ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF CHEMICAL ENGINEERING

M.Tech.

FOOD PROCESSING TECHNOLOGY

HAND BOOK

DEPARTMENT OF CHEMICAL ENGINEERING

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 EDUCATIONAL OBJECTIVES (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.

M.Tech. FOOD PROCESSING TECHNOLOGY

PROGRAMME OUTCOMES (POs):

Upon successful completion of this programme the students will be able to understand the;

1. Importance and physiochemical properties of food and significance of microorganisms related to food.
2. Important pathogens and spoilage microorganisms in food and methods to control deterioration and spoilage.
3. Processing and preservation of food by heat, non-thermal and low temperature techniques and principles and current practices of food processing techniques.
4. Specific unit operations required to produce a given food product.
5. Properties and uses of various packaging and storage of foods.
6. Structure and operation of food plant, mass and energy balances for a given food process, food plant equipments, instrumentation, food safety, food laws and regulation and business management.

7. Proper cryogenic fluid for particular application like freezing of foods, medical application.
8. Significance of toxicology, relevance of nutraceuticals and functional foods.
9. Processing, preservation and transportation of meat, poultry meat and fish.
10. Production of various breads, biscuits, chocolates, cakes, beverages, dairy and dairy products.

Mapping PO with PEO										
PEOs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
PEO1			√	√	√	√		√	√	√
PEO2	√	√	√			√	√	√	√	
PEO3			√	√	√				√	
PEO4		√	√			√			√	
PEO5				√	√	√				√

ANNAMALAI UNIVERSITY
FACULTY OF ENGINEERING AND TECHNOLOGY
M.E. / M. Tech (Two-Year Full Time & Three-year Part Time) DEGREE

PROGRAMME

CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS

1. **Condition 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 condition regarding qualifying marks and physical fitness as may be prescribed by the syndicate of the Annamalai University from time to time. The admission for 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 1**
3. **Courses of study**
   The courses of study and the respective syllabi for each of the M.E / M. Tech programmes offered by the different Departments of study are given separately.
4. **Scheme of Examinations**
   The scheme of Examinations is given separately.
5. **Choice Based Credit System (CBCS)**
   The curriculum includes three components namely Professional Core, Professional Electives and Open Electives in addition to Thesis. Each semester curriculum shall normally have a blend of theory and practical courses.
6. **Assignment of Credits for Courses**
   Each course is normally assigned one credit per hour of lecture / tutorial per week and one credit for two hours or part thereof for laboratory or practical per week. The total credits for the programme will be 65.
7. **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.
8. **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 II shall be done at the appropriate semesters.

9. Electives

The student has to select two electives in first semester and another two electives in the second semester from the list of Professional Electives. The student has to select two electives in third semester from the list of Open Electives offered by the department/ allied department. A student may be allowed to take up the open elective courses of third semester (Full Time program) in the first and second semester, one course in each of the semesters to enable them to carry out thesis in an industry during the entire second year of study provided they should 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.

Further, the two open elective courses to be studied in III semester (Full Time programme) may also be credited through the SWAYAM portal of UGC with the approval of Head of the Department concerned. In such a case, the courses must be credited before the end of III Semester.

10. Assessment

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

First assessment (Mid-Semester Test-I)	:	10 marks
Second assessment (Mid-Semester Test-II)	:	10 marks
Third Assessment	:	5 marks
End Semester Examination	:	75 marks

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

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

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.

11. Student Counsellors (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 counsellor for those students throughout their period of study. Such student counsellors shall advise the students, give preliminary approval for the courses to be taken by the students during each semester,

monitor their progress in SWAYAM courses / open elective courses and obtain the final approval of the Head of the Department.

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 Professor or 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 special invitees.

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 / 40 marks for practical and project work 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 the mid-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 65 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 65 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 65 credits within four years for full-time / six years for Part time from the time of admission.

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.

S.No.	Department		Programme (Full Time & Part time)	Eligible B.E./B.Tech Programme *
1	**Civil Engineering**	i.	Environmental Engineering	B.E. / B.Tech – Civil Engg, Civil & Structural Engg, Environmental Engg, Mechanical Engg, Industrial Engg, Chemical Engg, BioChemical Engg, 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 anf irrigation Engg, Geo informatics, Energy and Environmental Engg.
2	**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.	
3	**Mechanical Engineering**	i.	Thermal Power	B.E. / B.Tech – Mechanical Engg, Automobile Engg, Mechanical Engg (Manufacturing).
		ii.	Energy Engineering & Management	B.E. / B.Tech – Mechanical Engg, Automobile Engg, Mechanical (Manufacturing) Engg, Chemical Engg
4	**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, 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, Chemical Engg
5	**Electrical Engineering**	i.	Embedded Systems	B.E. / B.Tech – Electrical and Electronics Engg, Control and Instrumentation Engg, Information technology, Electronics and communication Engg, Computer Science and Engg
		ii.	Smart Energy Systems	B.E. / B.Tech – Electrical and Electronics Engg, Control and Instrumentation Engg, Electronics and communication Engg,
		iii.	Power System	
		i.	Process Control & Instrumentation	B.E. / B.Tech – Electronics and Instrumentation Engg, Electrical and Electornics Engg, Control and

