ANNAMALAI UNIVERSITY

(Accredited With 'A' Grade by NAAC)

Faculty of Engineering and Technology

Department of Chemical Engineering

M.Tech. Food Processing Technology

(Choice Based CreditSystem)

HAND BOOK

REGULATIONS AND SYLLABUS

REGULATIONS - 2023

ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF CHEMICAL ENGINEERING

M.E. / M. Tech (Two-Year Full Time& Three-year Part Time)

DEGREE PROGRAMME(CBCS)

REGULATIONS -2023

1. Conditions for Admission

Candidates for admission to the first year of the four-semester **M.E / M.Tech Degree programme in Engineering** shall be required to have passed B.E / B.Tech degree of Annamalai University or any other authority accepted by the syndicate of this University as equivalent thereto. They shall satisfy the conditions regarding qualifying marks and physical fitness as may be prescribed by the Syndicate of the Annamalai University from time to time. The admission for M.E Part Time programme is restricted to those working or residing within a radius of **90 km** from Annamalainagar. The application should be sent through their employers.

2. Branches of Study in M.E /M.Tech

The Branch and Eligibility criteria of programmes are given in Annexure I

3. Courses of study

The courses of study along with the respective syllabi and the scheme of Examinations for each of the M.E / M. Tech programmes offered by the different Departments of study in the Faculty of Engineering and Technology are given separately.

4. Choice Based Credit System(CBCS)

The curriculum includes three components namely Program Core, Program Electives and Open Electives, Mandatory Learning Courses and Audit Courses in addition to Thesis. Each semester curriculum shall normally have a blend of theory and practical courses.

5. Assignment of Credits for Courses

Each course is normally assigned one credit per hour of lecture / tutorial per week and0.5 credit for one hour of laboratory or project or industrial training or seminar per week. The total credits for the programme will be **68**.

6. Duration of the programme

A student of M.E / M.Tech programme is normally expected to complete in four semesters for full-time / six semesters for part-time but in any case not more than four years for full-time / six years for part-time from the date of admission.

7. Registration for courses

A newly admitted student will automatically be registered for all the courses prescribed for the first semester, without any option. Every other student shall submit a completed registration form indicating the list of courses intended to be credited during the next semester. This registration will be done a week before the last working day of the current semester. Late registration with the approval of the Dean on the recommendation of the Head of the Department along with a late fee

will be done up to the last working day. Registration for the Thesis Phase - I and Phase-II shall be done at the appropriate semesters.

8. Electives

8.1 Program Electives

The student has to select two electives in first semester, another two electives in the second semester and one more in the third semester from the list of Program Electives.

8.2 Open Electives

The student has to select two electives in third semester from the list of Open Electives offered by the Department and / or other departments in the Faculty of Engineering and Technology.

8.3 MOOC (SWAYAM)Courses

Further, the student can be permitted to earn credits by studying the Massive Open Online Courses offered through the SWAYAM Portal of UGC with the approval of the Head of the Department concerned. These courses will be considered as equivalent to open elective courses. Thus the credit earned through MOOC courses can be transferred and considered for awarding Degree to the student concerned.

8.4 Value added courses (Inter Faculty Electives)

Of the two open elective courses, a student must study one value added course that is offered byother Faculties in our University either in second or third semester of the M.E programme.

9. Industrial Project

A student may be allowed to take up the one program elective and two open elective courses of third semester (Full Time program) in the first and second semester, to enable him/her to carry out Project Phase-I and Phase-II in an industry during the entire second year of study. The condition is that the student must register those courses in the first semester itself. Such students should meet the teachers offering those elective courses themselves for clarifications. No specific slots will be allotted in the time table for such courses.

10. Assessment

10.1 Theory Courses

The break-up of continuous assessment and examination marks for theory courses is as follows:

First assessment (Mid-Semester Test-I)	: 08 marks
Second assessment (Mid-Semester Test-II)	:12 marks
Third Assessment	: 05marks
End Semester Examination	: 75marks

10.2 Practical Courses

The break-up of continuous assessment and examination marks for Practical courses is as follows:

First assessment (Test-I)	:15marks
Second assessment (Test-II)	:15marks
Maintenance of record book	: 10marks
End Semester Examination	: 60marks

10.3 Thesis work

The thesis Phase I will be assessed for 40 marks by a committee consisting of the Head of the Department, the guide and a minimum of two members nominated by the Head of the Department.

The Head of the Department will be the chairman. The number of reviews must be a minimum of three per semester. 60 marks are allotted for the thesis work and viva voce examination at the end of the third semester. The same procedure will be adopted for thesis Phase II in the fourth semester.

10.4 Seminar / Industrial Training

The continuous assessment marks for the seminar / industrial training will be 40 and to be assessed by a seminar committee consisting of the Seminar Coordinator and a minimum of two members nominated by the Head of the Department. The continuous assessment marks will be awarded at the end of the seminar session. 60 marks are allotted for the seminar / industrial training and viva voce examination conducted based on the seminar / industrial training report at the end of the semester.

11. Student Counselors(Mentors)

To help the students in planning their course of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counselor (mentor) for those students throughout their period of study. Such student counselors shall advise the students in selecting open elective courses from, give preliminary approval for the courses to be taken by the students during each semester, and obtain the final approval of the Head of the Department monitor their progress in SWAYAM courses / open elective courses.

12. Class Committee

For each of the semesters of M.E / M.Tech programmes, separate class committees will be constituted by the respective Head of the Departments. The composition of the class committees from first to fourth semesters for Full time and first to sixth semesters for Part-time will be as follows:

- Teachers of the individual courses.
- A Thesis coordinator (for Thesis Phase I and II) shall be appointed by the Head of the Department from among the Thesis supervisors.
- A thesis review committee chairman shall be appointed by the Head of the Department
- One Professoror Associate Professor,preferably not teaching the concerned class, appointed as Chairman by the Head of the Department.
- The Head of the Department may opt to be a member or the Chairman.
- All counselors of the class and the Head of the Department (if not already a member) or any staff member nominated by the Head of the Department may opt to be specialinvitees.

The class committee shall meet three times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the third assessment and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The third meeting will be held after all the assessments but before the University semester examinations are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 25 marks for theory courses / 40 marks for practical courses, for Industrial Training and for Thesis work (Phase-I and Phase-II) will be finalized for every student and tabulated and submitted to the Head of the

Department for approval and transmission to the Controller of Examinations.

13. Temporary Break of Study

A student can take a one-time temporary break of study covering the current semester and / or the next semester with the approval of the Dean on the recommendation of the Head of the Department, not later than seven days after the completion of themed-semester test. However, the student must complete the entire programme within the maximum period of **four years for Full time / six years for Part time.**

14. Substitute Assessments

A student who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the end of semester examination may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the third meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Head of the Department within a week from the date of the missed assessment.

15. Attendance Requirements

The students with 75% attendance and above are permitted to appear for the University examinations. However, the Vice Chancellor may give a rebate / concession not exceeding 10% in attendance for exceptional cases only on Medical Grounds.

A student who withdraws from or does not meet the minimum attendance requirement in a semester must re-register and repeat the same semester in the subsequent academic years.

16. Passing and declaration of Examination Results

All assessments of all the courses on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University. Thereafter, the controller of examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the grade point average (GPA) and cumulative grade point average (CGPA) and prepare the mark sheets.

90 to 100 marks	Grade 'S'
80 to 89 marks	Grade 'A'
70 to 79 marks	Grade 'B'
60 to 69 marks	Grade 'C'
55 to 59 marks	Grade 'D'
50 to 54 marks	Grade 'E'
Less than 50 marks	Grade 'RA'
Withdrawn from the Examination	Grade 'W'

A student who obtains less than 30 / 24 marks out of 75 / 60 in the theory / practical examinations respectively or is absent for the examination will be awarded grade RA.

A student who earns a grade of S, A, B, C, D or E for a course is declared to have successfully completed that course and earned the credits for that course. Such a course cannot be repeated by the student.

A student who obtains letter grade RA / W in the mark sheet must reappear for the examination of the courses.

The following grade points are associated with each letter grade for calculating the grade point

average and cumulative grade point average.

S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; RA - 0

Courses with grade RA / W are not considered for calculation of grade point average or cumulative grade point average.

A student can apply for re-totaling of one or more of his examination answer papers within a week from the date of issue of mark sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of Examinations with the recommendation of the Head of the Department.

After the results are declared, mark sheets will be issued to the students. The mark sheet will contain the list of courses registered during the semester, the grades scored and the grade point average for the semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the semester, divided by the sum of the number of credits for all courses taken in that semester.

CGPA is similarly calculated considering all the courses taken from the time of admission.

17. Awarding Degree

After successful completion of the programme, the degree will be awarded with the following classifications based on CGPA.

For First Class with Distinction the student must earn a minimum of 68 credits within four semesters for full-time / six semesters for Part time from the time of admission, pass all the courses in the first attempt and obtain a CGPA of 8.25 or above.

For First Class, the student must earn a minimum of 68 credits within two years and six months for full-time / three years and six months for Part time from the time of admission and obtain a CGPA of 6.75 or above.

For Second class, the student must earn a minimum of 68 credits within four years for full-time / six years for Part time from the time of admission.

The conversion of OGPA/CGPA (from I semester to IV Semester) to the corresponding Percentage of marks may be calculated as per the following formula:

Percentage of marks = (OGPA/CGPA - 0.25) x 10

Where $\boldsymbol{OGPA/CGPA} = \frac{\sum \boldsymbol{C_i GP_i}}{\sum \boldsymbol{C_i}}$

C_i- Credit hours of a course

GP_i - Grade Point of that course

18. Ranking of Candidates

The candidates who are eligible to get the M.E /M.Tech degree in First Class with Distinction will be ranked on the basis of CGPA for all the courses of study from I to IV semester for M.E / M.Tech full-time / I to VI semester for M.E / M.Tech part-time.

The candidates passing with First Class and without failing in any subject from the time of admission will be ranked next to those with distinction on the basis of CGPA for all the courses of study from I to

IV semester for full-time / I to VI semester for M.E / M.Tech part-time.

19. Transitory Regulations

If a candidate studying under the old regulations M.E. / M.Tech could not attend any of the courses in his/her courses, shall be permitted to attend equal number of courses, under the new regulation and will be examined on those subjects. The choice of courses will be decided by the concerned Head of the department. However he/she will be permitted to submit the thesis as per the old regulations. The results of such candidates will be passed as per old regulations.

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the courses of study and the syllabi from time to time.

ANNEXURE 1

S.No.	Department		Programme (Full Time & Part time)	Eligible B.E./B.TechProgramme
1	**Chemical Engineering**	i.	Chemical Engineering	B.E. / B.Tech – Chemical Engg, Petroleum Engg, Petrochemical Technology
		ii.	Food Processing Technology	B.E. / B.Tech - Chemical Engg, FoodTechnology, Biotechnology, Biochemical Engg, Agricultural Engg.
		iii.	Industrial Bio Technology	B.E. / B.Tech - Chemical Engg, FoodTechnology,Biotechnology, Leather Technology
		iv.	Industrial Safety Engineering	B.E. / B.Tech – Any Branch of Engineering
2	**Civil Engineering**	i.	Environmental Engineering	B.E. / B.Tech – Civil Engg, Civil & Structural Engg, Environmental Engg, Mechanical Engg, Industrial Engg, Chemical Engg, BioChemicalEngg, Biotechnology, Industrial Biotechnology, Chemical and Environmental Engg.
		ii.	Environmental Engineering & Management	
		iii.	Water Resources Engineering & Management	B.E. / B.Tech – Civil Engg, Civil & Structural Engg, Environmental Engg, Mechanical Engg, Agricutural and irrigation Engg, Geo informatics, Energy and Environmental Engg.
3	**Civil & Structural Engineering**	i.	Structural Engineering	B.E. / B.Tech – Civil Engg, Civil & Structural Engg.
		ii.	Construction Engg. and Management	
		iii.	Geotechnical Engineering	
		iv.	Disaster Management &Engg.	
4	**Computer Science & Engineering**	i.	Computer Science & Engineering	B.E. / B.Tech - Computer Science and Engineering, Information Technology, Electronics and CommunicationEngg, Software Engineering
5	**Electrical Engineering**	i.	Embedded Systems	B.E. / B.Tech – Electrical and Electronics Engg, Control and Instrumentation Engg, Information technology, Electronicsand communication Engg, Computer Science and Engg
		ii.	Smart Energy Systems	B.E. / B.Tech – Electrical and Electronics Engg, Control andInstrumentation Engg, Electronics and communication Engg,
		iii.	Power System	
6	**Electronics & Communication Engineering**	i.	Communication Systems	B.E. / B.Tech -Electronics and Communication Engg, Electronics Engg.

