K.S. Rangasamy College of Technology

(Autonomous)

CURRICULUM & SYLLABI

of

M.Tech., Food Technology Department

(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

Department of Food Technology

VISION

- To produce competent technologist, scientist, researchers and entrepreneurs in Food Technology

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: Carry out research/investigation independently and develop solutions to solve practical problems related to food industries

PO2: 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

PO3: Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

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

The M.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
PEO 1	2	3	3
PEO 2	3	3	2
PEO 3	3	3	2

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

MAPPING-PG-FOOD TECHNOLOGY

Year	Sem	Course Name	PO1	PO2	PO3
I	I	Applied Statistics for Food Technology	1	2	2
		Advanced Drying Technology	1	2	2
		Unit Operations in Food Process Engineering	1	1	1
		Food Chemistry and Microbiology	2	3	2
		Research Methodology and IPR	1	3	3
		Professional Elective I	1	2	2
		Mandatory Course I	2	2	2
		Food Testing and Evaluation Laboratory	2	2	2
	II	Instrumental Techniques and Methods for Food Analysis	-	2	1
		Advanced Refrigeration and Cold Chain Management	2	-	-
		Food Safety and Quality Control	1	2	3
		Professional Elective II	1	2	1
		Professional Elective III	1	1	1
		Professional Elective IV	1	2	1
		Mandatory Course II	2	1	2
		Food Products Development Laboratory	1	2	3
		Term Paper and Seminar	2	3	3
II	III	Plantation Crops and Spices Technology	2	1	3
		Food Process Plant Layout and Design	1	2	2
		Food Rheology	1	2	1
		Professional Elective V	1	1	2
		Professional Elective VI	2	1	2
		Project Work-Phase I	3	3	3
	IV	Project Work-Phase II	3	3	3

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Credit Distribution for M. Tech. Food Technology Programme–2023–2024 Batch

SUMMARY

S. No.	Category	Credits Per Semester				Total Credits	Percentage (%)
		I	II	III	IV		
1	PC	19	14	11	-	**44**	**55.00**
2	PE	3	9	6	-	**18**	**22.50**
3	EEC	-	-	6	12	**18**	**22.50**
4	AC	AC I	AC II	-	-	**-**	**-**
Total		**22**	**23**	**23**	**12**	**80**	**100**

PC-PROFESSIONAL CORE
PE–PROFESSIONAL ELECTIVES
EEC – EMPLOYMENT ENHANCEMENT COURSES
AC– AUDIT COURSE

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(An Autonomous Institution affiliated to Anna University)

PROFESSIONAL CORE (PC)

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1	60 PFT 101	Applied Statistics for Food Technology	PC	5	3	1	0	4	NIL
2	60 PFT 102	Advanced Drying Technology	PC	5	3	1	0	4	NIL
3	60 PFT 103	Unit Operations in Food Process Engineering	PC	3	3	0	0	3	NIL
4	60 PFT 104	Food Chemistry and Microbiology	PC	3	3	0	0	3	NIL
5	60 PED 001/ 60 PDB E26	Research Methodology and IPR	PC	3	3	0	0	3	NIL
6	60 PFT 1P1	Food Testing and Evaluation Laboratory	PC	4	0	0	4	2	NIL
7	60 PFT 201	Instrumental Techniques and Methods for Food Analysis	PC	5	3	1	0	4	NIL
8	60 PFT 202	Advanced Refrigeration and Cold Chain Management	PC	5	3	1	0	4	NIL
9	60 PFT 203	Food Safety and Quality Control	PC	3	3	0	0	3	NIL
10	60 PFT 2P1	Food Products Development Laboratory	PC	6	0	0	6	3	NIL
11	60 PFT 301	Plantation Crops and Spices Technology	PC	3	3	0	0	3	NIL
12	60 PFT 302	Food Process Plant Layout and Design	PC	5	3	1	0	4	NIL
13	60 PFT 303	Food Rheology	PC	5	3	1	0	4	NIL

PROFESSIONAL ELECTIVES (PE)

SEMESTER I, ELECTIVE I

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1	60 PFT E11	Advanced Fruit and Vegetable Processing Technology	PE	3	3	0	0	3	NIL
2	60 PFT E12	Novel Technologies in Food Processing	PE	3	3	0	0	3	NIL
3	60 PFT E13	Heat and Mass Transfer Operations in Food Processing	PE	3	3	0	0	3	NIL

SEMESTER II, ELECTIVE II

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 PFT E21	Industrial Engineering	PE	3	3	0	0	3	NIL
2.	60 PFT E22	Industrial Waste Management	PE	3	3	0	0	3	NIL
3.	60 PFT E23	Advanced Baking and Confectionery Technology	PE	3	3	0	0	3	Advanced Drying Technology

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SEMESTER II, ELECTIVE III

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 PFT E31	Technology of Food Colours and Flavours	PE	3	3	0	0	3	NIL
2.	60 PFT E32	Advanced Separation Techniques in Food Processing	PE	3	3	0	0	3	Advanced Drying Technology
3.	60 PFT E33	Food Product Design and Development	PE	3	3	0	0	3	NIL

SEMESTER II, ELECTIVE IV

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 PFT E41	Advanced Grain Science and Technology	PE	3	3	0	0	3	Advanced Drying Technology
2.	60 PFT E42	Food Additives, Nutraceuticals and Functional Foods	PE	3	3	0	0	3	NIL
3.	60 PFT E43	Advanced Beverage Technology	PE	3	3	0	0	3	NIL

SEMESTER III, ELECTIVE V

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 PFT E51	Snacks and Extruded Products Technology	PE	3	3	0	0	3	Food Safety and Quality Control
2.	60 PFT E52	Internet of Things in Food and Agriculture	PE	3	3	0	0	3	NIL
3.	60 PFT E53	Sensory Evaluation of Foods	PE	3	3	0	0	3	NIL

SEMESTER III, ELECTIVE VI

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 PFT E61	Advanced Food Supply Chain Management	PE	3	3	0	0	3	NIL
2.	60 PFT E62	Advanced Meat Processing Technology	PE	3	3	0	0	3	NIL
3.	60 PFT E63	Advanced Dairy Technology	PE	3	3	0	0	3	Advanced Refrigeration and Cold Chain Management

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AUDIT COURSES (AC)

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 PAC 001	English for Research Paper Writing	AC	2	2	0	0	0	NIL
2.	60 PAC 002	Disaster Management	AC	2	2	0	0	0	NIL
3.	60 PAC 003	Constitution of India	AC	2	2	0	0	0	NIL

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 PFT 2P2	Term Paper and Seminar	EEC	2	0	0	2	0	NIL
2.	60 PFT 3P1	Project Work-Phase I	EEC	12	0	0	12	6	NIL
3.	60 PFT 4P1	Project Work-Phase II	EEC	24	0	0	24	12	NIL

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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**
THEORY								
1	60 PFT 101	Applied Statistics for Food Technology	PC	5	3	1	0	4
2	60 PFT 102	Advanced Drying Technology	PC	5	3	1	0	4
3	60 PFT 103	Unit Operations in Food Process Engineering	PC	3	3	0	0	3
4	60 PFT 104	Food Chemistry and Microbiology	PC	3	3	0	0	3
5	60 PED 001/ 60 PDB E26	Research Methodology and IPR	PC	3	3	0	0	3
6	60 PFT E1*	Professional Elective I	PE	3	3	0	0	3
7	60 PAC 001	English for Research Paper Writing	AC	2	2	0	0	0
PRACTICALS								
8	60 PFT 1P1	Food Testing and Evaluation Laboratory	PC	4	0	0	4	2
			Total	**28**	**20**	**2**	**4**	**22**

SEMESTER–II								
S. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1.	60 PFT 201	Instrumental Techniques and Methods for Food Analysis	PC	5	3	1	0	4
2.	60 PFT 202	Advanced Refrigeration and Cold Chain Management	PC	5	3	1	0	4
3.	60 PFT 203	Food Safety and Quality Control	PC	3	3	0	0	3
4.	60 PFTE 2*	Professional Elective II	PE	3	3	0	0	3
5.	60 PFTE 3*	Professional Elective III	PE	3	3	0	0	3
6.	60 PFTE 4*	Professional Elective IV	PE	3	3	0	0	3
7.	60 PAC 002	Disaster Management	AC	2	2	0	0	0
PRACTICALS								
8.	60 PFT 2P1	Food Products Development Laboratory	PC	6	0	0	6	3
9.	60 PFT 2P2	Term Paper and Seminar	EEC	2	0	0	2	0
			Total	**32**	**20**	**2**	**8**	**23**

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SEMESTER–III								
S. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1.	60 PFT 301	Plantation Crops and Spices Technology	PC	3	3	0	0	3
2	60 PFT 302	Food Process Plant Layout and Design	PC	5	3	1	0	4
3	60 PFT 303	Food Rheology	PC	5	3	1	0	4
4.	60 PFTE 5*	Professional Elective V	PE	3	3	0	0	3
5.	60 PFTE 6*	Professional Elective VI	PE	3	3	0	0	3
PRACTICAL								
6.	60 PFT 3P1	Project Work-Phase I	EEC	12	0	0	12	6
			Total	**31**	**15**	**2**	**12**	**23**

SEMESTER–IV								
S. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
PRACTICAL								
1.	60 PFT 4P1	Project Work-Phase II	EEC	24	0	0	24	12
			Total	**24**	**0**	**0**	**24**	**12**

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K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)
M.E. / M.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 PFT 101	Applied Statistics for Food Technology	2	40	60	100	45	100
2	60 PFT 102	Advanced Drying Technology	2	40	60	100	45	100
3	60 PFT 103	Unit Operations in Food Process Engineering	2	40	60	100	45	100
4	60 PFT 104	Food Chemistry and Microbiology	2	40	60	100	45	100
5	60 PED 001/ 60 PDB E26	Research Methodology and IPR	2	40	60	100	45	100
6	60 PFT E1*	Professional Elective I	2	40	60	100	45	100
7	60 PAC 001	English for Research Paper Writing	2	100	-	100	-	100
PRACTICAL								
8	60 PFT 1P1	Food Testing and Evaluation 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 PFT 101	Applied Statistics for Food Technology	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To comprehend the concepts of Linear Programming Problems.
- To learn the concepts of transportation and assignment models.
- To get exposed to the basics of descriptive statistics.
- To familiarize with various methods in testing of hypothesis.
- To understand the basic concepts of analysis of variance and control charts.

Pre-requisites

NIL

Course Outcomes

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

CO1	Analyze various methods in linear programming techniques.	Analyze
CO2	Employ the different techniques for solving transportation and assignment models.	Apply
CO3	Apply the basics of descriptive statistics.	Apply
CO4	Test the statistical hypothesis using t, F, and chi-square tests.	Analyze
CO5	Analyze the design of experiments and interpret quality control charts.	Analyze

Mapping with Programme Outcomes

Cos	POs		
	1	**2**	**3**
CO1	3	3	2
CO2	2	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

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

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Syllabus

K.S. Rangasamy College of Technology–Autonomous R 2022								
M. Tech. Food Technology								
60 PFT 101 – Applied Statistics for Food Technology								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	3	1	0	60	4	40	60	100

Linear Programming Problems Formulation of LP problem - Solution of LP problem: Graphical method - Simplex method - Big-M method - Duality.	[9]
Transportation and Assignment Problems Transportation problems: North-west corner rule - Least cost method - Vogel's approximation method - MODI method. Assignment problems: Balanced and Unbalanced assignment problems - Traveling salesman problems.	[9]
Descriptive Statistics Measures of Central tendency – Mean, Median, and Mode – Measures of Dispersion – Quartile deviation - Mean deviation - Standard deviation Coefficient of variation.	[9]
Testing of Hypothesis 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 and Quality Control Analysis of variance – One-way classification – Completely randomized design – Two-way classification – Randomized block design – Latin square – Control charts – Mean (X^{-})(\bar{X})(X^{-}) and Range RRR chart – nPnPnP chart – PPP chart.	[9]
Total Hours(45)+Tutorial (15)	**60**
Text Book(s):	
1. Kanti Swarup, P.K. Gupta, and Man Mohan, "Operations Research," Sultan Chand & Sons, New Delhi.	
2. Gupta S.C. and Kapoor V.K., "Fundamentals of Mathematical Statistics," 11th Edition, Sultan Chand & Sons, New Delhi, 2007.	
Reference(s):	
1. Sundaresan V., Ganapathy Subramanian K.S., and Ganesan K., "Operations Research," A.R. Publications, Chennai.	
2. Veerarajan T., "Probability, Statistics and Random Process," Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2nd Edition, 2008.	
3. Introduction to Operations Research - Dr. G. Srinivasan, NPTEL online video courses.	
4. Probability and Statistics - Dr. Somesh Kumar, NPTEL online video courses.	

Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Linear Programming Problems**	
1.1	Formulation of LP problem	1
1.2	Graphical method	2
1.3	Simplex method	1
1.4	Tutorial	2
1.5	Big-M method	2
1.6	Duality	2
1.7	Tutorial	2
2	**Transportation and Assignment Problems**	
2.1	North-west corner rule	1
2.2	Least cost method	1
2.3	Vogel's approximation method	1
2.4	MODI method	2
2.5	Tutorial	2

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2.6	Balanced assignment problems	1
2.7	Unbalanced assignment problems	1
2.8	Traveling salesman problems	1
2.9	Tutorial	2
3	**Descriptive Statistics**	
3.1	Mean, Median, Mode	2
3.2	Quartile deviation	1
3.3	Mean deviation	1
3.4	Tutorial	2
3.5	Standard deviation	2
3.6	Coefficient of variation	2
3.7	Tutorial	2
4	**Testing of Hypothesis**	
4.1	Student's 't' test	1
4.2	Single mean	1
4.3	Difference of means	1
4.4	F-test	1
4.5	Tutorial	2
4.6	Chi-square test	2
4.7	Goodness of fit	1
4.8	Independence of attributes	1
4.9	Tutorial	2
5	**Design of Experiments and Quality Control**	
5.1	One-way classification	1
5.2	Completely randomized design	1
5.3	Two-way classification	1
5.4	Randomized block design	1
5.5	Tutorial	2
5.6	Latin square	1
5.7	Mean (X)(X)(X) and Range (R)(R)(R) chart	1
5.8	nPnPnP chart	1
5.9	P chart	1
5.10	Tutorial	2
	Total	60

Course Designer(s)

Mr.G.Mohan-mohang@ksrct.ac.in

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60 PFT 102	Advanced Drying Technology	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To apply the mechanism of drying and determine water activity.
- To make use of spray and freeze-drying techniques for food materials.
- To outline concepts of drying using inert particles, pneumatic, and fluidized bed drying.
- To select appropriate novel drying techniques for drying of food materials.
- To choose suitable advanced dryers for different food materials.

Pre-requisites

NIL

Course Outcomes

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

CO1	Apply the mechanism of drying and determine water activity.	Apply
CO2	Make use of spray and freeze-drying techniques for food materials.	Apply
CO3	Outline concepts of drying using inert particles, pneumatic, and fluidized bed drying.	Understand
CO4	Select appropriate novel drying techniques for drying of food materials.	Analyze
CO5	Choose suitable advanced dryers for different food materials.	Analyze

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	3	2
CO2	2	3	2
CO3	3	3	2
CO4	3	2	2
CO5	3	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

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

Syllabus

K.S. Rangasamy College of Technology–Autonomous R 2022								
M. Tech. Food Technology								
60 PFT 102– Advanced Drying Technology								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	3	1	0	60	4	40	60	100

Introduction to Drying Drying and dehydration - Principles - Mechanism of drying - Internal and external conditions of drying - Drying rate characteristic curves - Diffusion theories of drying - Effective Fickian diffusivity - Water activity - Water activity predictive models – Calculations – Sorption Isotherm - Hysteresis - Determination of sorption isotherms - Gravimetric method - Manometric method and Hygroscopic methods	[9]
Spray Drying and Freeze Drying Spray drying - Concept - Components of spray drier - Spray dryer nozzle - Mechanism of atomization - Drop size and drop distribution - Drying of droplets - Fundamentals - Residence time - Heat and mass balance - Drier efficiency - New developments in spray drying - Spray freeze drying. Freeze drying - Concept - Principle - Stages in freeze drying - Heat and mass transfer - Calculations - Design considerations - Industrial freeze dryers - Advances in freeze drying – Microwave freeze drying.	[9]
Drying on Inert Particles Introduction - Inert particle drying - Pneumatic drying - Principle - Mechanism - Working and its applications. Fluidized bed drying - Principles of fluidization - Components of fluidized bed system - Classification of fluidized bed dryers - Conventional and modified FBD.	[9]
Novel Drying Super-heated steam drying - Principles - Classification - Selection - Applications. Heat pump drying (HPD) – Principle - Low temperature HPD - Chemical HPD - Developments and trends. Contact - Sorption drying - Mechanism - Characteristics of sorbents/carriers – High electric field drying.	[9]
Advanced Dryers Microwave dryers - Basic concepts - Industrial applications - Hybrid microwave dryers - Infrared drying - Principles - Industrial dryers - Applications - Sonic drying - Slush drying - Refractance window drying.	[9]
Total Hours: 45 + 15 (Tutorial)	**60**

Text Book(s):	
1.	Mujumdar, A. S. (2007). *Handbook of Industrial Drying* (3rd ed.). CRC Press, Taylor and Francis Group, UK.
2.	Chen, X. D., & Mujumdar, A. S. (2008). *Drying Technologies in Food Processing* (1st ed.). Wiley-Blackwell.
Reference(s):	
1.	Kudra, T., & Mujumdar, A. S. (2009). *Advanced Drying Technologies* (2nd ed.). CRC Press, Taylor and Francis Group, UK.
2.	Mujumdar, A. S. (2007). *Handbook of Industrial Drying* (3rd ed.). CRC Press, Taylor and Francis Group, UK.

Course Contents and Lecture Schedule

S.No.	Topic	No. of Hours
1	Introduction to Drying	
1.1	Drying and dehydration principles	1
1.2	Mechanism of drying	2
1.3	Drying rate characteristic curves	1

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1.4	Diffusion theory	2
1.5	Water activity	2
1.6	Determination of sorption isotherms	2
1.7	Tutorial	2
2	**Spray Drying and Freeze Drying**	
2.1	Spray drying concept	1
2.2	Components of spray drying	1
2.3	Mechanism of atomization	1
2.4	Drying of droplets	2
2.5	Tutorial	2
2.6	Heat and mass balance	1
2.7	Freeze drying	1
2.8	Advances in freeze drying	1
2.9	Tutorial	2
3	**Drying of Inert Particles**	
3.1	Inert particle drying	2
3.2	Pneumatic drying principle	1
3.3	Mean deviation	1
3.4	Tutorial	2
3.5	Standard deviation	2
3.6	Coefficient of variation	2
3.7	Tutorial	2
4	**Novel Drying**	
4.1	Super-heated steam drying	1
4.2	Principle, classification, and applications	1
4.3	Heat pump drying	1
4.4	Low temperature HPD	1
4.5	Tutorial	2
4.6	Chemical HPD	2
4.7	Contact sorption drying	1
4.8	High electric field drying	1
4.9	Tutorial	2
5	**Advanced Drying**	
5.1	Microwave dryers	1
5.2	Basic concepts	1
5.3	Industrial applications	1
5.4	Hybrid microwave dryers	1
5.5	Tutorial	2
5.6	Infrared dryers	1
5.7	Principles of infrared dryers	1
5.8	Sonic drying	1
5.9	Slush drying	1
5.10	Tutorial	2
	Total	60

Course Designer(s)

Mr.T.G.N.Nagarjun-nagarjun@ksrct.ac.in

60 PFT 103	Unit Operations in Food Process Engineering	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To make use of material and energy balance in food processing operations
- To explain the concepts of fluids and fluid flow properties
- To outline the various mechanical operations carried out in food processing
- To classify modes of heat transfer and explain heat exchangers and evaporators
- To summarize the various mass transfer operations

Pre-requisites

NIL

Course Outcomes

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

CO1	Make use of material and energy balance in food processing operations	Analyze
CO2	Explain the concepts of fluids and fluid flow properties	Apply
CO3	Outline the various mechanical operations carried out in food processing	Understand
CO4	Classify modes of heat transfer and explain heat exchangers and evaporators	Analyze
CO5	Summarize the various mass transfer operations	Analyze

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	3	2
CO2	2	3	2
CO3	3	3	3
CO4	3	3	2
CO5	2	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

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

Passed in BoS Meeting held on 23/12/22
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Syllabus

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

M. Tech. Food Technology

60 PFT 103–Unit Operations in Food Process Engineering

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

Material and Energy Balance Stoichiometric principles - Material balance without chemical reaction like distillation, evaporation, crystallization, drying, and extraction - Heat capacity of solids, liquids, gases - Enthalpy changes in food - Standard heat of reaction - Heats of formation - Combustion - Energy balance for systems without chemical reaction	[9]
Fluid Flow Principles of fluid flow - Properties of liquids - Fluid dynamics - Potential energy - Kinetic energy - Pressure energy - Friction loss - Mechanical energy - Newtonian and non-Newtonian fluids - Streamline and turbulent flow - Flow measurement and measurement of viscosity - Kinematics of fluid flow - Concept of boundary layer - Basic equation of fluid flow: Equation of continuity and Bernoulli equation - Correction of Bernoulli equation for fluid friction - Application of Bernoulli equation for pump work	[9]
Mechanical Operation Screening - Screening equipment - Effectiveness of screens - Gravity settling - Sedimentation - Thickening - Clarifier - Flotation - Filtration principle - Types of filtrations – Equipment	[9]
Heat Transfer Concept of heat conduction - Fourier's law of heat conduction - One-dimensional steady-state heat conduction equation for flat plate and cylinder - Concept of heat convection - Natural and forced convection - Individual and overall heat transfer coefficient - Concept of radiation - Black body and grey body concept - Radiation properties - Stefan-Boltzmann law - Emissivity and absorptivity - Kirchhoff's Law - Introduction to heat exchanger and evaporator equipment	[9]
Mass Transfer Types of mass transfer operations - Fick's law - Molecular and eddy diffusion in gas and liquids - Steady-state diffusion under stagnant and laminar flow conditions - Diffusivity measurement - Local and overall mass transfer coefficients - Introduction to mass transfer operations: absorption, distillation, extraction, leaching, humidification	[9]
Total Hours:	**45**

Text Book(s):

1. Goshal, S. K., Sanyal, S. K., & Datta, S. (2006). *Introduction to Chemical Engineering* (19th ed.). Tata McGraw-Hill, Delhi.
2. McCabe, W. L., Smith, J. C., & Harriot, P. (2005). *Unit Operations of Chemical Engineering* (7th ed.). McGraw-Hill, New York.