ANNEXURE 1

				Instrumentation Engg, Instrumentation Engg
6	**Electronics & Instrumentation Engineering**	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 Electornics Engg, Electronics and communication Engg, Control and Instrumentation Engg, Instrumentation Engg, Bio Medical Engg, Mechatronics, Telecommunication Engg
7	**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, Food Technology, Biotechnology, Biochemical Engg, Agricultural Engg.
		iii.	Industrial Bio Technology	B.E. / B.Tech - Chemical Engg, Food Technology, Biotechnology, Leather Technology
		iv.	Industrial Safety Engineering	B.E. / B.Tech – Any Branch of Engineering
8	**Computer Science & Engineering**	i.	Computer Science & Engineering	B.E. / B.Tech - Computer Science and Engineering, Information Technology, Electronics and Communication Engg, Software Engineering
9	**Information Technology**	i	Information Technology	B.E. / B.Tech - Computer Science and Engineering, Information Technology, Electronics and Communication Engg, Software Engineering
10	**Electronics & Communication Engineering**	i.	Communication Systems	B.E. / B.Tech - Electronics and Communication Engg, Electronics Engg.

*** AMIE in the relevant discipline is considered equivalent to B.E**

COURSES OF STUDY AND SCHEME OF EXAMINATIONS
Full-Time

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits
S e m e s t e r – I										
1	PC-I	FPTC 101	Food Chemistry and Microbiology	4	-	-	25	75	100	3
2	PC-II	FPTC 102	Food Processing and Preservation Technology	4	-	-	25	75	100	3
3	PC-III	FPTC 103	Food Process Engineering	4	-	-	25	75	100	3
4	PC-IV	FPTC 104	Cereals, Legumes and Oil Processing Technology	4	-	-	25	75	100	3
5	PE-I	FPTE 105	Professional Elective – I	4	-	-	25	75	100	3
6	PE-II	FPTE 106	Professional Elective – II	4	-	-	25	75	100	3
7	PC Lab-I	FPTP 107	Food Processing Technology Laboratory – I	-	3	-	40	60	100	2
			Total	**24**	**3**	**-**	**190**	**510**	**700**	**20**

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits
S e m e s t e r – II										
1	PC-V	FPTC 201	Dairy Engineering and Technology	4	-	-	25	75	100	3
2	PC-VI	FPTC 202	Baking Technology	4	-	-	25	75	100	3
3	PC-VII	FPTC 203	Fruits and Vegetable Preservation Technology	4	-	-	25	75	100	3
4	PC-VIII	FPTC 204	Meat, Poultry and Fish Processing Technology	4	-	-	25	75	100	3
5	PE-III	FPTE 205	Professional Elective – III	4	-	-	25	75	100	3
6	PE-IV	FPTE 206	Professional Elective – IV	4	-	-	25	75	100	3
7	PC Lab-II	FPTP 207	Food Processing Technology Laboratory –II	-	3	-	40	60	100	2
8	Seminar	FPTS 208	Seminar	-	2	-	100	-	100	1
			Total	**24**	**5**	**-**	**290**	**510**	**800**	**21**

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits
S e m e s t e r – III										
1	OE-I	FPTE 301	Open Elective – I	4	-	-	25	75	100	3
2	OE-II	FPTE 302	Open Elective – II	4	-	-	25	75	100	3
3	Thesis	FPTT 303	Thesis Phase-I	-	-	4	40	60	100	4
4	Ind Training	FPTI 304	Industrial Training		*	-	100	-	100	2
			Total	**8**	**-**	**4**	**90**	**210**	**300**	**12**

Note: * - Four weeks during the summer vacation at the end of IInd Semester.

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits
S e m e s t e r – IV										
1	Thesis	FPTT 401	Thesis Phase-II	-	-	8	40	60	100	13
			Total	**-**	**-**	**8**	**40**	**60**	**100**	**13**

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

COURSES OF STUDY AND SCHEME OF EXAMINATIONS

Part Time

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits	Equivalent Course Code in M. Tech. Full Time
Semester – I											
1	PC-I	PFPTC 101	Food Chemistry and Microbiology	4	-	-	25	75	100	3	FPTC 101
2	PC-II	PFPTC 102	Food Processing and Preservation Technology	4	-	-	25	75	100	3	FPTC 102
3	PC-III	PFPTC 103	Food Process Engineering	4	-	-	25	75	100	3	FPTC 103
			Total	**12**	**-**	**-**	**75**	**225**	**300**	**9**	

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits	Equivalent Course Code in M. Tech. Full Time
Semester – II											
1	PC-IV	PFPTC 201	Dairy Engineering and Technology	4	-	-	25	75	100	3	FPTC 201
2	PC-V	PFPTC 202	Baking Technology	4	-	-	25	75	100	3	FPTC 202
3	PC-VI	PFPTC 203	Fruits and Vegetable Preservation Technology	4	-	-	25	75	100	3	FPTC 203
			Total	**12**	**-**	**-**	**75**	**225**	**300**	**9**	

