

**MAHATMA GANDHI UNIVERSITY
KOTTAYAM**

B Sc FOOD TECHNOLOGY & QUALITY ASSURANCE

**SYLLABUS RESTRUCTURE PROPOSAL
2016**

**Revised and restricted as per Choice Based Credit System for
Under Graduate Programmes, 2016 (UGCBCS 2016)**

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1. ACKNOWLEDGMENT

The course in B.Sc. Food Science and Technology has been designed keeping in mind the latest technological advances in the food processing industries and the need for complete professionals adept in all areas of the vast science of food. The course aims at training students not just academically but also in the areas that develop communication skills, soft skills and overall ability. The course is also designed to give a further thrust on developing in students a desirable attitude for self employment.

I take this opportunity to thank all the members on the Expert Committee for their untiring efforts and support for the preparation of the syllabus . I gratefully take this opportunity to thank all the expert members for their valuable contributions in drafting the syllabus of B.Sc. Food Science and Quality Control.

I place on record my gratitude to Miss. Neethu Ravikumar and Dr Shewta S. Dept of Food Technology and Quality Assurance , CFRD, Konni for the suggestions offered in the formulation of the syllabus.

NEED AND SCOPE OF THE COURSE

ˆ In the world, India is the second largest producer of food after China; the country has achieved the potential of being the biggest, with the food and agricultural sector. Indian food industry is considered to supply about two third of total Indian retail market needs. In addition to that, modern skills and equipment have been introduced in food industries such as canning, dairy, cereal processing, speciality processing, packaging, frozen food, refrigeration and thermal processing. India's food processing industry has been growing at the rate of 13% despite the global slowdown. And now the government is aiming to double the turnover in the next five year by setting up mega food parks to attract even global capital.

At present the export from agro-sector represents about 16% of total Indian exports. The primary export commodities are cereals, fruits, vegetables and their processed products, and marine products but fast growing specialty products have also penetrated into the foreign markets. Considering the contribution of these products in Indian export, it is necessary to have appropriate technology for handling and processing of agricultural produce.

Food technologist develops the manufacturing process and recipes. They work on existing and newly discovered ingredients and technologies to invent new products, recipes and concept. They are involved in conducting experiments and producing sample products as well as designing the processes and machinery for making products with a consistent flavor, color and texture.

- Modifying existing products, processes and new product development (NPD).
- Checking and improving quality control procedures from raw material stage to the finished product incorporating traceability.
- Addressing issues of safety and quality.
- Selecting raw material and other ingredients.
- Maintaining proper hygienic condition of entire food industry.
- Develop steps undertaken to meet the requirements with respect to hygiene, sanitation, good manufacturing practices, HACCP and nutritional quality.

PURPOSE OF COURSE

The purpose of this course is to enable the under-graduate to acquire the scientific, technical and professional skills for a career in the food industry through an understanding of science of food technology together with a deeper comprehension of food quality assurance.

The expected outcomes are that students acquire and demonstrate:

- Knowledge and competence in the principles of quality assurance and quality management system as they are applied in the food manufacture and distribution to produce safe, food meeting quality and legal requirements.
- Thorough knowledge of chemical, biological and physical principles which underlie food processing, package and storage.
- Ability to apply the principles of chemical analysis, microbiological and statistical control techniques to analyze and assure the quality and safety of food.
- Capacity for critical evaluation, presentation and interpersonal communication skills.

3. INTRODUCTION

The course enables graduates to acquire the technical and professional skills for a career in either the food industry or a government food control authority through an understanding of the sciences underlying food technology together with a comprehension of food quality assurance.

The expected outcomes for graduates are:

- A knowledge and competence in the principles of quality assurance and quality management systems as they are applied in the food manufacture and distribution to produce safe food meeting quality and legal requirements;
- An understanding of the chemical, biological and physical principles which underlie food processing and storage;
- An ability to apply the principles of chemical analysis, microbiology and statistical control techniques to assure the quality and safety of food;
- A capacity to undertake research into the science of foods;
- Critical, presentational and interpersonal skills.