Reference(s):

1. GavahaneK.A.,"Unit operation",27th Edition,Nirali Prakasham Publications,Pune,2016

Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Material and Energy Balance**	
1.1	Stoichiometric principles	1
1.2	Material balance without chemical reaction	2
1.3	Evaporation	1
1.4	Drying and extraction	2
1.5	Heat capacity of solids	2
1.6	Energy balance for systems	2
1.7	Tutorial	2
2	**Fluid Flow**	
2.1	Principles of fluid flow	1

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2.2	Properties of liquid	1
2.3	Fluid dynamics	1
2.4	Newtonian and non-Newtonian fluids	2
2.5	Tutorial	2
2.6	Kinematics of fluid flow	1
2.7	Concept of boundary layer	1
2.8	Equation of continuity	1
2.9	Tutorial	2
3	**Mechanical Operation**	
3.1	Screening	2
3.2	Effectiveness of screening	1
3.3	Gravity settling	1
3.4	Tutorial	2
3.5	Sedimentation	2
3.6	Filtration principle	2
3.7	Tutorial	2
4	**Heat Transfer**	
4.1	Concept of heat conduction	1
4.2	Fourier's law of heat conduction	1
4.3	Concept of heat convection	1
4.4	Natural and forced convection	1
4.5	Tutorial	2
4.6	Concept of radiation	2
4.7	Emissivity and absorptivity	1
4.8	Kirchhoff's law	1
4.9	Tutorial	2
5	**Mass Transfer**	
5.1	Types of mass transfer operations	1
5.2	Fick's law	1
5.3	Molecular and eddy diffusion	1
5.4	Diffusivity measurement	1
5.5	Tutorial	2
5.6	Introduction to mass transfer operations	1
5.7	Distillation	1
5.8	Extraction	1
5.9	Leaching	1
5.10	Tutorial	2
	Total	60

Course Designer(s)

Mr.M.Ramya-ramya@ksrct.ac.in

60 PFT 104	Food Chemistry and Microbiology	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To Analyze the role of water in food stability
- To examine the structure and functional role of food biomolecules
- To identify suitable techniques for the modification of biomolecules
- To outline the significance of microbes in fermentation, spoilage
- To outline the food borne infectious diseases

Pre-requisites

NIL

Course Outcomes

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

CO1	Analyze the role of water in food stability	Analyze
CO2	Examine the structure and functional role of food biomolecules	Apply
CO3	Identify suitable techniques for the modification of biomolecules	Apply
CO4	Outline the significance of microbes in fermentation, spoilage, and foodborne infectious diseases	Understand
CO5	Summarize the food preservation techniques	Analyze

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	3	2
CO2	3	3	3
CO3	3	2	2
CO4	3	3	2
CO5	3	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

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

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Syllabus

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

M. Tech. Food Technology

60 PFT 104–Food Chemistry and Microbiology

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

Water Relationships in Food and Carbohydrates Water activity and its relevance to deteriorative processes in foods - Glass transitions and molecular mobility - their relevance to quality and stability of foods. Structure and properties of simple and complex food carbohydrates - Modified starch and cellulose - Manufacture of maltodextrins and corn syrup - Cyclodextrins - Chemistry and food applications - Polyols and their applications - Carbohydrates as fat substitutes.	[9]
Lipids Classifications - Structure and roles of fatty acids. Food lipids and health – trans fatty acid, fatty acid, conjugated linolenic acid, phytosterols, carotenoids. Processing of oils and fats - refining - hydrogenation - interesterification and winterization. Deterioration of oils - hydrolytic rancidity - oxidative rancidity and their prevention.	[9]
Proteins Protein structure and conformation - Properties and reactions of proteins in food systems - Dissociation - Optical activity - Solubility - Hydration - Swelling - Foam formation - Stabilization - Gel formation - Emulsifying effect - Denaturation of proteins - Food sources - Functional role in foods - Texturized proteins – methods.	[9]
Microbial Growth and Microbial Spoilage Types of microorganisms normally associated with food - mold, yeast, and bacteria - Physical and chemical factors influencing growth of microorganisms - Biochemical changes caused by microorganisms - Microbial food fermentation – Microbiological standards for different foods - Food poisoning and microbial toxins. Principle and types of food spoilage - Microbial spoilage of different types of foods - Spoilage of fruits and vegetables - Fresh and processed meats, poultry, seafood, cereal products, bakery products, dairy products, fermented foods, and canned foods.	[9]
Microbiology and Food Preservation Effect of high temperature on microbes - TDT, D value, Z value, 12D concept - Calculation of process time. Effect of low temperature, radiation, and drying on microbes. Chemical preservatives. Advances in preservation of food by various biotechnological processes.	[9]
Total Hours:	**45**

Text Book(s):

1. Belitz, H. D., Grosch, W., & Schieberle, P. (2008). *Food Chemistry* (3rd ed.). Springer-Verlag, Berlin.
2. Vaclavik, V. A., & Christian, E. W. (2005). *Essentials of Food Science* (2nd ed.). Springer.

Reference(s):

1. Frazier, W. C., & Westhoff. *Food Microbiology* (4th ed.). Tata McGraw-Hill, New Delhi, 2011.
2. Vijaya, R. K. *Food Microbiology* (1st ed.). MJPP Publishers, Chennai, 2007.

Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Water Relationships in Food and Carbohydrates**	
1.1	Water activity and its relevance	1
1.2	Glass transitions and molecular mobility	1
1.3	Stability of foods	2
1.4	Modified starch	1
1.5	Cyclodextrins	1
1.6	Carbohydrates as fat substitutes	1
2	**Lipids**	
2.1	Classification and structure of fatty acids	1
2.2	Food lipids and health	2

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2.3	Conjugated linolenic acid	1
2.4	Processing of oils and fats	2
2.6	Hydrogenation	1
2.7	Deterioration of oils	1
2.8	Hydrolytic rancidity	1
3	**Proteins**	
3.1	Protein structure and conformation	2
3.2	Properties and reactions of proteins	1
3.3	Optical activity	2
3.4	Emulsifying effect	2
35	Denaturation of Proteins	2
4	**Microbial growth and Microbial Spoilage**	
4.1	Microorganisms associated with food	1
4.2	Physical and chemical factors	2
4.3	Biochemical changes	1
4.4	Microbial food fermentations	1
4.5	Microbiological standards of different foods	2
4.6	Spoilage of fruits	1
4.7	Fermented foods and canned foods	1
5	**Microbiology and Food preservation**	
5.1	Effect of temperature on microbes	2
5.2	Calculation of process time	1
5.3	Effect of low temperature	2
5.4	Radiation	1
5.5	Effect of low temperature	1
5.6	Radiation and drying on microbes	2
5.7	Chemical preservatives	1
5.8	Advances in preservation of food	1
	Total	45

Course Designer(s)

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Passed in BoS Meeting held on 23/12/22
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60 PED 001/ 60 PDB E26	Research Methodology and IPR	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To understand the principles of the research process.
- To develop knowledge in analytical skills for collection of research data.
- To understand the procedure in the preparation of reports.
- To gain a basic understanding of the process involved in intellectual property rights.
- To learn the process of patent filing

Pre-requisites

NIL

Course Outcomes

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

CO1	To understand the research process and design.	Apply
CO2	To gain knowledge about sources and methods of collecting research data.	Remember
CO3	To understand the procedure of data analysis, report preparation, and plagiarism checking.	Understand
CO4	To gain knowledge on trademarks and the role of UNESCO in intellectual property rights (IPR).	Apply
CO5	To learn about the benefits, e-filing, and examinations related to patents.	Apply

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	3	2
CO2	3	3	2
CO3	3	2	3
CO4	2	3	2
CO5	3	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

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

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Syllabus

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

M. Tech. Food Technology

60 PED 001/60 PDB E26 - Research Methodology and IPR

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

Research Design Overview of research process and design – Use of secondary and exploratory data to answer the research question, qualitative research, observation studies, experiments and surveys. Selection of the right medium and journal for publication, translation of research.	[9]
Data Collection and Sources Measurements, measurement scales, questionnaires and instruments, sampling and methods. Data – Preparing, exploring, examining and displaying.	[9]
Data Analysis and Reporting Overview of multivariate analysis, hypotheses testing and measures of association. Presenting insights and findings using written reports and oral presentation. Checks for plagiarism, falsification, fabrication, and misrepresentation.	[9]
Intellectual Property Rights Intellectual Property – The concept of IPR, evolution and development of the concept of IPR, IPR development process, trade secrets, utility models, IPR & biodiversity. Role of WIPO and WTO in IPR establishments, right of property, common rules of IPR practices, types and features of IPR agreements, trademark, functions of UNESCO in IPR maintenance.	[9]
Patents Patents – Objectives and benefits of patents, concept and features of patents, inventive step, specification, types of patent applications, process of e-filing, examination of patents, grant of patents, revocation, equitable assignments, licenses, licensing of related patents, patent agents, registration of patent agents.	[9]
Total Hours:	**45**

Text Book(s):

1. David I. Bainbridge, “Intellectual Property,” Longman, 9th Edition, 2012.
2. Cooper Donald R, Schindler Pamela S, and Sharma J.K., “Business Research Methods,” Tata McGraw Hill Education, 11th Edition (2012).

Reference(s):

1. Chawla H.S., “Introduction to Intellectual Property Rights,” CBS PUB & DIST PVT Limited, India, 2019.
2. Catherine J. Holland, “Intellectual Property: Patents, Trademarks, Copyrights, Trade Secrets,” Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, “Patent Searching: Tools & Techniques,” Wiley, 2007.
4. Arun K. Narasani, Kankanala K.C., Radhakrishnan V., “Indian Patent Law and Practice,” Oxford University Press, 2010.
5. Richard Stim, “Patent, Copyright & Trademark - An Intellectual Property Desk Reference,” NOLO Publishers, 2020.
6. The Institute of Company Secretaries of India, Statutory body under an Act of Parliament, “Professional Programme Intellectual Property Rights, Law and Practice,” September 2013.

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Research Design**	
1.1	Overview of research process and design	1
1.2	Use of secondary and exploratory data to answer the research question	2
1.3	Qualitative research	1
1.4	Observation studies	1
1.5	Experiments and surveys	1
1.6	Selection of the right medium and journal for publication	2
1.7	Translation of research	1
2.0	**Data Collection and Sources**	
2.1	Measurements, measurement scales	2
2.2	Questionnaires and instruments	2
2.3	Sampling and methods	2
2.4	Data - Preparing, exploring, examining and displaying	3
3.0	**Data Analysis and Reporting**	
3.1	Overview of multivariate analysis	1
3.2	Hypothesis testing and measures of association	2
3.3	Presenting insights	1
3.4	Findings using written reports and oral presentation	2
3.5	Checks for plagiarism	1
3.6	Falsification	1
3.7	Fabrication, and misrepresentation	1
4.0	**Intellectual Property Rights**	
4.1	Intellectual Property – The concept of IPR	1
4.2	Evolution and development of the concept of IPR, IPR development process	2
4.3	Trade secrets, utility models, IPR & biodiversity	2
4.4	Role of WIPO and WTO in IPR establishments	1
4.5	Right of property, common rules of IPR practices	1
4.6	Types and features of IPR agreements, trademark, functions of UNESCO in IPR maintenance	2
5.0	**Patents**	
5.1	Patents – Objectives and benefits of patents, concept, features of patents	2
5.2	Inventive step, specification, types of patent application	2
5.3	Process of e-filing, examination of patents	1
5.4	Grant of patent, revocation	1
5.5	Equitable assignments, licenses, licensing of related patents	2
5.6	Patent agents, registration of patent agents	1
	Total	**45**

Course Designer(s)

Dr.A.Murugesan–murugesana@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 PFT 1P1	Food Testing and Evaluation Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

Objectives

- To Analyze various food products
- To detect food adulteration and identify the components in foods
- To assess sensory properties and energy values of food products
- Understand food testing methods and quality evaluation techniques for safety assurance
- Develop skills in analyzing food samples and interpreting laboratory results accurately

Pre-requisites

NIL

Course Outcomes

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

CO1	Analyze various food products	Analyze
CO2	Detect food adulteration and identify the components in foods	Apply
CO3	Assess sensory properties and energy value of food products	Apply
CO4	Analyze food quality parameters and ensure compliance with safety standards	Apply
CO5	Evaluate food products using laboratory techniques for improved consumer health	Apply

Mapping with Programme Outcomes

COs	POs		
	1	2	3
CO1	3	3	2
CO2	3	3	2
CO3	3	2	3
CO4	2	3	2
CO5	3	3	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	-	-	-	-
Understand	-	-	-	-
Apply	25	12	50	50
Analyze	25	13	50	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

K.S. Rangasamy College of Technology–Autonomous R 2022								
M. Tech. Food Technology								
60 PFT 1P1- Food Testing and Evaluation Laboratory								
Semester	Hours/Week			Total hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	0	0	4	60	2	60	40	100

Name of Experiments

1. Assessment of freshness and characterization of edible oil
2. Analysis of turmeric: Curcumin content, Oleoresin, Moisture content
3. Estimation of capsaicin content and pungency level of chilies
4. Analysis of tea and coffee: Caffeine, Moisture content, Solubility
5. Analysis of proximate composition of food products
6. Evaluation and comparison of cooking quality characteristics of different types of pasta and comply the results with FSSAI standards
7. Detection of adulterants present in agriculture commodities and food products
8. Spectroscopic analysis of heavy metal sin foods
9. Discriminative and descriptive sensory analysis of food products
10. Estimation of moisture content, reducing sugar, total ash, acid insoluble ash and SO_2 content
11. Determination of drying using tray dryer/Freeze dryer.
12. Estimation of energy value of food products
13. Rheological and Textural Profile analysis of Food products
14. Estimation of minerals present in food samples by flame photometry.

Course Designer(s)

Ms.R.Ramya–ramya@ksrct.ac.in

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BOARD OF STUDIES

K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)
M.E. / M.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 Passing End Semester Exam	
				Continuous Assessment*	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1	60 PFT 201	Instrumental Techniques and Methods for Food Analysis	2	40	60	100	45	100
2	60 PFT 202	Advanced Refrigeration and Cold Chain Management	2	40	60	100	45	100
3	60 PFT 203	Food Safety and Quality Control	2	40	60	100	45	100
4	60 PFT E2*	Professional Elective II	2	40	60	100	45	100
5	60 PFT E3*	Professional Elective III	2	40	60	100	45	100
6	60 PFT E4*	Professional Elective IV	2	40	60	100	45	100
7	60 PAC 002	Disaster Management	2	100	-	100	-	100
PRACTICAL								
8	60 PFT 2P1	Food Products Development Laboratory	3	60	40	100	45	100
9	60 PFT 2P2	Term Paper and Seminar	2	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 PFT 201	Instrumental Techniques and Methods for Food Analysis	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To apply UV-Visible and IR spectroscopy in food analysis.
- To select suitable techniques for internal structure, thermal, and morphology analysis of food materials.
- To choose appropriate electrophoretic and rapid techniques to separate and identify food components.
- To make use of AAS, NMR, and mass spectroscopy to Analyze different food materials.
- To identify suitable chromatographic methods to separate and quantify food components.

Pre-requisites

NIL

Course Outcomes

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

CO1	Apply UV-Visible and IR spectroscopy in food analysis.	Apply
CO2	Select suitable techniques for internal structure, thermal, and morphology analysis of food materials.	Apply
CO3	Choose appropriate electrophoretic and rapid techniques to separate and identify food components.	Apply
CO4	Make use of AAS, NMR, and mass spectroscopy to Analyze different food materials.	Analyze
CO5	Choose suitable chromatographic methods to separate and quantify food components.	Analyze

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Modal Examination (Marks)	End Sem Examination (Marks)
	1	**2**		
Remember	10	10	10	10
Understand	20	10	20	20
Apply	30	20	30	30
Analyze	0	20	40	40
Evaluate	0	0	0	0
Create	0	0	0	0
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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Syllabus

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

M .Tech. Food Technology

60 PFT201 - Instrumental Techniques and Methods for Food Analysis

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

Introduction to Instrumental Methods and UV-Visible and IR Spectroscopy Classification of instrumental methods based on physical properties of molecules - The Electromagnetic spectrum - Interaction of photons with matter - Absorbance and transmittance - Beer and Lambert's laws. Deviation from Beer-Lambert's Law. Ultraviolet and Visible spectrometry: Theory - Types of Transitions - Red and blue shifts - Instrumentation - Single beam and double beam spectrophotometers and applications. Fluorimetry: Theory - Factors affecting fluorescence - Instrumentation and applications. Infrared spectrometry: Requirements for IR absorption - Modes of vibrations - Instrumentation - Applications - Fingerprint region.	[9]
X-Ray and Flame Photometer and Thermal Methods and Morphology Analysis Absorption - Non-dispersive Method - Diffraction - Rotating and powder crystal methods – Applications. Flame photometer, Polarimetry and Refractometry - Principle and instrumentation - Saccharimetry - Analysis of sugar. Thermogravimetry - Differential Thermal Analysis - Differential scanning calorimetry - Factors affecting the results - Instrumentation and applications. Morphology Analysis - Scanning Electron Microscopy - Transmission Electron Microscopy and Laser diffraction for particle analysis - Principle and Applications.	[9]
Electrophoresis and Rapid Techniques Basic Principle of paper - Starch gel, agarose, PAGE, SDS-PAGE electrophoresis – Immuno affinity techniques - Radio Assay Electrophoresis and applications. Isoelectric focusing, capillary electrophoresis - Microchip and 2D electrophoresis. Recent Development of Rapid Techniques - E-sensors - e-nose, e-tongue instrumentation - Applications and working principles - Flow cytometry - Epifluorescence microscopy - Principle and Applications.	[9]
Atomic Absorption Spectrophotometer and NMR and Mass Spectroscopy Principle, Advantages of AAS over FES - Instrumentation - Interference and applications. Nuclear Magnetic Resonance: Introduction to NMR - Energy levels of nucleus - Equivalent and non-equivalent protons - Chemical shift - Shielding - TMS - Factors affecting chemical shift - Splitting of signals and instrumentation (proton NMR) - Applications. Theory - Components of mass spectrometer - Mass spectrum. Resolution of mass spectrometer. Types of ions produced - General rules for Interpretation of mass spectra - Fragmentation methods - Applications of mass spectra.	[9]
Chromatography Techniques and Hyphenated Techniques Introduction - Classification of chromatographic methods: Column chromatography, Thin Layer chromatography, Paper chromatography, Gas chromatography and High-performance Liquid Chromatography (HPLC) - Principle, important components and their functions, mode of separation, Instrumentation and applications. ICP-MS, HR-MS, HPTLC, GC-MS, LC-MS and GC-FTIR – Principle, Instrumentation and applications.	[9]
Total Hours:45+15(Tutorial)	60

Text Book(s):

1.	Chatwal, G.R., & Anand, S.K. (2022). *Instrumentation Methods of Chemical Analysis* (5th ed.). Himalaya Publications, Bombay.
2.	Willard, H.H., Merritt, L.L., Dean, J.A., & Settle, F.A. (2004). *Instrumental Methods of Analysis* (7th ed.). CBS Publishers & Distributors, Delhi.

Reference(s):

1.	Yeshasahu, P., & Meloan, C.E. (1996). *Food Analysis* (2nd ed.). CBS Publishers & Distributors, Delhi.

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Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Introduction to Instrumental Methods and UV visible and IR Spectroscopy**	
1.1	Classification of Instrumental methods	1
1.2	Electromagnetic spectrum	2
1.3	Beer lamberts Law	1
1.4	Ultraviolet and Visible spectrometry	2
1.5	Fluorimetry	2
1.6	Modes of vibration	2
1.7	Tutorial	2
2	**X-ray and Flame Photometer and Thermal Methods and Morphology Analysis**	
2.1	Absorption Non-destructive Method	1
2.2	Diffraction	1
2.3	Application of Flame Photometer	1
2.4	Polarimeter	2
2.5	Tutorial	2
2.6	Thermogravimetry	1
2.7	Differential Scanning Calorimetry	1
2.8	Transmission Electron Microscope	1
2.9	Tutorial	2
3	**Electrophoresis and Rapid Techniques**	
3.1	Basic Principles of Paper Chromatography	2
3.2	Radio assay Electrophoresis and Applications	1
3.3	Isoelectric Focusing	1
3.4	Tutorial	2
3.5	E-Sensors	2
3.6	Flow Cytometer	2
3.7	Tutorial	2
4	**Atomic Absorption Spectrophotometer, NMR, Mass Spectroscopy**	
4.1	Principle and advantages of AAS over FES	1
4.2	Introduction to NMR	1
4.3	Energy Levels of Nucleus	1
4.4	Chemical Shift	1
4.5	Tutorial	2
4.6	Components of mass spectrometry	2
4.7	Resolution of mass spectrometry	1
4.8	Interpretation of mass spectra	1
4.9	Tutorial	2
5	**Chromatography Techniques and Hyphenated techniques**	
5.1	Classification of Chromatographic Methods	1
5.2	Thin Layer Chromatography	1
5.3	Paper Chromatography	1
5.4	Gas Chromatography	1
5.5	Tutorial	2
5.6	ICP-MS (Inductively Coupled Plasma Mass Spectrometry)	1
5.7	HR-MS (High-Resolution Mass Spectrometry)	1
5.8	GC-MS (Gas Chromatography-Mass Spectrometry)	1
5.9	FTIR (Fourier Transform Infrared Spectroscopy)	1
5.10	Tutorial	2
	Total	60

Course Designers

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BOARD OF STUDIES

60 PFT 202	Advanced Refrigeration and Cold Chain Management	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To apply the concepts of refrigeration systems and determine their effectiveness.
- To illustrate the working and function of various components of refrigeration systems.
- To examine the effect of low-temperature storage on product quality.
- To classify and construct cold storage units and calculate cooling loads.
- To develop a cold chain system for transporting food products.