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits	Equivalent Course Code in M. Tech. Full Time
Semester – III											
1	PC-VII	PFPTC 301	Cereals, Legumes and Oil Processing Technology	4	-	-	25	75	100	3	FPTC 104
2	PE-I	PFPTE 302	Professional Elective – I	4	-	-	25	75	100	3	FPTE 105
3	PE-II	PFPTE 303	Professional Elective – II	4	-	-	25	75	100	3	FPTE 106
4	PC Lab-I	PFPTP 304	Food Processing Technology Laboratory – I	-	3	-	40	60	100	2	FPTP 107
			Total	**12**	**3**	**-**	**115**	**285**	**400**	**11**	

S.No	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits	Equivalent Course Code in M. Tech. Full Time
S e m e s t e r – IV											
1	PC-VIII	PFPTC 401	Meat, Poultry and Fish Processing Technology	4	-	-	25	75	100	3	FPTC 204
2	PE-III	PFPTE 402	Professional Elective – III	4	-	-	25	75	100	3	FPTE 205
3	PE-IV	PFPTE 403	Professional Elective – IV	4	-	-	25	75	100	3	FPTE 206
4	PC Lab-II	PFPTP 404	Food Processing Technology Laboratory – II	-	3	-	40	60	100	2	FPTP 207
5	Seminar	PFPTS 405	Seminar	-	2	-	100	-	100	1	FPTS208
			Total	**12**	**5**	**-**	**215**	**285**	**500**	**12**	

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits	Equivalent Course Code in M. Tech. Full Time
S e m e s t e r – V											
1	OE-I	PFPTE 501	Open Elective – I	4	-	-	25	75	100	3	FPTE 301
2	OE-II	PFPTE 502	Open Elective – II	4	-	-	25	75	100	3	FPTE 302
3	Thesis	PFPTT 503	Thesis Phase-I	-	-	4	40	60	100	4	FPTT 303
4	Ind Training	PPTI 504	Industrial Training		*	-	100		100	2	FPTI 304
			Total	**8**	**-**	**4**	**90**	**210**	**300**	**12**	

Note: * - Four weeks during the summer vacation at the end of IVth Semester.

Sl. No.	Category	Course Code	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	Thesis	PFPTT 601	Thesis Phase-II	-	-	8	40	60	100	13	PFPTT 401
			Total	**-**	**-**	**8**	**40**	**60**	**100**	**13**	

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

LIST OF PROFESSIONAL ELECTIVES

S.No	Subject
1	Beverage Technology
2	Chocolates and Confectionery Technology
3	Food Safety and Quality Control
4	Food Laws and Regulations
5	Nutraceuticals and Functional Foods
6	Food Packaging Technology
7	Food Toxicology

LIST OF OPEN ELECTIVES

S.No	Subject
1	Cryogenic Engineering
2	Process Instrumentation and Control in Food Processing
3	Industrial Organization and Business Management
4	Food Industrial Equipments

FPTC101	FOOD CHEMISTRY AND MICROBIOLOGY	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To learn about the characteristics and compositions of foods.
- To study the importance and significance of microorganisms related to food.

Carbohydrates:Monosaccharides,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 denaturation, 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 and Mastigatory substances.

Importance and significance of microorganisms in food science. Micro-organisms importance in food – Factors affecting the growth of micro organisms in food – Intrinsic and 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 and 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 Gastroenteritics) 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.

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COURSE OUTCOMES:

1. At the end of the course the learners will be able to know about the physiochemical properties and the nutritional values of carbohydrates, proteins, lipids and amino acids.
2. Students will understand the role of microorganisms on food materials.

Mapping with Programme outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	√		√							
CO2	√	√	√							

FPTC102	**FOOD PROCESSING AND PRESERVATION TECHNOLOGY**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES:

Enable the students to know about

- Processing and preservation by heat.
- Processing and preservation by non-thermal methods.
- Processing and preservation by low temperature methods.

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

Processing and preservation 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 and preservation by low Temperature and irradiation – refrigeration, freezing and dehydrofreezing. Food irradiation, history and mechanism, the electro-magnetic spectrum, forms of radiant energy. Principles of using electromagnetic radiation in food processing. ionizing radiations and non ionizing radiations, advantages and disadvantages. Controlling undesirable changes in food during irradiation.

Processing and preservation 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 and 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 and preservation by non-thermal methods: High pressure, pulsed electric field, hurdle technology. GRAS and permissible limits for chemical preservatives and 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 and Modified Atmosphere preservation technology.

REFERENCES:

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

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 preservation of food.

Mapping with Programme outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1		√	√							
CO2		√	√	√						
CO3		√	√	√			√			

FPTC103	**FOOD PROCESSING ENGINEERING**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES:

- Enable the students to have a better understanding about various food processing techniques.
- To know about thermal and non-thermal processing of food.

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 and non Newtonian fluids. Visco-elastic behaviour of dough. Pressure measurement and 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 and liquid foods as well as convective drying for solid foods.