REGULATIONS FOR

B Sc Food Technology & Quality Assurance

Programme under

CHOICE BASED CREDIT SYSTEM for

U.G. PROGRAMMES 2016

(UGCBCS 2016)

NAME OF PROGRAMME: B Sc Food Technology & Quality Assurance

1. FACULTY : Faculty of Science

2. DURATION OF COURSE

- i. The curriculum requirement of B. Sc. Food Technology and Quality Assurance shall consist of a period of 3 academic years as prescribed in the curriculum.
- ii. The academic years shall be split into 6 semesters (6 months each). Examinations will be conducted at the end of each semester in subjects prescribed in the respective scheme of examinations.
- iii. The duration of odd semesters shall be from June to October and that of even semesters from November to March. There shall be three days semester break after odd semesters and two months vacation during April and May in every academic year. (The commencement of first semester may be delayed owing to the finalization of the admission processes.)
- iv. A student may be permitted to complete the Programme, on valid reasons within a period of 12 continuous semesters from the date of commencement of the first semester of the programme.

4. DEFINITIONS

- 4.1 Academic week:** is a unit of five working days in which distribution of work is organized from day one to five, with five contact hours of one hour duration on each day. A sequence of 18 such academic weeks constitutes a semester.
- 4.2 College co-ordinator:** is a teacher nominated by the College Council to co-ordinate the continuous evaluation undertaken by various departments within the college. He/she shall be nominated to the college-level monitoring committee.
- 4.3 Course:** means a complete unit of learning which will be taught and evaluated within a programme. It comprises of 'Paper(s)' which will be taught and evaluated within a programme.
- 4.4 Common Course I** means a course that comes under the category of courses for English and Environmental Studies & Human Rights & **Common Course II** means additional language.
- 4.5 Complementary course:** means a course which would enrich the study of core courses.
- 4.6 Core course:** means a course in the subject of specialization within a degree programme.
- 4.7 Vocational course (Skill Enhancement Course):** means a course that enables the students to enhance their practical skills and ability to pursue a vocation in

their subject of specialization.

- 4.8 Choice based course:** means a course that enables the students to familiarize the advanced areas of core course.
- 4.9 Paper:** means a complete unit of learning which will be taught and evaluated within a semester.
- 4.10 Credit (C):** is a numerical value assigned to a paper according to the relative importance of the content of the syllabus of the programme.
- 4.11 Credit point (CP):** is the value obtained by multiplying the grade-point (GP) by the credit (C); $CP = C \times GP$
- 4.12 Cumulative Grade Point Average (CGPA):** is the value obtained by dividing the sum of credit-points in all the courses taken by a student for the entire programme by the total number of credits. This shall be rounded off to two decimal places. CGPA indicates the broad level of academic performance of a student in a programme. An overall letter grade (Cumulative Grade) for the entire programme shall be awarded to a student depending on his/her CGPA.
- 4.13 Department:** means any teaching department in a college.
- 4.14 Department Co-ordinator:** is a teacher nominated by a Department Council to co-ordinate the continuous evaluation under-taken in that department.
- 4.15 Department Council:** means the body of all teachers of a department in a college.
- 4.16 Faculty Advisor:** means a teacher from the parent department nominated by the department council who will advise the student in the choice of his/her courses and other academic matters.
- 4.17 Generic Elective (GE):** means an elective paper chosen from any discipline/subject, in an advanced area.
- 4.18 Grace Marks:** shall be awarded to the candidates as per the University Orders issued from time to time.
- 4.19 Grade:** means a letter symbol (e.g. - A, B, C etc) which indicates the broad level of performance of a student in an answer/course/semester/programme.
- 4.20 Grade point (GP):** is the numerical indicator of the percentage of marks awarded to a student in a paper.
- 4.21 Grade Point Average (GPA):** is the value obtained by dividing the sum of the total credit points obtained by a student in an examination of a course in a semester by the total number of credits taken in those examinations. The GPA shall be rounded off to two decimal places.
- 4.22 Institutional Average (IA):** means average mark secured (Internal + external) for a paper at the college level.
- 4.23 Parent Department:** means the department which offers core-courses within

an undergraduate programme.

4.24 Programme: means a three year programme of study and examination spread over six semesters, the successful completion of which would lead to the award of a degree.