S.No.	Department		Programme (Full Time & Part time)	Eligible B.E./B.TechProgramme
7	**Electronics & Instrumentation Engineering**	i.	Process Control & Instrumentation	B.E. / B.Tech – Electronics and Instrumentation Engg, Electrical and Electornics Engg, Control and Instrumentation Engg, Instrumentation Engg, Electronics and Communication Engg,
		ii.	Rehabilitative Instrumentation	B.E. / B.Tech – Electronics and Instrumentation Engg, Electrical and Electornics Engg, Electronics and Communication Engg, Control and Instrumentation Engg, Instrumentation Engg, Bio Medical Engg, Mechatronics.
		iii	Micro Electronics and MEMS	B.E. / B.Tech – B.E. / B.Tech – Electronics and Instrumentation Engg, Electrical and ElectornicsEngg, Electronics and communication Engg, Control and Instrumentation Engg, Instrumentation Engg, Bio Medical Engg, Mechatronics, Telecommunication Engg
8	**Information Technology**	i	Information Technology	B.E. / B.Tech - Computer Science and Engineering, Information Technology,Electronics andCommunication Engg, Software Engineering
9	**Mechanical Engineering**	iv.	Thermal Power	B.E. / B.Tech – Mechanical Engg, Automobile Engg,Mechanical Engg (Manufacturing).
		v.	Energy Engineering & Management	B.E. / B.Tech – Mechanical Engg, Automobile Engg,Mechanical (Manufacturing) Engg, Chemical Engg
10	**Manufacturing Engineering**	i.	Manufacturing Engineering	B.E. / B.Tech – Mechanical Engg, Automobile Engg, Manufacturing Engg, Production Engg, Marine Materials science Engg, Metallurgy Engg,Mechatronics Engg and Industrial Engg.
		ii.	Welding Engineering	
		iii.	Nano Materials and Surface Engineering	B.E. / B.Tech – Mechanical Engg, Automobile Engg, Manufacturing Engg, Production Engg, Marine Materials science Engg, Metallurgy Engg, ChemicalEngg

ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF CHEMICAL ENGINEERING

Program: **M.Tech** Specialization: **Food Processing Technology**

CURRICULUM-2023

SEMESTER I									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
23CHFTPC11	**PC**	Food Chemistry and Microbiology	3	-	-	25	75	100	3
23CHFTPC12	**PC**	Food processing Technology	3	-	-	25	75	100	3
23CHFTPE13	**PE**	Program Elective-I	3	-	-	25	75	100	3
23CHFTPE14	**PE**	Program Elective-II	3	-	-	25	75	100	3
23CHFTMC15	**MC**	Research Methodology and IPR	2	-	-	25	75	100	2
232CHFTCP16	**CP**	Food Biochemistry Laboratory	-	-	3	40	60	100	2
23CHFTCP17	**CP**	Formulation and Testing of Fruits & Vegetables Laboratory	-	-	3	40	60	100	2
23CHFTAC18	**AC**	Audit Course-I	2	-	-	-	-	-	0
							Total		**18**

SEMESTER II									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
23CHFTPC21	**PC**	Food Engineering	3	-	-	25	75	100	3
23CHFTPC22	**PC**	Dairy Engineering and Technology	3	-	-	25	75	100	3
23CHFTPE23	**PE**	Program Elective-III	3	-	-	25	75	100	3
23CHFTPE24	**PE**	Program Elective-IV	3	-	-	25	75	100	3
23CHFTCP25	**OE**	Open Elective (Inter Faculty)	3	-	-	25	75	100	3
23CHFTOE26	**CP**	Food Analysis Laboratory	-	-	3	40	60	100	2
23CHFTTS27	**TS**	Industrial Training and Seminar / Mini project		Tr 2	S 2	40	60	100	2
23CHFTAC28	**AC**	Audit Course-II	2	-	-	-	-	-	0
							Total		**19**

SEMESTER III									
CourseCode	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
23CHFTPE31	**PE**	Program Elective-V	3	-	-	25	75	100	3
23CHFTOE32	**OE**	Open Elective (inter faculty)	3	-	-	25	75	100	3
23CHFTPV33	**PV-I**	Project work & Viva-voce Phase-I	-	Pr 16	S 4	40	60	100	10
							Total		**16**

SEMESTER IV									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
23CHFTPV41	**PV-II**	Project work & Viva-voce Phase-II	-	Pr 24	S 6	40	60	100	15
							Total		**15**

ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF CHEMICAL ENGINEERING

M.Tech Food Processing Technology (PART TIME) - DEGREE PROGRAMME

Choice Based Credit System (CBCS)

REGULATION - 2023

Courses of Study and Scheme of Examination

Sl. No.	Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.Tech. Full Time
SEMESTER – I											
1	23PCHFTPC11	**PC**	Food Chemistry and Microbiology	3	-	-	25	75	100	3	23CHFTPC11
2	23PCHFTPC12	**PC**	Food processing Technology	3	-	-	25	75	100	3	23CHFTPC12
3	23PCHFTMC13	**MC**	Research Methodology and IPR	2	-	-	25	75	100	2	23CHFTMC15
4	23PCHFTCP14	**CP**	Food Biochemistry Laboratory	-	-	3	40	60	100	2	23CHFTCP16
	Total						**115**	**285**	**400**	**10**	

Sl. No.	Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.Tech. Full Time
SEMESTER – II											
1	23PCHFTPC21	**PC**	Food Engineering	3	-	-	25	75	100	3	23CHFTPC21
2	23PCHFTPC22	**PC**	Dairy Engineering and Technology	3	-	-	25	75	100	3	23CHFTPC22
3	23PCHFTOE23	**OE**	Open Elective - I	3	-	-	25	75	100	3	23CHFTOE25
4	23PCHFTCP24	**CP**	Food Analysis Laboratory	-	-	3	40	60	100	2	23CHFTCP26
	Total						**115**	**285**	**400**	**11**	

Sl. No.	Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.Tech. Full Time
SEMESTER – III											
1	23PCHFTPE31	**PE**	Program Elective-I	3	-	-	25	75	100	3	23CHFTPE13
2	23PCHFTPE32	**PE**	Program Elective-II	3	-	-	25	75	100	3	23CHFTPE14
3	23PCHFTCP33	**CP**	Formulation and Testing of Fruits & Vegetables Laboratory	-	-	3	40	60	100	2	23CHFTCP17

	Total						**90**	**210**	**300**	**8**	

P - Part-Time, SCN – Department Branch Code, YY - PG Specialization

L: Lecture ,**P:** Practical,**T**: Thesis, **CA:** Continuous Assessment; **FE:** Final Examination

Sl. No.	**Course Code**	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**	**Equivalent Course Code in M.Tech. Full Time**
S E M E S T E R – IV											
1	23PCHFTPE41	PE	Program Elective-III	3	-	-	25	75	100	3	23CHFTPE23
2	23PCHFTPE42	PE	Program Elective-IV	3	-	-	25	75	100	3	23CHFTPE24
3	23PCHFTTS43	TS	Industrial Training and Seminar / Mini project		Tr 2	S 2	40	60	100	2	23CHFTTS27
	Total						**90**	**210**	**300**	**8**	

Sl. No.	**Course Code**	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**	**Equivalent Course Code in M.Tech. Full Time**
S E M E S T E R –V											
1	23PCHFTPE51	**PE**	Program Elective-V	3	-	-	25	75	100	3	23CHFTPE31
2	23PCHFTOE52	**OE**	Open Elective - II (From the Dept)	3	-	-	25	75	100	3	23CHFTOE32
3	23PCHFTPV53	**PV-I**	Project work & Viva-voce Phase-I	-	Pr 16	S 4	40	60	100	10	23CHFTPV33
	Total						**90**	**210**	**300**	**16**	

Sl. No.	**Course Code**	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**	**Equivalent Course Code in M.Tech. Full Time**
S E M E S T E R –VI											
1	23PCHFTPV61	**PV-II**	Project work & Viva-voce Phase-II	-	Pr 24	S 6	40	60	100	15	23CHFTPV41
	Total						**40**	**60**	**100**	**15**	

PROGRAMME ELECTIVES

1. Cereals, Legumes and Oil Processing Technology
2. Baking Technology
3. Fruits and Vegetable Preservation Technology
4. Meat, Poultry and Fish Processing Technology
5. Beverage Technology
6. Chocolates and Confectionery Technology
7. Food Safety and Quality Control
8. Food Laws and Regulations
9. Food Packaging Technology
10. Nutraceuticals and Functional Foods
11. Food Toxicology
12. Waste Recycling And Resources Recovery Systems
13. Industrial Organization and Business Management
14. Agrochemicals and Residues in foods
15. Flavour Chemistry and Technology

OPEN ELECTIVES

1. Cryogenic Engineering
2. Juice Processing Technology
3. Process Instrumentation and Control in Food Processing
4. Snack Food Technology

DEPARTMENT OF CHEMICAL ENGINEERING M.Tech.

FOOD PROCESSING TECHNOLOGY

VISION

Our vision is to be a leading Chemical Engineering Department in the Nation, to create and develop technocrats, entrepreneurs and business leaders

MISSION

The department fosters chemical engineering as a profession that interfaces engineering and all aspects of basic sciences to disseminate knowledge in order to prepare the students to be successful leaders and practitioners and to meet the present and future needs of the society by highest degree of standards and ethics.

PROGRAM EDUCATIONALOBJECTIVES (PEOs):

1. To provide adequate education, training, research and development services in the field of food processing technology.
2. To impart knowledge on the causes of food spoilage and methods of processing and preserving food.
3. To identify and select processing equipments and preservation methods appropriate for specific foods.
4. To describe the effect of preservation methods on the quality of food.
5. To provide adequate knowledge about food plant, equipments used in food industry, food safety, food laws and business management in food industry.

PROGRAMME OUTCOMES (POs):

	For PG Programme
PO1	**Scholarship of Knowledge** Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesise existing and new knowledge, and integration of the same for enhancement of knowledge.
PO2	**Critical Thinking** Analyse complex engineering problems critically, apply independent judgement for synthesising information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.
PO3	**Problem Solving** Think laterally and originally, conceptualise and solve engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.
PO4	**Research Skill** Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyse and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of engineering.
PO5	**Usage of modern tools** Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities with an understanding of the limitations.
PO6	**Collaborative and Multidisciplinary work** Possess knowledge and understanding of group dynamics, recognise opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.
PO7	**Project Management and Finance** Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economical and financial factors.
PO8	**Communication** Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.
PO9	**Life-long Learning** Recognise the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.
PO10	**Ethical Practices and Social Responsibility** Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

PO11	**Independent and Reflective Learning** Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback.

PEO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
PEO1	3	2		2	2	2	1		3	2	1
PEO2	3	2	2	2	2	2	2		3	2	1
PEO3	2	2	2	3	2	2	2		3	3	2
PEO4	3	2	2	3	2	2	2		3	3	2
PEO5	3	2		3		2	2		3	2	2

1–Slight, 2–Moderate, 3–Substantial

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Ability to develop technologies for newer food products to address the societal needs.

PSO2: Ability to process the agricultural produces into value addition by following the professional and ethical responsibilities.

PSO3: Ability to provide solutions to the food sector enterprises in advanced food processing techniques for improved shelf-life of agricultural produces.

Semester – I

23CHFTPC11	FOOD CHEMISTRY AND MICROBIOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn about the characteristics and compositions of foods.
- To study the importance and significance of microorganisms related to food.
- To know about carbohydrates, proteins and lipids.
- To study about food spoilage.

Carbohydrates: Monosaccharide's – Oligosaccharides–Polysaccharides–Starch–Cellulose– Guar and Locust Bean Gum– Xanthan– Carrageenans– Algins– Pectins– Gum Arabica and Dietary fiber. Lipids: Classification– physical aspects– chemical aspects– chemistry of fats and oil processing– role of food lipids in flavor– physiological effects of Lipids.

Proteins: Physiochemical properties of amino acids– protein structure– protein de naturation– functional properties of proteins– nutritional properties of proteins– processing induced physical and chemical changes of protein.

Food colorants: pigments in animal and plant tissues. Flavors: Taste and nonspecific saporous– sensations– vegetable– fruit and spice flavor. Food additives: Acid– bases– buffer systems– chelating agent– antioxidant– antimicrobial agent– sweeteners– fat replacers – Mastigatory substances.

Importance – significance of microorganisms in food science. Micro-organisms importance in food – Factors affecting the growth of micro organisms in food – Intrinsic – Extrinsic parameters that affect microbial growth. Food spoilage: characteristic features– dynamics and significance of spoilage of different groups of foods – Cereal and cereal products– vegetables and fruits– meat poultry – sea foods– milk and milk products– packed and canned foods.