Pre-requisites

NIL

Course Outcomes

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

CO1	Apply the concepts of refrigeration systems and determine their effectiveness.	Apply
CO2	Select suitable working and function of various components of refrigeration systems.	Apply
CO3	Choose the effect of low-temperature storage on product quality.	Apply
CO4	Select and construct cold storage units and calculate cooling loads.	Analyze
CO5	Choose a cold chain system for transporting food products.	Analyze

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

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

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Syllabus

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

M. Tech. Food Technology

60 PFT202–Advanced Refrigeration and Cold Chain Management

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

Introduction to Refrigeration Refrigeration, ton of refrigeration, refrigeration capacity calculations, single vapor compression and vapor absorption systems-COP determinations and calculations. Refrigerants-characteristics of different refrigerants, ozone depletion potentials, pressure-enthalpy charts.	[9]
Components of a Refrigeration System Types of compressors-POsitive displacement and roto-dynamic types and performance. Evaporators and their functional aspects, condensing units and cooling towers, expansion valves, humidifying systems, piping, and different controls.	[9]
Low Temperature Storage of Foods Effect of temperature on food spoilage. Low temperature storage methods-chilling, freezing, evaporative cooling and its applications. Novel freezing methods and freezer types, freezing rates, growth rate of ice crystals, crystal size and its effect on texture and quality of foods.	[9]
Cold and Frozen Storage Construction and operation-insulation, types of storage rooms, design and requirements of cold stores and frozen stores, total refrigeration load calculations, automated cold stores, temperature requirements in frozen storage, maintenance, packaging, and energy conservation.	[9]
Cold Chain Management Scope and importance of cold chain in the food processing industry and retail chain. Cold chain-overview, planning and designing, transport of frozen foods-different modes, time-temperature indicators, data loggers, safety aspects, flexibility storage systems, cold chain transportation inland and export, retail and supermarket cold chain-retail display cabinets.	[9]
Total Hours:45+15(Tutorial)	60

Text Book(s):

1.	Rajput, R.K. “Refrigeration and Air-conditioning.” 3rd Edition, S.K. Kataria & Sons, Delhi, 2013.
2.	Dellino, C.V.J. “Cold and Chilled Storage Technology.” 2nd Edition, Springer, 2011.

Reference(s):

1.	Kennedy, C.J. “Managing Frozen Foods.” 1st Edition, Woodhead Publishing Ltd., 2000.
2.	Fellows, P.J. “Food Processing Technology: Principles and Practice.” 3rd Edition, Woodhead Publishing Ltd., 2009.

Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Introduction to Refrigeration**	
1.1	Refrigeration and Capacity Calculation	1
1.2	Single Vapor Compression	2
1.3	Vapor Absorption	1
1.4	COP Determination and Calculation	2
1.5	Refrigerants and Ozone Depletion	2
1.6	Pressure Enthalpy Charts	2
1.7	Tutorial	2
2	**Components of a Refrigeration System**	
2.1	Types of Compressors	1
2.2	Positive Displacement	1
2.3	Evaporator and Its Functions	1
2.4	Condensing Units	2
2.5	Cooling Towers	2
2.6	Expansion Valves	1

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2.7	Humidifying Systems	1
2.8	Tutorial	1
2.9	Components of a Refrigeration System	2
3	**Low Temperature Storage of Foods**	
3.1	Effect of Temperature on Food Spoilage	2
3.2	Low Temperature Spoilage Methods	1
3.3	Chilling	1
3.4	Freezing	2
3.5	Evaporative Cooling	2
3.6	Novel Freezing Methods	2
3.7	Crystal Size	2
4	**Atomic Absorption Spectrophotometer and NMR and Mass Spectroscopy**	
4.1	Construction and Operation of Cold Storage	1
4.2	Types of Storage Rooms	1
4.3	Design and Requirements	1
4.4	Refrigeration Load Calculation	1
4.5	Tutorial	2
4.6	Automated Cold Store	2
4.7	Temperature Requirements	1
4.8	Maintenance and Packaging	1
4.9	Tutorial	2
5	**Cold Chain Management**	
5.1	Scope and Importance of Cold Chain	1
5.2	Cold Chain Overview	1
5.3	Transport of Frozen Foods	1
5.4	Time-Temperature Indicators	1
5.5	Tutorial	2
5.6	Safety Aspects	1
5.7	Flexibility of Storage Systems	1
5.8	Cold Chain Transportation	1
5.9	Supermarket Cold Chain	1
5.10	Tutorial	2
	Total	60

Course Designers

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60 PFT 203	Food Safety and Quality Control	Category	L	P	T	Credit
		PC	3	0	0	3

Objectives

- To infer the importance of food quality and safety.
- To outline different food hazards and their control measures.
- To select suitable methods for microbial inactivation and microbial growth modeling.
- To outline the functions of various national and international food agencies.
- To identify suitable food safety management systems for food products.

Pre-requisites

NIL

Course Outcomes

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

CO1	Analyze the importance of food quality and safety.	Analyze
CO2	Examine different food hazards and their control measures.	Apply
CO3	Identify suitable methods for microbial inactivation and microbial growth modeling.	Apply
CO4	Outline the functions of various national and international food agencies.	Understand
CO5	Summarize the food safety management systems for food products.	Remember

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

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

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Syllabus

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

M. Tech. Food Technology

60 PFT 203 - Food Safety and Quality Control

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

Contemporary Food Safety Strategies Principles and need for quality control and safety, strategy and criteria for food safety. Consumer lifestyle and demand, issues in food safety, food traceability and recall, case against food biotechnology and irradiation. Case studies in food safety.	**[9]**
Food Hazards and Contaminants Characterization of food hazards, foodborne diseases and their control, food contaminants and their control. Naturally available toxins in foods, cross-contamination: toxicants resulting from food processing. Management of food allergens. Risk analysis of food hazards.	**[9]**
Microbial Growth and Modelling Inactivation of microbial growth - thermal and non-thermal methods, process dependent microbial modelling, integration of process and microbial growth modelling. Applications of predictive microbial modelling. Advanced methods for rapid detection of food spoilage.	**[9]**
Quality Control and Food Safety Agencies National Regulatory Agencies and International Agencies: Quality control importance, measures and procedures. BIS, AGMARK, FSSAI. Organizational structure and functions of United States Food and Drug Administration (USFDA), Global Food Safety Initiative (GFSI), International Consultative Group on Food Irradiation (ICGFI), European Food Safety Authority (EFSA), British Retail Consortium (BRC) global standards, Codex Alimentarius, Sanitary and Phyto-Sanitary measures (SPS), Plant Quarantine Act.	**[9]**
Food Quality Management System Duties and responsibilities of food safety regulators, food safety and standards for food products, implementation, validation, verification and improvement of food safety management systems. HACCP, Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), Good Laboratory Practices (GLP), ISO 22000, FSSC 22000, Food Safety Audit.	**[9]**
Total Hours: 45	**45**

Textbook(s):

1.	DaWenSun.,"Handbook of Food Safety Engineering", 1stEdition, JohnWiley&Sons, NewJersey, 2011.
2.	Ronald H.Schmidt and Gary E.Rodrick., "Food Safety Hand book", 1stEdition, John Wiley & Sons, New Jersey,2003.

Reference(s):

1.	Yasmine Motarjemi and Huub Lelieveld. "Food Safety Management – A Practical Guide for the Food Industry." 1st edition, Elsevier, New York, 2013.
2.	S.P. Singh. "Food Safety, Quality Assurance and Global Trade: Concerns and Strategies." 1st edition, International Book Distribution Company, India, 2009.

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Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Contemporary Food Safety Strategies**	
1.1	Principles and need for quality	1
1.2	Strategy and food safety	1
1.3	Consumer Lifestyle	2
1.4	Food Traceability	1
1.5	Case against food biotechnology	1
1.6	Case studies in food safety	1
2	**Food Hazards and Contaminants**	
2.1	Characterization of food hazards	1
2.2	Foodborne diseases	2
2.3	Food contaminants	1
2.4	Naturally available toxins in food	2
2.6	Cross-contamination	1
2.7	Management of food allergens	1
2.8	Risk analysis and food hazards	1
3	**Microbial Growth and Modelling**	
3.1	Inactivation of microbial growth	2
3.2	Thermal and non-thermal methods	1
3.3	Microbial growth modelling	2
3.5	Applications of predictive microbial modelling	2
3.6	Rapid detection of food spoilage	2
4	**Quality Control and Food Safety Agencies**	
4.1	National Regulatory Agencies	1
4.2	Quality control importance	2
4.3	BIS, AGMARK, FSSAI	1
4.4	USFDA	1
4.6	International Consultative Group on Food Irradiation	2
4.7	European Food Safety Authority	1
4.8	Plant Quarantine Act	1
5	**Food Quality Management Systems**	
5.1	Duties and responsibilities of food safety regulators	2
5.2	Food safety standard management	1
5.3	HACCP	2
5.4	Good Manufacturing Practices	1
5.6	Good Hygienic Practices	1
5.7	Good Laboratory Practices	2
5.8	ISO 22000	1
5.9	FSSC 22000	1
	Total	45

Course Designers

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60 PFT 2P1	Food Products Development Laboratory	Category	L	T	P	Credits
		PC	0	0	6	3

Objectives

- To develop novel food products in the bakery, confectionary, beverage, dairy and snack foods.
- To make use of functional and specialty ingredients in preparing food products.
- To evaluate the developed food products for the desired quality parameters including sensory attributes.
- Enhance skills in formulating innovative food products through practical experimentation.
- Understanding of food safety and quality in product development.

Pre-requisites

NIL

Course Outcomes

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

CO1	Develop novel food products in the bakery, confectionery, beverage, dairy and snack foods	Analyze
CO2	Make use of functional and specialty ingredients in preparing food products	Apply
CO3	Evaluate the developed food products for the desired quality parameters including sensory attributes.	Apply
CO4	Develop and evaluate new food products effectively.	Apply
CO5	Implement safety protocols while creating high-quality food products.	Apply

Mapping with Programme Outcomes

COs	POs		
	1	2	3
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2
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

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BOARD OF STUDIES

Syllabus

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

M.Tech. Food Technology

60 PFT 2P1 – Food Products Development Laboratory

Semester	Hours/Week			Total hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	0	0	6	90	3	60	40	100

List of Experiments:

1. Development of protein-enriched biscuits/cookies and evaluation.
2. Development of deep fat fried snack product and analysis of quality parameters.
3. Development of phytochemicals-rich beverage and estimation of phytochemical content in the product.
4. Development of blended food flavour-based products and quality evaluation.
5. Development of dry health food premix and evaluation of quality and sensory attributes.
6. Development of marshmallow and assessment of texture and quality.
7. Development of product using dairy replacer specialty fats and quality evaluation.
8. Development of eggless cake and quality evaluation.
9. Development of nutritional/energy bar and product analysis.
10. Development of low fat spread and sensory evaluation.
11. Development of symbiotic dairy product and its sensory and microbiological analysis.
12. Development of sugar-free confectionery product and evaluation.
13. Development of millet-based ice cream wafer and evaluation of its quality.
14. Development of pasta using whole wheat flour and estimation of sensory attributes.
15. Development of gelatos and jellies and evaluation of sensory and quality parameters.
16. Virtual Lab: Canning of foods – Demo.

Course Designer

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Passed in BoS Meeting held on 23/12/22
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60 PFT 2P2	Term Paper and Seminar	Category	L	T	P	Credit
		PC	0	0	2	0

Objectives

- Develop their scientific and technical reading and writing skills that they need to understand and construct research articles.
- A term paper requires a student to obtain information from a variety of sources (i.e., journals, dictionaries, reference books) and then place it in logically developed ideas.
- To identify the recent topics in the research area and formulate the problem.
- To analyze the mathematical model for the identified problem.
- To design and simulate/develop prototype models.

Pre-requisites

NIL

Course Outcomes

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

CO1	Survey the relevant bibliography such as national/international referred journals for the preferred areas of research	Analyze
CO2	Develop scientific, technical reading and writing skills for the technical report preparation to apply it in their topics of research	Apply
CO3	Implement and Analyze the various complex problems in different practical applications	Apply
CO4	Analyze the mathematical model for the identified problem.	Analyze
CO5	Design and simulate/develop prototype models.	Apply

Mapping with Programme Outcomes

COs	POs		
	1	2	3
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2
3 - Strong; 2 - Medium; 1 – Some			

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Activity	Instructions	Submission week	Evaluation
Selection of area of interest and Topic Stating an Objective	An area of interest, topic has to be selected and objective to be framed	2nd week	3 % Based on clarity of thought, current relevance and clarity in writing
Collecting Information about chosen area & topic	1.List 1 Special Interest Groups or professional society 2. List2journals 3. List 3 conferences, symposia or workshops 4. List1thesistitle 5. List 5 web presences (mailing lists, forums News sites) 6. List 6 authors who publish regularly in your area 7. Attach a call for papers(CFP)from your area. 8. Conference/Journal/Symposium In the chosen area.	3rd week	3% (the selected Information must be area specific and of international and national standard)
Collection of Journal papers in the topic in the context of the objective – collect 20 &then filter	• Provide a complete list of references you will be using- Based on the objective -Search various digital libraries and Google Scholar • When picking papers to read– tryt o: • Pick papers that are related to each other in some ways and/or that are in the same field so that a meaningful survey can be written • Favour papers from well-known journals and conferences, • Favour-first or foundational papers in the field (as indicated in other people's survey paper),Favour more recent papers, • Pick a recent survey of the field so you can quickly gain an overview, • Find relationships with respect to each other and to your topic area(classification scheme/categorization) • Mark in the hard copy of papers whether complete work or section/sections of the paper are Being considered	4th week	6% (the list of standard papers and reason for selection)

Reading and notes for first 5papers	Reading Paper Process • For each paper form at able answering the following questions: • What is the main topic of the article? • What was/were the main issue(s)the authors aid they want to discuss? • Why did the author claim it was important? • How does the work build on other's work, in the author's opinion? • What simplifying assumptions does the author claim to be making? • What did the author do? • How did the author claim they were going to evaluate their work and compare it to others? • What did the authors were the limitations of the research? What did the authors were the important directions for future research?	5th week	8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)
	Concludewithlimitations/issuesnotaddressedbythepaper(fromthepersp ectiveofyoursurvey)		
Reading and notes for next5papers	Repeat Reading Paper Process	6th week	8%(the table given should indicate your understanding of the paper and the evaluation is based on your conclusions About each paper)
Reading and notes for final5 papers	Repeat Reading Paper Process	7^{th}week	**8%**(the table given should indicate your understanding of the paper and the evaluation is based on Your conclusions about each paper)
Draftoutline1andLinkingpapers	Prepare a draft Outline, your survey goals, along with a classification/categorization diagram	8^{th}week	**8%**(this component will be evaluated based on the linking and classification among The papers)

Abstract	Prepare a draft abstract and give a presentation	9th week	**6%** (Clarity, purpose and conclusion)**6%** Presentation & Viva Voce
Introduction Background	Write an introduction and Background sections	10th week	**5%**(clarity)
Sections of the paper	Write the sections of your paper based on the classification/categorization diagram in keeping with the goals of your survey	11th week	**10%**(this component will be evaluated based on the linking and classification among the papers)
Conclusions	Write your conclusions and future work	12th week	**5%**(conclusions–clarity and your ideas)
Final Draft	Complete the final draft of your paper	13th week	**10%** (formatting, English, Clarity and linking) **4%**Plagiarism Check Report
Seminar	Abrief15slidesonyourpaper	14th &15th week	**10%**(based on presentation and Viva-voce)

K.S. Rangasamy College of Technology–Autonomous R 2022								
60 PFT 2P2–Term Paper and Seminar								
M. Tech. Food Technology								
Semester	Hours/Week			Total hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	0	0	2	30	0	60	40	100

The work involves the following steps:

1. Selecting a subject, narrowing the subject into a topic.
2. Stating an objective.
3. Collecting the relevant bibliography(at least 15 journal papers)
4. Preparing a working outline.
5. Studying the papers and understanding the authors contributions and critically analyzing each paper.
6. Preparing a working outline.
7. Linking the papers and preparing a draft of the paper.
8. Preparing conclusions based on the reading of all the papers.
9. Writing the Final Paper and giving final Presentation

Please keep a file where the work carried out by you is maintained. Activities to be carried out

Course Designer

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CHAIRMAN
BOARD OF STUDIES

K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)
M.E. / M.Tech. Degree Programme
SCHEME OF EXAMINATIOS
(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 PFT 301	Plantation Crops and Spices Technology	2	40	60	100	45	100
2	60 PFT 302	Food Process Plant Layout and Design	2	40	60	100	45	100
3	60 PFT 303	Food Rheology	2	40	60	100	45	100
4	60 PFTE 5*	Professional Elective V	2	40	60	100	45	100
5	60 PFTE 6*	Professional Elective VI	2	40	60	100	45	100
PRACTICAL								
6	60 PFT 3P1	Project Work Phase I	3	60	40	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 PFT 301	Plantation Crops and Spices Technology	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To explain the recent trends in plantation crops processing
- To utilize functional properties of spices and condiments in product development
- To select extraction methods required for spices processing
- To outline different herbs and their processing
- To Analyze the advances in processing of flavour materials

Pre-requisites

Nil

Course Outcomes

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

CO1	Analyze the recent trends in plantation crops processing.	Analyze
CO2	Examine the functional properties of spices and condiments in product development.	Apply
CO3	Identify the extraction methods required for spices processing.	Analyze
CO4	Outline the different herbs and their processing.	Understand
CO5	Summarize the advances in processing of flavour materials.	Remember

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	2	3	2
CO2	3	3	2
CO3	2	3	2
CO4	3	3	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	20	20	30
Apply	20	20	30
Analyze	10	10	20
Evaluate	0	0	0
Create	0	0	0
Total	60	60	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 R 2022								
M.Tech. Food Technology								
60 PFT 301 –Plantation Crops and Spices Technology								
Semester	Hours/Week			Total hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Plantation Crops Types of Plantation crops. Recent trends and innovation in cocoa, coconut, cashew and tuber crops processing. Tea: Manufacturing of diversified tea products — instant tea, functional and herbal tea products. Coffee: Chemistry, Recent Trends in coffee technology, Quality grading of coffee, Chicory chemistry	**[9]**
Spices & Condiments Classification of spices. Functions of spices — Primary, secondary and emerging functions. Nutritive value of spices and their health benefits. Different forms of spices based on application – fresh, dried, volatile oils, oleoresins, paste, and other extractives. Commercial spice blends and seasonings formulations. Emerging spice blends and seasonings –Popular global spice blends. Growing demand for authenticity.	**[9]**
Advances in spice processing Spice oil - advances in SCFE, novel solvent free extraction methods using microwave, ultrasound. Cryogenic grinding of spices. Extraction of oleoresins, concepts and technology, desolventization methods, regulatory and statutory requirements for oleoresin processing. Spice encapsulation. Recent spice research- antioxidants, antimicrobial and health benefits of spice compound Intact Heater(DCH),Plate Heater(PHE),advantages and disadvantages. Evaporator-types-Performance measures.	**[9]**
Herbal spices Description of various types of herbs - Basil, Cilantro, Dill, Coriander, Mint, Oregano, Borage,Thyme,Parsley,Curryleaves,bilvaleaves,Bayleaves,Safflower,Rosemary,Lavender.Proces sing and post - harvest handling. Functional properties. Quality issues. Recent trends, health benefits and innovations of herbs in food Industry.	**[9]**
Flavouring Materials Recent advances and trends Natural flavours, sources of natural flavouring materials — herbs and spices, Genetic engineering in flavour, Flavours generated by enzymes and biological systems, Key aroma and taste components, Flavour stability during food processing and storage, Retention and release of flavours.	**[9]**
Total Hours: 45	**45**

Textbook(s):

1.	PeterK.V.,"HandbookofHerbsandSpices",2ndEdition,Woodhead Publishing, UK,2012.
2.	P.S.Ahuja,A.Gulati,R.D.Singh,R.K.Sud,R.C.Boruah.,"ScienceofTeaTechnology",1st Edition, Scientific Publishers,India,2013.

Reference(s):

1.	AmitBaranSharangi,SuchandDatta.,"ValueAdditionofHorticulturalCrops:RecentTrends and Future Directions",1stedition,Springer,India,2015.

