treatment of Waste in the Food Industry", 1st Edition, Springer Science and Business Media, USA, 2006.
2.	Gómez-García, R. et al. Food Byproducts Management and their utilization. First. Palm Bay, FL, Boca Raton, FL: Apple Academic Press Inc.; CRC Press.2024.

Reference(s):

1.	Chandrasekaran M., "Valorization of Food Processing By-Products", 1st Edition, CRC Press, USA, 2016.
2.	Keith Waldron, "Handbook of waste management and co-product recovery in food processing", 1st Edition, Wood head Publishing Ltd, England, 2007.
3.	Utilization of by-products and treatment of waste in the food industry (2019). Scholars Portal.
4.	Dhull, S.B., Singh, A. and Kumar, P. Food Processing Waste and utilization: Tackling pollution and enhancing product recovery. Boca Raton, FL: CRC Press 2023.

***SDG 9 – Industry Innovation and Infrastructure**

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction on Waste and disposal strategies ***	
1.1	Introduction : Different Sources of waste from Food Industries and their availability in India	2
1.2	Nature of different waste, potentials and prospects of developing by products in India.	1
1.3	Characteristics of Industrial Waste and disposal strategies : Classification of waste	1
1.4	Characterization of waste	1
1.5	Magnitude of waste generation in different food processing industries,	1
1.6	Importance of waste management	1
1.7	Economical aspects of waste treatment and disposal,	1
1.8	Strategies for minimizing waste	1
1.9	Application of 3R_s and Life Cycle Assessment (LCA).	1
2.0	**Waste utilization in Cereal Food Industries ***	
2.1	Waste utilization in Cereal Food Industries	1
2.2	Waste utilization from rice mill	1
2.3	Thermal and biotechnological uses of rice husk	1
2.4	Pyrolysis and gasification of rice husk	1
2.5	Cement preparation	1
2.6	Different thermal applications	1
2.7	Utilization of rice bran	1
2.8	Stabilization	1
2.9	Defatted bran utilization	1
3.0	**By Products from Oil Seed and Tuber Processing Industries ***	
3.1	By Products from Oil Seed and Tuber Processing Industries	1
3.2	Oil processing industries – Introduction, De-oiled cake, animal feed	1
3.3	Fertilizer, bio sorbents, waxes	1
3.4	Soap stock, cocoa butter replacer	1
3.5	Tuber processing industries- Introduction, enzyme production,	1
3.6	Biogas, bakers yeast	1
3.7	Bio-ethanol, animal feed	1
3.8	Corn syrup, organic acids	1
3.9	Nutraceuticals	1
4.0	**By Products from Animal Product based Industries ***	
4.1	By Products from Animal Product based Industries: Dairy industry - Introduction-opportunities – whey	1
4.2	Bio surfactants, bacteriocin	1
4.3	Meat, fish, poultry processing industries	1
4.4	Bio active peptide	1
4.5	Protein extract, gelatin, heparin	1
4.6	Pepsin, bio molecule from bone and blood	1
4.7	Keratin form animal hair, bone meal, meat meal	1
4.8	Chondroitinsulfate, squalene, fish oil	1
4.9	Micro nutrients- vitamins and minerals, pigments	1
5.0	**Utilization of Fruits, Vegetables and Food Packaging Waste**	
5.1	Utilization of Fruits and Vegetables waste: processes for waste utilization from fruits and vegetable industries	1
5.2	Pectin, essential oils, antioxidants, and organic acids.	1
5.3	Distillation for production of alcohol	1
5.4	SCP production	1
5.5	By products of sugar industry	1
5.6	Handling of Food Packaging Waste	1
5.7	Handling and treatment	1
5.8	Far waste	1
5.9	Incineration of solid food waste and its disposal	1

Course Designer(s)

1. **Dr.A.S.Ruby Celsia-** rubycelsia@ksrct.ac.in

Passed in BoS Meeting held on 22.05.24
Approved in Academic Council Meeting held on 25.05.24

CHAIRMAN
BOARD OF STUDIES

OPEN ELECTIVE

60 FT L01	Nutrition and Healthy Life	Category	L	T	P	Credit
		OE	3	0	0	3

Objectives

- Knowledge in nutrition, balanced diet
- To learn nutritional disorder
- To learn the concept of disease management
- To impart knowledge on nutritional requirements of exercise
- Knowledge about healthy life style and fitness.