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

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

REFERENCES:

1. Smith, P.G.2005. "*Introduction to Food Process Engineering*" Springer.
2. Gopala Rao, Chandra, 2006. "*Essential of Food Process Engineering*", BS Publications.
3. Majumdar, A.S. 2004."*Dehydration of Products of Biological Origin*", Oxford & IBH Publication.
4. Das, H.2005 "*Food Processing Operations Analysis*", Asian Books.
5. Rao, M.A., S.S.H. Rizvi and A.K. Datta.2005. "*Engineering Properties of Rood*", 3rd Edition, Taylor & Francis.

COURSE OUTCOMES:

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

1. Know about canning, sterilization and aseptic processing, HTST, UHT. Understand about sterilization, pasteurization and blanching processes.
2. Understand the process of freezing and thawing.
3. Understand membrane filtration, pulsed electric and irradiation.

Mapping with Programme outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1		√	√	√						
CO2		√	√							
CO3		√	√	√						

FPTC104	**CEREALS, LEGUMES AND OIL PROCESSING TECHNOLOGY**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES:

- Enable the students to learn about the structure and composition of cereals, legumes and oilseeds.
- To know about the processing of cereals, legumes and oil.

General introduction and production and utilization trends; Structure and composition of common cereals, legumes and oilseeds.

Wheat: Types and 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 and refining, parboiling methods of rice criteria of quality of rice: aging of rice – quality changes; processed products based on rice.

Corn: Types and nutritive value; dry and wet milling, processing of corn in breakfast cereals, snacks, tortilla etc., 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. 2003. "*Chemistry and Technology of Oils and Fats"*. Prentice Hall.
2. Dendy, D.A.V., and Dobraszczyk, B.J. 2001. "*Cereal and Cereal Products*". Aspen.
3. Hamilton, R.J.,and Bhati, A. 1980. "*Fats and Oils - Chemistry and Technology*". App. Sci.Publ.
4. Hoseney, R.S. 1994. *"Principles of Cereal Science and Technology*". 2nd Ed. AACC.
5. Kay, D.E. 1979. "Food *Legumes*". Tropical Products Institute.
6. Kent, N.L. 1983. "*Technology of Cereals*". 4th Ed. Pergamon Press.

COURSE OUTCOMES:

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

1. Know about the processing of rice, rice bran oil extraction and refining.
2. Understand the production of edible oil, flour, protein concentrates and isolates.
3. Understand about the mechanism of oil extraction and oil refining.

Mapping with Programme outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	√			√		√				
CO2	√			√		√				
CO3	√			√		√				

FPTP 107	FOOD PROCESSING TECHNOLOGY LABORATORY – I	L	T	P
		0	0	3

COURSE OBJECTIVES:

- To train the student to analyse 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 Production of Wine from Grapes

2 Osmatic Dehydration of Vegetable

3 Manufacture of Bread

4 Manufacture of Tutti Frutti From Papaya

5 Production and Analysis of Butter

6 Production and Analysis of Cheese

7 Production of Ice Cream

8 Citric Acid Production by Solid State Fermentation – Using *Aspergillus Niger*

9 Production of Vinegar

10 Production of Baking Powder

11 Production of Custard Powder

12 Production of Icing Sugar

13 Continuous Drying of Food Products Using Rotary Dryers

14 Sedimentation and Filtration-Principles and Practical Applications

15 Centrifugation, Spray Drying, Freeze Drying and Vacuum Dryning-Principles and Practical Applications

16 Preparation of Jam

17 Preparation of Marmalades

18 Production of Casein

COURSE OUTCOMES:

1. Students would be able to assess the quality of the food
2. Students would be able to develop newer methods of food analysis
3. The students have gained knowledge of engineering properties of food materials

Mapping with Programme outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	√		√	√	√				√	
CO2	√		√		√				√	√
CO3	√			√						

FPTC201	DAIRY ENGINEERING AND TECHNOLOGY	L	T	P
		4	0	0

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.

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 and Cheese.

Sanitization: Materials and 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. Drying Principle and operation of Spray driers, Drum driers, Tray driers and Freeze driers.

Filling Operation: Principles and working of different types of bottle filters and 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 and sanitizing agents, Effluent treatment: Type, degree and treatment of waste. Dairy Plant design and layout.

REFERENCES:

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

Mapping with Programme outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	√			√		√				√
CO2	√			√		√				√

FPTC202	**BAKING TECHNOLOGY**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES:

To acquaint the student about

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

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 Flour Test.

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 French bread.

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 Not Baked.

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 and 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 Leavened Products.

REFERENCES:

1. W. P. Edwards. 2007. "*The Science of Bakery Products*", The Royal Society of Chemistry U.K.
2. Weibiao Zhou and Y. H. Hui. 2014. "*Bakery Products Science and Technology*", 2nd Edition, Wiley Blackwell
3. Iain Davidson. 2016. "*Biscuit Baking Technology- Processing and Engineering Manual*", 2nd Edition, 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, Maryland, 2005.

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 of bread.
2. The students will be able to know about the manufacturing processes of various breads, characteristics of bread, making of biscuits, types of biscuits, cake making and problems of cake making.

Mapping with Programme outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	√			√						√
CO2						√				√

FPTC203	**FRUITS AND VEGETABLES PRESERVATION TECHNOLOGY**	**L**	**T**	**P**
		4	**0**	**0**

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, and transportation and quality assurance.