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BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	Plantation Crops	
1.1	Types of Plantation Crops	1
1.2	Recent Trends and Innovation in Cocoa	1
1.3	Manufacturing of Diversified Tea Products	2
1.4	Quality Grading of Coffee	1
1.5	Chicory Chemistry	2
2	Spices & Condiments	
2.1	Classification of Spices	1
2.2	Different Forms of Spices	2
2.3	Commercial Spice Blends	1
2.4	Seasoning Formulation	2
2.6	Emerging Spice Blends	1
2.7	Popular Global Spice Blends	1
2.8	Growing Demand for Authenticity	1
3	Advances in Spice Processing	
3.1	Spice Oil and Advances in SCFE	2
3.2	Novel Solvent-Free Extraction	1
3.3	Extraction of Oleoresins	2
3.5	Spice Encapsulation	2
3.6	Evaporator and Its Types	2
4	Herbal Spices	
4.1	Description of Various Types of Spices	1
4.2	Basil	2
4.3	Cilantro	1
4.4	Coriander	1
4.6	Oregano	2
4.7	Processing and Post-Harvest Handling	1
4.8	Innovations in Food Industry	1
5	Flavouring Materials Recent Advances and Trends	
5.1	Natural Flavours	2
5.2	Sources of Natural Flavouring Agents	1
5.3	Genetic Engineering in Flavours	2
5.4	Enzymes and Biological Systems	1
5.6	Aroma and Taste Components	1
5.7	Flavour Stability	2
5.8	Storage	1
5.9	Retention and Release of Flavours	1
	Total	45

Course Designers

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BOARD OF STUDIES

60 PFT 302	Food Process Plant Layout and Design	Category	L	T	P	Credit
		PC	3	1	0	4

Objective

- To explain the recent trends in food processing.
- To utilize functional properties of product development.
- To select extraction methods required for spices processing.
- To outline different layouts of industries.
- To analyze the advances in processing of food safety.

Prerequisite

NIL

Course Outcomes

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

CO1	Analyze the recent trends in plantation crops processing.	Analyze
CO2	Examine the functional properties of spices and condiments in product development.	Apply
CO3	Identify the extraction methods required for spices processing.	Apply
CO4	Outline the different herbs and their processing.	Understand
CO5	Summarize the advances in processing of flavour materials.	Remember

Mapping with Programme Outcomes

COs	POs		
	1	2	3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3
3- Strong;2-Medium;1-Low			

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Semester Examination (Marks)
	1	2	
Remember (Re)	10	20	10
Understand(Un)	10	20	20
Apply(Ap)	20	20	30
Analyze(An)	20	0	40
Evaluate(Ev)	0	0	0
Create(Cr)	0	0	0
Total	60	60	100

Passed in BoS Meeting held on 23/12/22
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CHAIRMAN
BOARD OF STUDIES

K.S. Rangasamy College of Technology–Autonomous R 2022								
60 PFT 302 – Food Process Plant Layout and Design								
M. Tech. Food Technology								
Semester	Hours/Week			Total hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	1	0	60	4	40	60	100

Selection of Plant Location Introduction and classification of food processing plants, site selection - location - types of layout - characteristics of an efficient layout. Techniques of plant layout. General requirements and considerations for construction, materials and floors. Drains and drain layout. Ventilation, fly control, mould prevention, illumination in food plants.	**[9]**
Procedure for Plant Layout Introduction. Plant layout procedure. Layout problems. Layout of a new plant. Workstation layout. Revising and improving existing layout. Operation analysis. Reasons for inefficient layouts. Weaknesses in a poor plant layout. Reasons for redesign of layout. Procedure of revision and improvement of layout.	**[9]**
Industrial Safety Potential hazards, toxic chemicals and physical safety analysis, high pressure, high temperature operation, radioactive materials, safe handling and operation of machinery. Safety appraisal, steps to implement safety procedures, proper selection and replacement of handling equipment, personal protective equipment.	**[9]**
Accidents Industrial accidents – accident costs – identification of accident spots, remedial measures, identification and analysis of causes of injury to men and machines – accident prevention – accident proneness – vocational guidance, fault-free analysis. Fire prevention and fire protection.	**[9]**
Health Hazards and Legal Aspects: Health hazards – occupational – industrial health hazards – health standards and rules – safe working environments – parliamentary legislations – Factories Act – Labour Welfare Act – ESI Act – Workmen Compensation Act.	**[9]**
Total Hours	**45**

Textbook(s):	
1.	Kumar, A., and K. Jain. Food Plant Design and Operations: A Comprehensive Guide. Springer, 2017.
2.	Manufacturing Facilities Design and Material Handling by Fred E. Meyers, and Matthew P. Stephens, 3rdEdition,Pearson,PrenticeHall,2000
Reference(s):	
1.	Kumar, S. and S. R. Joshi. Food Safety and Quality Systems in Developing Countries. 1st edition, CRC Press, 2018.
2.	Murthy, N. S. Plant Layout and Material Handling: Design and Planning. 2nd edition, Wiley, 2019.

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CHAIRMAN
BOARD OF STUDIES

Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Selection of Plant location**	
1.1	Introduction and classification of food processing plants,	1
1.2	Site selection - location - types of layout-characteristics of an efficient layout.	1
1.3	Techniques of plant layout. General requirements and considerations for construction, materials and floors.	2
1.4	Drains and drain layout.	1
1.5	Ventilation, fly control, mould prevention, illumination in food plants.	2
2	**Procedure For Plant Layout**	
2.1	Introduction. Plant layout procedure.	1
2.2	Layout problems. Layout of a new plant. Workstation layout.	2
2.3	Revising and Improving existing layout.	1
2.4	Operation Analysis.	1
2.6	Reasons for inefficient layouts.	1
2.7	Weaknesses in a poor plant layout.	1
2.8	Reasons for redesign of layout. Procedure of revision and improvement of layout	2
3	**Industrial Safety:**	
3.1	Potential hazards, toxic chemicals and physical safety analysis	2
3.2	High pressure, high temperature operation	1
3.3	radioactive materials, safe handling and operation of machineries.	2
3.5	Safety Appraisal, steps to implement safety procedure, proper selection	2
3.6	Replacement of handling equipments, personal protective equipments.	2
4	**Accidents**	
4.1	Industrial accidents – accident costs	1
4.2	Identification of accident spots, remedial measures, identification	2
4.3	Remedial measures, identification	1
4.4	Analysis of causes of injury to men and machines	1
4.6	Accident prevention – accident proneness	2
4.7	Vocational guidance, fault free analysis.	1
4.8	Fire prevention and fire protection.	1
5	**Health Hazards and Legal Aspects**	
5.1	Health hazards & occupational	2
5.2	Industrial health hazards	1
5.3	Health standards and rules	2
5.4	safe working environments	1
5.6	parliamentary legislations	1
5.7	factories act and Labour welfare act	2
5.8	ESI Act	1
5.9	Work men Compensation Act.	1
	Total	45

Course Designers

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BOARD OF STUDIES

60 PFT 303	Food Rheology	Category	L	T	P	Credit
		PC	3	1	0	4

Objective

- To explain the fundamentals of food rheology.
- To interpret the different rheological models.
- To assess the rheological behavior of processed fluids and semi-solid foods.
- To evaluate the rheological behavior of food gels.
- To analyze the importance of rheology in fluid food handling and processing.

Prerequisite

NIL

Course Outcomes

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

CO1	Analyze the fundamentals of food rheology.	Analyze
CO2	Examine the different rheological models.	Apply
CO3	Identify the rheological behavior of processed fluids and semi-solid foods.	Analyze
CO4	Outline the rheological behavior of food gels.	Understand
CO5	Summarize the importance of rheology in fluid food handling and processing.	Remember

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3
3- Strong;2-Medium;1-Low			

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Semester Examination (Marks)
	1	**2**	
Remember (Re)	10	10	10
Understand(Un)	10	10	20
Apply(Ap)	20	20	30
Analyze(An)	20	20	40
Evaluate(Ev)	0	0	0
Create(Cr)	0	0	0
Toatl	60	60	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								
60 PFT 303 - Food Rheology								
M. Tech. Food Technology								
Semester	Hours/Week			Total hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	1	0	60	4	40	60	100

Food Rheology Stress and strain tensors viscometric properties shear stress shear rate relationships units in rheological measurements types of fluid flow behavior apparent viscosity intrinsic viscosity stress strain behavior of solid foods linear viscoelasticity phase transitions in foods	**[9]**
Models for Rheological Properties of Foods Time Independent Flow Behaviour Newtonian Model Power Law Model Herschel Bulkley Model Quemada Model Time Dependent Flow Behaviour Weltman Model Tiu Boger Model Shear Thinning Foods Cross and Carreau Models Effect of Temperature on Viscosity Peclet Number of Dispersions	**[9]**
Rheological Behavior of Processed Fluid and Semisolid Foods Fruit Juices and Purees Role of Soluble and Insoluble Solids Rheological Properties of Chocolate Rheology of Milk and Milk Concentrate Rheology of Mayonnaise Salad Dressing and Margarine Rheology of Salad Dressings Structural Analysis of Food Dispersions	**[9]**
Rheological Behavior of Food Gels Rheological Tests to Evaluate Properties of Gel Systems Mechanisms of Gelation Classification of Gels Theoretical Treatment of Gels Rubber Elasticity Percolation Theory Cascade Theory Gel Point and Sol Gel Transition by Rheological Measurements Mixed Polymer Gels Starch Gels	**[9]**
Rheology in Fluid Food Handling and Processing Velocity Profiles in Tubes Pump Selection and Pipe Sizing Energy Requirements for Pumping Power Consumption in Agitation Residence Time Distribution in Aseptic Processing Systems Role of Rheology in Thermal Processing of Canned Foods Continuous Flow Sterilization	**[9]**
Total Hours:45+15(Tutorial)	**60**

Textbook(s):

1.	**Rao, M. A.** "Rheology of Fluid and Semisolid Foods: Principles and Applications," 2nd Edition, Springer, New York, 2007.
2.	**Bourne, M. C.** "Food Texture and Viscosity: Concept and Measurement," 2nd Edition, Academic Press, USA, 2002.

Reference(s):

1.	Jasim, Ahmed, Pawel Ptaszek, and Santanu Basu. "Advances in Food Rheology and Its Applications," 1st Edition, Woodhead Publishing, USA, 2017.

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Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Food Rheology**	
1.1	Stress and strain tensors	1
1.2	Viscometric properties	1
1.3	Shear stress – Shear rate relationships	2
1.4	Types of fluid flow behavior	1
1.5	Intrinsic viscosity	2
2	**Models of Rheological Properties of Foods**	
2.1	Time Independent Flow	1
2.2	Newtonian Model	2
2.3	Power Law Model	1
2.4	Herschel-Bulkley Model	2
2.5	Weltman Model	1
2.6	Shear Thinning Foods	1
2.7	Peclet Number of Dispersions	1
3	**Rheological Behavior of Processed Fluid and Semi Solid Foods**	
3.1	Fruit Juices and Purees	2
3.2	Role of Soluble and Insoluble Solids	1
3.3	Rheological Properties of Chocolates	2
3.4	Rheology of Mayonnaise	2
3.5	Salad Dressing	2
4	**Rheological behavior of Food gels**	
4.1	Mechanism of Gelation	1
4.2	Treatment of Gels	2
4.3	Rubber Elasticity	1
4.4	Percolation Theory	1
4.6	Cascade Theory	2
4.7	Starch Gels	1
4.8	Mechanism of Gelation	1
5	**Rheology in Fluid Food Handling and Processing**	
5.1	Velocity Profiles in Tubes	2
5.2	Energy Requirements for Pumping	1
5.3	Agitation	2
5.4	Power Consumption in Agitation	1
5.6	Time Distribution in Aseptic Processing Systems	1
5.7	Role of Rheology in Thermal Processing of Canned Foods	2
5.8	Continuous Flow Sterilization	1
5.9	Velocity Profiles in Tubes	1
	Total	45

Course Designers

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60 PFT 3P1	Project Work-Phase I	Category	L	T	P	Credit
		PC	0	0	12	6

Objective

- To impart practical knowledge to the students.
- To make them carry out the technical procedures in their project work.
- To provide an exposure to the students to refer, read, and review the research articles, journals, and conference proceedings relevant to their project work.
- To independently carry out research/investigation.
- To conduct development work to solve practical problems in the field of Food Technology.

Prerequisite

NIL

Course Outcomes

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

CO1	Survey the relevant literature such as books, national/international refereed journals, and contact resource persons for the selected topic of research.	Analyze
CO2	Use different experimental techniques, software, and computational/analytical tools.	Apply
CO3	Conduct tests on existing setups/equipment.	Apply
CO4	Work in a research environment or in an industrial environment, drawing logical conclusions from the results after analyzing them.	Apply
CO5	Survey the relevant literature such as books, national/international refereed journals, and contact resource persons for the selected topic of research.	Apply

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2
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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BOARD OF STUDIES

Syllabus

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

M. Tech. Food Technology

60 PFT 3P1– Project Work-Phase I

Semester	Hours/Week			Total hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	0	0	12	180	6	100	-	100

- The project work should preferably be a problem with research potential.
- The project should involve scientific research, design, generation/collection, and analysis of data, determining a solution, and must preferably bring out the individual contribution.
- The seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M.E/M. Tech.
- Three reviews will be conducted by a committee of subject experts.
- Each review has to be evaluated for 100 marks.
- Internal evaluation has to be done for 100 marks.
- The final examination shall consist of the preparation of a report consisting of a detailed problem statement and a literature review.
- The preliminary results (if available) of the problem may also be discussed in the report.
- The work has to be presented in front of the examiners panel set by the Head and PG Project Coordinator.

Total Hours: 180

Course Designer

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CHAIRMAN
BOARD OF STUDIES

K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)
M.E. / M.Tech. Degree Programme
SCHEME OF EXAMINATIOS
(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
PRACTICAL								
1	60 PFT 4P1	Project Work-Phase II	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 40 marks for Project end semester examination.

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60 PFT 4P1	Project Work-Phase II	Category	L	T	P	Credit
		PC	0	0	24	12

Objective

- This enables and strengthens the students to carry out the project on their own and to implement their innovative ideas to forefront the risk issues and to retrieve the hazards by adopting suitable assessment methodologies and staring it to global

Prerequisite

NIL

Course Outcomes

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

CO1	Develop attitude of life-long learning and will develop interpersonal Skills to deal with people working in diversified field will.	Apply
CO2	Write technical reports and research papers to publish at national and international level	Apply
CO3	Develop strong communication skills to defend their work in front Of technically qualified audience.	Apply
CO4	Work in a research environment or in an industrial environment, drawing logical conclusions from the results after analyzing them.	Apply
CO5	Survey the relevant literature such as books, national/international refereed journals, and contact resource persons for the selected topic of research.	Apply

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	3	3	3
CO3	3	2	2
CO4	3	3	2
CO5	3	3	2
3-Strong;2-Medium;1-Some			

Assessment Pattern

Internal Assessment (60)					End Semester (40)
Items	**Review 1**	**Review 2**	**Review 3**	**Publication**	
Marks	**5**	**10**	**15**	**30**	**40**
	Total internal marks 60				

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Approved in Academic Council Meeting held on 03/06/23

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BOARD OF STUDIES

K.S. Rangasamy College of Technology–Autonomous R 2022								
M. Tech. Food Technology								
60PFT4P1– Project Work Phase II								
Semester	Hours/ Week			Total hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	0	0	24	360	12	60	40	100
It is a continuation of Project work started in semester III. Students have to submit the report in prescribed format and also present a seminar. The dissertation should be presented in standard format as provided by the department. The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion. The report must bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a guide, co-guideetc.as decided by the Head and PG coordinator. The candidate has to be in regular contact with his guide.								
Total Hours: 60								

Course Designer

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Passed in BoS Meeting held on 12/05/23
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CHAIRMAN
BOARD OF STUDIES

ELECTIVE I

60 PFT E11	Advanced Fruit and Vegetable Processing Technology	Category	L	P	T	Credit
		PE	3	0	0	3

Objectives

- To choose suitable Post-harvest processing methods and genetic modification for fresh produce.
- To select suitable edible coatings for fruits and vegetables, and outline the applications of vacuum technology in fruit processing.
- To apply minimal processing techniques for the production of fresh-cut fruits and vegetables.
- To develop fruit and vegetable-based jam, jelly, and juice products.
- To examine the effect of ozone and enzyme maceration in fruit processing.

Pre-requisites

NIL

Course Outcomes

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

CO1	Analyze suitable Post-harvest processing methods and genetic modification for fresh produce.	Analyze
CO2	Examine different edible coatings for fruits and vegetables and outline the applications of vacuum technology in fruit processing.	Apply
CO3	Identify minimal processing techniques for the production of fresh-cut fruits and vegetables.	Apply
CO4	Outline the concept of fruit and vegetable-based jam, jelly, and juice products.	Understand
CO5	Summarize the effect of ozone and enzyme maceration in fruit processing.	Remember

Mapping with Programme Outcomes

COs	POs		
	1	2	3
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Modal Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	20	20	30	30
Understand	20	20	30	30
Apply	10	20	20	20
Analyze	10	-	20	20
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								
M. Tech. Food Technology								
60 PFT E11 - Advanced Fruit and Vegetable Processing 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

Post-harvest Processing and Improving the Shelf-life of Vegetables by Genetic Modification: Pre-harvest factors on Post-harvest life, maturity index, precooling, Post-harvest treatments-curing, sprout suppressants, degreening. Storage-refrigerated storage, hypobaric storage, controlled atmosphere stores, MAP. Fruit ripening-changes during ripening, ripening rooms. Ethylene-sources, alternatives. Genetic control of leaf senescence and fruit ripening, future trends.	[9]
Edible Coatings and Vacuum Technology: Introduction, principle, selection of edible coatings, polysaccharide, protein, and lipid-based coatings. Gas permeation properties, wettability, coating effectiveness, diffusivities of fruits-determination, measuring internal gas composition, future trends. Introduction, principles-mass transfer and product behavior. Applications and future trends.	[9]
Minimal Processing: Introduction, quality changes, processing-physiological and microbiological impacts. Fresh-cut products-fresh produce quality and safety. Strategies for minimizing quality loss, improving quality, bio-control agents, browning inhibition. Storage and packaging. Fresh-cut chain-harvest to market. Equipment requirements, traceability of fresh-cut products, layout of a fresh-cut processing facility.	[9]
Fruit and Vegetable Product Manufacturing: Jams and jellies-gelling agent, sweetening agent, acidulants, colouring and flavouring agents, method of manufacturing. Fruit beverages-classification, production of filtered and cloudy fruit drinks-preparation steps, juice extraction, clarification, concentrate production. Production of fruit nectars-preparation steps, freeze concentration.	[9]
Ozonation and Enzyme Maceration: Introduction, ozone properties, ozone generation methods-electrical, electrochemical, radiochemical, and ultraviolet methods. Ozone in fruit juice processing-gaseous and aqueous applications, factors affecting efficacy of ozone processing-extrinsic and intrinsic parameters. Mechanism of microbial inactivation, effect on food quality, industrial health and safety. Introduction-function of enzymes in fruit juice processing-applications and future trends.	[9]
Total Hours:45	**45**

Text Book(s):	
1.	Jongen, W. “Fruit and Vegetable Processing: Improving Quality.” 1st Edition, Woodhead Publishing Series in Food Science, Technology and Nutrition, 2002.
2.	Nirmal Sinha, Jiwan Sidhu, Jozsef Barta, James Wu, M. Pila Cano. “Handbook of Fruits and Fruit Processing.” 2nd Edition, Blackwell Publishing, 2012.
Reference(s):	
1.	Srivastava, R. P., & Sanjeev Kumar. “Fruit and Vegetable Preservation: Principles and Practices.” 3rd Edition, CBS Publishers & Distributors, New Delhi, 2014.
2.	Rodrigues, Sueli, and Fabiano Andre Narciso Fernandes (Eds). “Advances in Fruit Processing Technologies.” 1st Edition, CRC Press, 2012.

Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Post-harvest Processing and Improving the Shelf-life of Vegetables by Genetic Modification**	
1.1	Pre-harvest Factors	1
1.2	Maturity Index	1
1.3	Storage	2
1.4	Ripening Rooms and Techniques	1
1.5	Genetic Code of Leaf Senescence	2
2	**Edible coating and Vacuum Technology**	
2.1	Introduction, Principles, Selection of Edible Coating	1
2.2	Polysaccharide	2

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2.3	Lipid-based Coating	1
2.4	Gas Permeation Properties	2
2.6	Wettability	1
2.7	Coating Effectiveness	1
2.8	Diffusivities of Fruits	1
3	**Minimal Processing**	
3.1	Quality Changes and Processing	2
3.2	Physiological and Microbiological Impacts	1
3.3	Fresh cut products	2
3.5	Strategies form in minimizing quality loss	2
3.6	Traceability of fresh cut	2
4	**Fruit and vegetable products**	
4.1	Manufacturing of Jam and Jellies	1
4.2	Fruit beverages	2
4.3	Production of filtered and cloudy fruit drink	1
4.4	Juice extraction	1
4.6	Concentrate production	2
4.7	Production of Fruit nectars	1
4.8	Freeze concentration	1
5	**Ozonation and Enzyme Maceration**	
5.1	Ozone properties	2
5.2	Radio chemical and Ultraviolet method	1
5.3	Ozone in fruit juice processing	2
5.4	Gaseous and aqueous applications	1
5.6	Efficiency of ozone processing	1
5.7	Extrinsic and intrinsic para meters	2
5.8	Mechanism of microbial inactivation	1
5.9	Effect on food Quality	1
	Total	45

Course Designers

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60 PFT E12	Novel Technologies in Food Processing	Category	L	P	T	Credit
		PE	3	0	0	3

Objectives

- To apply the concepts of novel enzyme technology and membrane processing in food processing
- To outline the basics of pulsed electric field and light technology for food materials
- To demonstrate the concept of irradiation and ultrasound for food treatments
- To explain the concepts of ohmic heating and cold plasma techniques for food applications
- To apply the concepts of vacuum cooling and osmotic membrane distillation in food processing

Pre-requisites

NIL

Course Outcomes

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

CO1	Analyze the concepts of novel enzyme technology and membrane processing in food processing	Analyze
CO2	Examine the basics of pulsed electric field and light technology for food materials	Apply
CO3	Identify the concept of irradiation and ultrasound for food treatments	Analyze
CO4	Outline the concepts of ohmic heating and cold plasma techniques for food applications	Understand
CO5	Summarize the concepts of vacuum cooling and osmotic membrane distillation in food processing	Remember

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	**3**	2
CO2	3	**3**	2
CO3	3	**3**	2
CO4	3	**3**	2
CO5	3	**3**	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

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

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Syllabus

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

60 PFT E12–Novel Technologies in Food Processing

M.Tech .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

Novel Enzyme Technology in Food Processing and Novel Membrane Technology for Protein Concentration and Fractionation Introduction–Typesofcross-linkingmethods–Applicationsofcross-linking enzymes. Meat and fish products, bakery and pasta products, dairy and miscellaneous products. Introduction – principles – configurations – mode of operation – scale up strategies - Applications using concentration and fractionation.	[9]
Shock Waves for Meat Tenderization Meat tenderness – processing interventions for meat tenderization – shock wave technology –principle - effect of shock wave treatment on meat tenderization – shock wave implication on biochemical components and microstructure–effect on other meat quality traits. Cost analysis and future considerations.	[9]
Vacuum Frying Technology Principles–processandequipment–effectofvacuumfryingconditionsonfriedfoods-pre-Treatment, frying temperature, time and pressure. Combination of vacuum microwave drying with vacuum frying. Storage stability of vacuum fried products.	[9]
Fluidized Bed Coating Technology and Anti-microbial food packaging Principles — Batch fluidized bed coating — Design, modification and possibilities for the food industry–Continuous fluidized bed coating–Applications Issues and problems in food powder coating technology introduction, agents, factors, non-migratory bioactive polymers (NMBP) in food packaging, introduction, Advantages of NMBP, limitations, Polymers with immobilized bioactive Compounds	[9]
Vacuum Cooling and Osmotic Membrane Distillation(OMD) Principles–Process–Equipment–Application–Fruits and Vegetables, Bakery, Fishery, Particulate foods, Ready meals. Advantages and Disadvantages–Process Parameters. Fundamentals–OMD membranes–Process parameters–Osmotic agent, Concentration, Temperature, Membrane. Direct osmosis. Applications in food system.	[9]
Total Hours:	**45**

Text Book(s):

1. Maria Laura Passos, Claudio P.Ribeiro ,Innovation in Food Engineering-New Techniques and Products, 1stEdition, CRCPress, 2016.
2. Kai Knoerzer, Pablo Juliano, Geoffrey W. Smithers, Innovative Food Processing Technologies :Extraction, Separation, Component Modification and Process Intensification, 1stEdition, Woodhead Publishing Ltd,2016.