Pre-requisites

Thermal Engineering

Course Outcomes

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

CO1	pronounce major types of food groups, balanced diet and RDA requirement for all age	Understand
CO2	illustrate the concept and types of management of nutritional disorder	Understand
CO3	explicit the complication and symptoms of CVD, diabetes and liver	Analyze
CO4	remember the complication and management of gastrointestinal diseases	Analyze
CO5	recall the importance, benefits and nutritional requirements of exercise and fitness	Understand

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	30
Understand	40	20	50
Apply	-	10	10
Analyse	-	10	10
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 23/12/2022
Approved in Academic Council Meeting held on 07/01/2023

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B. Tech. Food Technology								
60 FT L01 - Nutrition and Healthy Life								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		**C**	CA	ES	Total
-	3	0	0	45	3	40	60	100

Food Groups and Overview of Nutrition Introduction to food science, Major food groups and their classification, Balanced diets, Recommended Dietary Allowances (RDA) for all age groups. Planning a healthy diet, BMR and BMI calculations. Nutritional requirements of carbohydrates, protein and fats; Water - recommended intakes; fluid/electrolyte balance.	[9]
Nutritional Disorders Types - anemia, Malnutrition: Kwashiorkor and Marasmus, obesity, vitamin and major mineral deficiency – diagnosing – long term effect; treatment – oral and Parenteral Administration. Dietary changes.	[9]
Diet for Diseases I Etiology, symptoms, classification - short term and long term complications - prevention, monitoring criteria and management of various diseases - Cardiovascular disease - Diabetes - Diseases of Liver, Gall bladder & Pancreas - Renal disease	[9]
Diet for Diseases II Complication and management of Gastrointestinal diseases/disorders - Gastritis and Peptic ulcer - Crohn's disease, diarrhea, constipation, ulcerative colitis. Diagnosis, Nutrition in the etiology of cancer, Nutritional implications of cancer therapy.	[9]
Nutrition and Physical Fitness* Exercise and Fitness- Definition, benefits, components and indicators of fitness. Nutritional requirements for exercise - body adaptation – energy need - macronutrient, fluids, vitamins and minerals requirement. Alternative health and fitness –yoga and meditation.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Sharda Gupta, Santosh Jain Passi, Rama Seth, Ranjana Mahna & Seema Puri Kumud Khanna "Textbook of Nutrition and Dietetics" 2nd edition, Elite Publishing House, 2016.
2.	Srilakshmi B., "Nutrition Science", 7th Edition, New Age International Ltd., New Delhi, 2022.
Reference(s):	
1.	Gopalan C., B.V. Rama Sastri, and S.C. Balasubramanian S. C. "Nutritive Value of Indian Foods". NIN, ICMR, 2004.
2.	Damodaran, S., K.L. Parkin and O.R. Fennema. "Fennema's Food Chemistry". 4th Edition, CRC Press, 2008.
3.	Belitz,H.-D, Grosch W and Schieberle P. "Food Chemistry", 3rd Rev. Edition, Springer- Verlag, 2004.

*SDG 3 – Good Health and Well Being

Passed in BoS Meeting held on 23/12/2022
Approved in Academic Council Meeting held on 07/01/2023

CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Food Groups and overview of nutrition**	
1.1	Introduction to food science	1
1.2	Food Groups and overview of nutrition	1
1.3	Major food groups and their classification	1
1.4	Balanced diets	1
1.5	Recommended Dietary Allowances (RDA) for all age groups	1
1.6	Planning a healthy diet	1
1.7	BMR and BMI calculations.	1
1.8	Nutritional requirements of carbohydrates, protein and fats	1
1.9	Water - recommended intakes; fluid/electrolyte balance	1
2.0	**Nutritional disorders**	
2.1	Nutritional disorders - definitions	1
2.2	Types - anemia,	1
2.3	Malnutrition: Kwashiorkor and Marasmus, obesity, vitamin	1
2.4	Major mineral deficiency	1
2.5	Malnutrition: diagnosing	1
2.6	Malnutrition: long term effect	1
2.7	Treatment – oral administration.	1
2.8	Treatment – parenteral administration.	1
2.9	Dietary changes	1
3.0	**Diet for diseases I**	
3.1	Diet for diseases - Etiology, symptoms	1
3.2	Classification of diseases	1
3.3	Short term and long term complications - prevention	1
3.4	Monitoring criteria and management of various diseases	1
3.5	Cardiovascular disease	1
3.6	Diabetes	1
3.7	Diseases of Liver	1
3.8	Gall bladder & Pancreas	1
3.9	Renal disease	1
4.0	**Diet for diseases II**	
4.1	Complication and management of Gastrointestinal diseases/disorders	1
4.2	Gastritis and Peptic ulcer	2
4.3	Crohn's disease Diarrhea	1
4.4	Constipation	1
4.5	Ulcerative colitis	1
4.6	Diagnosis	1
4.7	Nutrition in the etiology of cancer	1
4.8	Nutritional implications of cancer therapy	1
5.0	**Nutrition and physical fitness**	
5.1	Physical fitness and Exercise	1
5.2	Fitness- Definition and benefits	1
5.3	Exercise and Fitness - components and indicators of fitness.	1
5.4	Nutritional requirements for exercise, Body adaptation	2
5.5	Energy need – macronutrient and fluids	1
5.6	Energy need - vitamins and minerals requirement.	1
5.7	Alternative health and fitness	1
5.8	Yoga and meditation	1