Food borne diseases: Bacterial food borne diseases (Staphylococcal intoxification– Botulism– Salmonellosis– Shigellosis– Enteropathogenic Escherichia Coli Diarrhoea– Clostridium Perfringens gastroenteritis– Bacillus cereus Gastroenteritis) Food Borne Viral Pathogens (Norwalk virus– Norovirus– Reovirus– Rotavirus– Astrovirus– Adenovirus– Parvovirus, – Hepatitis A Virus) Food Borne Animal Parasites Protozoa – Giardiasis, Amebiasis, Toxoplasmosis, Sarcocystosis, Crypotosporiodiosis. Cysticercosis/Taeniasis. Roundworm – Trichinosis, Anisakiasis. Mycotoxins: Aflatoxicosis– Deoxyni valenol Mycotoxicosis– Ergotism.

REFERENCES:

1. Beltz, H.D., "Food Chemistry", 2005, SpringerVerlag.
2. Fennema, O.R., "Food Chemistry", 2006, Academic Press.
3. Meyer, L.H., "Food Chemistry", 1987, CBS publishers and Distributors, New Delhi.
4. Potter, N.N. and Hotchikiss, J.H., "Food Sciences", Fifth edition, 2006, CBS publishers and Distributors, NewDelhi.
5. Frazier, W.C., "Food Microbiology", 4th Edition 2007, Mc Graw HillInc.

6. Pelezar, M.I. and Reid, R.D., “Microbiology”, 5th Edition, 2007, McGraw Hill Book Company, NewYork.
7. James, M.J., “Modern Food Microbiology”, 2nd Edition, 2000, CBSPublisher.
8. Adams, M.R. and Moss, M.G., “Food Microbiology”, 1st Edition, 2009, New Age International (P) Ltd.
9. Doyle, P., Bonehat, L.R. and Mantville, T.J., “Food Microbiology, Fundamentals and Frontiers”, 2010, ASM Press, WashingtonDC.

COURSE OUTCOMES:

At the end of the course the learners will be able to

1. Know about the physiochemical properties and the nutritional values of carbohydrates, proteins, lipids and aminoacids.
2. Understand the role of microorganisms on food materials.
3. Learn about food colorants.
4. Know foodspoilage.
5. Know about food bornediseases.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	3		2			2	2		2	2	2
CO2	3	2	2	3		3			2	2		2	2	2
CO3	3	3	3	3		3			2	2		2	2	2
CO4	3	2	3	3		3			2	2		2	2	2
CO5	3	3	3	3		3			2	2		2	2	2

23CHFTPC12	**FOOD PROCESSING TECHNOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

Enable the students to know about

- Processing of food by heat.
- Processing by non-thermal methods.
- Processing by low temperature methods.
- Various dehydration equipments.

Principles of fresh food storage: Nature of harvested crop– plant– animal– product storage– effect of cold storage and quality – storage of food grains.

Processing by heat: Blanching– pasteurization– sterilization and UHT processing– canning– extrusion cooking– dielectric heating– microwave heating– baking– roasting and frying. Retort processing of Ready to eat (RTE) products. Drying – water activity– microbial spoilage due to moisture. Dehydration of fruits, vegetables, milk, animal products– Newer methods of thermal processing – batch and continuous.

Processing by low Temperature and irradiation – refrigeration– freezing – dehydrofreezing. Food irradiation– history and mechanism– the electro-magnetic spectrum– forms of radiant energy. Principles of using electromagnetic radiation in food processing– ionizing radiations

– non ionizing radiations– advantages – disadvantages. Controlling undesirable changes in food during irradiation.

Processing by drying, concentration and evaporation : Various methods employed in production of dehydrated commercial products– selection of methods based on characteristics of foods to be produced– advantages and disadvantages of different methods– sun-drying– tray drying– tunnel drying– spray drying– drum drying– freeze drying – fluidized bed drying. Physical and chemical changes during drying control of chemical changes–desirable and undesirable changes. Packaging and storage of dehydrated products. Ultra-filtration– reverse osmosis– Freeze drying and freeze concentration.

Processing by non-thermal methods: High pressure– pulsed electric field– hurdle technology. GRAS – permissible limits for chemical preservatives – legal aspects for gamma irradiation. Use and application of enzymes and microorganism in processing and preservation of foods– food fermentations– pickling– smoking etc; Food additives: Definition– types and functions– permissible limits and safety aspects. Controlled Atmosphere preservation – Modified Atmosphere preservation technology.

REFERENCES:

1. Desrosier, N.W. and James, N., "Technology of food preservation", 2007, AVI. Publishers.
2. Fellows, P.J., "Food Processing Technology: Principle and Practice", 3rd Ed, 2009, CRC Publishers.
3. Potter, N.N. and Hotchikiss, J.H., "Food Sciences", Fifth edition, 2006, CBS publishers and Distributors, NewDelhi.
4. Jelen, P., "Introduction to Food Processing", 2005, PrenticeHall.

COURSE OUTCOMES:

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

1. Understand about sterilization, pasteurization and blanching processes.
2. Know about CA and MA methods of preservation.
3. Understand the role of refrigeration and freezing techniques for the processing and preservation of food.
4. Know about various dryers.
5. Know about non-thermal preservation methods.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	3	3		2			2	3		2	3	3
CO2	2	2	3	3		2			2	3		2	3	3
CO3	3	2	3	3		3			2	3		2	3	3
CO4	3	2	3	3		3			2	3		2	3	3
CO5	3	2	3	3		3			2	3		2	3	3

23CHFTMC15	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		2	0	0	2

Meaning of research problem– Sources of research problem– Criteria– Characteristics of a good research problem– Errors in selecting a research problem– Scope and objectives of research problem. Approaches of investigation of solutions for research problem– data collection– analysis– interpretation– Necessary instrumentations

Effective literature studies approaches– analysis Plagiarism– Research ethics,
Effective technical writing– how to write report– Paper Developing a Research Proposal– Format of research proposal– a presentation and assessment by a review committee

Nature of Intellectual Property: Patents– Designs– Trade and Copyright. Process of Patenting and Development– technological research– innovation–patenting– development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents– Patenting undercut.

Patent Rights: Scope of Patent Rights– Licensing and transfer of technology– Patent information and databases– Geographical Indications.

New Developments in IPR: Administration of Patent System– New developments in IPR– IPR of Biological Systems– Computer Software etc. Traditional knowledge Case Studies– IPR and IITs.

REFERENCES:

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction forscience & engineeringstudents’”
2. Wayne Goddard and Stuart Melville, “Research Methodology: AnIntroduction”
3. Ranjit Kumar, “Research Methodology: A Step by Step Guide for beginners”, 2nd Edition .
4. Halbert, “Resisting Intellectual Property”, 2007, Taylor & FrancisLtd.
5. Mayall , “Industrial Design”, 1992,McGrawHill.
6. Niebel , “Product Design”,1974, McGrawHill.
7. Asimov , “Introduction to Design”, 1962,Prentice Hall.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”,2016.
9. T. Ramappa, “Intellectual Property Rights Under WTO”, 2008, S.Chand.

COURSE OUTCOMES:

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

1. Understand researchproblem formulation.
2. Analyze research related information and followresearch ethics.
3. Understand that today’s world is controlled by Computer, Information Technology,buttomorrow world will be ruledbyideas,concept, and creativity.
4. UnderstandingthatwhenIPRwouldtakesuchimportantplaceingrowthofindividuals&nation,itisneedlesstoemphasistheneedofinformationaboutIntellectualPropertyRighttobepromotedamongstudentsingeneral&engineeringinparticular.

5. Understand that IPR protection provides an incentive to inventors for further researchwork and investment in R & D, which leads to creation of new and better products,andin turn bringsabout, economicgrowthand social benefits.

Mapping with PO& PSO													
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	2				3		3	3	3	3
CO2	3	3	3	3	2				3		2	3	3	3
CO3	3		2			2	2		3	3	3	3	3	3
CO4	3	3	2	2	3	2			3	3	3	3	3	3
CO5	3	3	2	3		3	2	3	3	3	3	3	3	3

23CHFTCP16	**FOOD BIOCHEMISTRY LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**2**

COURSE OBJECTIVES:

- To train the student to analyze food components
- To make the students aware of the standards of food quality
- To study about the different engineering properties of foods
- To study the methods of determining the quality and properties of different foods

LIST OF EXPERIMENTS

1. Estimation of Glucose
2. Estimation of Protein
3. Estimation of free fatty acids
4. Estimation of Acid Value
5. Estimation of Saponification Value of Oil
6. Drying characteristics of vegetables.
7. Estimation of Curcumin in Turmeric Powder
8. Estimation of Chlorophylls in Bitter Guard
9. Estimation of Fructose
10. Estimation of Lactic Acid in Fermented Cabbage
11. Estimation of Insulin
12. Estimation of preservative level in juices
13. Determination of Microbial load in Meat and Meat products

COURSE OUTCOMES:

1. Students would be able to assess the quality of thefood
2. Students would be able to develop newer methods of foodanalysis
3. The students have gained knowledge of engineering properties of foodmaterial.
4. Students would be able to estimate the glucose, protein and free fatty acid contents of food.
5. Students can estimate the saponification value and acid value of oils.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	3	3		2			2	2		3	3	3
CO2	2	2	3	3		2			2	3		3	3	3
CO3	2	3	3	3		3			3	3		3	3	3
CO4	2	3	3	3		3			3	3		3	3	3
CO5	2	3	3	3		3			3	3		3	3	3

23CHFTCP17	**FORMULATION AND TESTING OF FRUITS & VEGETABLES LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**2**

COURSE OBJECTIVES:

- To train the student to analyze food components
- To make the students aware of the standards of food quality
- To study about the different preparation methods of food products
- To study the methods of determining the quality and properties of different foods

LIST OF EXPERIMENTS

1. Production of Wine from Grapes
2. Osmotic Dehydration of Vegetables
3. Estimation of Total Soluble Solids in fruits and vegetables
4. Citric Acid Production by Solid State Fermentation – Using *Aspergillus Niger*
5. Estimation of acidity in fruit juices and pulps (Tomato pulp)
6. Preparation of candies and chocolates
7. Determination of vitamin C (Ascorbic acid) in fruits and vegetables
8. Production of Icing Sugar
9. Determination of fruit content in fruit juices
10. Preparation of snack foods based on cereals, nuts, fruits and vegetables
11. Lyophilization
12. Preparation of Jam
13. Preparation of Marmalades

COURSE OUTCOMES:

1. Students would be able to assess the quality of milk, milk products, fruits and vegetables.
2. Students would be able to develop newer methods for the production of food products.
3. The students have gained knowledge of engineering properties of food materials.
4. Students can able to prepare chocolates, jam and snack foods.
5. Students would able estimate the acidity and fruit content in fruit juices.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3	3	2	3	1		2	3	1	3	3	3
CO2	2	3	3	3	2	3	1		2	3	1	3	3	3
CO3	2	3	3	3	2	3	1		2	3	1	3	3	3
CO4	3	3	3	3	2	3	1		2	3	1	3	3	3
CO5	3	3	3	3	2	3	1		2	3	1	3	3	3

Semester II

23CHFTPC21	**FOOD ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- Enable the students to understand about transport phenomena.
- To know about thermal processing of food.
- To know about drying of milk, fruit juices and liquid foods.
- To learn about membrane filtration.

Transport Phenomena: Nature and properties of fluids– Transport phenomena with respect to foods– Transport property– Flow of food fluid - Laminar and turbulent flow– Laws governing fluid flow– Newtonian – non Newtonian fluids– Visco-elastic behavior of dough– Pressure measurements– fluid metering– Pumping of liquid food

Heat processing of food: Mechanism of heat transfer– Study of heat exchangers– boiling and condensation– Evaporation– Multiple effect evaporators in sugar and fruit juice industry– Thermal processing as applicable in canning– sterilization– microbial death rates. Batch and continuous processing– Operation of plate heat exchangers– shell and tube and other designs for aseptic processing– HTST– UHT.

Drying curves– equilibrium moisture– adsorption isotherms and relation to storage– water activity– absolute humidity and relative humidity. Drying of milk– fruit juices – liquid foods– convective drying for solidfoods.

Principles of mass and energy balance– Factors affecting heat and mass transfer– Phase change operations – Freezing – thawing– Mechanical refrigeration – refrigerants.

Principles of other food processing such as membrane filtration (ultra– osmosis – reverse osmosis– dialysis) – pulsed electric– irradiation – other non-thermal technologies.

REFERENCES:

1. Smith, P.G., “Introduction to Food Process Engineering”, 2005,Springer.
2. Gopala Rao, Chandra, “Essential of Food Process Engineering”, 2006, BSPublications.
3. Majumdar, A.S., “Dehydration of Products of Biological Origin”, 2004, Oxford & IBH

Publication.