Reference(s):

1. Bhattacharya, Suvendu, (Eds), “Conventional and Advanced Food Processing Technologies”, 1stEdition, John Wiley & Sons, 2014.

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Course Contents and Lecture Schedule

S.No.	Topic	No.of Hours
1	**Novel Enzyme Technology in Food Processing and Novel Membrane Technology for Protein Concentration and Fractionation**	
1.1	Introduction	1
1.2	Types of cross-linking methods	1
1.3	Application of Cross-linking enzymes	2
1.4	Meat and fish products	1
1.5	Dairy and Miscellaneous products	2
2	**Shock waves for Meat Tenderization**	
2.1	Meat Tenderness	1
2.2	Shock wave technology	2
2.3	Effect of shockwave	1
2.4	Shock wave implications	2
2.6	Effect of meat traits	1
2.7	Cost analysis	1
2.8	Future considerations	1
3	**Vacuum Frying Technology**	
3.1	Principle of Process equipment	2
3.2	Effect of Vacuum frying	1
3.3	Pretreatment	2
3.5	Frying temperature	2
3.6	Combination of vacuum microwave drying	2
4	Fluidized Bed Coating and Anti-Microbial Food Packaging	
4.1	Principle of Batch Fluidized Bed Coating	1
4.2	Design and Modification	2
4.3	Continuous Fluidized Bed Coating	1
4.4	Application Issues and Problems	1
4.6	Non-Migrating Bioactive Compounds	2
4.7	Advantages of NMBP (Non-Migrating Bioactive Packaging)	1
4.8	Polymer with Immobilized Bioactive Compound	1
5	Vacuum Cooling and Osmotic Membrane Distillation	
5.1	Principle and Process Equipment	2
5.2	Fruits and Vegetables	1
5.3	Particulate Food	2
5.4	Ready Meals	1
5.6	Process Parameters	1
5.7	OMD Membranes (Osmotic Membrane Distillation Membranes)	2
5.8	Osmotic Agents	1
5.9	Application in Food Systems	1
	Total	45

Course Designers

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60 PFT E13	Heat and Mass Transfer Operations in Food Processing	Category	L	P	T	Credit
		PE	3	0	0	3

Objectives

- To explain condensation and evaporative heat transfer phenomena
- To analyse the heat exchanger performance
- To explain distillation process and estimate number of stages
- To choose and apply extraction techniques
- To explain leaching process and estimate number of stages

Pre-requisites

NIL

Course Outcomes

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

CO1	Analyze the concepts condensation and evaporative heat transfer Phenomena	Analyze
CO2	Examine the heat exchanger performance	Apply
CO3	Identify the concept of distillation process and estimate number of Stages	Analyze
CO4	Outline the extraction techniques	Understand
CO5	Summarize the concepts of leaching process and estimate number of Stages	Remember

Mapping with Programme Outcomes

COs	Pos		
	1	2	3
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2
3 – Strong; 2 – Medium; 1 – Some			

Assessment Pattern

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

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Syllabus

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

60 PFT E13–Heat and Mass Transfer Operations in Food Processing

M. Tech. 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

Condensation and Boiling and Evaporators Condensation number – Film condensation – Boiling heat transfer – Simplified relations. Single and multiple effect evaporators – Performance of evaporators and boiling point elevation – capacity – economy and heat balance – Types of evaporators.	[9]
Heat Exchangers Overall heat transfer coefficients – Fouling factor – Types of Heat Exchanger – LMTD – Heat exchanger effectiveness by NTU method – Compact Heat Exchangers – Analysis for variable properties.	[9]
Distillation Batch Distillation – Flash Vaporization – Continuous fractionation – Design of multistage tray towers for binary systems: McCabe-Thiele method and Panchon-Savorit method. Introduction to multicomponent distillation.	[9]
Extraction Single stage, multistage cross current and multistage counter current operations – Introduction to newer extraction techniques: Supercritical extraction, pulsed electric field extraction, microwave extraction, ultrasound-assisted extraction, subcritical water extraction, high-pressure assisted extraction.	[9]
Leaching Solid-liquid equilibria, single stage leaching, multistage crosscurrent and counter current leaching, calculations for number of stages – leaching equipment. Batch percolators – Fixed bed multistage systems – continuous contactors.	[9]
Total Hours:	**45**

Text Book(s):

1. McCabe, W. L., Smith, J. C., Harriott, P., "*Unit Operations of Chemical Engineering*", 5th Edition, McGraw-Hill Education, 2010.
2. Holman, J. P., "*Heat Transfer*", 10th Edition, McGraw-Hill, New York, 2012.

Reference(s):

1. Treybal, R. E., "*Mass Transfer Operations*", 3rd Edition, McGraw-Hill, New York, 2012.
2. Ibarz, A., "*Unit Operations in Food Engineering*", 1st Edition, CRC Press, 2003.

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Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	Condensation and Boiling and Evaporators	
1.1	Condensation Number	1
1.2	Film Condensation	1
1.3	Boiling Heat Transfer	2
1.4	Simplified Relations	1
1.5	Types of Evaporators	2
2	Heat Exchangers	
2.1	Overall Heat Transfer	1
2.2	Fouling Factor	2
2.3	Types of Heat Exchanger	1
2.4	LMTD (Log Mean Temperature Difference)	2
2.6	NTU Method (Number of Transfer Units Method)	1
2.7	Compact Heat Exchanger	1
2.8	Analysis of Variable Properties	1
3	**Distillation**	
3.1	Batch Distillation	2
3.2	Flash Vaporization	1
3.3	Continuous Fractionation	2
3.5	Design of Multistage Tray Towers for Binary Systems	2
3.6	McCabe-Thiele Method	2
4	**Extraction**	
4.1	Single Stage Countercurrent Operation	1
4.2	Multistage Countercurrent Operation	2
4.3	Introduction to Newer Techniques	1
4.4	Supercritical Extraction	1
4.6	Pulsed Electric Field Extraction	2
4.7	Microwave Extraction	1
4.8	High-Pressure Assisted Extraction	1
5	**Leaching**	
5.1	Solid liquid equilibria	2
5.2	Single stage leaching	1
5.3	Multi stage Cross current	2
5.4	Counter current leaching	1
5.6	Calculations for number of stages	1
5.7	Leaching experiment	2
5.8	Batch percolators	1
5.9	Fixed bed multi stage systems	1
	Total	45

Course Designer

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ELECTIVE II

60 PFT E 21	Industrial Engineering	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To outline the role of industrial engineering and concept of productivity
- To make use of concepts of work study and apply existing methods of working for specified job
- To explain the significance of forecasting in pre-planning
- To select suitable layout design procedures of facility
- To Identify the Importance of Industrial Engineering in Cost Analysis

Pre-requisites

Nil

Course Outcomes

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

CO1	Analyze the Role of Industrial Engineering and the Concept of Productivity	Analyze
CO2	Examine the Concepts of Work Study and Apply Existing Methods of Working for Specified Jobs	Apply
CO3	Identify the Significance of Forecasting in Pre-Planning	Analyze
CO4	Outline the Suitable Layout Design Procedures for Facilities	Understand
CO5	Summarize the Importance of Industrial Engineering in Cost Analysis	Remember

Mapping with Programme Outcomes

COs	POs		
	1	2	3
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

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

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R 2022								
M.Tech. Food Technology								
60 PFT E21–Industrial Engineering								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	**3**	**0**	**0**	**45**	**3**	**40**	**60**	**100**

Historical Evolution of Production and Operations Management Management - Industrial Engineering – Role of Industrial Engineering – System concept of production - Types of production system-flow, job, batch and project- Productivity- Factors affecting productivity-Productivity measures – Productivity improvement techniques -Business Process Re-engineering (BPR)	[9]
Work Study Method, basic procedure – Selection – Recording of process – Critical analysis, Development - Implementation – Micromotion and memo motion study – Principles of motion economy-Work measurement Techniques of work measurement -Time study –computation of standard time-Work sampling- Synthetic data- Predetermined motion time standards- Job Evaluation, Merit Rating-Ergonomics and Safety	[9]
Modules of pre-planning Introduction- Forecasting: Need for forecasting- demand patterns- Forecasting models-Judgmental Techniques, Time series analysis, moving average, exponential smoothing, Regression and correlation method- Forecast error costs and accuracy of forecasts.	[9]
Facility Planning Facility location- factors influencing plant location- single and multifacility location problems-Minimax, Gravity and Euclidean– Distance location problem. Capacity planning, Models for Facility Decisions - Plant layout- Layout classification- Layout Design Procedures- CRAFT, ALDEP, CORELAP- Material handling systems unit load concept- material handling principles-Types of Material handling equipment and its selection	[9]
Value Engineering Value engineering– function, aims, procedure. Make or buy decision, Interest formulae and their applications: Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series, annual equivalent factor, Effective interest rate, Introduction to Methods of comparison of Alternatives	[9]
Total Hours:	**45**

Text Book(s):	
1.	Gupta S., Starr M., “Production and Operations Management Systems”,1st Edition, CRC Press, 2014.
2.	HooverC., “Industrial Engineering and Production Management”,1st Edition, Clanrye International, 2017.
Reference(s):	
1.	Telsang M., “Industrial Engineering and Production Management”,1st Edition,S.Chand and Company, New Delhi, 2006.

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Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Historical Evolution of Production and Operations**	
1.1	Management and Industrial Engineering	1
1.2	Role of Industrial Engineering	1
1.3	System concept of production	2
1.4	Types of production	1
1.5	Business process re-engineering	2
2	**Work Study**	
2.1	Method basic procedure	1
2.2	Selection, Recording of process	2
2.3	Critical Analysis	1
2.4	Work Measurement Techniques	2
2.6	Time study computation	1
2.7	Work sampling	1
2.8	Merit rating	1
3	**Modules Preplanning**	
3.1	Introduction	2
3.2	Need for forecasting	1
3.3	Demand patterns	2
3.5	Forecasting model	2
3.6	Regression and Forecasting method	2
4	**Facility Planning**	
4.1	Facility locators	1
4.2	Multifacility location	2
4.3	Minimax gravity	1
4.4	Material Handling system	1
4.6	Material handling principles	2
4.7	Material handling equipment	1
4.8	Selection of material handling equipment	1
5	**Value engineering**	
5.1	Value engineering function	2
5.2	Procedure make or buy decision	1
5.3	Interest formulae and their application	2
5.4	Single payment compound factor	1
5.6	Single payment present worth factor	1
5.7	Equal payment series	2
5.8	Present worth factor equal	1
5.9	Uniform gradient series	1
	Total	45

Course Designers

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60 PFT E22	Industrial Waste Management	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To summarize the present industrial impact on the environment
- To select suitable wastewater treatment options and reuse
- To outline the sources of solid waste and segregation
- To utilize solid waste for energy recovery and disposal
- To apply waste management principles in different industries

Pre-requisites

Nil

Course Outcomes

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

CO1	Analyze the present industrial impact on the environment	Analyze
CO2	Examine the suitable wastewater treatment options and reuse	Apply
CO3	Identify the sources of solid waste and segregation	Analyze
CO4	Outline the solid waste for energy recovery and disposal	Understand
CO5	Summarize the waste management principles in different industries	Remember

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	3	2
CO2	2	3	2
CO3	3	3	2
CO4	2	3	2
CO5	3	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

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

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Syllabus

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

M.Tech Food Technology

60 PFT E22–Industrial Waste Management

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

Industries and Environment Industrial scenario in India – Industrial activity and Environment – Uses of water by industry –Sources and types of industrial waste water– Industrial waste water and environmental impacts– Regulatory requirements for treatment of industrial wastewater – Industrial waste survey – Industrial wastewater generation rates, characterization and variables – Population equivalent –Toxicity of industrial effluents and Bio assay tests.	[9]
Management of Industrial Waste Water and Treatment Plants Treatments: Aerobic and anaerobic biological treatment– batch and high- rate reactors–Chemical oxidation — Ozonation — Photo catalysis — Wet Air Oxidation — Evaporation — Ion Exchange – Membrane Technologies. Individual and common Effluent Treatment plants – Joint treatment of industrial waste water– Zero effluent discharge systems–Quality requirements for waste water reuse– Industrial reuse– DisPOsal on water and land–Residuals of Industrial waste water treatment.	[9]
Solid Waste Sources and Segregation Sources: Types and Sources of solid wastes– Need for solid waste management– Elements of integrated waste management and roles of stakeholders– Salient features of Indian legislations on management and handling of municipal solid wastes. Handling and segregation of wastes at sources– storage and collection of municipal solid wastes– Analysis of collection systems– Need for transfer and transport– Transfer stations- Optimizing waste allocation– compatibility.	[9]
Energy Recovery and DisPOsal Objectives of waste processing – material separation and processing technologies – biological and chemical conversion technologies– methods and controls of comPOsting–energy recovery and other modern techniques in managing solid waste– case studies. Waste disPOsal options–DisPOsal in land fills – Land fill classification, types and methods – site selection – design and operation of sanitary landfills, secure landfills – leachate and land fill gas management – landfill Closure of landfills– land fill remediation.	[9]
Waste Management in different industrial segments Industrial manufacturing process description- wastewater and solid waste characteristics – source reduction options and waste treatment flow sheet for Textiles – Tanneries – pulp and paper –petroleum refining–pharmaceuticals– sugar and distilleries–Food processing–fertilizers– Thermal power plants and Industrial Estates.	[9]
Total Hours:	**45**

Text Book(s):

1. Arceivals S.J., “Wastewater Treatment for Pollution Control”, 3rd Edition, Tata Mc Graw-Hill, 2017
2. Ecken felder W.W.,“Industrial Water Pollution Control”, 3rd Edition, Mc Graw-Hill, 2017.

Reference(s):

1. Landreth R.E. and Rebers P.A., “Municipal Solid Wastes-Problems and Solutions”,1st Edition, CRC Publishers, 2019.

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Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Industries and Environment**	
1.1	Industrial Scenario in India	1
1.2	Industrial Waste water and environmental impact	1
1.3	Industrial waste water generation rates	2
1.4	Toxicity of industrial Effluents	1
1.5	Bio assay Tests	2
2	**Management of Industrial Waste water and Treatment Plant**	
2.1	Aerobic and Anaerobic biological Treatment	1
2.2	Photo Catalysis	2
2.3	Joint treatment of Industrial Waste water	1
2.4	Zero effluent Discharge systems	2
2.6	Industrial Reuse	1
2.7	Disposal on water and land	1
2.8	Industrial Wastewater Treatment	1
3	**Solid Waste Sources and Segregation**	
3.1	Types and sources of solid waste	2
3.2	Salient features of Indian Legislations	1
3.3	Handling and Segregation of wastes at sources	2
3.5	Need for transfer and Transport	2
3.6	Optimizing Waste allocation	2
4	**Energy Recovery and Disposal**	
4.1	Objectives of waste processing	1
4.2	Material Separation	2
4.3	Waste Disposal option	1
4.4	Landfill Classification	1
4.6	Secure landfills	2
4.7	Leachate and Land fill gas Management	1
4.8	Land fill closure	1
5	**Waste Management in Different Industrial Segments**	
5.1	Industrial Manufacturing Process	2
5.2	Water and Solid waste Characteristics	1
5.3	Source reduction options	2
5.4	Waste water flow sheet for textiles	1
5.6	Pulp and Paper Industries	1
5.7	Food Processing industries	2
5.8	Fertilizer	1
5.9	Thermal power plant and Industrial Estates	1
	Total	45

Course Designers

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60 PFT E23	Advanced Baking and Confectionery Technology	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To summarize the role of ingredients and working of equipment in the production of bakery products
- To Analyze and interpret rheological properties of bakery products
- To select the appropriate techniques in industrial production of bakery products
- To apply the heat and mass transfer phenomena in bakery product processing and outline the role of confectionery ingredients
- To apply the process technology for development of confectionery products

Pre-requisites

Advanced Drying Technology

Course Outcomes

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

CO1	Analyze the role of ingredients and working of equipment in production of bakery products	Analyze
CO2	Examine the rheological properties of bakery products	Apply
CO3	Identify the appropriate techniques in industrial production of bakery Products	Analyze
CO4	Outline the heat and mass transfer phenomena in bakery product Processing and outline the role of confectionery ingredients	Understand
CO5	Summarize the process technology for development of confectionery Products	Remember

Mapping with Programme Outcomes

COs	POs		
	1	2	
CO1	3	3	2
CO2	3	3	2
CO3	2	3	2
CO4	3	3	2
CO5	2	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Modal Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	20	20	30	30
Understand	10	10	20	20
Apply	10	10	20	20
Analyze	20	20	30	30
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

M.Tech Food Technology

60 PFT E23 – Advanced Baking and Confectionery Technology

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

Bakery Ingredients and Equipment Essential bakery ingredients: Flour, yeast and sour dough, water, salt- Other ingredients: Sugar, colour, flavour, fat, milk, bread improvers, leavening agents, shortenings, enzymes, emulsifiers and antioxidants. Role of fat and sugar replacers, clean label ingredients. Bulk handling of ingredients, dough mixers, dividers, rounders, sheeters, laminators, Fermentation enclosures and brew equipment, ovens and slicers.	[9]
Rheological Properties of Dough and Batter Rheological methods-Fundamental testing and Empirical methods, Rheological testing equipment, compression, penetration, modified penetrometers, transient tests, dynamic tests, extensional viscosity. Effect of ingredients, mixing, dosing and temperature on rheological properties, cake batter rheology and bread dough rheology	[9]
Technology of Bakery Products: Bread and Cake, Biscuits and Other bakery products Various stages and methods, Formulation and production-frozen dough, refrigerated dough and partially baked bread. Types-Foam style and shortened style, industrial preparation and baking of cakes. Production process and quality control, healthy biscuit formulation. Manufacture of cookies, pretzel sand pastries. Requirement of dietetic bakery	[9]
Interactions between formulation and process methodologies and Confectionery Basic concepts of heat and mass transfer mechanism in bakery products. Foam to sponge conversion and the collapse of bakery products, Effect of ingredient, recipe and product interactions. Classification, Ingredients sources and their role for various products: sweeteners —alternative and high intensity sweeteners, water, lipids, emulsifiers, starch, protein, pectin, gums and other ingredients. Factors influencing rheology of candy mass and chocolate	[9]
Technology for confectionery products Formulation and Processing— Hard candy, fondant, creams, jellies, gummies, licorices, compressed tablets, chocolates and compound coatings, sugar free confections. Quality standards of confectionery products. Packaging and shelf life of Confectionery products.	[9]
Total Hours:	**45**

Text Book(s):

1. Weibiao Zhou and Y.H.Hui.,"Bakery Products Science and Technology",2nd Edition, Wiley Black well, US,2014.
2. Servet Gulum Sumnuand Serpil Sahin., "Food Engineering Aspects of Baking Sweet Goods",1st Edition, CRC Press, USA, 2008.