Course Designer(s)

Dr. P. Shanmugam – shanmugam@ksrct.ac.in

Passed in BoS Meeting held on 23/12/2022

Approved in Academic Council Meeting held on 07/01/2023

CHAIRMAN
BOARD OF STUDIES

60 FT L02	Livestock, Poultry and Fish Production Management	Category	L	T	P	Credit
		OE	3	0	0	3

Objectives

- Knowledge in livestock and poultry management.
- To learn about feeding, farming and management system
- To know about swine husbandry, care and management
- To impart knowledge on feed and composition of chick
- To learn about the Fish production management

Pre-requisites

Thermal Engineering

Course Outcomes

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

CO1	Significance of livestock and poultry and understand about integrated farming and management system	Understand
CO2	Classification of cattle breed and its importance and study about the care management and nutrition	Understand
CO3	Classification of sheep breeds and understand about swine husbandry care and management	Understand
CO4	Describe the poultry management and study about the feed and composition of chick	Understand
CO5	Describe about breeding of fishes and feed	Analyze

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	30
Understand	40	40	50
Apply	-	-	10
Analyze	-	-	10
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Passed in BoS Meeting held on 23/12/2022
Approved in Academic Council Meeting held on 07/01/2023

CHAIRMAN
BOARD OF STUDIES

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B. Tech Food Technology

60 FT L02 - Livestock, Poultry and Fish Production Management

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
-	3	0	0	45	3	40	60	100

Introduction to Livestock and Poultry Management Significance of livestock and poultry management in Indian economy-Livestock and Poultry census, export and import scenario - Various systems of livestock production- extensive - semi intensive- intensive mixed. Integrated Farming systems- Definition, Scope, Factors and Advantages.	[9]
Cow and Buffalo Breeding and management Definition of breed-classification of indigenous, exotic cattle and buffaloes. Breeding- importance of cross breeding. Care and management of new born calf and heifers, pregnant, lactating animals and work bullocks. Clean milk production- method of milking- hand and machine milking. Feed system Nutrition-Definition-Ration-Balanced ration.	[9}
Sheep, Goat and Swine Farming Classification of Breeds: Indian and exotic origin. Systems of rearing-Housing management. Care and management of ram, ewe and lamb- Nutrition Feeds and fodder for small Ruminants. Swine Husbandry –Common breeds of exotic origin - housing of pigs. Care and management of Sow, Boar and Piglets-Nutrition- Creep feeding.	[9]
Poultry management Classification of poultry - layer, broiler and dual purpose- Nomenclature of commercial layer and broiler strains. Brooder management - Care and management of day old chicks, layers and broilers. Poultry Nutrition-Feed formulation of chick mash grower, layer, broiler starter and finisher mashes.	[9]
Fish Breeding Structure and composition of fish, Types of breeding – natural, semi natural, artificial. Brood stock fish for spawning, Induced spawning and egg collection, Egg incubation and hatching, Incubators – types, Larval rearing, planning of small hatchery, Fish feeds types and proximate composition.	[9]
Total Hours:	**45**

Text Book(s):

1.	James, R. Gillespie, and Frank B. Flanders, “Modern Livestock and Poultry Production”, 8th Edition Delmar, Cengage Learning, 2010.
2.	Ramesh Nandan, K. “Livestock and Poultry Production: Management and Planning”, Anmol Publication, 2015.