4. Das, H., "Food Processing Operations Analysis", 2005, AsianBooks.
5. Rao, M.A., S.S.H. Rizvi, S.S.H., Datta, A.K., "Engineering Properties of Rood", 3rd Edition, 2005, Taylor & Francis.

COURSE OUTCOMES:

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

1. Understand the transport phenomena with respect to foods.
2. Know about canning, sterilization and aseptic processing, HTST, UHT. Understand about sterilization, pasteurization and blanching processes.
3. Understand the principles of mass and energy balance.
4. Understand the process of freezing and thawing.
5. Understand membrane filtration, pulsed electric and irradiation.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	1	1	2			2	1		3	2	3
CO2	2	3	2	2	1	2			2	1		3	2	3
CO3	2	3	3	2	1	2			2	1		3	2	3
CO4	2	3	3	2	1	2			2	1		3	2	3
CO5	2	3	3	2	1	2			2	1		3	2	3

23CHFTPC22	**DAIRY ENGINEERING AND TECHNOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

Enable the students to understand about

- Milk and its composition, properties and uses of milk constituents.
- Quantitative analysis of milk.
- Manufacturing processes of milk products.
- Food hygiene.

Milk–Composition and Structure–Principal Components– Structural Elements– Properties of Milk– Milk components – Lactose, salts, Lipids, Proteins, Enzymes and other components– Milk Products: Pasteurized mill– Sterilized milk– Reconstituted milk– Cream– Butter– Milk powder– Casein– Fermented milk – Cheese.

Sanitization: Materials – sanitary features of the dairy equipment– Sanitary pipes and fittings– standard glass piping– plastic tubing– fittings and gaskets– installation– care and maintenance of pipes & fittings. Description–working and maintenance of can washers– bottle washers. Factors affecting washing operations– power requirements of can the bottle washers– CIP cleaning and designing of system.

Pasteurization: Batch, flash and continuous (HTST) pasteurizers– Flow diversion valve– Pasteurizer control– Care and maintenance of pasteurizers. Different type of sterilizers– in bottle sterilizers– autoclaves– continuous sterilization plant– UHT sterilization. Aseptic

packaging and equipment– Care and maintenance of Sterilizers. Mechanical Separation: Fundamentals involved in separation– Sedimentation– Principles involved in filtration– Types, rates of filtration– pressure drop calculations. Gravity setting– principles of centrifugal separation– different types of centrifuges– Application in Dairy Industry– clarifiers– tri processors– cream separator– Self- dislodging centrifuge– Bacto-fuge– care and maintenance of separators and clarifiers.

Homogenization: Classification– single stage and two stage homogenizer pumps– power requirement– care and maintenance of homogenizers– aseptic homogenizers– Evaporation and Concentration of milk– Mixing and agitation: Theory and purpose of mixing– Equipment used for mixing solids and liquids– Different types of stirrers– paddles and agitators. Power consumption of Mixer-impeller– selection of mixing equipments in dairy industry– mixing pumps. Filling Operation: Principles and working of different types of bottle fillers – capping machine– pouch filling machine (Pre-pack and aseptic filling) – bulk handling system– care and maintenance. Refrigeration and cooling of milk and milk products.

Food hygiene– personnel hygiene– plant hygiene– water quality etc – Cleaning and Sanitation – different type of cleaning – sanitizing agents– Effluent treatment– Type– degree and treatment of waste– Dairy Plant design and layout.

REFERENCES:

1. Tufail ahmed, “Dairy Plant Engineering and Management”, 2001, CBS Publishers and distributors, NewDelhi.
2. De sukumar, “Outlines of Dairy Technology”, 1999, Oxford University Press, New Delhi.
3. Edgar R.Ling, “A Text book of dairy chemistry”, 1956, Chapman And HallLtd.
4. Robinson, R.K., “Advances in Milk Processing”, 1996, Elsevier Applied Science Publishers Ltd., London,UK.
5. Norman N.Potter, Joseph H.Hotchkiss, “Food Science”, CBS publishers &distributors.
6. Ananthakrishnan, C.P. and Sinha, M.N.,“Technology and Engineering of Dairy Plant Operations”, Lakshmi Publications,NewDelhi.
7. Lincoln M.Lampert, “Milk and Dairy Products”, Chemical Publishing Co., INC New York.

COURSE OUTCOMES:

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

1. Milk constituents, sampling of milk, cream, condensed milk and analysis of butter and cheese.
2. Manufacturing processes of milk products like cream, butter, evaporated milk, condensed milk, cheese, fermented milk, whey, dried milk products.
3. The steps involved in the processing ofmilk.
4. Various dairy equipments used in dairy industry.
5. Dairy plant layout and design.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	3		2			2	2		2	3	3
CO2	2	2	3	3	1	2			2	2		2	3	3
CO3	2	2	3	3	2	3			2	2		2	3	3

CO4	2	3	3	3	2	2			2	2		2	3	3
CO5	2	3	3	3	1	3			2	2		2	3	3

23CHFTCP26	**FOOD ANALYSIS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**2**

COURSE OBJECTIVES:

- To train the student to analyze food components
- To make the students aware of the standards of food quality
- To study about the different engineering properties of foods
- To study the methods of determining the quality and properties of different foods

LIST OF EXPERIMENTS

1 Qualitative & Quantitative analysis of Iron in Wheat flour

2 Determination of Riboflavin, Thiamine in fortified flours by HPLC

3 Qualitative & Quantitative analysis of Benzoic acid in beverages

4 Analysis of Non-Nutritive Sweeteners (Saccharin) in beverages

5 Estimation of Total fat in Meat and Meat products

6 Determination of Meat swelling capacity

7 Determination of Total Volatile bases in fish and frozen fish

8 Determination of moisture content, sodium chloride and ash content in dried fish

9 Adulteration- Testing for food adulteration in various foods

10 Determination of starch & Acidity in the canned fish

11 Estimation of Gluten in wheat flour

12 Analysis of Milk

COURSE OUTCOMES:

At the end of the course

1. Students would be able to assess the quality of wheat flour, meat and fish.
2. Students would be able to develop newer methods of food analysis.
3. The students have gained knowledge of engineering properties of food materials.
4. Students can able to know various analyses related to juices and beverages.
5. Student can know the production and analysis of milk products like butter, cheese.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	3		3			2	2		3	3	3
CO2	3	3	3	3		3			2	2		3	3	3
CO3	3	3	3	3		3			2	3		3	3	3
CO4	3	2	2	3		3			2	3		3	3	3
CO5	3	2	2	3		3			2	3		3	3	3

23CHFTTS27	INDUSTRIAL TRAINING AND SEMINAR / MINI PROJECT	Tr	T	P	C
		2	0	2	2

COURSE OBJECTIVES:

- To train the students in the field work related to Food technology and to have a practical knowledge in carrying out work at Food technology
- To train and develop skills in solving problems during execution of certain works related to Food technology

The students individually undergo a training program in reputed concerns in the field of Food technology during the summer vacation (at the end of second semester for full-time/ IV semester for part time) for a minimum stipulated period of four weeks. At the end of the training, the student has to submit a detailed report on the training they had, within ten days from the commencement of third semester for full time/fifth semester for part time. The student will be evaluated by a team of staff members nominated by head of the department through a viva-voce examination

COURSE OUTCOME:

After completion of the course,thestudents will be able to

1. Interact with industrial personnel and follow engineering practices and discipline prescribed in industry.
2. Develop awareness about general workplace behavior and build interpersonal and team skills.
3. Prepare professional work reports and presentations.
4. Manage the situation arises during the execution of work related to chemical process industries.
5. Generate ideas for the startup and new business opportunities.

MappingwithPOs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3			1		2		1				1	1	2
CO2	3	2	2					1				2	1	2
CO3	3	2	2		3	1		2	1	2		2	1	2
CO4	3	3	3	3			1				2	2	1	2
CO5	3		1	1		1	3				1	2	3	2

Semester III

23CHFTPV 33	**PROJECT WORK VIVA VOCE PHASE – I**	**L**	**P**	**S**	**C**
		0	**16**	**4**	**10**

Semester IV

23CHFTPV 41	**PROJECT WORK VIVA VOCE PHASE – II**	**L**	**P**	**S**	**C**
		0	**24**	**6**	**15**

Dissertation Phase – I and Phase – II
Teaching Scheme Lab work: 20 and 30 hrs/week for phase I and II respectively

COURSE OBJECTIVES:
At the end of this course, students will be able to

- Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
- Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
- Ability to present the findings of their technical solution in a written report.
- Presenting the work in International/ National conference or reputed journals.

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following

- Relevance to social needs of society
- Relevance to value addition to existing facilities in the institute
- Relevance to industry need
- Problems of national importance
- Research and development in various domains The student should complete the following:
- Literature survey
- Problem Definition
- Motivation for study and Objectives
- Preliminary design / feasibility / modular approaches
- Implementation and Verification
- Report and presentation

The dissertation stage II is based on a report prepared by the students on dissertation allotted to them.It may be based on:

- Experimental verification / Proof ofconcept.
- Design, fabrication, testing of CommunicationSystem.
- The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Phase – I and II

• As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January toJune.

• The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & Pcoordinator.
• After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include Springer/Science Direct. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred andreported.
• Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date ofregistration.
• Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, A record of continuous progress.
• Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the phase-I work.
• During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.
• Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, A record of continuous progress.
• Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating thework

COURSE OUTCOMES:

After completion of the course, the students will be able to

1. Come acrossdifferentliteraturesrelevanttohisstudy
2. Reflecton,evaluate,and criticallyassessone'sownandothers'scientificresults
3. Apply the relevant knowledge and skills, which are acquired within the technical area,to solve a given problem
4. Present the findings of the technical solution in a written report
5. Publishingthe noveltyofthe workin conferencesof journals

MappingwithPOs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	2	3	2	2	3	2	3	3	3	3
CO2	3	3	3	3	2	3	2	2	3	2	3	3	3	3
CO3	3	3	3	2	2	3	2	3	3	2	3	3	3	3
CO4	3	3	3	2	2	3	2	3	3	2	3	3	3	3
CO5	3	3	3	2	1	3	2	3	3	2	3	3	3	3

PROGRAMME ELECTIVES

23CHFTPESCN	CEREALS, LEGUMES AND OIL PROCESSING TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Enable the students to learn about the structure and composition of cereals, legumes and oilseeds.
- To know about the processing of wheat, rice, corn, barley and oats.
- To know about the processing and storage of edible oil.
- To learn various oil extraction processes.

General introduction – production – utilization trends– Structure – Composition of common cereals– legumes– Structure– Composition– oilseeds–production– utilization.

Wheat: Types – physicochemical characteristics– wheat milling– products and byproducts– factors affecting quality parameters– physical, chemical and rheological tests on wheat flour– additives used in bakery products– flour improvers and bleaching agents– manufacture of bakery products– pasta products and various processed cereal based foods– manufacture of whole wheat atta– blended flour and fortified flour– Production of starch and vital wheat gluten.

Rice: Classification– physicochemical characteristics– cooking quality– rice milling technology– by- products of rice milling and their utilization– Rice bran stabilization– oil extraction – refining– parboiling methods of rice– criteria of quality of rice– aging of rice – quality changes– processed products based on rice.

Corn: Types – nutritive value– dry and wet milling– processing of corn in breakfast cereals– snacks– tortilla – production of glucose syrups– dextrose– high fructose corn syrups– modified starches. Barley– composition– milling– malting of barley– chemical and enzymatic changes during malting– uses of malt. Oat– composition– processing of oat– byproducts of oatmeal milling.

Legumes and oilseeds: composition– anti-nutritional factors– processing and storage– processing for production of edible oil– meal, flour, protein concentrates and isolates– extrusion cooking technology– snack foods– development of low cost protein foods. Oil extraction process – mechanism– solvent– SCE– oil refining–utilization of byproducts of oil milling.

REFERENCES:

1. Chakrabarthy, M.M., “Chemistry and Technology of Oils and Fats”, 2003, PrenticeHall.
2. Dendy, D.A.V., and Dobraszczyk, B.J., “Cereal and Cereal Products”, 2001,Aspen.
3. Hamilton, R.J.,and Bhati, A., “Fats and Oils - Chemistry and Technology”, 1980, App. Sci.Publ.
4. Hoseney, R.S., “Principles of Cereal Science and Technology”, 2nd Edition, 1994, AACC.
5. Kay, D.E., “Food Legumes”, 1979, Tropical ProductsInstitute.