Reference(s):

1. Richard W. Hartel,JoachimH.von Elbe, Randy Hofberger., "Confectionery science and technology",1st Edition, Springer,2022

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	**Bakery Ingredients and Equipment**	
1.1	Essential Bakery ingredients	1
1.2	Bread improvers	1
1.3	Emulsifiers and antioxidants	2
1.4	Bulk handling of ingredients	1
1.5	Ovens and Slicers	2
2	**Rheological Properties of Dough and Batter**	
2.1	Rheological Methods	1
2.2	Fundamental Testing and Empirical methods	2
2.3	Modified penetrometers	1
2.4	Transient tests	2
2.6	Effect of dosing on rheological properties	1
2.7	Cake Batter rheology	1
2.8	Bread dough Rheology	1
3	**Technology of Bakery Products: Bread and Cake, Biscuits and Other Bakery Products**	
3.1	Various Stages and Methods	2
3.2	Formulation and Production of Frozen Dough	1
3.3	Industrial preparation and baking of cakes	2
3.5	Healthy Biscuits formulation	2
3.6	Manufacturing of Cookies, Pretzels and Pastries	2
4	**Interactions between formulation and process methodologies and Confectionary**	
4.1	Basic Concepts of heat and mass transfer mechanism	1
4.2	Foam to sponge conversion	2
4.3	Effect of ingredients	1
4.4	Product interactions	1
4.6	Classification, Ingredient sources and their role	2
4.7	Water, lipids and emulsifiers	1
4.8	Factors influencing rheology of candy mass and chocolate	1
5	**Technology of Confectionary Products**	
5.1	Formulation and Processing	2
5.2	Compound coatings	1
5.3	Emulsifiers	2
5.4	Pectin	1
5.6	Gums	1
5.7	Sugar free confections	2
5.8	Quality Standard of confectionary products	1
5.9	Packaging and shelf life of confectionary products	1
	Total	45

Course Designers

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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 PFT E31	Technology of Food Colours and Flavours	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To summarize the basic concepts related to flavours and colours
- To apply the technological aspects of colours in food product development
- To apply the technological aspects of flavours in food product development
- To examine the techniques involved in analysis of flavour and colour
- To select and apply appropriate flavours and colours for different food products

Pre-requisites

Nil

Course Outcomes

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

CO1	Analyze the basic concepts related to flavours and colours	Analyze
CO2	Examine the technological aspects of colours in food product Development	Apply
CO3	Identify the technological aspects of flavours in food product Development	Analyze
CO4	Outline the techniques involved in analysis of flavour and colour	Understand
CO5	Summarize the appropriate flavours and colours for different food products	Remember

Mapping with Programme Outcomes

COs	POs		
	1	2	3
CO1	2	3	2
CO2	3	3	2
CO3	3	2	2
CO4	3	3	2
CO5	2	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Modal Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	20	20
Apply	10	10	30	30
Analyze	20	20	30	30
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

M.Tech Food Technology

60 PFT E31–Technology of Colours and Flavours

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 Food Flavours and Basics of Food Colours Introduction, classification of food flavours, perception of flavour and taste–Theories of olfaction -Molecular structure and activity relationships of taste — sweet, bitter, acid and salt, Chemicals causing pungency, astringency, cooling effect — properties. Regulations regarding additions, toxicology and safety aspects of food flavour.	[9]
Origin of Food colours and Technology of food colours Plant - Chlorophyll and chlorophyll derivatives, carotenoids, annatto, saffron, turmeric, Caramel colour, anthocyanins and betalains. Animal- Haems and bilins, monascus, cochineal and related pigments. Synthetic -Forms and types, certified F, D and C colourants. Technology for the production of dried colourants, stability- pH, temperature and other processing conditions. Role of Microorganism in synthesis of food colours, encapsulated food colourants.	[9]
Food flavours from plant origin and Flavours evolution during processing and Technology of food flavours Alliaceous flavours, bittering agents, coffee and cocoa, fruit flavours. Enzymatic development, effect of roasting, cooking, frying on flavour developments. Essential oils and oleoresins — extraction methods. Liquid and dry flavour production, encapsulated flavours, microbial synthesis of flavours, Flavour enhancer and seasonings. Factors affecting stability of flavours	[9]
Flavour Analysis and Colour Analysis Aroma Compounds - Sample Selection/Preparation, Principles of Aroma Isolation — Solubility, Sorptive Extraction, Volatility. Methods of Aroma Isolation — Static Headspace, Headspace Concentration Methods (Dynamic Headspace)- Distillation Methods – Solvent Extraction, Sorptive Extraction - Concentration for Analysis, Aroma Isolation, Prefractionation - Gas Chromatography, GC/Olfactometry (GC/O) GC- MS/Olfactometry (GC-MS/O), Mass Spectrometry. Preparation and isolation of sample, spectrophotometry, colourimetry, Hunter Colour lab, CI Esystem, Lovi bond Tintometer, Munsell colour system.	[9]
Flavourant applications in food and Colourants applications in food Soups and stocks, sauces, seasonings, and marinades, baked goods and bakery products, snack foods, sugar based confectionery products and chewing gum, dairy Products - flavoured milks, flavoured yogurts, flavoured dairy desserts. Beverages, dairy products, confections, baked products and other foods.	[9]
Total Hours:	**45**

Text Book(s):

1.	Re ineccius G.and HeathH.B.,"Flavour Chemistry and Technology", 2nd Edition, CRC Press, 2006.
2.	Carmen Socaciu., "Food Colourants: Chemical and Functional Proerties",1st Edition, CRC Press, 2008.

Reference(s):

1.	Rowe D.J.,"Chemistry and Technology of Flavours and Fragrances",1st Edition, Blackwell Publishing

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	**Basics of Food Flavours and Basics of Food Colours**	
1.1	Introduction and classification of food flavours	1
1.2	Perception of flavour and Taste	1
1.3	Chemicals causing pungency	2
1.4	Regulations regarding additions	1
1.5	Toxicology and Safety aspects of food flavour	2
2	**Origin of Food Colours and Technology of Food Colours**	
2.1	Plant chlorophyll and chlorophyll derivatives	1
2.2	Carotenoids	2
2.3	Synthetic forms and types	1
2.4	Certified food colourants	2
2.6	Technology for production of dried colourants	1
2.7	Synthesis of food colours	1
2.8	Encapsulated food colourants	1
3	**Food flavours from plant origin and flavours evolution during processing and technology of foods**	
3.1	Alliaceous flavours	2
3.2	Enzymatic Development	1
3.3	Effect of roasting	2
3.5	Effect of frying on flavour development	2
3.6	Factors affecting stability of flavours	2
4	**Flavour Analysis and Colour analysis**	
4.1	Aroma compounds	1
4.2	Sample selection	2
4.3	Principles of Aroma isolation	1
4.4	Methods of Aroma Isolation	1
4.6	Solvent extraction	2
4.7	Flavour enhancer	1
4.8	Munsell Colour system	1
5	**Flavourant applications in food and Colourants applications in food**	
5.1	Soups and stocks	2
5.2	Sauces and seasonings	1
5.3	Baked goods and bakery products	2
5.4	Confectionary products and Chewing Gum	1
5.6	Dairy products	1
5.7	Flavoured milks	2
5.8	Flavoured Yogurts	1
5.9	Baked products	1
	Total	45

Course Designers

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Passed in BoS Meeting held on 23/12/22
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BOARD OF STUDIES

60 PFT E32	Advanced Separation Techniques in Food Processing	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To infer the concepts of separation techniques
- To choose different solid liquid separation process
- To outline the adsorption and particle separation process
- To categorize separation based on membranes
- To make use of ionic separation and permeation processes

Pre-requisites

Advanced Drying Technology

Course Outcomes

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

CO1	Analyze the concepts of separation techniques	Analyze
CO2	Examine the different solid liquid separation process	Apply
CO3	Identify the adsorption and particle separation process	Analyze
CO4	Outline the separation based on membranes	Understand
CO5	Summarize the use of ionic separation and permeation processes	Remember

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	3	3
CO2	3	3	2
CO3	2	3	3
CO4	3	3	2
CO5	3	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Modal Examination (Marks)	End Sem Examination (Marks)
	1	**2**		
Remember	20	20	30	30
Understand	20	20	30	30
Apply	10	10	20	20
Analyze	10	10	20	20
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

M.Tech Food Technology

60 PFT E32–Advanced Separation Techniques in Food Processing

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

Separation Techniques Introduction, separation from solids, separation from liquids, separation from gases and vapors, Filtration- centrifugation- equipment and application in food processing.	[9]
Solid Separation Process Separation Concept based on particle size and shape. Magnetic separation, Eddy-current separation, Ballistic separation, Colour separation, Wet Separation Process, liquid-solid and liquid-liquid separation by hydro cyclones, Surface velocity classifier, Elutriators, Impingement separator, Electrostatic precipitation.	[9]
Adsorption based and other Separation Processes and Powder Technology Types and choice of adsorbents, Mechanisms of Affinity chromatography and immunochromatography. Foam separation, Super critical fluid extraction - Food Application. Classification of powder, separation of powder sieving, air classification and its factors affecting, air separation, particle size distribution.	[9]
Membrane Technology Membrane modules, Mechanism and equipment employed for micro-filtration, ultrafiltration, nanofiltration, reverse osmosis, concentration polarization, pervaporation and application of membrane technology in food industry.	[9]
Ionic Separation Processes and Permeation Techniques Electrophoresis, Dielectrophoresis, ion-exchange chromatography, electrodialysis-Theory and equipment Permeation of liquids and gases.	[9]
Total Hours:	**45**

Text Book(s):

1.	King, C.J.,"Separation Processes",2nd Edition, Dover Publications, inc. Mineola, NewYork, 2013.
2.	Grandison A.S.,and LewisM.J.,"Separation process in the food & biotechnology industries", 1st Edition, wood head publication, England,1996.

Reference(s):

1.	Ronald. W. Rousseau., "Handbook of Separation Process Technology",1st Edition, Wiley India Pvt Ltd, 2009.

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	**Separation Techniques**	
1.1	Introduction	1
1.2	Separation from solids	1
1.3	Separation from liquids	2
1.4	Separation from gases and Vapors	1
1.5	Application in Food Processing	2
2	**Solid Separation Process**	
2.1	Separation Concept based on particle size	1
2.2	Magnetic separation	2
2.3	Eddy Current Separation	1
2.4	Wet separation process	2
2.6	Liquid solid and Liquid–liquid separation	1
2.7	Elutriators	1
2.8	Electrostatic Separator	1
3	**Adsorption based and other separation processes and powder technology**	
3.1	Types and choices of adsorbents	2
3.2	Mechanism of Affinity Chromatography	1
3.3	Immuno Chromatography	2
3.5	Super critical fluid extraction	2
3.6	Classification and separation of powder	2
4	**Membrane Technology**	
4.1	Membrane Modules	1
4.2	Mechanism and membrane employed for microfiltration	2
4.3	Microfiltration	1
4.4	Ultrafiltration	1
4.6	Nanofiltration	2
4.7	Pervaporation	1
4.8	Application of Membrane technology in Food industries	1
5	**Ionic Separation Process and permeation technique**	
5.1	Electrophoresis	2
5.2	Dielectrophoresis	1
5.3	Ion-exchange chromatography	2
5.4	Electrodialysis	1
5.6	Equipment	1
5.7	Permeation	2
5.8	Permeation of Liquids	1
5.9	Permeation of Gases	1
	Total	45

Course Designers

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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 PFT E33	Food Product Design and Development	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To infer the concept and importance of developing new food products
- To design the process for developing new food products
- To identify process parameters for standardization and product scaleup
- To infer the quality, safety and regulatory aspects for new product development
- To outline the advertisement and marketing strategies for the commercialization

Pre-requisites

Nil

Course Outcomes

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

CO1	Analyze the concept and importance of developing new food products	Analyze
CO2	Examine the process for developing new food products	Apply
CO3	Identify the process parameters for standardization and product scale Up	Analyze
CO4	Outline the quality, safety and regulatory aspects for new product Development	Understand
CO5	Summarize the advertisement and marketing strategies for the Commercialization of products	Remember

Mapping with Programme Outcomes

COs	POs		
	1	2	3
CO1	3	3	2
CO2	2	3	2
CO3	3	3	2
CO4	3	3	2
CO5	2	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Modal Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	20	20	30	30
Understand	20	20	30	30
Apply	10	10	20	20
Analyze	10	10	20	20
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 R 2022								
M.Tech. Food Technology								
60 PFT E33 – Food Product Design and Development								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

New product development Introduction-new products, customers and consumers, value addition, market. Marketing characteristics of new products- Product life cycle, profit picture. Corporate avenues for growth and profitability, opportunities in the market place for new product development, technological advances driving new product development, government's role in new product development.	[9]
Designing new products New Food Product Development (NPD) process and activities, NPD success factors, new product design, food innovation case studies, market-oriented NPD methodologies, organization for successful NPD; Recipe development; use of traditional recipe and modification; involvement of consumers, chefs and recipe experts; selection of materials/ingredients for specific purPOses; modifications for production on large scale, cost effectiveness, nutritional needs or uniqueness; Use of novel food ingredients and novel processing technologies.	[9]
Standardization & Large scale production Process and equipment design; establishing process parameters for optimum quality; sensory evaluation; lab requirements; different techniques and tests; statistical analysis; application in product development and comparison of market samples; stages of the integration of market and Sensory analysis	[9]
Quality, Safety & Regulatory aspects Product stability; evaluation of shelf life; changes in sensory attributes and effects of environmental conditions; accelerated shelf-life determination; developing packaging systems for maximum stability and cost effectiveness; regulatory aspects; approval for proprietary product	[9]
Advertisement, Marketing & Case studies Product performance testing market POsitioning, Marketing: developing test market strategies; various tools and methodologies to evaluate consumer attitudes, preferences and market acceptance factors; Case Studies- successes and failures, innovation, best practices, technological and marketing approaches to NPD; food choice models and new product trends	[9]
Total Hours:	**45**

Text Book(s):	
1.	Brody, A.L.,and John B.L.,"Developing New Food Products for a Changing Marketplace",2nd Edition, CRC press, Taylor and Francis Group, UK, 2008.
2.	Gordon W Fuller., "New Food Product Development: From Concept to Market place",3rd Edition, CRC press, Taylor and Francis Group, UK,2016.
Reference(s):	
1.	Catherine Side., "Food Product Development: Based on Experience",2nd Edition, Iow State Press, Black well publications, 2008.

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	**New Product Development**	
1.1	Introduction to New Products	1
1.2	Value Addition	1
1.3	Marketing Characteristics	2
1.4	Product Life Cycle	1
1.5	Government's Role in New Product Development	2
2	**Designing New Product**	
2.1	New food product development	1
2.2	Recipe development	2
2.3	Recipe modification	1
2.4	Involvement of customers	2
2.6	Chefs and recipe experts	1
2.7	Cost-effectiveness	1
2.8	Novel processing technologies	1
3	Standardization & large-scale production	
3.1	Process and equipment design	2
3.2	Establishing process parameters for optimum quality	1
3.3	Statistical analysis	2
3.5	Application in food product development	2
3.6	Integration of market and sensory evaluation	2
4	Quality, safety, and regulatory aspects	
4.1	Product stability	1
4.2	Evaluation of shelf life	2
4.3	Changes in sensory attributes	1
4.4	Effects of environmental conditions	1
4.6	Shelf-life determination	2
4.7	Developing packaging systems	1
4.8	Approval for proprietary products	1
5	Advertisement, marketing & case study	
5.1	Product performance	2
5.2	Marketing	1
5.3	Methodologies to evaluate consumer attitudes	2
5.4	Preferences and market acceptance factors	1
5.6	Case studies	1
5.7	Innovation in NPD	2
5.8	Technological and marketing approaches	1
5.9	Food choice models	1
	Total	45

Course Coordinator

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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 PFT E41	Advanced Grain Science and Technology	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To outline the grain properties and pre-processing operations of grains
- To identify the suitable milling technologies for rice processing
- To make use of appropriate wheat milling process and flour treatment methods
- To choose various milling methods suitable for barley, corn and oats
- To develop different cereal-based products

Pre-requisites

Advanced Drying Technology

Course Outcomes

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

CO1	Analyze the grain properties and preprocessing operations of grains	Analyze
CO2	Examine the suitable milling technologies for rice processing	Apply
CO3	Identify the use of appropriate wheat milling process and flour Treatment methods	Analyze
CO4	Outline the various milling methods suitable for barley, corn and oats	Understand
CO5	Summarize the different cereal-based products	Remember

Mapping with Programme Outcomes

COs	POs		
	1	2	3
CO1	3	3	2
CO2	2	3	2
CO3	3	3	2
CO4	3	3	2
CO5	2	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Modal Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	20	20	30	30
Understand	10	10	20	20
Apply	10	10	20	20
Analyze	20	20	30	30
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								
M.Tech Food Technology								
60 PFT E41– Advanced Grain Science and Technology								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Grains Introduction, structural components of cereal grains, engineering properties of grains, harvesting, threshing, grain cleaning, grading, drying, storage, aeration and stored grain management, control of insects, microorganisms and rodents during storage	[9]
Rice Milling Structure. Principles of size reduction, rice milling - flow sheet. Improving nutritional properties of rice by different methods. Changes in physicochemical, pasting and milling properties during aging of rice. Water mist polishing, rice moisture conditioning, Instruments for rice quality control –rice analyzer, broken rice analyzer, fwm analyzer, rice taste analyzer.	[9]
Wheat Milling Morphology of wheat, Classification, Wheat milling - Flow sheet. Turbo milling, air classifiers. Criteria of wheat and flour quality, structure and functional properties of gluten, wheat grain protein, starch, phytochemicals, dough chemistry, rheology, evaluation of flour quality by farinograph, mixo graph, extension graph, alveo graph, rapid visco Analyzer, dynamic rheometry, mixolab.	[9]
Barley, Corn and Oat Milling Barley– Processing, finishes products and end uses. Corn–wet and dry milling, Manufacture of value-added products such as ze in from corn. Oat milling and flaking. Dietary fibre from barley and oats: β glucan structure, extraction, physiological effects and functional properties.	[9]
Cereal Products Rice snack foods, Rice noodles, quick cooking rice, canned and frozen rice, Baby foods, extruded rice, puffed rice cake, pasta, instant noodles, breakfast cereals, cereal enrichment, malted cereals, Special food ingredients from cereals, future trends.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Karel Kulp., “Hand book of Cereal Science and Technology”, 2nd Edition, CRC Press,2000.
2.	Amalendu Chakraverty, ArunS. Mujumdar, Hosahalli S. Ramaswamy., “Handbook of Postharvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices”,1st Edition, CRC Press,2003.
Reference(s):	
1.	Serna-Saldivar, Sergio O.,“Cerealgrains: Properties, Processing and Nutritional Attributes”,1st Edition, CRC Press, 2016.

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Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Grains**	
1.1	Structural components of cereal grains	1
1.2	Engineering properties of grains	1
1.3	Harvesting	2
1.4	Threshing and Grain cleaning	1
1.5	Stored grain management	2
2	**Rice Milling**	
2.1	Structure and principle of size reduction	1
2.2	Rice milling flow sheet	2
2.3	Improving nutritional properties of rice	1
2.4	Changes in Physio-chemical properties	2
2.6	Instruments for rice quality	1
2.7	Instruments for rice quality	1
2.8	FWM Analyzer	1
3	**Wheat Milling**	
3.1	Morphology of Wheat	2
3.2	Wheat Milling	1
3.3	Structure and Functional properties of gluten	2
3.5	MIxo graph	2
3.6	Mixo lab	2
4	**Barley, Corn and Oat milling**	
4.1	Barley processing	1
4.2	Corn wet and dry milling	2
4.3	Manufacturing of Value-added products	1
4.4	Oat Milling and Flaking	1
4.6	Dietary Fiber from barley	2
4.7	Physiological effects	1
4.8	Functional Properties	1
5	**Cereal Products**	
5.1	Rice snack foods	2
5.2	Rice Noodles	1
5.3	Quick cooking rice	2
5.4	Canned and Frozen rice	1
5.6	Instant Noodles	1
5.7	Cereal enrichment	2
5.8	Malted Cereals	1
5.9	Special Food ingredients	1
	Total	45

Course Designers

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60 PFT E42	Food Additives, Nutraceuticals and Functional Foods	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To classify and choose food additives for various food applications
- To select the suitable types of eyes, heart and digestive health ingredients
- To make use of appropriate ingredients for women, bone and joint health
- To summarize various functional foods and nutraceuticals in the market
- To infer the significance of Asian functional foods

Pre-requisites

Nil

Course Outcomes

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

CO1	Analyze the food additives for various food applications	Analyze
CO2	Examine the suitable types of eye, heart and digestive health ingredients	Apply
CO3	Identify the use of appropriate ingredients for women, bone and joint health	Analyze
CO4	Outline the various functional foods and nutraceuticals in the market	Understand
CO5	Summarize the significance of Asian functional foods	Remember

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	2	3
CO2	3	3	3
CO3	2	2	2
CO4	3	3	2
CO5	2	2	3
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

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

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Syllabus

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

M.Tech Food Technology

60 PFT E42–Food Additives, Nutraceuticals and Functional Foods

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

Food Additives Introduction, classification and functions; Role of additives in foods - preservatives, antioxidants, sequestrants, emulsifiers -selection of emulsifier based on Hydrophilic and Lipophilic balance (HLB)and its application, stabilizers and thickeners, bleaching and maturing agents, starch modifiers, food colourants and colour retention agents, sweeteners, humectants, flavourants and flavour enhancers, leavening agents, pH control agents, fat substitutes and replacers, anti-foaming agents. International Product Code.	[9]
Introduction to Nutraceuticals and Eye, Heart and Digestive Health Ingredients Sources, understanding benefits of nutraceuticals. Scope involved in industry, Indian and global scenario. Eye health ingredients — lutein, zeaxanthin, astaxanthin, beta-carotene, bilberry extracts; Heart health ingredients - omega-3, omega-6, omega-9, beta-glucan, soy protein, phytosterols; Digestive Health Ingredients– prebiotics, probiotics, synbiotics, digestive enzymes, zinccarnosine.	[9]
Women Health Ingredients and Bone and Join the alth ingredients Women health ingredients - Vitamin D, iron, calcium, soy isoflavones, folic acid, cranberry extract, lycopene, phytoestrogens. Prebiotic fiber, glucosamine, chondroitin, collagen peptide, hyaluronic acid, devil sclaw, olive polyphenols, boswelia Serrata, horsetail extract.	[9]
Dietary Supplements and Functional food and beverages Introduction to dietary supplements, Dietary supplements—Need for dietary supplements, supplements forms- tablets, capsules, powders, softgels, gelcaps, liquids. Agnuscastus, Aloevera, Bee products, Chitosan, Echinacea, Garlic, Ginger, Ginkg obiloba, Ginseng, Guarana, Kelp, Milk thistle, Saw palmetto, Spirulina, Chlorella, Hypericum perforatum, Tea extracts.	[9]
Asian Functional Food Functional Foods from Meat, Fruit, Fermented Vegetable Products: Kimchi, Sugarcane, Garlic, Onion, Date Fruits, Japanese Green Tea, Miso, Fermented Soybean Products. Cereal based Functional food and their health effects.	[9]
Total Hours:	**45**

Text Book(s):

1. Wildman, Robert E.C.,Robert Wildman,Taylor C.Wallace(Eds).,"Hand book of Nutraceuticals And Functional Foods",2nd edition, CRC Press, New York, 2007.
2. Titus A. M. M sagati.,"Chemistry of Food Additives and Preservatives", 1st edition, Wiley-Blackwell,2013.