Freezing of Fruits and Vegetables: Different freezing methods and equipments, problems associated with specific fruits and 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 and other modern methods, choice of suitable methods, preserving the colour, flavour and 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, CBS, 2001.
2. Salunkhe, D.K. and Kadam, S.S. "*Handbook of Fruit Science and Technology: Production, Composition, Storage, and Processing*", Marcel Dekker, 2005.
3. Vaclavik, V.A. and Christian, E.W. "*Essentials of Food Science*", 2nd Edition, Springer, 2005.
4. Alzamora, S.M., Tapia, M.S. and Lopez – Malo, A. "*Minimally Processed Fruits and Vegetables: Fundamental Aspects and Applications*", Springer, 2005.

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 know about different drying methods like sun drying, cabinet drying, tray drying, spray and vacuum drying.
3. At the end of the course students able to understand about fruit and Vegetable products and Standards.

Mapping with Programme outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1			√	√		√				
CO2			√			√				

FPTC 204	**MEAT, POULTRY AND FISH PROCESSING TECHNOLOGY**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES:

To acquaint the student about the

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

Meat composition from different sources; muscle structure and compositions; post-mortem muscle chemistry; Factors influencing the quality of meat. Meat Microbiology and 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 and smoking; prepared meat products like sausages, kebabs, etc. 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.

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

REFERENCES:

1. Fidel Toldrá. 2010. "*Handbook of Meat Processing*". Blackwell Publishing.
2. Legarreta,I.G. 2010. "*Handbook of Poultry Science and Technology (Volume I and Volume II)".* John Wiley & Sons, Inc., Hoboken, New Jersey. U.S
3. Sam, A.R. 2001. "*Poultry meat processing*". CRC Press Taylor & Francis Group
4. Hui YH. 2001. "*Meat Science and Applications*". Marcel Dekker.
5. Kerry, J. 2002. "*Meat Processing*". Woodhead Publ. CRC Press.
6. Levie A. 2002. "*Meat Hand Book*". 4th Ed. AVI Publ.
7. Mead M. 2004. "*Poultry Meat Processing and Quality*". Woodhead Publ.
8. Pearson, A.M. & Gillett, T.A. 2006. "*Processed Meat*". 3rd Ed. Chapman & Hall.
9. Lawrie, R.A. 2006. "*Meat Science*". 7th Edn. Woodhead publishers.UK.
10. K.Gopakumar. 2002. "Fish Processing Technology", Indian council of Agri metural research, 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 shell fish.

Mapping with Programme outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1			√		√				√	
CO2			√						√	
CO3			√						√	

FPTP 207	FOOD PROCESSING TECHNOLOGY LABORATORY – II	L	T	P
		0	0	3

COURSE OBJECTIVES:

- To train the student to analyse 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 Lactose in Skimmed Milk Powder
2 Quantitative Analysis of Cream, Condensed Milk and Milk Powder
3 Determination of Ash Content in Milk.
4 Estimation of Protein In Milk
5 Detection of Calcium In Milk
6 Estimation of Free Fatty Acid
7 Estimation of Acid Value
8 Estimation of Saponification Value of Gingelly Oil.
9 Determination of Moisture Content in Meat
10 Drying Characteristics of Vegetables
11 Estimation Of Acidity of Tomato Pulp
12 Estimation of Curcumin In Turmeric Powder
13 Testing of Milk And Milk Products-Physical, Chemical, Biochemical and Bacteriological Test
14 Estimation of Chlorophylls In Bitter Guard
15 Estimation of Fructose And Inulin
16 Determination of Peroxide Value
17 Estimation of Gluten
18 Estimation of Lactic Acid In Fermented Cabbage

COURSE OUTCOMES:

1. Students would be able to assess the quality of the food
2. Students would be able to develop newer methods of food analysis
3. The students have gained knowledge of engineering properties of food materials

Mapping with Programme outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	√		√	√	√				√	
CO2	√		√		√				√	√
CO3	√			√						

FPTT 303	THESIS PHASE – I	L	T	P
		0	4	0

COURSE OBJECTIVES:

- To learn the ability to take data through literature survey
- To observe and assess the various food processing and food preservation techniques in an industrial environment
- To document and present one's own work, for a given target group, with strict requirements on structure, format, and language usage

A thesis work on a specialized topic in Food processing and preservation Technology should be taken at the beginning of the Third Semester in consultation with the Head of the Department. A report must be submitted at the end of the Third semester and there will be a Viva Voce examination on the thesis.

COURSE OUTCOMES:

After learning the course, the students should be able to

1. Come across different literatures relevant to his study
2. Reflect on, evaluate, and critically assess one's own and others' scientific results
3. Apply the relevant food processing and preservation knowledge and skills, which are acquired within the technical area, to solve a given problem

Mapping with Programme outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	√	√	√	√		√				√
CO2	√		√	√		√				√
CO3	√		√	√		√				√

FPTI 304	INDUSTRIAL TRAINING	L	T	P
		0	0	2

COURSEOBJECTIVES

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

The students individually undergo a training program in reputed concerns in the field of Process Control and Instrumentation during the summer vacation (at the end of second semester for full – time / fourth 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 the third semester for Full-time / fifth semester for part-time. The students will be evaluated by a team of staff members nominated by head of the department through a viva-voce examination.