6. Kent, N.L., "Technology of Cereals", 4th Edition, 1983, PergamonPress.

COURSE OUTCOMES:

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

1. Learn about the structure and composition of cereals, legumes andoilseeds.
2. Know about the processing of rice, wheat, barley, corn andoats.
3. Know about the equipments used for the processing ofcereals.
4. Understand the production of edible oil, flour, protein concentrates andisolates.
5. Understand about the mechanism of oil extraction and oilrefining.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	3	1	2			2	2		2	3	3
CO2	2	2	3	3	2	2			2	2		2	3	3
CO3	2	2	3	3	2	3			2	2		2	3	3
CO4	2	3	3	3	2	2			2	2		2	3	3
CO5	2	3	3	3	2	3			2	2		2	3	3

23CHFTPESCN	**BAKING TECHNOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

To acquaint the student about

- Various raw materials used in bakery industry.
- Different bread making methods.
- Production of cakes and biscuits.
- Production of various cookies.

Introduction to baking technology – History and development of bakery industry– Bakery science– Raw materials for bakery products – Wheat, Barley, Rye, Maize, Dried Gluten, Soy beans and Margarine. Milling – Flour grades and types– Leavening agents– Flour treatments– Fats– Emulsifiers– Colours– Flavours– Antioxidants– sugars– Dairy ingredients– Gums and gelling agents.

Analytical techniques in baking technology– Introduction– Analytical Tests– Empirical Tests– Test Baking–Empirical Testing Regimes – the Hagberg Falling Number– Chopin Alveograph– Brabender Instruments– Mixograph– Grade Colour test– Sodium Dodecyl Sulfate (SDS) Test and Cookie FlourTest.

Baking Machinery – Introduction to Mixing– Bread Dough Mixers– Biscuit Dough Mixers– Cake Mixers– Pastry Mixers– Measuring and Weighing Ingredients– Proving and Retarding– Shaping and Panning– Scaling and Baking– Extrusion – Classification and Extrusion Cooking. Bread Making – The Chemistry of Dough Development– Making of Bread –Unleavened Bread– Sour Dough Bread– Bulk Fermentation and Sponge Batter or Sponge Dough of Flour– Brew- Chorleywood Bread Process– Activated Dough Development (ADD) – The Spiral Mixer

Process and Other Mechanical Dough Development Methods– Continuous Processes, Emergency No Time Process– Gas Injection Processes– Part-baked Loaves and Frenchbread.

Other Breads – Brown and Whole Breads– Wheat Germ Breads– High Protein Breads– High Fibre and Multigrain Breads– Soft Grain Breads– Ethnic Multigrain Breads– Slimming and Health High Fibre Breads– Bread with Added Malt Grains– Bread Containing Cereals Other than Wheat– Crisp bread– Bread for Special Dietary Needs and War and Famine Breads. Other Variants of Bread –Flat Breads– Pitta Bread– Muffins– Crumpets– Pizza– Rich Dough Products– Hot Cross Buns– Buns– Danish Pastries– Pretzels and NotBaked.

Production of cakes and cookies/biscuits. Types of biscuit dough's – Developed dough– short dough's– semi-sweet, enzyme modified dough's and batters – importance of the consistency of the dough– Cake making: Ingredients – their function structure builders– Tenderizers– moisteners and flavor enhancers – Selection and preparation of mould Temperature and time required for different type of cake– problems of baking. Products Other than Bread – Puff Pastry– Short Pastry– Hot Water Pastry– Biscuits– Wafers– Cakes and Miscellaneous Chemically LeavenedProducts.

REFERENCES:

1. Edwards, W.P., "The Science of Bakery Products", 2007, The Royal Society of ChemistryU.K.
2. Weibiao Zhou and Hui, Y.H., "Bakery Products Science and Technology", 2nd Edition, 2014, WileyBlackwell
3. Iain Davidson, "Biscuit Baking Technology- Processing and Engineering Manual", 2nd Edition, 2016, Academic Press.
4. Matz, Samuel A., "Bakery Technology and Engineering", Third Edition, Chapman & Hall,London.
5. Cauvain, Stanley P., and Yound, Linda S., "Technology of Bread Making", Second Aspen Publication, 2005, Maryland.

COURSE OUTCOMES:

1. This course equips students to have knowledge about the functional properties of various essential ingredients such as flour, yeast, water, salt and other ingredients such as sugar, fat, milk, colour, flavor used for the making ofbread.
2. The students will be able to know about the manufacturing processes of variousbreads.
3. The students will be able to know the making ofbiscuits.
4. The students will be able to know the making of cakes andcookies.
5. The students will be able to learn various baking products other than bread like pastries, wafers.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	3	1	2			2	1		3	3	3
CO2	2	2	3	3	2	3			2	2		3	3	3
CO3	2	2	3	3	2	3			2	2		3	3	3
CO4	2	3	3	3	1	2			2	2		3	3	3
CO5	2	3	3	3	1	3			2	2		3	3	3

23CHFTPESCN	FRUITS AND VEGETABLES PRESERVATION TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students about the

- Preprocessing of fresh fruits and vegetables.
- Freezing of fruits and vegetables and associated problems.
- Dehydration of fruits and vegetables.
- Different packaging of processed fruits and vegetables.

Indian and global scenario on production and processing of fruits and Vegetables– Pre-processing: Fresh fruits and vegetables – Handling– grading– cleaning– pre-treatments– transportation– pre-cooling– chilling– modified atmosphere packaging– Controlled atmosphere storage– packaging– transportation – quality assurance.

Freezing of Fruits – Vegetables– introduction– different freezing methods– equipments– problems associated with specific fruits and vegetables– preserving the colour– flavour – nutrient content of the fruits– vegetables.

Dehydration of Fruits and Vegetables– dehydration – different methods of drying– including sun, tray, cabinet, drum, spray, vacuum, tunnel, spray– low temperature drying process– process calculations– osmotic dehydration – other modern methods– choice of suitable methods– preserving the colour– flavour – nutrient content of the products.

Canning, Juices & Concentrates– Different unit operations involved in fruit and vegetable– Pulp/juice extraction– concentration– Bulk aseptic packaging of fruit and vegetable pulps– juices and concentrates– aseptic packaging of fruit drinks– juices and other products– Bottling– canning – essential principles– different types of cans– unit operations in canning– blanching– exhausting– processing conditions– Fruit Juice– pulp– Nectar and concentrates– general and specific processing– different packing including aseptic– vegetable purees and pastes– processing of tomato and tomato products.

Fruit and Vegetable Products & Standards– Ready to eat vegetable products– Jams, Marmalades– Squashes– cordials– ketchup/sauces– chutneys– fruit bar– soup powders– candied fruits– natural colours– fruit and vegetable fibres – specific processing, different packing including aseptic– product specifications and standards– food regulations with respect to fruit and vegetable products.

REFERENCES:

1. Potter, N.N. and Hotchkiss, J.H., “Food science”, 5th Edition, 2001, CBS.
2. Salunkhe, D.K. and Kadam, S.S., “Handbook of Fruit Science and Technology: Production, Composition, Storage, and Processing”, 2005, MarcelDekker.
3. Vaclavik, V.A. and Christian, E.W., “Essentials of Food Science”, 2nd Edition, 2005, Springer.
4. Alzamora, S.M., Tapia, M.S. and Lopez – Malo, A., “Minimally Processed Fruits and

Vegetables: Fundamental Aspects and Applications", 2005,Springer.

COURSE OUTCOMES:

1. This course equips students to have knowledge about the processing of fruits and vegetables like handling, grading, cleaning and pretreatments.
2. The students will be able to learn various freezing methods of fruits and vegetables.
3. The students will be able to know about different drying methods like sun drying, cabinet drying, tray drying, spray and vacuum drying.
4. The students will be able to know pulp and juice processing.
5. At the end of the course students able to understand about fruit and Vegetable products and Standards.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	3	1	2			2	2		3	2	3
CO2	2	2	3	3	3	2			2	2		3	2	3
CO3	2	2	3	3	2	3			2	2		3	2	3
CO4	2	3	3	3	2	2			2	2		3	2	3
CO5	2	3	3	3	1	3			2	2		3	2	3

23CHFTPESCN	**MEAT, POULTRY AND FISH PROCESSING TECHNOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

To acquaint the student about the

- Structure and composition of meat.
- Various slaughtering types.
- Processing and preservation of poultry meat.
- Processing, preservation and transportation of fish.

Meat– composition – different sources– muscle structure – compositions– post-mortem – muscle chemistry– Quality– Factors influencing the quality of meat– Meat Microbiology – Meat safety.

Ante mortem inspection and handling– Stunning types– Slaughtering types– Steps in slaughtering (Pig, Cattle, Sheep/ Goat) and dressing– Slaughter house operations– Hoisting rail and traveling pulley system– Modern abattoirs– typical layout and features– Offal handling and inspection– Grading of meat – retail and whole sale cuts– Operational factors affecting meat quality– Byproduct utilization– Meat plant hygiene – GMP and HACCP.

Processing and preservation of meat– Chilling and freezing of meat– Canning– cooking– drying– pickling– curing – smoking– prepared meat products like sausages, kebabs– Intermediate moisture and dried meat products– Packaging of meat products.

Poultry– methods of slaughtering– Slaughtering equipment and operations– dressing– handling– storage and preservation of poultry meat– Spoilage and its control– Freezing and

chilling of poultry– Whole sale and retail cuts– Eggs– Composition, handling, candling, washing, coating, packaging and storage– Egg processing– Egg powder manufacturing and pasteurization– Egg spoilage and its control.

Marine– Commercially important marine products from India– Proximate composition– Post mortem changes in fish muscle– Handling– preservation – transportation of fish– Indices of fish quality– Microbiology of fish – shell fish– freezing of fish and shell fish.

REFERENCES:

1. Fidel Toldrá, "Handbook of Meat Processing", 2010 BlackwellPublishing.
2. Legarreta,I.G., "Handbook of Poultry Science and Technology (Volume I andVolume II)", 2010, John Wiley & Sons, Inc., Hoboken, New Jersey,U.S.
3. Sam, A.R., "Poultry meat processing", 2001, CRC Press Taylor & FrancisGroup
4. Hui Y.H., "Meat Science and Applications". MarcelDekker.
5. Kerry, J., "Meat Processing", 2002, Woodhead Publ. CRCPress.
6. Levie A., "Meat Hand Book", 4th Edition, 2002, AVIPubl.
7. Mead M., "Poultry Meat Processing and Quality", 2004, WoodheadPubl.
8. Pearson, A.M. & Gillett, T.A., "Processed Meat", 3rd Edition, 2006, Chapman &Hall.
9. Lawrie, R.A., "Meat Science", 7th Edition, 2006, Woodhead publishers.UK.
10. Gopakumar K., "Fish Processing Technology", 2002, Indian council of Agrimeturalresearch, New Delhi.

COURSE OUTCOMES:

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

1. Chilling, freezing, canning, cooking, drying and pickling of meat.
2. Slaughtering, dressing, handling, storage and preservation of poultry meat.
3. Post mortem changes in fish muscle, freezing of fish and shellfish.
4. Importance of marine products.
5. Handling, preservation and transportation offish.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	3	1	2			2	2		2	2	3
CO2	2	2	3	3	1	2			2	2		2	2	3
CO3	2	2	3	3	2	3			2	2		2	2	3
CO4	2	3	3	3	2	2			2	2		2	2	3
CO5	2	3	3	3	1	3			2	2		2	2	3

		L	T	P	C
23CHFTPESCN	**BEVERAGE TECHNOLOGY**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

To acquaint the student about the

- Definition, classification and ingredients used for the manufacture ofbeverages.
- Knowledge and skills of process techniques and equipments used for the production of beverages.
- Processing of coffee beans, cocoabeans.
- Manufacturing process of beer.

Beverage– definition– why we drink beverages– ingredients– water, carbon dioxide, bulk and intense sweeteners– water miscible and water dispersible flavouring agents– colours – natural and artificial– Micro and nanoemulsions of flavors a– odors in beverages– preservatives– emulsifiers and stabilizers –Procedures – carbonation equipments – ingredients – preparation of syrups – Filling system – packaging – containers – closures.

Coffee: Occurrence– chemical constituents– harvesting– fermentation of coffee beans– changes taking place during fermentation– drying– roasting– process flow sheet for the manufacture of coffee powder– instant coffee technology– chicory chemistry– quality grading of coffee.

Tea: Occurrence– chemistry of constituents– harvesting; types of tea – green, oolong and CTC– chemistry and technology of CTC tea– manufacturing process for green tea – black tea manufacture– instant tea manufacture– quality evaluation and grading of tea– Cocoa:Occurrence– chemistry of the cocoa bean– changes taking place during fermentation of cocoa bean– processing of cocoa bean– cocoa powder– cocoa liquor manufacture.

Ingredients – Malt – hops – adjuncts – water, yeast– Beer manufacturing process– malting– preparation of sweet wort– brewing– fermentation– pasteurization and packaging– Beer defects and Spoilage– Wine – fermentation – types – red and white– Wine defects and spoilage. Alcoholic Beverages based on fruit juices (wines) – cereals (whisky, beer, vodka) – sugar cane (rum).
Beverage industries– Effective application of quality controls– sanitation and hygiene in beverage industry–Quality of water used in beverages– threshold limits of various ingredients according to PFA– EFSA and FDA – Absolute requirements of Soluble solids– titrable acidity in beverages.