Reference(s):

1. John Shi,Chi-Tang Ho and Fereido on Shahidi.,"Asian Functional Foods",1st Edition, CRC Press, 2005.

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Course Contents and Lecture Schedule

S. No.	Topic	No.of Hours
1	**Food Additives**	
1.1	Classification and Function	1
1.2	Role of Additives in food	1
1.3	Selection of Emulsifier based on hydrophilic and lipophilic balance	2
1.4	Flavourants	1
1.5	International Product Code	2
2	**Introduction to Nutraceuticals and Eye, Heart and Digestive Health Ingredients**	
2.1	Sources	1
2.2	Scope involved in the industry	2
2.3	Indian and Global Scenario	1
2.4	Eye health ingredients	2
2.6	Heart Health Ingredients	1
2.7	Digestive health ingredients	1
2.8	Prebiotics and Probiotics	1
3	**Women Health Ingredients and Bone and Joint Health ingredients**	
3.1	Woman Health ingredients	2
3.2	Prebiotic fibre	1
3.3	Hyaluronic acid	2
3.5	Devils Claw	2
3.6	Horsetail extract	2
4	**Dietary Supplements and Functional Foods and Beverages**	
4.1	Introduction to dietary supplements	1
4.2	Need for dietary supplements	2
4.3	Supplements from capsules	1
4.4	Agnus Castus	1
4.6	Milk Thistle	2
4.7	Spirulina	1
4.8	Tea extracts	1
5	**Asian Functional Food**	
5.1	Functional Foods from meat	2
5.2	Fruits	1
5.3	Fermented Vegetables	2
5.4	Sugarcane	1
5.6	Japanese green tea	1
5.7	Miso	2
5.8	Fermented soybeans products	1
5.9	Cereal based functional foods	1
	Total	45

Course Designers

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BOARD OF STUDIES

60 PFT E43	Advanced Beverage Technology	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To provide students with a knowledge about ingredients used in beverages
- To know the production process of different kinds of beverages.
- To instigate to develop new formulation in beverage processing
- To learn the quality control related to beverage technology.
- To impart the knowledge on safety issues of beverage industry

Course Outcomes

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

CO1	Recall the scope and ingredients of different beverage.	Understand
CO2	Assess the production process of alcoholic beverages	Apply
CO3	Analyze the process of carbonated beverage, fruit and milk based beverages	Analyze
CO4	Identify the processing technology of coffee, tea, cocoa, sports beverages and bottled waste	Apply
CO5	Recall the quality control and safety issues of beverages	Understand

Mapping with Programme Outcomes

COs	POs			PSOs
	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)		Modal Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	20	10	20	20
Understand	30	20	30	30
Apply	10	20	30	30
Analyze	-	10	20	20
Evaluate	-	-	-	-
Create	-	-	-	-
Total	60	60	100	100

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BOARD OF STUDIES

Syllabus

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

M.Tech Food Technology

60 PFT E43 - Advanced Beverage Technology

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

Unit 1- Beverage Overview Beverage: Introduction, Global and Indian scenario. Classification of beverages. Nutritional benefits. Properties of ingredients - Water, sweeteners, bulking agents, acidulants, emulsifiers, stabilizers. Flavouring and Colouring agents. Threshold limits of ingredients.	[9]
Unit 2 - Non-alcoholic Beverages Carbonated beverages - types of soft drinks and their functions, Properties of carbon dioxide, methods of production - Preparation of syrup, filling, and packaging. Formulation of various natural fruit-based juices, squash, and RTS (ready to serve) – a modern method of processing. Preservation of tender coconut water. Milk-based beverages – condensed milk, flavoured milk, whey-based beverages.	[9]
Unit 3 - Alcoholic Beverages Alcoholic Beverages: Types of alcoholic beverages. Wine – types – production and defects. Beer – Types – Production and defects. Distilled beverages – Brandy, Whiskey, Rum, Gin – Production and defects.	[9]
Unit 4 - Carbonated Beverage Preparation of Syrup making, blending, Carbonation of soft drinks, filling, packaging, containers and closures. Powdered dry mix; Energy drinks and sports drinks; Fruit-based carbonated beverages, carbonated water. Equipment used in the manufacture of carbonated beverages.	[9]
Unit 5 - Quality Control Quality control in soft drink industries – water and other ingredient quality, Requirements of Soluble solids and titratable acidity in beverages, Threshold limits of ingredients, Standards and regulations in India. Sanitation and Hygiene in Beverage Industries. HACCP concept.	[9]
Total Hours:	**45**

Text Book(s):

1.	Philip R. Ashurst, “Chemistry and Technology of Soft Drinks and Fruit Juices”, 2nd Edition, Blackwell Publishing Ltd., 2005
2.	Paquin P., “Functional and Speciality Beverage Technology”, 1st Edition, Wood Head Publishing in Food Science Technology and Nutrition, 2009

Reference(s):

1.	R.Singaravelan, “Food and Beverage service”, Oxford university press, New Delhi, 2011
2.	Mitchell A.J., “Formulation and Production Carbonated Soft Drinks” Blackie and Sons Ltd., USA, 1990.
3.	Jagan Mohan Rao and K.Rama lakshmi, “Recent trend in Soft beverages’, Woodhead Publishing India Pvt Ltd., New Delhi 2011

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Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Beverage Overview**	
1.1	Beverage: Introduction	1
1.2	Global and Indian scenario	1
1.3	Classification of beverages	1
1.4	Nutritional benefits	1
1.5	Properties of ingredients - Water, sweeteners	1
1.6	Properties of ingredients - bulking agents, acidulants	1
1.7	Properties of ingredients - emulsifiers, stabilizers	1
1.8	Flavouring and Colouring agents	1
1.9	Threshold limits of ingredients.	1
2	**Non-alcoholic Beverages**	
2.1	Carbonated beverages - types of soft drinks and their functions	1
2.2	Properties of carbon dioxide, methods of production	1
2.3	Preparation of syrup, filling, and packaging.	1
2.4	Formulation of various natural fruit-based juices, squash	1
2.5	Formulation of various natural fruit-and RTS (ready to serve)- a modern method of processing	1
2.6	Preservation of tender coconut water	1
2.7	Milk-based beverages – condensed milk	1
2.8	Milk-based beverages – flavoured milk	1
2.9	Milk-based beverages – whey-based beverages.	1
3	**Alcoholic Beverages**	
3.1	Alcoholic Beverages	1
3.2	Types of alcoholic beverages	1
3.3	Wine – types	1
3.4	Production and defects	1
3.5	Beer –Types	1
3.6	Production and defects	1
3.7	Distilled beverages – Brandy, Whiskey	1
3.8	Distilled beverages- Rum, Gin	1
3.9	Production and defects.	1
4	**Carbonated Beverage**	
4.1	Preparation of Syrup making, blending	2
4.2	Carbonation of soft drinks	1
4.3	Filling, packaging	1
4.4	Containers, and closures.	2
4.5	Powdered dry mix	1
4.6	Energy drinks and sports drinks	1
4.7	Fruit-based carbonated beverages	1
4.8	Carbonated water	1
4.9	Equipment used in the manufacture of carbonated beverages.	
5	**Quality Control**	
5.1	Quality control in soft drink industries	1

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5.2	Water and other ingredient quality	1
5.3	Requirements of Soluble solids in beverages	1
5.4	Requirements of titratable acidity in beverages	1
5.5	Threshold limits of ingredients	1
5.6	Standards and regulations in India	1
5.7	Sanitation and Hygiene in Beverage Industries	1
5.8	HACCP concept.	2

Course Designers

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60 PFT E51	Snacks and Extruded Products Technology	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To learn about the production process of snacks and extruded products.
- To impart the concept of characteristic features of ingredients used in snacks.
- To learn equipment implemented in the production of extruded products.
- To recall the concept of extrusion technology.
- To elaborate the production process of pasta and noodles.

Pre-requisites

Food Safety and Quality Control

Course Outcomes

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

CO1	Illustrate the types and characteristic features of ingredients used in snacks.	Understand
CO2	Infer the different methods of popcorn, corn puff, and tortilla production.	Apply
CO3	Analyze the production process of potato and rice-based chips.	Analyze
CO4	Recall the concept of extrusion.	Understand
CO5	Elaborate the production process of pasta and noodles.	Remember

Mapping with Programme Outcomes

COs	POs		
	1	2	3
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	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	20	30
Apply	10	20	30
Analyze	-	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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

M. Tech. Food Technology

60 PFT E51 - Snacks and Extruded Products Technology

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: 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, colouring and flavouring substances.	[9]
Corn Based Snacks: Popcorn-Popping methods, oil popping and dry popping. Commercial and industrial popcorn process. Flavourings and Applicators. Tortilla chip processing-Corn soaking, steeping, milling, Sheeting and Cutting, Baking and Frying, cooling, addition of flavour. 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 dehydratedpotato.RicebasedSnacks–Productsusingwholegrains–Puffedrice, flaked rice, papad production, products using flours.	[9]
Extrusion Technology: Food Extrusion: Definition, introduction to extruders, principles and types(Single screw extruder and Twin-screw extruder), Uses of extruders in the food industry, Pre-conditioning of raw materials used in extrusion process, Extruder Selection, Design, and Operation for Different Food Applications. Effect of extrusion on food products. Breakfast cereals by extrusion technology. Recent Advances in extrusion technology.	[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,surfacesalting,bakinganddrying,Other food products - some breads (croutons, bread sticks, and flat breads), various ready-to-eat snacks, pre-made cookie dough, some baby foods, some beverages, and dry and semi-moist pet foods.	[9]
Total Hours	45

Textbook(s):

1. Edmund W. Lusas andLloydW.Rooney,“SnackFoodProcessing”,1stEdition,CRC Press,Florida,2001.
2. RobinGuy,“Extrusioncooking:TechnologiesandApplications”,1stEdition,CRC Press,Florida,2001

Reference(s):

1. Panda H.,”The Complete Technology Book on Snack Foods”, National Institute of Industrial Research, NewDelhi,2003
2. Sergio O. Serna-Saldivar, “Industrial Manufacture of Snack Food ”Wood head Publishing, New Delhi, 2008
3. Jean Marie Bouvier Osvaldo H. Campanella. “Extrusion Processing Technology: Food and Non FoodBiomaterials”,JohnWiley&Sons,Ltd.2014.
4. Fast R.B. and Caldwell E.F. “Breakfast Cereals and How they are made. American Association of CerealChemists”,St.Paul,Minnesota,2000

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Course Contents and Lecture Schedule

S. No	Topic	No. of Hours
1	**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,	1
1.3	Directly expanded extruded snack, Puffed Snacks and other.	1
1.4	Types and Functions of ingredients – structure forming materials,	1
1.5	Dispersed phase/filling materials,	1
1.6	Plasticizers/lubricants,	1
1.7	Soluble solids,	1
1.8	Nucleating substances,	1
1.9	Colouring and flavouring substances	1
2	**Corn Based Snacks**	
2.1	Popcorn – Popping methods, oil popping and dry popping.	2
2.2	Commercial and industrial popcorn process. Flavourings and Applicators	2
2.3	Tortilla chip processing — Corn soaking, steeping, milling, Sheeting and Cutting,	2
2.4	Baking and Frying, cooling, addition of flavour.	1
2.5	Corn puff–production process.	2
3	**Potato and Rice based Snacks**	
3.1	Potato chips production process: Pre cleaning and peeling, slicing, drying/frying, salting and seasoning, quality control.	2
3.2	Fabricated potato snacks – potato flakes, potato granules,	1
3.3	potato starch, ground and crushed dehydrated potato.	1
3.4	Rice based Snacks.	1
3.5	Products using whole grains	1
3.6	Puffed rice, flaked rice, papad production,	2
3.7	Products using flours	1
4	**Extrusion Technology**	
4.1	Food Extrusion: Definition, introduction to extruders,	1
4.2	principles and types(Single screw extruder and Twins crew extruder)	1
4.3	Uses of extruders in the food industry	1
4.4	Pre-conditioning of raw materials used in extrusion process.	1
4.5	Uses of extruders in the food industry	1
4.6	Pre-conditioning of raw materials used in extrusion process	1
4.7	Extruder Selection, Design, and Operation for Different Food Applications.	1
4.8	Effect of extrusion on food products.	1
4.9	Breakfast cereals by extrusion technology.	1

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5	**Pasta and other Products**	
5.1	Overview of pasta making process, Types of Pasta products,	1
5.2	Production process of Spaghetti, noodles and macaroni.	1
5.3	Pretzel–Types–FormulationandProcessing-mixing,extrusion,proofing,cooking,surfacesalting,bakinganddrying,	2
5.4	Other food products - some breads (croutons, bread sticks, and flat breads),	1
5.5	Various ready-to-eat snacks.	1
5.6	Pre-made cookie dough,	1
5.7	Some baby foods, some beverages,	1
5.8	Dry and semi-moist pet foods	1
	Total	**45**

Course Designers

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Passed in BoS Meeting held on 23/12/22
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CHAIRMAN
BOARD OF STUDIES

60 PFT E52	Internet of Things in Food and Agriculture	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To outline the basic concepts of IoT.
- To summarize the fundamental concepts of Internet-connected products.
- To apply the concept of IoT for management of agriculture and supply chain.
- To make use of appropriate IoT concepts for rapid detection of food spoilage.
- To utilize IoT methods to solve food trace ability and food waste management.

Pre-requisites

NIL

Course Outcomes

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

CO1	Analyze the basic concepts of IoT.	Analyze
CO2	Examine the fundamental concepts of Internet-connected products.	Apply
CO3	Identify the concept of IoT for management of agriculture and supply chain.	Apply
CO4	Outline the appropriate IoT concepts for rapid detection of food spoilage.	Understand
CO5	Summarize the IoT methods to solve food traceability and food waste management problems	Remember

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	2	2
CO2	3	2	2
CO3	3	3	3
CO4	3	3	3
CO5	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	20
Understand	20	30	30
Apply	20	20	30
Analyze	10	0	20
Evaluate	0	0	0
Create	0	0	0
Total	60	60	100

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Syllabus

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

60 PFT E52–Internet of Things in Food and Agriculture

M. Tech. Food Technology

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 to Internet of Things (IoT) Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT Communication Models - IoT Communication application programming interfaces – IoT enabled technologies – Wireless Sensor Networks - Cloud Computing – Big data analytics – Communication Protocols, Embedded Systems – IoT Levels and Templates - organizational implementation and management challenges.	[9]
Python, Physical Devices and Endpoints for IoT Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, classes, exception handling. Python packages – HTTPLib, URLLib, SMTPLib. Introduction to Raspberry PI – Interfaces (serial, Serial Peripheral Index (SPI), I2C Programming) – Python program with Raspberry PI with focus of interfacing external gadgets – controlling output – reading input from pins – connecting IoT to Cloud – Xively.	[9]
IoT in Agriculture and IoT in Food Smart agriculture, type of IoT sensors for agriculture – monitoring of climate conditions, Greenhouse automation, crop management, cattle monitoring and management, End-to-End farm management systems. Benefits and applications of smart farming, Issues and challenges in food and agriculture-efficient routing protocols and ambient energy harvesting for IoT. RFID and sensor network integration in food industry - RFID in food production, food supply chain, retailing and sustainability. RFID in sensor network and food processing - Case studies - Big data analytics in food industries - Food supply chain visibility, Intelligent food supply chain. Blockchain - Concepts - Potential Applications in Food Industry.	[9]
IoT in Food Spoilage and Safety Importance of IoT concerning food quality, safety and security. Biosensors for detection of foodborne pathogens – prevention & retardation of food spoilage. Microbial detection, GIS, Sensor Networks. Case study on ensuring safety by enhanced IoT. IoT linked wearable devices for managing food safety in the healthcare sector.	[9]
IoT in Food Traceability and IoT in Food Waste Management Food Traceability: Need of new technologies in food traceability systems. Architecture of traceability system - ICT & Electronic Product Code (EPC) enabled systems. Real-time tracking and remote monitoring – Wireless sensing technologies, remote communications, and Intelligent traceability. Food Waste Management: Scope and significance of IoT in food waste management. Smart Garbage System (SGS) - components, design, architecture of SGS, implementation and efficiency, real-time application in food waste	[9]
Total Hours:	**45**

Text Book(s):

1.	Qusay F. Hassan, Attaur Rehman Khan, Sajjad A. Madani. "Internet of Things: Challenges, Advances, and Applications," 1st Edition, CRC Press, Taylor and Francis Group, 2017.
2.	Selwyn Piramuthu, Weibiao Zhou. "RFID and Sensor Network Automation in the Food Industry: Ensuring Quality and Safety through Supply Chain Visibility," 1st Edition, Wiley & Sons, UK, 2016.

Reference(s):

1.	Montserrat Espiñeira, Francisco J. Santaclara. *Advances in Food Traceability Techniques and Technologies: Improving Quality Throughout the Food Chain*, 1st Edition, Woodhead Publishing, 2016.

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Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Introduction to internet of Things (IoT)**	
1.1	Definition and Characteristics of IoT	1
1.2	Communication application programing interfaces	1
1.3	Big Data Analytics	2
1.4	Communication Protocols	1
1.5	Embedded systems	2
2	**Python, Physical Devices and End points for IoT**	
2.1	Language Features of Python	1
2.2	Data types	2
2.3	Data structures	1
2.4	Control of Flow	2
2.6	12C Programming	1
2.7	Rasp berry Pi	1
2.8	Connecting IoT cloud Xively	1
3	**IoT in Agriculture and IoT in Food**	
3.1	Smart Agriculture	2
3.2	Type of IoT Sensors	1
3.3	Monitoring of Climate Conditions	2
3.5	RFID Sensors	2
3.6	Block chain concepts	2
4	**IoT in Food Spoilage and Safety**	
4.1	Importance of IoT concerning food quality	1
4.2	Bio sensors	2
4.3	Microbial detection	1
4.4	GIS	1
4.6	Sensornet works	2
4.7	IoT linked wearable	1
4.8	Health Sector	1
5	**IoT in Food Traceability and IoT in Food Waste Management**	
5.1	Food Traceability	2
5.2	Need of new technologies	1
5.3	Real time tracking and remote monitoring	2
5.4	Wireless sensing Technology	1
5.6	Remote Communication	1
5.7	Intelligent Traceability	2
5.8	Food Waste Management	1
5.9	Smart Garbage	1
	Total	45

Course Designer(s)

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60 PFT E53	Sensory Evaluation of Foods	Category	L	T	P	Credit
		PC	3	1	0	4

Objective

- Know the various kinds Sensory evaluation methods
- Familiarize with planning a sensory project.
- Analyze the different types of Discriminative Test Methods
- Study the different types of Descriptive Tests and Affective Tests
- Apply sensory application in various new product development of food secters.

Prerequisite

Nil

Course Outcomes

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

CO1	Demonstrate an understanding of the concepts in sensory evaluation and detail about the sensory organs in evaluation	Understand
CO2	Know about the requirements for sensory testing and plan a sensory evaluation session	Analyze
CO3	Detail about the difference test methods in sensory evaluation and outline the discriminative test methods	Apply
CO4	Select suitable descriptive test for sensory analysis and outline the affirmative test methods	Analyze
CO5	Setline the basic statistical concepts for sensory evaluation and elaborate on steps involved in statistical method	Analyze

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	2
3- Strong, 2-Medium, 1-Some			

Assessment Pattern

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

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

60 PFT E53 - Sensory Evaluation of Foods

M.Tech. Food Technology

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

Introduction Sensory evaluation – definition, Role of sensory evaluation in food industry, Sensory perception – vision, gustation, olfaction, touch, audition, multimodal perception. Factors affecting sensory measurements, Factors contributing to successful sensory evaluation. Requirements for sensory testing – Resources, Sample preparation and presentation, Assessors – screening and selection, training, motivation, advantages and disadvantages of internal and external panels	[9]
Planning a Sensory Project Product type, Budget, Timings, Selecting the test method, Setting action standards, Experimental design - treatment structure, design structure, Measurement scales, Sensory data analysis – types of data, distribution, data handling, choosing appropriate statistical test.	[9]
Discriminative Test Methods Overall Difference tests - Triangle test, Duo-trio test, Difference from control test, Same and different test, 'A' 'not A' test. Attribute specific test - Paired comparison, Alternative forced choice, Ranking test. Similarity test - The power of the test, Proportion of true discriminators, Selecting the correct number of assessors.	[9]
Descriptive Tests and Affective Tests Consensus profiling, Flavour Profiling, Texture Profiling, Quantitative Descriptive Analysis, Spectrum method, Free choice profiling, Flash profiling, Difference from control profiling, Temporal dominance of sensations. Questionnaire design, Qualitative methods - Focus groups, Preference tests, Acceptance tests, Attribute diagnostics. Linking consumer, sensory and product data. Advantages and disadvantages of test locations.	[9]
Sensory applications in new product development and consumer research Adoption and use of Flash Profiling in standardizing new product development, Improving team tasting in the food industry, Alternative methods of sensory testing -working with chefs, culinary professionals and brew masters, Sensory testing with flavourists: challenges and solutions. Working with children, older people. Empathy and experiment – working with new population groups	[9]
Total Hours:45+15(Tutorial)	45

Textbook(s):

1. Sarah Kemp, Tracey Hollowood, Joanne Hort., "Sensory Evaluation: A Practical Handbook", 1st Edition, Wiley Blackwell Publishers, UK, 2009.
2. 2. Julien Delarue, J., Ben Lawlor, Michel Rogeaux., "Rapid Sensory Profiling Techniques and Related Methods", 1st Edition, Woodhead Publishing, UK, 2015

Reference(s):

1. Herbert Stone, Rebecca N. Bleibaum, Hetaher A.Thomas., "Sensory Evaluation Practices", 4th Edition, Academic Press, USA, 2018.
2. Harry T. Lawless and Hildegarde Heymann., "Sensory Evaluation of Food: Principle and Practices", 2nd Edition, Springer, UK, 2010.