COURSE OUTCOMES

1. The students can face the challenges in the practice with confidence.
2. The student will be benefited by the training with managing the situation arises during the execution of works related to Food Processing Technology.

FPTT401	THESIS PHASE – II	L	T	P
		0	8	0

COURSE OBJECTIVES:

- To learn the ability to take data through literature survey
- To observe and assess the various food processing and food preservation techniques in an industrial environment
- To document and present one's own work, for a given target group, with strict requirements on structure, format, and language usage
- To identify one's need for further knowledge and continuously develop one's own competencies

The thesis work on a specialized topic in Food processing and preservation Technology already selected in the Third Semester will be continued in the fourth semester. A report must be submitted at the end of the Fourth semester and there will be a Viva Voce examination on the thesis.

COURSE OUTCOMES:

After learning the course, the students should be able to

1. Manage the selection and initiation of individual projects
2. Conduct project planning activities that accurately forecast the process scenarios
3. Reflect on, evaluate, and critically assess one's own and others' scientific results
4. Apply the relevant knowledge and skills, which are acquired within the technical area, to solve a given problem
5. Demonstrate techniques that result in food processing and preservation environment

Mapping with Programme outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	√		√	√		√				√
CO2	√	√	√	√		√				√
CO3	√		√	√		√				√
CO4	√		√	√		√				√
CO5	√		√	√		√				√

PROFESSIONAL ELECTIVES

FPTEXXX	BEVERAGE TECHNOLOGY	L	T	P
		4	0	0

COURSE OBJECTIVES:

To acquaint the student about the

- Definition, classification and ingredients used for the manufacture of beverages.
- Knowledge and skills of process techniques and equipments used for the production of beverages.

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 and olors in beverages, preservatives, emulsifiers and stabilizers.

Procedures – carbonation equipments – ingredients – preparation of syrups – Filling system – packaging – containers and 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 and 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 etc,), sugar cane (rum).

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 and titrable acidity in beverages.

REFERENCES:

1. Alan J. Buglass. 2011. "*Hand book of Alcoholic beverages Technical, Analytical and Nutritional Aspects Volume I*". John wiley Publications.
2. Ashurst, P.R. 2005. "Chemistry and technology of soft drink and fruit juices", 2nd edition, Blackwell Publishing Ltd.
3. Charles, W.Bamforth, 2005. "*Food, fermentation and microorganisms*", Blackwell Science Publishing Ltd.

4. Steen, D.P and Ashurst, P.R, "*Carbonated soft drinks – Formulation and manufacture*", Blackwell Publishing Ltd. 2000.
5. Shankunthala Manay, N. and Shadakdharaswamy, M, 2000. "*Foods – Facts and Principles*", New Age International Pvt. Ltd, 3rd revised edition.
6. *"Prevention of Food Adulteration Acts and Rules Manual"*

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 various unit operations involved in the food beverage manufacturing.
3. List the quality control steps in beverage preparation.

Mapping with Programme outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1										√
CO2				√	√	√				√
CO3						√				√

FPTEXXX	**CHOCOLATES AND CONFECTIONERY TECHNOLOGY**	**L**	**T**	**P**
		4	**0**	**0**

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 and cocoa products.

Status of confectionery industries in India – Raw materials for confectionery products – Essential and optional. PFA Specification of raw materials.

Definition, importance of sugar confectionery and flour confectioner. Types of confectionery products – chocolate boiled sweets, caramels, toffees and fondants.

Manufacturing process and spoilage of confectionery products. Good manufacturing practices (GMP) in confectionery industries. Computerization in plant and laboratory, Sanitation and safety.

Chocolates – types, chemistry and technology of chocolate manufacture; quality control of chocolates.

Health and safety – Food safety rules and regulations for bakery and confectionery products – safe practices in the work places – sanitation – duties of the sanitation equipments – Code for hygiene condition in confectionery manufacturing UNIT.

REFERENCES:

1. Potter, N.N. and Hotchkiss, J.H. "*Food science*", 5th Edition, CBS, 2001.
2. Bernard. W. Minifie.2013. "*Chocolate, Cocoa, and Confectionery (Science and Technology)*", Springer Science and Business Media.
3. Peter P. Greweling. 2013. "*Chocolates and Confections: Formula, Theory, and Technique for the Artisan Confectioner*", 2nd Edition, The Culinary Institute of America (CIA)

COURSE OUTCOMES:

1. This course equips students to have knowledge about confectionery and chocolate products, sugar based confections, ingredients, chocolate and cocoa products.
2. The students will be able to know the manufacturing practices of confectionery products.

Mapping with Programme outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1				√						√
CO2				√		√				√

FPTEXXX	**FOOD SAFETY AND QUALITY CONTROL**	**L**	**T**	**P**
		4	**0**	**0**

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.

Food safety concept - Importance of food safety in the food processing industry Risk classification, National and international food regulatory agencies, General food laws and food safety regulations, Nutritional labelling 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 and 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 and 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), and 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, and 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 Act 2006.