REFERENCES:

1. Alan J. Buglass, “Hand book of Alcoholic beverages Technical, Analytical and Nutritional Aspects Volume I”, 2011, John wileyPublications.
2. Ashurst, P.R., “Chemistry and technology of soft drink and fruit juices”, 2nd edition, 2005, Blackwell PublishingLtd.
3. Charles, Bamforth, W., “Food, fermentation and microorganisms”, 2005, Blackwell Science PublishingLtd.
4. Steen, D.P and Ashurst, P.R., “Carbonated soft drinks – Formulation and manufacture”, 2000, Blackwell PublishingLtd.
5. Shankunthala Manay, N. and Shadakdharaswamy, M., “Foods – Facts and Principles”, 3rd revised edition, 2000, New Age International Pvt.Ltd.

COURSE OUTCOMES:

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

1. Understand various concepts, principles and procedures involved in processing of beverages.
2. Know the processing of coffee and cocoa beans.
3. Know the various unit operations involved in the food beverage manufacturing.
4. Know the manufacture of alcoholic beverages based on fruit juices, cereals and sugar cane.
5. List the quality control steps in beverage preparation.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	3	1	2			2	2		2	3	2
CO2	2	2	3	3	1	2			2	2		2	3	2
CO3	2	2	3	3	1	3			2	2		2	3	2
CO4	2	3	3	3	1	2			2	2		2	3	2
CO5	2	3	3	3	1	3			2	2		2	3	2

23CHFTPESCN	**CHOCOLATES AND CONFECTIONERY TECHNOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- Enable the students to understand the definition and importance of confectionery products.
- To learn about the ingredients used for the manufacture of chocolate.
- To know about the processing of chocolates.
- To know the manufacture of caramel, toffee and fudge.

Raw materials for Confectionery Manufacture– Comprehensive understanding of raw materials used in the confectionery manufacturing and processing industry– quality control methods– cocoa– sugar– dried milk products– special fats– emulsifiers– nut kernels– alcoholic ingredients– production of cocoa bean– dark, milk and white chocolates– Manufacturing processes.

Chocolate Processing Technology– compound coatings– candy bars– tempering technology– chocolate hollow figures– chocolate shells– enrobing technology– manufacture of candy bars– presentation and application of vegetable fats– Production of chocolate mass.

Sugar confectionery manufacture– general technical aspects of industrial sugar confectionery manufacture– types– center-filled– lollipops– co-extruded products– Manufacture of gums – jellies–quality aspects.

Manufacture of Miscellaneous Products– caramel– toffee– fudge–Liquorices paste– aerated confectionery– sugar panning– chewing gum– quality aspects– fruit confections.

Flour confectionery Ingredients and flour specification – types of dough– developed dough– short dough– semi-sweet, enzyme modified dough and batters– importance of the consistency of the dough– Indian flour confections manufacture– flour specification– ingredient– manufacturing process– types of chemically aerated goods.

REFERENCES:

1. Potter, N.N. and Hotchkiss, J.H., “Food science”, 5th Edition, 2001, CBS.
2. Bernard. W. Minifie, “Chocolate, Cocoa, and Confectionery (Science and Technology)”, 2013, Springer Science and Business Media.

3. Peter P. Greweling, “Chocolates and Confections: Formula, Theory, and Technique for the Artisan Confectioner”, 2nd Edition, 2013, The Culinary Institute of America(CIA)
4. Jackson EB, “Sugar confectionery Manufacture”. 2nd Edition, 1999, AspenPubl.
5. Manley DJR, “Technology of Biscuits, Crackers and Cookies”, 1983, EllisHorwood.
6. Junk WR & Pancost HM, “Hand book of Sugars for Processors. Chemists and Technologists”, 1973, AVIPubl.
7. Pomeranz Y, “Modern Cereal Science and Technology”, 1987, MVCHPubl.

COURSE OUTCOMES:

1. This course equips students to have knowledge about confectionery and chocolate products, sugar based confectionaries, ingredients, chocolate and cocoaproducts.
2. The students will be able to know the manufacturing practices of confectioneryproducts.
3. The students can know the manufacture of sugar confectioneries like lollipops, gums and jellies.
4. The students can know the manufacture of caramels, toffee andfudge.
5. The students can understand the flour specification and ingredients used for flour confectioneries.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	2		2			2	2		3	3	2
CO2	2	2	1	2		2			2	2		3	3	2
CO3	2	2	1	3		2			2	2		3	3	2
CO4	2	2	2	3		2			2	2		3	3	2
CO5	2	1	2	2		2			2	2		3	3	2

23CHFTPESCN	**FOOD SAFETY AND QUALITY CONTROL**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

To acquaint the student about

- The concept and importance of food safety in food process industry.
- Various food safety as well as food hygiene programs.
- Food safety regulations and management systems.
- Hazard analysis and risk assessment.

Food safety concept– Importance of food safety in the food processing industry– Risk classification– National and international food regulatory agencies– General food laws – food safety regulations– Nutritional labeling regulation (mandatory and optional nutrients, nutritional descriptors and approved health claims) – Microbial contamination (including cross- contamination/indirect contamination) – Chemical contamination– Physical contamination– Allergen contamination

Food Safety Programs: Definitions – importance– Good Manufacturing Practices (GMPs) – Pest Control Program– Facility Maintenance– Personal Hygiene– Supplier Control– Sanitary Design of Equipment and Infrastructure– Procedures for Raw Material– Reception– Storage

– Finished

Product Loading– Sanitation Program– Sanitation Standard Operating Procedures (SSOPs) – Product Identification– Tracking and Recalling Program– Preventive Equipment Maintenance Program– Education and Training Programs.

Hazard Analysis and Risk Assessment: Physical hazards (metals, glass, etc) – Chemical hazards (food additive toxicology– natural toxins– pesticides– antibiotics– hormones– heavy metals and packaging components) – Biological hazards (epidemiology of biological pathogens– virus, bacteria and fungi) – Evaluation of the severity of a hazard Controlling– Food Hazards– Hazard Analysis Critical Control Point (HACCP) system.

Food Hygiene Programs: Personal hygiene– Training programs– Infrastructure– Personal habits– Hygiene verification– Water in the food industry– Water sources– Water uses– Water quality– Treatments– Cleaning and sanitation– Cleaning agents– Sanitizing agents– Equipment and systems– Evaluation of sanitation efficacy– Pest Control– Pest Classification (insects, rodents and birds) – Prevention and control.

Food Safety regulations and management systems: National and international food quality regulations– Quality systems– Introduction to the legal system– principles in the general food law– principles of self control, risk analysis on food– international food trade– Codex Alimentarius– traceability– EU regulations on the hygiene of foodstuffs– EU regulations on the official food control– Food quality standard: IPM, GAP, Organic farming– GMP, Standard of food quality and food quality analysis– Environmental risk assessment in food safety aspect– Food hygiene and surveillance system– Standard of food quality and control system– Food industries and quality assurance in food production– ISO certifications– Indian Food regulations
– History of Indian Food Regulations: BIS, ISI, FPO, PFA and FDA– Food Safety and Standards Act2006.

REFERENCES:

1. Early, R., “Guide to Quality Management Systems for the Food Industry”, 2005, Blackie, Academic and professional,London.
2. Gould, W.A and Gould, R.W., “Total Quality Assurance for the Food Industries”, 2006, CTI Publications Inc.Baltimore.
3. Pomeraz, Y. and MeLoari, C.E., “Food Analyasis: Theory and Practice”, 2006, CBS publishers and Distributor, NewDelhi.
4. Bryan, F.L., “Hazard Analysis Critical Control Point Evaluations A Guide to Identifying Hazards and Assessing Risks Associated with Food Preparation and Storage”, 2000, World Health Organisation,Geneva.

COURSE OUTCOMES:

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

1. Concept of food safety.
2. Various food safety programs.
3. Hazard analysis and risk assessment.
4. Food hygiene programs.
5. Food safety regulations and management systems.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1			2			2	2		2	2	3
CO2	2	2	2			2			2	2		2	2	3
CO3	2	2	2	2	2	2	2		2	2		2	2	3
CO4	2	2	2		2	2	2		2	2		2	2	3
CO5	2	2	2		2	2	2		2	2		2	2	3

23CHFTPESCN	**FOOD LAWS AND REGULATIONS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- Enable the students to understand the history and origin of food laws.
- To learn about food quality, safety and testing.
- To know about food laws and implementing agencies, food safety and standards.
- To know the international scenario in food regulation.

Food Laws– Historical Perspectives including necessity of Food Laws–Enforcement of safety of food products– Establishment of US Pure Food Law in early 1900s – Food & Drug Administration to enforce safety of food products– Urbanisation of population– necessity of processed and preserved foods–necessity of ensuring quality of food to prevent adulteration.

Food Quality, Safety & Testing: Quality of Foods and Quality Standards like BIS; Agmark and other optional standards– the difference between mandatory and optional standards– enforcement of optional standards– Food Safety Systems: Quality systems standards including ISO– Auditing– Good Manufacturing Practice and HACCP– Various ways of testing the safety of foods– Detection of harmful chemicals and microbes in foods– Testing of ingredients and additives; using animals for evaluating safety– Clinical studies– Responsibility of agriculture, food industry & food supply sector– Standards of Weights & Measures– British Regulatory Consortium(BRC) –American Institute of Bakers(AIB) and some provisions under these regarding food products such as requirements of labeling and giving information therein, size of packages etc– Important Issues of GM Foods– Fortification– Nutrition Information on Label– Organic Foods– Safety of additives, Processes affecting consumers and industry.

Food Laws & Implementing Agencies-National– Prevention of Food Adulteration Act 1954 & Rules 1955 established in India to enforce safety and purity of food products– Various aspects of defining adulteration– taking samples of food for analysis by public analyst– prosecution for adulteration and punishment– Standards of various food products– FPO– Infant Milk Substitute Act– Laws relating to vegetable oils– Use of permitted additives like colours, preservatives, emulsifiers, stabilizers, antioxidants– Food Safety & Standards Act 2006 and the provisions therein– Integrated Food Law – Multi departmental – multilevel to single window control system– consumer protection Act

International Scenario in Food Regulation USFDA, EFSA, UK, Canada, A & NZ, Japan, Malaysia, Singapore; Consumer Movements– Intellectual Property Rights and Trade Marks– Protection of investment – efforts in research and development by patenting– Criteria of patentability– National and international patent– Terms of patents– Copyright.

International Agencies in Food Regulation– Food Codex Alimentarius– The necessity of harmonised Food Standards for international trade– various aspects and relation with domestic laws– Codex Nodal agency– FAO– WHO– WTO– TUV– Consumer protection forums.

REFERENCES:

1. Rajesh, M., and George, J., "Food Safety Regulations, Concerns and Trade: The Developing Country Perspective", 2005,Macmillan.
2. Naomi, R., and Watson, D., "International Standards for Food Safety", 2007, Aspen Publication.
3. Newslow, D.L., "The ISO 9000 Quality System: Applications in Food and Technology", 2007, John Wiley &Sons.
4. Hubbard, Merton R., "Statistical Quality Control for the Food Industry", 3rd Edition, 2003,Springer.

COURSE OUTCOMES:

1. This course equips students to have knowledge about food quality standards like BIS, Agmark, other optional standards and the difference between mandatory and optional standards.
2. The students will be able to know about food safety systems including quality standards, testing of ingredients, additives and standards of weight admeasurements.
3. The students will be able to know various food laws and implementing agencies.
4. The students will be able to understand the international scenario in food regulation.
5. The students will be able to know the necessity of harmonized food standards for international trade.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2				2			2	2		2	1	3
CO2	2	2	2	2		2			2	3		2	1	3
CO3	2	2				2			2	3		2	1	3
CO4	2	2				2			2	3		2	1	3
CO5	2	2		2					2	3		2	1	3

23CHFTPESCN	**FOOD PACKAGING TECHNOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

To acquaint the student about

- Various packaging materials and their properties.
- Packaging systems and methods used for the packaging of fresh and processed foods.
- Packaging of fruits and vegetables.
- Packaging design.

Food packaging– Introduction – Packaging terminology – definition– types–Functions of food packaging– Packaging environment– Characteristics of food stuff that influences packaging selection.

Packaging material and their properties– Glass, Paper and paper board– Corrugated fibre board (CFB) – Metal containers– Tin Plate and Aluminum, Composite containers– Collapsible tubes– Plastic Films– Laminations– Metalized films– Co extruded films– Testing of packaging material.