Reference(s):

1.	Gideon Waddwell- “Poultry Science” Published by Larsen and Keller Education, 2017.
2.	Carlos Hassey – “Animal Breeding and Livestock Management”, Syrawood Publishing House, 2017.
3.	V.K. Bharti Sh K.B. Gupta,” Breeding and Seed Production of Finfishes and Shellfishes”, Indian Council of Agricultural Research, 2019.

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Livestock and Poultry Management**	
1.1	Significance of livestock and poultry management in Indian economy	2
1.2	Livestock and Poultry census	1
1.3	export scenario	1
1.4	import scenario	1
1.5	Various systems of livestock production	1
1.6	extensive - semi intensive- intensive mixed	2
1.7	Integrated Farming systems Definition, Scope, Factors and Advantages	1
2.0	**Cow and Buffalo Breeding and management**	
2.1	Definition of breed-classification of indigenous, exotic cattle and buffaloes	2
2.2	Breeding- importance of cross breeding	1
2.3	Care and management of new born calf and heifers	1
2.4	pregnant, lactating animals and work bullocks	1
2.5	Clean milk production- method of milking	1
2.6	hand and machine milking.	1
2.7	Feed system Nutrition	1
2.8	Ration-Balanced ration.	1
3.0	**Sheep ,Goat and Swine Farming**	
3.1	Classification of Breeds: Indian and exotic origin	2
3.2	Systems of rearing-Housing management	1
3.3	Care and management of ram, ewe and lamb	1
3.4	Nutrition Feeds and fodder for small Ruminants	1
3.5	Swine Husbandry –Common breeds of exotic origin	1
3.6	housing of pigs	1
3.7	Care and management of Sow, Boar and Piglets-Nutrition	1
3.8	Creep feeding	1
4.0	**Poultry management**	
4.1	Classification of poultry - layer, broiler and dual purpose	1
4.2	Nomenclature of commercial layer and broiler strains	1
4.3	Nomenclature of broiler strains	1
4.4	Brooder management - Care and management of day old chicks, layers and broilers	3
4.5	Poultry Nutrition	2
4.6	Feed formulation of chick mash grower, layer, broiler starter and finisher mashes	1
5.0	**Fish Breeding**	
5.1	Structure and composition of fish	1
5.2	Types of breeding – natural, semi natural, artificial	2
5.3	Brood stock fish for spawning	1
5.4	Induced spawning and egg collection	1
5.5	Egg incubation and hatching	1
5.6	Incubators – types, Larval rearing	1
5.7	planning of small hatchery	1
5.8	Fish feeds types and proximate composition.	1

Course Designer(s)

Dr. J. Philip Robinson- philip@ksrct.ac.in

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60 FT L03	Food Supply Chain Management	Category	L	T	P	Credit
		OE	3	0	0	3

Objectives

- To learnt about the food supply chain and its logistics.
- To analyse the import and export requirements
- To learn logistics management.
- To impart knowledge on Indian agencies in logistics.
- To review the export and import procedures and its documentation

Pre-requisites

Nil

Course Outcomes

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

CO1	Recall the fundamentals of logistics, supply chain management and understand the scope significance and drivers of supply chain.	Remember
CO2	Infer the different demand planning, demand forecast process and analyse the warehouse.	Understand
CO3	Identify the various sources of distribution channels in transportation.	Understand
CO4	Recall the concept of packaging and its logistics and elaborate on export and import labelling.	Understand
CO5	Recall the concept of packaging and its logistics and elaborate on export and import labelling	Understand

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	40
Understand	40	40	60
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 FT L03 - Food Supply Chain Management								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
-	3	0	0	45	3	40	60	100

Introduction to Food Supply Chain Management Logistics and supply chain management; fundamentals of LSCM - Scope, Significance and Drivers; Basic Model – Primary and Secondary Activities; Role and Challenges of Logistics and supply chain management in food industry.	[9]
Procurement and warehousing Demand and supply management; Demand planning, and demand forecasting processes, Forecasting techniques, Strategic planning for material sourcing, Outsourcing strategies Organizing and detailing of all tactical & operational information; Warehouse strategies Planning and managing warehouse operations; Inventory models and control techniques.	[9]
Distribution and transportation Various sources of distribution channels, Distribution models: Nature, Functions & Services of 3PL and 4PL, Distribution network planning: customer-side and network-side solutions, Modes of transportation, Design of transshipment: Concepts of transportation management and managing transportation operations and its interaction.	[9]
Packaging and information technology* Applications of Packaging in logistics, Types of packaging and packaging materials, Export &import packaging and labeling details, Containerization, Pervasiveness of IT in Supply Chain Management –ERP, Bar-coding, RFID, GPS, E- Procurement	[9]
Global LSCM and performance analysis Export and import procedure and Documentation, Risk management in global logistics, Customer relationship management in LSCM, Performance metrics in Supply Chain, Indian agencies- EIC, EIA,APEDA, MEPEDA. Rapid alert system.	[9]
Total Hours:	**45**