REFERENCES:

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

COURSE OUTCOMES:

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

1. National, international food regulatory agencies, general food laws and food safety regulations.
2. Hazard analysis and risk assessment.
3. Food quality standard and food quality analysis.

Mapping with Programme outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1						√				
CO2						√				
CO3				√	√	√				

FPTEXXX	FOOD LAWS AND REGULATIONS	L	T	P
		4	0	0

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.

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

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 labelling and giving information therein, size of packages etc. Important Issues of GM Foods, Fortification, Nutrition Information on Label, Organic Foods, Safety of additives, Processes etc. 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, stabilisers, 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 and 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. 2005. "*Food Safety Regulations, Concerns and Trade: The Developing Country Perspective*", Macmillan.
2. Naomi, R., and Watson, D. 2007. "*International Standards for Food Safety*", Aspen Publication.
3. Newslow, D.L. 2007. "*The ISO 9000 Quality System: Applications in Food and Technology*", John Wiley & Sons.
4. Hubbard, Merton R. 2003. "*Statistical Quality Control for the Food Industry*", 3rd Edition, 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 and measurements.

Mapping with Programme outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1						√				√
CO2						√				√

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FPTEXXX	**NUTRACEUTICALS AND FUNCTIONAL FOODS**	**L**	**T**	**P**
		4	**0**	**0**

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.

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.

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

Dosage for effective control of disease or health benefit with adequate safety; studies with animals and humans; acute and chronic studies. Regulatory issues.

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 immunomodulators /vaccines through functional foods. Nutrigenomics – concept of personalized medicine. Use of nanotechnology in functional food industry.

REFERENCES:

1. Wildman, R.E.C. 2007. "*Handbook of Nutraceuticals and Functional Foods*", second edition. CRC Press.
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*".Wiley VCH. 2006.
5. Cupp J and Tracy TS. "*Dietary Supplements: Toxicology and Clinical Pharmacology*".Humana Press. 2003.

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 and disorders.
2. Definition, types and relevance related to Prebiotics, probiotics and symbiotics.

Mapping with Programme outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	√	√						√		
CO2	√	√						√		

FPTEXXX	**FOOD PACKAGING TECHNOLOGY**	**L**	**T**	**P**
		4	**0**	**0**

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.

Introduction to food packaging: Packaging terminology – definition. 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 – like aseptic system, form and fill (volumetric and gravimetric), bottling machines. Form Fill Seal (FFS) and multilayer aseptic packaging machines.

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 waste disposal.

REFERENCES:

1. Robertson, G.L. 2006. "*Food Packaging: Principles and Practice (2nd ed.)*", Taylor & Francis
2. NIIR. 2003. "*Food Packaging Technology Handbook*", National Institute of Industrial Research Board, Asia Pacific Business Press Inc.
3. Ahvenainen, R. (Ed.) 2003. "*Novel Food Packaging Techniques*", CRC Press.
4. Han, J.H. (Ed.) 2005. "*Innovations in Food Packaging*", Elsevier Academic Press.
5. Coles, R., McDowell, D. and Kirwan, M.J. (Eds.) 2003. "*Food Packaging Technology*, CRC Press.

COURSE OUTCOMES:

1. This course equips students to have knowledge about various food packaging like vacuum packaging, CAP, MAP, aseptic packaging, edible packaging, shrink and stretch packaging.
2. The students will be able to know the design and issues in packaging of foods.

Mapping with Programme outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1		√	√	√	√					
CO2			√		√					

FPTEXXX	FOOD TOXICOLOGY	L	T	P
		4	0	0

COURSE OBJECTIVES:

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

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; Clinical trials.

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 and allergenisity of GM foods. Safety of toys and children consumables.

Environmental Contaminants and Drug Residues in Food: Fungicide and 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 and potential toxicity of food adultrants.

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 toxic effects.

REFERENCES:

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

COURSE OUTCOMES:

The students will be able to understand the

1. Biotransformation and mechanisms of toxicity.
2. Environmental contaminants and drug residues in food.
3. Food additives and toxicants added or formed during food processing.

Mapping with Programme outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1			√					√		
CO2			√					√		
CO3			√	√				√		

OPEN ELECTIVES

FPTEXXX	CRYOGENIC ENGINEERING	L	T	P
		4	0	0

COURSE OBJECTIVES:

This course enables the students to

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

Cryogenics – Introduction and history. Applications – space and aerospace industry, cryobiology and superconductivity. Thermodynamic analysis of low temperature processes-refrigeration and 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 and medical application

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 and design concepts of cryogenic propulsions.

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

REFERENCES:

1. Harold Weinstock, 1970. "*Cryogenic Technology*", Boston Technical Publications.
2. Boris V.Kuznetsov, 1981. "*Theory and design of Cryogenic system*". MIR Publishers, 1981.
3. C.Rose Innes, 1964. "*Low Temperature Techniques*" ,English University Press.
4. Mamata Mukhopathay. "*Fundamentals of Cryogenic Engineering*".

COURSE OUTCOMES:

1. This course equips students for selecting the proper cryogenic fluid for particular application like freezing of foods, medical application.
2. The students will be able to know the way to handle cryogenic fluid and right instrumentation to measure the properties of cryogenic fluid.