Packaging Systems and methods– Vacuum Packaging– Controlled atmospheric packaging– Modified atmospheric packaging– Aseptic Packaging– Retort processing– Microwave packaging– Active Packaging– intelligent packaging– Edible packaging– Shrink and stretch packaging.

Packaging of fresh and processed foods– Packaging of Fruits and vegetables– Fats and Oils– Spices– meat, Poultry and sea foods– Dairy Products– Bakery– beverages– Dehydrated and frozen foods– Liquid and powder filling machines – aseptic system, form and fill (volumetric and gravimetric) – bottling machines– Form Fill Seal (FFS) and multilayer aseptic packagingmachines.

Packaging Design & Environmental Issues in Packaging– Food marketing and role of packaging– Packaging aesthetic and graphic design– Coding and marking including bar coding– Consumer attitudes to food packaging materials– Packaging Laws and regulations– safety aspects of packaging materials– sources of toxic materials and migration of toxins into food materials– Packaging material residues in food products– Environmental & Economic issues– recycling and wastedisposal.

REFERENCES:

1. Robertson, G.L., “Food Packaging: Principles and Practice”, 2nd edition, 2006, Taylor & Francis
2. NIIR, “Food Packaging Technology Handbook”, 2003, National Instituteof Industrial Research Board, Asia Pacific Business PressInc.
3. Ahvenainen, R., “Novel Food Packaging Techniques”, 2003, CRCPress.
4. Han, J.H., “Innovations in Food Packaging”, 2005, Elsevier AcademicPress.
5. Coles, R., McDowell, D. and Kirwan, M.J., “Food Packaging Technology”, 2003, CRC Press.

COURSE OUTCOMES:

1. This course equips students to have knowledge about various functions of food packaging.
2. The students can able to know different packaging materials and theirproperties.
3. The students can understand various packaging systems andmethods.
4. The students will know the packaging of fruits andvegetables.
5. The students will be able to know the packaging design and environmental issues in packaging.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	2		2			2	1		2	2	3
CO2	2	1	1	2		2			2	2		2	2	3
CO3	2	2	2	2		2			2	2		2	2	3
CO4	2	1	2	3		2			2	2		2	2	3
CO5	2	2	3	3		2			2	3		2	2	3

23CHFTPESCN	**NUTRACEUTICALS AND FUNCTIONAL FOODS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- Enable the students to understand the definition, concept and evolution of nutraceuticals and functional foods market.
- To learn about natural occurrence of phytochemicals and isolation of phytochemicals from plant materials.
- Enable the students to know the isolation of phytochemicals from plant materials.
- To know the development of functional food.

Nutraceuticals and functional Foods – Definition– concept– history and market– Evolution of nutraceuticals and functional foods market– Classification of nutraceuticals and functional foods– Significance and relevance of nutraceuticals and functional foods in the management of diseases and disorders. Dosage for effective control of disease or health benefit with adequate safety– studies with animals and humans– acute and chronic studies– Regulatoryissues.

Natural occurrence of certain phytochemicals – Antioxidants – flavonoids– omega- 3 fatty acids– carotenoids– dietary fiber– phytoestrogens– glucosinates– organosulphur compounds.

Isolation of phytochemicals from plant materials– Care in handling and storage of raw materials with minimal damage to sensitive bioactive compounds– Extractive methods for maximum recovery and minimal recovery and minimal destruction of active material– stability studies– Recent developments in the isolation– purification and delivery of phytochemicals.

Prebiotics, probiotics and symbiotics – Probiotics: Definition– types and relevance– Usefulness in gastro intestinal health and other health benefits– development of a probiotic products– recent advances in probiotics– Challenges and regulatory issues related to probiotic products– Prebiotics: Prebiotic ingredients in foods– types of prebiotics and their effects on gut microbes– health benefits of prebiotics– recent development in prebiotics– Symbiotics.

Functional foods – Definition– development of functional foods– use of bioactive compounds in appropriate form with protective substances and activators– Effect of environmental condition and food matrix– Effects of processing conditions and storage– Development of biomarkers to indicate efficacy of functional ingredients– Research frontiers in functional foods– delivery of immune modulators /vaccines through functional foods–

Nutrigenomics – concept of personalized medicine– Use of nanotechnology in functional foodindustry.

REFERENCES:

1. Wildman, R.E.C., "Handbook of Nutraceuticals and Functional Foods", second edition, 2007, CRCPress.
2. Gibson GR and William CM, "Functional Foods - Concept to Product", 2000.
3. Goldberg I, "Functional Foods: Designer Foods, Pharma Foods",2004.
4. Brigelius-Flohé, J and Joost HG, "Nutritional Genomics: Impact on Health and Disease", 2006, WileyVCH.
5. Cupp J and Tracy TS, "Dietary Supplements: Toxicology and Clinical Pharmacology", 2003, HumanaPress.

COURSE OUTCOMES:

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

1. Significance and relevance of nutraceuticals and functional foods in the management of diseases anddisorders.
2. Isolation of phytochemicals from plantmaterials.
3. Definition, types and relevance related to Prebiotics, Probiotics and Symbiotics.
4. Development of functionalfoods.
5. Concept of personalizedmedicine.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1	2		2			2	2		3	3	3
CO2	2	2	1	3		2			2	2		3	3	3
CO3	2	2	1	3		2			2	3		3	3	3
CO4	3	3	2	3		3			2	3		3	3	3
CO5	3	2	2	3		3			2	3		3	3	3

23CHFTPESCN	**FOOD TOXICOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To understand the principles of toxicology, classification and characteristics of toxic agents.
- To learn about the natural toxins in food.
- To know about food allergies and sensitivities.
- To study about environmental contaminants.

Principles of Toxicology– Classification of toxic agents– characteristics of exposure– spectrum of undesirable effects– interaction and tolerance– biotransformation and mechanisms of toxicity– Evaluation of toxicity– Risk vs. benefit– Experimental design and evaluation– Prospective and retrospective studies– Controls: Statistics (descriptive, inferential) – Animal models as predictors of human toxicity– Legal requirements and specific screening methods– LD50 and TD50– In vitro and in vitro studies– Clinicaltrials.

Natural Toxins in Food– Natural toxins of importance in food – Toxins of plant and animal origin– Microbial toxins (e.g. Algal toxins, bacterial toxins and fungal toxins) – Natural occurrence– toxicity and significance– Food poisoning– Mycotoxicoses of significance– Determination of toxicants in foods and their management.

Food allergies and sensitivities– Natural sources and chemistry of food allergens– true/untrue food allergies– handling of food allergies– food sensitivities (anaphylactoid reactions– metabolic food disorders and idiosyncratic reactions) – Safety of Genetically Modified food– potential toxicity – allergenisity of GM foods– Safety of toys and children consumables.

Environmental Contaminants – Drug Residues in Food– Fungicide – pesticide residues in foods– heavy metal and their health impacts– use of veterinary drugs (e.g. Malachite Green in fish and β- agonists in pork) – other contaminants in food– Radioactive contamination of food– Food adulteration– potential toxicity of foodadulterants.

Food Additives and toxicants added or formed during Food Processing– Safety of food additives– toxicological evaluation of food additives– food processing generated toxicants– nitrosocompounds– heterocyclic amines– Dietary Supplements and Toxicity related to Dose– Common dietary supplements– relevance of the dose– possible toxiceffects.

REFERENCES:

1. Helferich, W., and Winter, C.K., "Food Toxicology", 2001, CRCPress.
2. Shibamoto, T. and Bjeldanes, L., "Introduction to Food Toxicology", 2nd Edition, 2009, Elsevier Inc., Burlington,MA.
3. Duffus, J.H. and Worth, H.G. J., "Fundamental Toxicology", 2006, The Royal Society of Chemistry.
4. Stine, K.E. and Brown, T.M., "Principles of Toxicology", 2nd edition, 2006, CRCPress.
5. Tönu, P., "Principles of Food Toxicology", 2007, CRC Press, LLC. Boca Raton,FL.

COURSE OUTCOMES:

The students will be able to understand the

1. Biotransformation and mechanisms oftoxicity.
2. Natural toxins infood.
3. Food allergies and sensitivities.
4. Environmental contaminants and drug residues infood.
5. Food additives and toxicants added or formed during foodprocessing.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	2	2	2			2	2		2	2	3
CO2	2	2	2	2	2	2			2	2		2	2	3
CO3	2	2	2	3	2	3			2	3		2	2	3
CO4	2	2	3	3	3	3			2	3		2	2	3
CO5	2	2	3	3	3	3			2	3		2	2	3

23CHFTPESCN	WASTE RECYCLING AND RESOURCES RECOVERY SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To know about the types of food processing wastes.
- To learn various treatment methods.
- To study the utilization of by-products.
- To learn biomethanation and biocomposting.

Waste– definition – consequences in pollution and global warming– food processing wastes– types– their present disposal methods.

Treatment of plant waste by physical– chemical– biological methods– Effluent treatment plants– Use of waste and waste water.

Types– availability and utilization of by-products of cereals– legumes– oilseeds– Utilization of by-products from fruits and vegetables processing industries– sugar and agro based industries– brewery – distillery waste.

Status and utilization of dairy by-products like whey– butter– ghee residues– Availability and utilization of by-products of meat industries– poultry industry– fish processing units.

Biomethanation and biocomposting technology for organic waste utilization– incineration – efficient combustion technology– Integration of new and renewable energy sources for waste utilization.

REFERENCES:

1. Chaturvedi P, "Energy Management:Challenges for the Next Millennium",2000.
2. Kreit F and Goswami DY, "Energy Management and Conservation Handbook", 2008, CRCPress.
3. MurphyWR and McKay G, "Energy Management", 1982, BSPublications.
4. Patrick DR, "Energy Management and Conservation", 1982, ElsevierPublication.
5. Patrick DR, Fardo SW, Richardson RE and Steven, "Energy Conservation Guidebook", 2006, The FairmontPress.
6. Wulfinghoff DR, "Energy Efficiency Manual" Energy InstitutePress.

COURSE OUTCOMES:

The students will be able to understand the

1. The importance of waste recycling and recoverysystem.
2. Treatment of plantwastes.
3. Various technologies available for the utilization by-products from fruits and vegetable processingindustries.
4. Utilization of dairyby-products.
5. Biomethanation and biocompostingtechnology.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	2	2		2			2	2		2	1	3
CO2	1	2	2	2		2			3	3		2	1	3
CO3	2	3	2	3		2			3	3		2	1	3
CO4	2	2	2	3		2			3	3		2	1	3
CO5	2	2	2	3		2			3	2		2	1	3

23CHFTPESCN	**INDUSTRIAL ORGANISATION AND BUSINESS MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- Enable the students to understand the definition, scope and techniques in operational research.
- To learn about the structure and operation of food plant.
- To know about deterministic and probabilistic models.
- To know about industrial cost accounting, purchase procedure, budget and budgetary control.

Operation Research– definition– scope– techniques in operation research– Food plant management– Factors bearing on location and layout of food plants– Regulatory requirements of food industries.

Structure – operation of food plants– Executive design making in a food plant– Decision protocols– Evolution and role of management planning– organising and controlling– Decision processed for raising efficiency– productivity and quality in food plant operation– System analysis– its need and methodology.

Model building – deterministic and probabilistic models– Management decision making– problems of productions– production intending– marketing – sales forecasting– inventor, finance

– Break down maintenance– inventory, finance replacement and maintenance– inventory, finance replacement and maintenance.

Network models– Computer applications– database operating systems– networking project management– spread sheeting– Statistical Quality Control (SQC).

Industrial cost accounting– purchase procedure– stores procedure– material accounting– overhead costing– budget and budgetary control– process costing– Cost factor in fixation of prices– job costing– product costing.

REFERENCES:

1. Sivarethinamohan, R, “Operations Research”, 2005, Tata McGraw-Hill Pub. Co.Ltd.
2. Metha, P.L., “Managerical Economics- Analysis, Problems and cases”, 2003, Sultan Chand and Sons, NewDelhi.

3. Sherilaker, “Marketing Management”, 2001, Himalaya PublishingCompany.

COURSE OUTCOMES:

1. This course equips students to have knowledge about food plantmanagement.
2. Students will be able to know about the structure and operation of foodplants.
3. The students will understand about building of deterministic and probabilisticmodels.
4. The students will learn about network models, computerapplications.
5. Students will be able to know about industrial costaccounting.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	1		1	2		2	1				3
CO2	2	2	2	2		2	1		2	2				3
CO3	2	2	3	2		2			2					3
CO4	2	2	3	2		2			2					3
CO5	2	2	3	2		2	3		2					3

23CHFTPESCN	**AGROCHEMICALS AND RESIDUES IN FOODS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- Enable the students to know the classification of agrochemicals
- To know about agrochemical residues
- To study various veterinary drugs.
- To know the chemicals used in grains and spices.