Text Book(s):	
1.	D K Agarwal, “Logistics and supply chain management”, Macmillan Publishers India Ltd., Eighth Impressions, 2010.
2.	Sunil Chopra and Peter Meindi, “Supply chain management” Pearson Education, 6th edition, 2016.
Reference(s):	
1.	David Taylor and David Brunt, “Manufacturing Operations and Supply chain Management”, VikasThomson Learning publishers, 2009.
2.	Michael A. Bourlakis and Paul W. H. Weightman “Food Supply Chain Management” , Blackwell Publishing Limited, 2004
3.	Douglas M. “Supply Chain Management: Processes”, Partnerships, Performance Lambert (ed). The Supply Chain Management Institute, FL. 2nd Edition , 2006.
4.	Laura R. Kopczak and M. Eric Johnson, “The Supply Chain Management Effect”, MIT Sloan Management Review, Vol. 44, 2003.

*SDG 12 – Responsible Consumption and Production

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Food Supply Chain Management**	
1.1	Logistics and supply chain management	1
1.2	Fundamentals of LSCM	1
1.3	Scope of LSCM	1
1.4	Significance and Drivers	1
1.5	Basic Model – Primary Activities	1
1.6	Basic Model – Secondary Activities	1
1.7	Role and Challenges of Logistics	1
1.8	Supply chain management in food industry.	2
2.0	**Procurement and warehousing**	
2.1	Demand and supply management	1
2.2	Demand planning and demand forecasting processes	1
2.3	Forecasting techniques	1
2.4	Strategic planning for material sourcing	1
2.5	Outsourcing strategies Organizing and detailing of all tactical	1
2.6	Operational information	1
2.7	Warehouse strategies Planning	1
2.8	Managing warehouse operations	1
2.9	Inventory models and control techniques	1
3.0	**Distribution and transportation**	
3.1	Various sources of distribution channels	1
3.2	Distribution models: Nature	1
3.3	Distribution models: Functions & Services of 3PL and 4PL	2
3.4	Distribution network planning: customer-side solutions	1
3.5	Distribution network planning: network-side solutions	1
3.6	Modes of transportation	1
3.7	Design of trans-shipment: Concepts of transportation management	1
3.8	Managing transportation operations and its interaction	1
4.0	**Packaging and information technology**	
4.1	Applications of Packaging in logistics	1
4.2	Types of packaging and packaging materials	1
4.3	Export &import packaging	1
4.4	Labelling details	1
4.5	Containerization	1
4.6	Pervasiveness of IT in Supply Chain Management –ERP	1
4.7	Bar-coding	1
4.8	RFID, GPS, E- Procurement	3
5.0	**Global LSCM and performance analysis**	
5.1	Export and import procedure and Documentation	1
5.2	Risk management in global logistics	1
5.3	Customer relationship management in LSCM	1
5.4	Performance metrics in Supply Chain	1
5.5	Indian agencies- EIC	1
5.6	EIA	1
5.7	APEDA, MEPEDA	2
5.8	Rapid alert system	1

Course Designer(s)

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60 FT L04	Basics of Packaging Technology	Category	L	T	P	Credit
		OE	3	0	0	3

Objectives

- To provide students with different types of packaging and its background
- To learn the produce and pack using glass materials
- To learn the Cushion materials manufacturing and used in pack.
- To study the different types of metals and its application
- To provide the classification and use of steel packaging

Pre-requisites

NIL

Course Outcomes

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

CO1	Understand different types of paper for packaging	Understand
CO2	Explain about types of glass and glass containers	Understand
CO3	Analysis of cushioning material	Understand
CO4	Understand different types of metal cans.	Understand
CO5	Analysis of various types of Corrugated Board.	Understand

Mapping with Programme Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	40
Understand	40	40	60
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.Tech. Food Technology								
60 FT L04 - Basics of Packaging Technology								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
-	3	0	0	45	3	40	60	100