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Mapping with Programme outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1			√				√			
CO2			√			√	√			

FPTEXXX	**PROCESS INSTRUMENTATION AND CONTROL IN FOOD PROCESSING**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES:

- Enable the students to provide sound knowledge in the concepts of process instrumentation.
- To gain the knowledge of different process instruments.

Introduction to food processing industries- canned and 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 and 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 and indicators- Food sorting and grading control- Discrete, Adaptive and Intelligent controllers.

Computer – Based Monitoring and Control – Introduction and 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. 2007. "*Measurements and Control in Food Processing*" CRC, Taylor and Francis.
2. E Kress-Rogers and C J B Brimelow. 2001. "*Instrumentation and Sensors for the Food Industry*" 2nd Edition Woodhead Publishing.
3. William C. Dunn. 2006. "*Introduction to Instrumentation, Sensors and Process Control*", Artech House Inc.
4. Eckman.D.P, 1984. "*Industrial Instrumentation*", Wiley Eastern Ltd.
5. James E. Bailey and David F. Ollis, 1986. "*Biochemical Engineering Fundamentals*", McGraw-Hill Book Company, 2nd ed.

COURSE OUTCOMES:

1. This course equips students to have knowledge of field instrumentation.
2. The students will be able to know the application of control systems in various processes.

Mapping with Programme outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1				√		√				
CO2				√		√				

FPTEXXX	**INDUSTRIAL ORGANISATION AND BUSINESS MANAGEMENT**	**L**	**T**	**P**
		4	**0**	**0**

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 industrial cost accounting, purchase procedure, budget and budgetary control.

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

Structure and 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, inventory , 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 and 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 and product costing.

REFERENCES:

1. Sivarethinamohan, R. 2005. "*Operations Research*". Tata McGraw_Hill Pub. Co. Ltd.
2. Metha, P.L. 2003. "*Managerical Economics- Analysis, Problems and cases*", Sultan Chand and Sons, New Delhi.
3. Sherilaker, 2001. "*Marketing Management*". Himalaya Publishing Company.

COURSE OUTCOMES:

1. This course equips students to have knowledge about food plant management, factors affecting on location and layout of food plants.
2. The students will be able to understand about building of deterministic and probabilistic models, management decision making, production problems, marketing and sales forecasting.

Mapping with Programme outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1			√			√				
CO2			√			√				

FPTEXXX	**FOOD INDUSTRIAL EQUIPMENTS**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES:

- Enable the students to know about various equipments used for milling rice, wheat and dhal.
- To provide the hands on experience in basic concepts of heat exchanging, mixing, blending, extrusion and filling equipments.

Washing, Filtration & Centrifugation equipment. Different Fruits and Vegetable washing systems; Conveyor belts – types, material of construction, product specific conveyors. Screw, bucket, belt, oscillating and vibratory conveyors. Filtration of liquid foods (dairy, fruit & vegetables); centrifugation systems: Solid bowl and disc bowl centrifuges; cyclone separator and self cleaning centrifuge.

Milling Equipments: Types of equipment used for milling rice and wheat, pearling and flaking equipment; dhal mills.

Heat Processing & Cooling Equipments: Heat exchangers – Plate, shell and tube etc. Autoclaves - types, operation; Different Dryers and freezers – Tray, tunnel, Fluidized. Spray dryer, Blast and IQF, Freezers, short tube and pan evaporators.

Mixing, Blending. Extrusion & Filling Equipments: Agitation and mixing of liquid foods, powders and pastes; Mixers - ribbon blenders, augur, nauta, cone. Cold and hot extruders, single screw, twin screw, extrusion cooking.

Screening; Types of screens; Grizzly; Revolving screen; Shaking screen, Rotary screen, Vibratory screen; Horizontal screen; Perforated metal screens; Wire mesh screens; Ideal and Actual screens; Effectiveness of screen; Air-screen cleaners; Separators

Storage: Direct damages; Indirect damages; Sources of infestation; Traditional storage structures; Improved storage structures; Modern storage structures; Storage of agricultural perishables; Controlled and modified atmosphere storage.

REFERENCES:

1. Lopez – Gomez, A. and Barbosa – Canovas, G.V. 2005. "*Food Plant Design*", Taylor & Francis.
2. Smith, P.G. 2005. "*Introduction to Food Process Engineering*", Springer.
3. Rao, M.A. Rizvi, S.S.H. and Datta, A.K. 2005. "*Engineering Properties of Food*", 3rd Edition,Taylor & Francis.
4. Sahay, K.M. and Singh, K.K. 2005. "*Unit operations of agricultural processing*". Vikas Publishing house Pvt. Ltd.

COURSE OUTCOMES:

1. At the end of the course the students will be able to know about fruits and vegetables washing systems, filtration of liquid foods and centrifugation systems.
2. The student will have the knowledge in the field heat processing and cooling of foods.
3. They also know about the equipments used for screening and various storage structures like traditional, improved and modern.

Mapping with Programme outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1			√	√						
CO2		√	√							
CO3					√	√				