Agrochemicals in Agriculture including growth regulators – purpose– classification– methods of dispensing them– characteristics– estimation.

Agrochemical residues– Pesticides– fungicides– herbicides– permitted levels– toxicity details– methods to remove these residues.

Fumigants other chemicals used in grain/spices – storage– purpose– chemicals used– toxicity– Ripening agents– types– uses– effects– residue evaluation.

Veterinary drugs including antibiotics and hormones– purpose of use– classification– residue levels – its associated hazards and toxicity.

Uptake of agrochemicals from soil– water– environment– packaging by plant foods– Concept of organic farming and systems.

REFERENCES:

1. Brooks GT, “Pesticide Chemistry and bioscience”, 1999,Woodhead
2. Felix D’Mello JP, “Toxic Substances in Crop Plants”, 1991,Woodhead.
3. Watson DH, “Food chemicals safety Vol I”, 2001,Woodhead.
4. Watson DH, “Pesticide, Veterinary and other residues in Foods”, 2004, CRCPress.

COURSE OUTCOMES:

The students will be able to understand about

1. Agrochemicals including growthregulators.
2. The agrochemical residues.
3. Various chemicals used in grains andspices.
4. Veterinarydrugs.
5. The concept of organicfarming.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1		2		**2**			2	2		1		3
CO2	2	2		2		3			2	2		1		3
CO3	2	2		2		3			2	2		1		3
CO4	2	2	2	2		3			2	2		1		3
CO5	2	2	2	2		3			2	2		1		3

23CHFTPESCN	**FLAVOUR CHEMISTRY AND TECHNOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- Enable the students to understand the science behind flavouring foods.
- To know the legal aspects on use of flavours in food products.
- To understand the biogenesis of flavours infood.
- To study about sensory evaluation of flavours.

Sources of flavours (natural–processed and added) – Flavour composites (natural– semi-synthetic– synthetic).

Biogenesis of flavours in food– natural and processed foods (Maillard Reaction – lipid Oxidation).

Analysis of Flavour (Subjective and objective) –Formulations of flavours– adulteration– Flavour emulsions– Flavour production in fermented foods– Off-flavours in foods.

Spices and spice-based products as flavours– Plantation crops as flavours– tea, coffee, cocoa and vanilla.

Sensory evaluation of flavours– selection of flavourist– flavours and legal issues.

REFERENCES:

1. Ashurst PR,"Food Flavourings", Second Edition, 1994,Blackie.
2. Burdock GA, "Fenaroli's Handbook of Flavor Ingredients", 5th Edition, 2004, CRC Press.
3. Deibler D and Delwiche J, "Handbook of Flavor, Characterization; Sensory Analysis, Chemistry and Physiology", 2004, MarcelDekker.
4. Heath HB and Reineccius G, "Flavor chemistry and Technology", 1986, AVI Publication.
5. Taylor A,"Food flavor Technology" 2002, Sheffield AcademicPress.

COURSE OUTCOMES:

The students will be able to know about

1. Various natural and processed flavours, their properties and sources.
2. The formulation of flavours.
3. Spices and spices based products as flavours.
4. Sensory evaluation of flavours.
5. The legal issues related to the addition of flavours.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	2		2			2	2		2	3	1
CO2	2	2	2	2		2			2	2		2	3	1
CO3	2	2		2		2			2	2		2	3	1
CO4	2	2	2	2		2			2	2		2	3	1
CO5	2	2	2	2		2			2	2		2	3	1

OPEN ELECTIVES

		L	T	P	C
23CHFTOESCN	**CRYOGENIC ENGINEERING**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

This course enables the students to

- Learn about the concept of cryogenics and its applications.
- Understand various cycles ofcryogenics.
- Know about cryogenic refrigerators for different applications, handling and instrumentation of cryogenicfluids.
- Storage and transportation of cryogenicfluids.

Cryogenics – Introduction and history– Applications – space and aerospace industry– cryobiology and superconductivity– Thermodynamic analysis of low temperature processes– refrigeration– production of low temperatures.

Cryogenic liquefaction processes – Liquefaction process of Nitrogen– Oxygen– Argon– Methane– Natural gas, Neon– Hydrogen and Helium– Separation processes for cryogens (Air, Hydrogen and Helium) – Non- Cryogenic separation processes for Air and Helium– Cryogenic gas purification processes.

Thermophysical properties of cryogenic fluids – VLE data on mixtures of cryogenic liquids– Prediction of thermodynamic properties – Transport properties of cryogenic fluids– Unique properties of noble gases and Hydrogen isotopes – selection of proper cryogenic fluid for freezing of foods – medicalapplication

Cold exchange in cryogenic fluids – Introduction– heat exchanger configurations– Heat exchanger design analysis– cryogenic regeneration– thermal insulations for cryogenic systems– Cryogenic propellants for rocket propulsion – Introduction– challenge–

performance analysis– selection of propellants – design concepts of cryogenic propulsions.

Measurement devices at cryogenic temperatures – Temperature– sub-atmospheric pressure– vacuum– flow rates – liquid level– Storage and transportation of cryogenic fluids– Material properties at cryogenic temperatures.

REFERENCES:

1. Harold Weinstock, "Cryogenic Technology", 1970, Boston TechnicalPublications.
2. Boris V.Kuznetsov, "Theory and design of Cryogenic system", 1981, MIRPublishers.
3. C.Rose Innes, "Low Temperature Techniques", 1964, English UniversityPress.
4. Mamata Mukhopathay, "Fundamentals of Cryogenic Engineering".

COURSE OUTCOMES:

The students equips students

1. For selecting the proper cryogenic fluid for particular application like freezing of foods, medicalapplication.
2. To know cryogenic liquefactionprocesses.
3. To learn thermophysical properties of cryogenicfluids.
4. About cold exchange in cryogenicfluids.
5. About the storage and transportation of cryogenicfluids.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1	2		2			2	2		2	2	1
CO2	2	2	2	2		2			2	2		2	2	1
CO3	2	2	3	2		2			2	2		2	2	1
CO4	2	2	3	2		2			2	2		2	2	1
CO5	2	2	2	2		2			2	2		2	2	1

23CHFTOESCN	**JUICE PROCESSING TECHNOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

This course enables the students to

- Learn about the basic fundamentals of juice processing.
- Know the processing of fruits.
- Learn about fruit beverages.
- Know the equipments used for juice extraction.

Juice Processing– Present status of juice processing in India and Abroad– Recent advances in juice processing technology– Prospects of future growth in juice processing in India.

Fruits &its processing–Harvesting and pre-processing consideration– Post-harvesting processing– washing– skin removal– cutting and trimming– blanching– canning– freezing– dehydration of fruits– Fruit Processing– Freezing– blanching– ascorbic acid dip–SO_2 dip– sugar syrup preservation– salt preservation– vacuum dehydration– concentration and drying– Application of membrane technology in processing ofjuices.

Juice Processing: –orange juice– Grape juice– Lemon & Lime juice– Pineapple juice– Apple

juice– Mango juice.

Fruits Beverages & other processing– Fruit Beverages– Orange squash– Grape fruit squash– Lemon squash– Pineapple squash– Syrups– Rose– Sandal– Pineapple– Orange– Mulberry & Apple– Carbonated beverages– lemon– lime– pineapple– Fruit juice concentrate– tamarind juice concentrates and fermented beverages– tropical fruit beverages– Manufacture of non alcoholic beverages.

Equipments & tools for juice extraction– Equipments for fruit juices– Washing equipment– sorting– extraction equipments– Halving & burring machine– Roller type press– Crusher for grape berries– Pulping equipment– Straining and screening– filtration equipment– flash pasteurizer.

REFERENCES:

1. Nelson PE and Tressler DK, "Fruit & Vegetable Juice Processing Technology", Vol.III, 1980, AVIPublication.
2. Potter NN, "Food Science". 3rd Edition, 1978, AVIPublication.
3. Lal G, Siddappa GS and Tandon GL,"Preservation of Fruits and Vegetables", 1998, ICAR.
4. Desrosier NW and James N, "The Technology of Food Preservation", 4th Edition, 2004, CBS

COURSE OUTCOMES:

The students would know about

1. The recent advances in juice processing
2. Fruits and its processing.
3. Fruit beverages.
4. The manufacture of non alcoholic beverages.
5. Various equipments and tools used for the extraction ofjuices.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	2		3			2	2		2	3	2
CO2	2	1	1	2		3			2	2		2	3	2
CO3	2	1	1	2		3			2	2		2	3	2
CO4	2	1	2	2		2			2	2		2	3	2
CO5	2	2	3	2		2			2	2		2	3	2

23CHFTOESCN	**PROCESS INSTRUMENTATION AND CONTROL IN FOOD PROCESSING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- Enable the students to provide sound knowledge in the concepts of process instrumentation.
- To gain the knowledge related to the measurements in food processing
- To learn about controllers and indicators.
- To study about computer based monitoring and control.

Introduction to food processing industries– canned – bottled fruits and vegetables– beer– ciders– soft drinks– sugar– jams– jellies and beverages– Introduction process instrumentation and control– Industrial processes– process parameters– batch and continuous processes– instrumentation and control and selection of controllers.

Measuring and controlling devices in food processing– role– Classification – types of transducers– Selection of transducers– Actuating and controlling devices.

Measurements in food processing– moisture– humidity– turbidity– colour– flow metering– viscosity– brix– pH– food enzymes– flavour measurement– texture– particle size and food constituents analysis.

Controllers and indicators– Temperature control in food dehydration and drying– Electronic controllers– flow ratio control– atmosphere control– timers – indicators– Food sorting – grading control– Discrete Adaptive and Intelligent controllers.

Computer – Based Monitoring and Control – Introduction – Importance of monitoring and control – Hardware features of a data acquisition and control – Remote data acquisition – signal interfacing – Examples of computer based measurement and control in food processing.

REFERENCES:

1. Manabendra Bhuyan, “Measurements and Control in Food Processing”, 2007CRC, Taylor andFrancis.
2. E Kress-Rogers and C J B Brimelow, “Instrumentation and Sensors for the Food Industry”, 2nd Edition, 2001, WoodheadPublishing.
3. William C. Dunn, “Introduction to Instrumentation, Sensors and Process Control”, 2006, Artech House Inc.
4. Eckman.D.P., “Industrial Instrumentation”, 1984, Wiley EasternLtd.
5. James E. Bailey and David F. Ollis, “Biochemical Engineering Fundamentals”, 2nd edition, 1986, McGraw-Hill BookCompany.

COURSE OUTCOMES:

1. This course equips students to have knowledge of fieldinstrumentation.
2. The students will be able to know the application of control systems in variousprocesses.
3. The students would know the measurements in foodprocessing.
4. The student will be able to understand various controllers andindicators.
5. The students would understand computer based monitoring andcontrol.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2		1	2		2			2	2		2	1	2
CO2	2	1	1	2		2			2	2		2	1	2
CO3	2	1	2	2		2			2	2		2	1	2
CO4	2	2	2	2		2			2	2		2	1	2
CO5	2	2	3	2		2			2	2		2	1	2

23CHFTOESCN	SNACK FOOD TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Enable the students to provide sound knowledge on grain based snacks.
- To know about flour based products.
- To learn about extruded snack foods.
- To review current practices for preparation of fried chips and other snacks

Technology for grain based snacks– whole grains– roasted– toasted– puffed– popped – flakes– coated grains– salted– spiced – sweetened.

Flour based- batter – dough based products– savoury and farsans– formulated chips– wafers– papads– instant premixes of traditional Indian snack foods

Technology for fruits and vegetable based snacks– Chips– Wafers– Technology for coated nuts- salted– spiced – sweetened– chikkis.

Extruded snack foods– formulation and processing technology– colouring– flavouring – packaging.

Equipments for frying– baking – drying– toasting– roasting and flaking– popping– blending– coating– chipping.

REFERENCES:

1. Edmund WL, “Snack FoodsProcessing”.
2. Frame ND, “The Technology of Extrusion Cooking”, 1994, BlackieAcademic.
3. Gordon BR, “Snack Food”, 1997, AVIPublications.
4. Samuel AM, “Snack Food Technology”, 1976, AVIPublications.

COURSE OUTCOMES:

1. This course equips students to have knowledge on grain basedsnacks.
2. The students would know about flour basedsnacks.
3. The students will be able to understand the formulation and processing of extruded snack foods.
4. The students would know the colouring, flavouring and packaging of snackfoods.
5. The students will be able to know the equipments used for frying, baking, roasting, and toasting.

Mapping with POs and PSOs														
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	2		2			2	2		2	2	2
CO2	2	1	1	2		2			2	2		2	2	2
CO3	2	1	2	2		2			2	2		2	2	2
CO4	2	2	2	2		2			2	2		2	2	2
CO5	2	2	3	2		2			2	2		2	2	2