Paper & Corrugated Board in Packaging Types of Papers for Packaging, Corrugated Board, Materials, Components of Corrugated Board, Liners, Fluting, Adhesives, Board and box manufacture, Box style, Box Dimensions, printing, Closing Box, Box Design, Flute selection.	[9]
Glass in Packaging** History, Introduction to Glass Materials, Composition of Glass, Chemical Structure of Glass, Raw Materials used for manufacturing glass containers, Properties of Glass, Types of Glass, Types of glass containers, Uses, Applications Advantages & Disadvantages, Types and Design of Bottles, Closures, Seals. Glass Industry, Market Overview.	[9]
Cushioning Materials Packaging*** Cushioning materials, Factor Considered in cushion design, Need of cushion Packaging, Properties of cushion materials, Solid vs. Loose fill, Foam-in-place, Cushion curves and design, corrugated as a cushioning material, Economics of cushion designing and advantages - packaging costs vs. product damage.	[9]
Metals in Packaging-I* History, Introduction of Metals - Overview of Extraction Processes, Important Metals in Packaging & their properties (Physical, Chemical & Mechanical), Aluminum based packaging*, Conversion processes for Sheets, Aluminum Foil, properties & their applications. Market & Industry Overview	[9]
Metals in Packaging-II* Steel based: Stainless & Galvanized Steel - Coated steels like Tinplate, Tin free Steel, and Metal Cans: History of Metal Cans, Types of Metal Cans - Three piece & Two piece Cans, Welded & Seamless Cans, and Can Dimensioning. Introduction to Metal Collapsible Tubes - its design, Advantages & Disadvantages. Introduction to Aerosol Containers Classification of Aerosols, Advantages & Disadvantages of Aerosols.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Soroka, Walter. Fundamentals of Packaging Technology, Institute of Packaging Professionals, St. Charles, IL 2014.
2.	Joseph Hanlon F. Handbook of Package Engineering. McGraw-Hill, 2016.
Reference(s):	
1.	Mark J. Kirwan. Handbook of Paper and Paperboard Packaging Technology. 2nd edition, Wiley-Blackwell, 2013.
2.	Yam, Kit L., ed. The Wiley encyclopedia of packaging technology. John Wiley & Sons, 2010.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being
***SDG 12 - Responsible consumption and production

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Paper & Corrugated Board in Packaging**	
1.1	Types of Papers for Packaging, Corrugated Board	1
1.2	Materials, Components of Corrugated Board	2
1.3	Liners, Fluting, Adhesives	1
1.4	Board and box manufacture	1
1.5	Box style, Box Dimensions, printing, Closing Box,	2
1.6	Box Design, Flute selection.	2
2.0	**Glass in Packaging** :	
2.1	History, Introduction to Glass Materials	1
2.2	Composition of Glass, Chemical Structure of Glass	1
2.3	Raw Materials used for manufacturing glass containers	1
2.4	Properties of Glass	1
2.5	Types of Glass, Types of glass containers, Uses, Applications	2
2.6	Advantages & Disadvantages of glasses	1
2.7	Types and Design of Bottles, Closures, Seals	1
2.8	Glass Industry, Market Overview	1
3.0	**Cushioning Materials Packaging:**	
3.1	Cushioning materials	1
3.2	Factor Considered in cushion design	1
3.3	Need of cushion Packaging	1
3.4	Properties of cushion materials	1
3.5	Solid vs. Loose fill, Foam-in-place	2
3.6	Cushion curves and design, corrugated as a cushioning material	1
3.7	Economics of cushion designing and advantages	1
3.8	packaging costs vs. product damage	1
4.0	**Metals in Packaging-I:**	
4.1	History of Metals	1
4.2	Introduction of Metals	1
4.3	Overview of Extraction Processes	1
4.4	Important Metals in Packaging & their properties (Physical, Chemical & Mechanical)	2
4.5	Aluminum based packaging	1
4.6	Conversion processes for Sheets	1
4.7	Aluminum Foil, properties & their applications.	1
4.8	Market & Industry Overview	1
5.0	**Metals in Packaging-II:**	
5.1	Steel based: Stainless	1
5.2	Galvanized Steel - Coated steels like Tin plate	1
5.3	Tin free Steel and Metal Cans	1
5.4	History of Metal Cans	1
5.5	Types of Metal Cans - Three piece & Two piece Cans	1
5.6	Welded & Seamless Cans, and Can Dimensioning	1
5.7	Introduction to Metal Collapsible Tubes - its design, Advantages & Disadvantages.	1
5.8	Introduction to Aerosol Containers Classification of Aerosols	1
5.9	Advantages & Disadvantages of Aerosols.	1

Course Designer(s)

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