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Content Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Introduction**	
1.1	Sensory evaluation – definition, Role of sensory evaluation in food industry	2
1.2	Sensory perception – vision, gustation, olfaction, touch, audition, multimodal perception.	2
1.3	Factors affecting sensory measurements	1
1.4	Factors contributing to successful sensory evaluation	1
1.5	Requirements for sensory testing – Resources, Sample preparation and presentation	1
1.6	Assessors – screening and selection, training, motivation	1
1.7	Advantages and disadvantages of internal and external panels	1
2	**Planning a Sensory Project**	
2.1	Product type	1
2.2	Budget, Timings	1
2.3	Selecting the test method	1
2.4	Setting action standards	1
2.5	Experimental design - treatment structure	1
2.6	Design structure	1
2.7	Measurement scales	1
2.8	Sensory data analysis - types of data, distribution, data handling	1
2.9	Choosing appropriate statistical test.	1
3	**Discriminative Test Methods**	
3.1	Overall Difference tests - Triangle test	1
3.2	Duo-trio test	1
3.3	Difference from control test	1
3.4	Same and different test	1
3.5	‘A’ ‘not A’ test.	1
3.6	Attribute specific test - Paired comparison	1
3.7	Alternative forced choice	1
3.8	Ranking test	1
3.9	Similarity test - The power of the test, Proportion of true discriminators, Selecting the correct number of assessors.	1
4	**Descriptive Tests and Affective Tests**	
4.1	Consensus profiling, Flavour Profiling	1
4.2	Texture Profiling, Quantitative Descriptive Analysis	1
4.3	Spectrum method, Free choice profiling	1
4.4	Flash profiling, Difference from control profiling	1
4.5	Temporal dominance of sensations.	1
4.6	Questionnaire design	1
4.7	Qualitative methods - Focus groups, Preference tests, Acceptance tests, Attribute diagnostics.	1
4.8	Linking consumer, sensory and product data.	1
4.9	Advantages and disadvantages of test locations	1
5	**Sensory applications in new product development and consumer research**	

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5.1	Adoption and use of Flash Profiling in standardizing new product development	2
5.2	Improving team tasting in the food industry	1
5.3	Alternative methods of sensory testing	1
5.4	Working with chefs, culinary professionals and brew masters	2
5.5	Sensory testing with flavourists: challenges and solutions.	1
5.6	Working with children, older people.	1
5.7	Empathy and experiment – working with new population groups	1
	Total	**45**

Course Designer

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BOARD OF STUDIES

	Advanced Food Supply Chain Management	Category	L	T	P	Credit
60 PFT E61		PE	3	0	0	3

Objectives

- To learn about the food supply chain and its logistics.
- To analyze 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 their documentation.

Pre-requisites

Nil

Course Outcomes

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

CO1	Analyze the fundamentals of logistics, supply chain management, and understand the scope, significance, and drivers of the supply chain.	Analyze
CO2	Examine different demand planning and demand forecast processes.	Apply
CO3	Identify various sources of distribution channels in transportation.	Analyze
CO4	Outline the concept of packaging and its logistics, and elaborate on export and import labelling.	Understand
CO5	Summarize the export and import procedures and their documentation with risk management.	Remember

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	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	30
Apply	20	20	30
Analyze	10	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R 2022								
M.Tech Food Technology								
60 PFT E61–Advanced Food Supply Chain Management								
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 **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 the 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 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 their 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 procedures and documentation, Risk management in global logistics, Customer relationship management in LSCM, Performance metrics in Supply Chain, Indian agencies - EIC, EIA, APEDA, MEPEDA.	[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, 6the dition,2016
Reference(s):	
1.	David Taylor and David Brunt,“ Manufacturing Operations and Supply chain Management”,Vikas Thomson Learning publishers,2009
2.	Michael A.Bourlakis and Paul W.H. Weight man “Food Supply Chain Management”, Black well Publishing Limited,2004

Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Introduction**	
1.1	Logistic sand supply chain management	1
1.2	Fundamentals of LSCM	1
1.3	Basic Model	2
1.4	Secondary activity	1
1.5	Role and Challenges of logistics	2
2	**Procurement and Warehousing**	
2.1	Demand and Supply chain management	1
2.2	Demand planning	2
2.3	Demand Forecasting	1
2.4	Forecasting and strategic planning	2

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2.6	Out sourcing strategies	1
2.7	Warehouse strategies	1
2.8	Inventory models and control techniques	1
3	**Distribution and transportation**	
3.1	Various Sources of distribution channels	2
3.2	Distribution models	1
3.3	Distribution and network planning	2
3.5	Modes of transport	2
3.6	Transportation Management	2
4	**Packaging and Information Technology**	
4.1	Applications of Packaging in Logistics	1
4.2	Types of packaging and packaging materials	2
4.3	Export and Import packaging	1
4.4	Labelling details	1
4.6	Containerization	2
4.7	IT in Supply chain management	1
4.8	Bar coding	1
5	**Global LSCM and Performance analysis**	
5.1	Export and Import procedure	2
5.2	Risk management in global logistics	1
5.3	Customer relations	2
5.4	Performance metrics in Supply Chain	1
5.6	Indian Agencies	1
5.7	EIC	2
5.8	EIA	1
5.9	APEDA	1
	Total	45

Course Designers

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BOARD OF STUDIES

60 PFT E62	Advanced Meat Processing Technology	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To select suitable techniques for meat slaughter and meat quality evaluation.
- To apply various methods to preserve poultry products and utilize poultry waste.
- To examine the quality of eggs and develop beneficial egg products.
- To select suitable methods for utilization and preservation of marine products.
- To make use of advanced technologies in meat and fish processing.

Pre-requisites

Nil

Course Outcomes

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

CO1	Analyze the suitable techniques for meat slaughter and meat quality evaluation.	Analyze
CO2	Examine the various methods to preserve poultry products and utilize poultry waste.	Apply
CO3	Identify the quality of eggs and develop beneficial egg products.	Analyze
CO4	Outline the suitable method for utilization and preservation of marine products.	Understand
CO5	Summarize the advanced technologies in meat and fish processing	Remember

Mapping with Programme Outcomes

COs	POs		
	1	2	3
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	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	30
Apply	20	20	30
Analyze	10	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

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

M.Tech. Food Technology

60 PFT E62–Advanced Meat Processing Technology

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

Meat and Advances in Meat Quality Assurance Chemical composition and structure of meat. Scientific slaughter: stunning techniques – mechanical & electrical. Pre-and post-slaughter operations. Factors affecting post-mortem changes. Advances in meat fraud detection. Gene technology for meat traceability and safety. Rapid identification of animal and meat quality. Drug residues in meat.	[9]
Poultry Meat Birds common to the live bird marketing system. Poultry birds - pre-slaughter care and dressing. Strategies for shelf-life extension of poultry meat and its products. Co-products and by-products from poultry processing. Low fat, low salt poultry products. Problems and solutions in deboning of poultry meat. Poultry waste management – selecting the right approach.	[9]
Egg Commercially important eggs. Hen egg - structure, composition, chemical contaminants in eggs. Pre harvest measures to improve the safety of eggs. Advances in egg defect detection and quality assessment. Traceability of eggs along the supply chain. Effects of processing on the allergenicity of egg proteins. Bioactive egg compounds - applications. Frozen egg products. Designer eggs.	[9]
Marine Products Processing Edible products from the sea. Fish – types, on-board fish processing and its advantages. Individual quick freezing. Retort pouch processing of fish. Quality chain management in fish processing. Food utilization of by-catch and underutilized species; advances in fishery by-products technology - production of fish protein concentrate, fish liver oil, fish sauce, and insulin. Bioactive substances from seaweeds.	[9]
Advances in Meat Products and Processing Operations Accelerated conditioning technologies for meat. New approaches for the development of functional meat products. Tailored designing of nitrite-free meat products. Latest developments in meat bacterial starters. Probiotic meat products, spreadable raw fermented sausage. Advances in the manufacture of sausage casings. Advances in bulk packaging for the transport of fresh fish. New sources of animal protein – cultured meat, edible insects.	[9]
Total Hours:	**45**

Text Book(s):

1.	AlaaEl-DinA, Bekhit.,"Advances in Meat Processing Technology",1stEdition,CRCPress, USA, 2017.
2.	George M. Hall, "Fish Processing: Sustainability and New Opportunities",1st Edition, Wiley Blackwell Publications,USA,2011.

Reference(s):

1.	Patricia Hester., "Egg Innovations and Strategies for Improvements",1st Edition, Academic Press,UK,2017.

Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Meat and Advances in meat quality Assurance**	
1.1	Chemical composition and structure of meat	1
1.2	Scientifics laughter	1
1.3	Factors affecting postmortem changes	2
1.4	Advances in meat fraud detection	1

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1.5	Drug residues in meat	2
2	**Poultry Meat**	
2.1	Birds commemorative bird marketing system	1
2.2	Poultry birds pre slaughter	2
2.3	Co products and-byproducts from poultry processing	1
2.4	Low fat products	2
2.6	Problems and solution in bonding	1
2.7	Poultry waste management	1
2.8	Selecting the right approach	1
3	**Egg**	
3.1	Commercially important eggs	2
3.2	Hen egg structure composition	1
3.3	Advances in egg defect detection	2
3.5	Effects of processing on the allergenic of egg protein	2
3.6	Bioactive egg compounds	2
4	**Marine Products processing**	
4.1	Edible products from sea	1
4.2	On board fish processing	2
4.3	Quality chain management in fish processing	1
4.4	Food utilization by catch	1
4.6	Advances in fishery by-product technology	2
4.7	Production of fish protein concentrate	1
4.8	Fish liver oil	1
5	**Advances in Meat products and Processing Operations**	
5.1	Accelerating conditioning technologies	2
5.2	New approaches for development of functional meat	1
5.3	Designing of nitrite free meat products	2
5.4	Latest developments in meat bacterial starters	1
5.6	Probiotic meat	1
5.7	Spread able raw fermented as usage	2
5.8	Advances in manufacturing sausage casings	1
5.9	New sources of animal protein	1
	Total	45

Course Designers

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BOARD OF STUDIES

60 PFT E63	Advanced Dairy Technology	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To outline the characteristics of milk constituents and its analytical techniques.
- To examine changes in milk due to heat and biotechnological interventions.
- To identify the advanced methods in dairy processing.
- To make use of advances in technology for manufacturing dairy products.
- To interpret fouling processes and automation in the dairy industry.

Pre-requisites

Advanced Refrigeration and Cold Chain Management

Course Outcomes

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

CO1	Analyze the characteristics of milk constituents and its analytical techniques.	Analyze
CO2	Examine the changes in milk due to heat and biotechnological interventions.	Apply
CO3	Identify the advanced methods in dairy processing.	Analyze
CO4	Outline the use of advances in technology for manufacturing dairy products.	Understand
CO5	Summarize the fouling process and automation in the dairy industry.	Remember

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	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	30
Apply	20	20	30
Analyze	10	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

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

M.Tech Food Technology

60 PFT E63– Advanced Dairy Technology

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

Milk Constituents and Its Properties Constituents of milk, factors affecting milk composition, properties of milk - thermal, optical, electrical, and rheological properties, refractive index, effects of high-pressure treatment on constituents and properties of milk, bioactive compounds from milk, advances in fractionation and analysis of milk.	[9]
Heat-Induced Changes and Biotech Approaches in Dairy Products Chemical and physical changes in Ultra Heat Temperature treatment, heat-induced reactions in milk – surface reactions, bulk reactions. Genetically modified cheese: a novel biotechnological development. Recent biotechnological approaches in dairy and food industry: bio-functional whey-based beverages, production and enrichment of bioactive peptides derived from milk proteins, membrane bioreactors: classification, theory, applications of membrane bioreactors and fermenters in the dairy industry.	[9]
Advanced Dairy Processing Microwave processing, high-pressure processing, pulsed electric field processing, ultrasound processing, ultraviolet and pulsed light processing, advanced heating processes - extended shelf life (ESL), innovative steam injection (ISI), modern approaches to lactose production.	[9]
Dairy Products Manufacture Liquid infant formulae, anhydrous milk fat, frozen cream, dried cream, processed cheese, dairy protein products, blends and blended spreads – production and quality aspects, glycosylated whey proteins, milk imitations, fermented whey, indirect biological acidification process, manufacturing process for cholesterol reduction.	[9]
Operational Considerations, Limitations, and Automation in Dairy Industry Fouling - types, mechanisms, factors affecting fouling, biofilm - formation, detection, control. Factors contributing to automation, stages in automation in dairy, automation at the enterprise level - Enterprise Resource Planning.	[9]
Total Hours:	**45**

Text Book(s):

1.	Spreer E.,"Milk and Dairy Product Technology",1st Edition, Routlege,UK,2017.
2.	Nurcan Koca.,"Technological Approaches for Novel Applications in Dairy Processing",1st Edition,InTech Open,UK, 2022.

Reference(s):

1.	Datta N., Tomasula P.M., "Emerging Dairy Processing Technologies: Opportunities for the Dairy Industry",1st Edition,John Wiley & Sons, US,2015.

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Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**Milk Constituents and its Properties**	
1.1	Constituent so milk	1
1.2	Factors affecting Milk composition	1
1.3	Properties of milk	2
1.4	Effects of high-pressure treatment	1
1.5	Advances in Fractional and Analysis of Milk	2
2	**Heat induced changes and biotech approaches in dairy products**	
2.1	Chemical and Physical changes in Ultra heat Temperature	1
2.2	Heat induced reactions	2
2.3	Genetically Modified cheese	1
2.4	Food Industry	2
2.6	Production and enrichment of bioactive peptides	1
2.7	Membrane bioreactors	1
2.8	Application of membrane bioreactor	1
3	**Advanced Dairy Processing**	
3.1	Microwave Processing	2
3.2	Pulsed electric field processing	1
3.3	Advanced heating processes	2
3.5	Extended Shelf life	2
3.6	Approaches to Lactose production	2
4	**Dairy Products Manufacture**	
4.1	Liquid infant formulation	1
4.2	Anhydrous Milk fat	2
4.3	Frozen cream	1
4.4	Production and quality aspects	1
4.6	Glycosylated whey protein	2
4.7	Indirect biological acidification process	1
4.8	Manufacturing process for cholesterol reduction	1
5	**Operational Considerations and limitations and Automation in Dairy Industry**	
5.1	Fouling types	2
5.2	Factors affecting fouling	1
5.3	Biofilm formation	2
5.4	Factors contributing to automation	1
5.6	Stages in automation in dairy	1
5.7	Automation at Enterprise level	2
5.8	Enterprise Resources Planning	2
	Total	45

Course Designers

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60 PAC 001	English for Research Paper Writing	Category	L	T	P	Credit
		AC	2	0	0	0

Objectives

- Teach how to improve writing skills and level of read ability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

Pre-requisites

Nil

Course Outcomes

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

CO1	Understand how to improve writing skills and level of readability.	Understand
CO2	Learn about what to write in each section.	Remember
CO3	Understand the skills needed when writing a title.	Understand
CO4	Understand the skills needed when writing the conclusion.	Understand
CO5	Ensure the good quality of a paper at first-time submission.	Apply

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)	
	1	2
Remember	40	40
Understand	40	40
Apply	20	20
Analyze	-	-
Evaluate	-	-
Create	-	-
Total	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 R 2022								
M.Tech. Food Technology								
60 PAC 001-English for Research Paper Writing								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	2	0	0	30	0	100	-	100

Introduction to Research Paper Writing Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.	[6]
Presentation Skills Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts	[6]
Introduction Title Writing Skills Key skills needed when writing a Title ,Key skills needed when writing an Abstract, Key skills needed when writing an Introduction, Skills needed when writing a Review of the Literature, Methods, Results, Discussion, and Conclusions The Final Check.	[6]
Result Writing Skills Skills needed when writing the Methods, Skills needed when writing the Results, Skills needed when writing the Discussion, Skills needed when writing the Conclusions.	[6]
Verification Skills Useful Phrases, Checking Plagiarism, How to Ensure the Paper is as Good as It Could possibly Be for the First-Time Submission	[6]
Total Hours:	**30**

Text Book(s):	
1.	Adrian Wall work, *English for Writing Research Papers*, Springer, New York, Dordrecht, Heidelberg, London, 2011.
2.	Day R., *How to Write and Publish a Scientific Paper*, Cambridge University Press, 2006.
Reference(s):	
1.	Goldbort R., *Writing for Science*, Yale University Press, 2006 (available on Google Books).
2.	Highman N., *Handbook of Writing for the Mathematical Sciences*, SIAM, 1998.

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60 PAC 002	Disaster Management	Category	L	T	P	Credit
		AC	2	0	0	0

Objectives

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches Teach how to improve writing skills and level of read ability

Pre-requisites - Nil

Course Outcomes

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

CO1	Ability to summarize basics of disaster.	Apply
CO2	Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.	Apply
CO3	Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	Apply
CO4	Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	Apply
CO5	Ability to develop the strengths and weaknesses of disaster management approaches.	Apply

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)	
	1	2
Remember	30	30
Understand	30	30
Apply	40	40
Analyze	-	-
Evaluate	-	-
Create	-	-
Total	100	100

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R 2022								
M.Tech. Food Technology								
60 PAC 002 –Disaster Management								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	2	0	0	30	0	100	-	100

Introduction Disaster: Definition, Factors and Significance, Difference between Hazard and Disaster, Natural and Manmade Disasters: Difference, Nature, Types and Magnitude	[6]
Repercussions of Disasters and Hazards Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem, Natural Disasters, Earthquakes, Volcanism, Cyclones, Tsunamis, Floods, Droughts, Famines, Landslides, Avalanches. Man-made Disasters: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Disease Outbreaks, Epidemics, War, Conflicts	[6]
Disaster Prone Areas in India Study of Seismic Zones Areas Prone to Floods, Droughts, Landslides, Avalanches, Areas Prone to Cyclonic and Coastal Hazards (with special reference to Tsunamis),post-Disaster Diseases and Epidemi	[6]
Disaster Preparedness and Management Preparedness: Monitoring phenomena triggering a disaster or hazard ,Evaluation of Risk : Application of Remote Sensing, Meteorological Data, Media Reports Governmental and Community Preparedness	[6]
Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation, Techniques of Risk Assessment, Global Cooperation in Risk, Assessment and Warning People's Participation in Risk Assessment ,Strategies for Survival	[6]
Total Hours:	**30**

Text Book(s):	
1.	Goel S.L., *Disaster Administration and Management: Text And Case Studies*, Deep & Deep Publications Pvt. Ltd., New Delhi, 2009.
2.	Nishitha Rai, Singh A.K., *Disaster Management in India: Perspectives, Issues and Strategies*, New Royal Book Company, 2007.
Reference(s):	
1.	Sahni, Pardeep et al., *Disaster Mitigation Experiences and Reflections*, Prentice Hall of India, 2001.
2.	Subramanian R., *Disaster Management*, Vikas Publishing Housing Pvt. Ltd., 2018.

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60 PAC 003	Constitution of India	Category	L	T	P	Credit
		AC	2	0	0	0

Objectives

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights, as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the BolshevikRevolutionin1917anditsimpact on the initial drafting of the Indian Constitution.

Pre-requisites

Nil

Course Outcomes

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

CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.	Apply
CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	Apply
CO3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party (CSP) under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.	Apply
CO4	Discuss the passage of the Hindu Code Bill of 1956.	Apply
CO5	Discuss the role and functioning of the Election Commission of India.	Apply

Mapping with Programme Outcomes

COs	POs		
	1	**2**	**3**
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2
3 - Strong; 2 - Medium; 1 – Some			

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)	
	1	2
Remember	30	30
Understand	30	30
Apply	40	40
Analyze	-	-
Evaluate	-	-
Create	-	-
Total	100	100

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Syllabus

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

M.Tech. Food Technology

60 PAC 003–Constitution of India

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
	2	0	0	30	0	100	-	100

History of Making of The Indian Constitution History, Drafting Committee: Composition & Working, Philosophy of The Indian Constitution, Preamble, Salient Features	[6]
Contours of Constitutional Rights and Duties, Fundamental Rights: Right to Equality, Right to Freedom , Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties	[6]
Organs of Governance Parliament – Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President , Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers, and Functions	[6]
Local Administration - District's Administration Head: Role and Importance, Municipalities: Introduction, Mayor and Role of Elected Representative, CEO, Municipal Corporation, Panchayat Raj: Introduction-PRI: Zila Panchayat, Elected Officials and Their Roles, CEO Zila Panchayat: POsition and Role, Block Level: Organizational Hierarchy (Different Departments), Village Level:Role of Elected and Appointed Officials,Importance of Grassroot Democracy	[6]
Election Commission Role and Functioning, Chief Election Commissioner and Election Commissioners, Institutes and Bodies for the Welfare of SC/ST/OBC and Women	[6]
Total Hours:	30

Text Book(s):

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Busi S.N., Ambedkar B.R., *Framing of Indian Constitution, 1st Edition, 2015.

Reference(s):

1. Jain, M.P., Indian Constitutional Law*, 7th Edition, Lexis Nexis, 2014.
2. Basu, D.D., Introduction to the Constitution of India, Lexis Nexis, 2015.

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