4.25 Semester: means a term consisting of a minimum of 450 contact hours distributed over 90 working days, inclusive of of tutorials, examination days and other academic activities, within 18 five-day academic weeks (a period of six months).

Odd semester: shall be from June to October.

Even semester: shall be from December to April.

4.26 Semester Grade Point Average (SGPA): is the value obtained by dividing the sum of credit points (P) obtained by a student in various courses taken in a semester by the total number of credits taken by him/her in that semester. The grade-points shall be rounded off to two decimal places.

4.27 Total Credit Point (TCP): is the sum of credit points.

4.28 Words and expressions used and not defined in this regulation shall have the same meaning assigned to them in the Act and Statutes of the University.

ELIGIBILITY FOR ADMISSION

A pass in Plus-two/equivalent degree accepted by M.G. University in the stream, Science (Physics, Chemistry, Biology/Mathematics) or Home Science with Chemistry, Physics & Biology or Aquaculture with Chemistry and Biology/Mathematics (as auxiliary) can apply for the B Sc Food Technology & Quality Assurance Programme.

The eligibility for admission, norms for admission and reservation of seats to the B. Sc programme shall be according to the regulations framed/orders issued by the University in this regard, from time to time.

MODE OF ADMISSION

- i. Selection of candidates will be based on the marks in the Plus-two examination.
- ii. The candidates shall also satisfy the conditions regarding physical fitness as may be prescribed by the University.
- iii. Weightage of marks for proficiency in NCC/NSS etc and bonus marks for ex-service men applicants and widows and children of Jawans- ex-service men will be given as per the existing rules of admission. Reservation for the candidates with outstanding reports in sports and games shall be allowed as per rules. Reservation of the seat under merit quota for physically challenged candidates shall be given as per the existing rules of admission of University.
- iv. No admission shall be made after 30 working days from the date of commencement of the first semester as per the academic calendar approved by the University

- v. All the above rules will be subjected to change as per the general rules prescribed by Mahatma Gandhi University from time to time

RULES FOR READMISSION

- i. Students who are unable to attend classes on medical grounds after completing the first-two semesters may be re-admitted to the respective semester along with the subsequent batch.
- ii. Such students seeking re-admission shall give a written application to the Principal
- iii. Students who have been removed from the nominal rolls due to default in payment of the semester fees shall be re-admitted, subject to the existing rules of the University

REGISTRATION

- i. The registration of students, selection of number of courses by students shall remain as per existing rules of the University.
- ii. The strength of students for each programme shall remain as per existing regulations, as approved by the University.
- iii. The college shall send a list of students registered for each programme in each semester giving the details of courses registered including repeat courses to the University in the prescribed form within **20** days from the commencement of the Semester.
- iv. Those students who possess the required minimum attendance during an academic year/semester and could not register for the semester examination are permitted to apply for Notional Registration to the examinations concerned enabling them to get promoted to the next class.

SCHEME OF PROGRAMME

- i. The U.G. programme shall include
 - (a) Common courses I and/or II
 - (b) Core course(s)
 - (c) Complementary/Vocational Courses
 - (d) Generic Elective Course (GE)
- ii. There shall be one Generic Elective paper in the fifth semester with a choice of one out of three elective papers from any programme or from the Physical Education department.
- iii. There shall be one Choice Based paper in the sixth semester with a choice of one out of three elective papers.

- iv. Credit Transfer and Accumulation System can be adopted in the programme. Transfer of credit consists of acknowledging, recognizing and accepting credits by an institution for programmes or courses completed at another institution. The Credit Transfer Scheme shall allow students pursuing a programme in one University to continue their education in another University without break.
- v. A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 40% are required for a pass for a paper. For a pass in a programme, a separate minimum of **Grade D** is required for all the individual papers. If a candidate secures **F Grade** for any one of the paper offered in a Semester/Programme, **only F grade** will be awarded for that Semester/ Programme until he/she improves this to **D Grade** or above within the permitted period. (See Clause 3. iv)
- vi. Students who complete the programme with ‘D’ grade in the “Regulations for Under Graduate Programmes under Choice Based Credit System 2016” will have one betterment chance within 12 months, immediately after the publication of the result of the whole programme.
- vii. Students discontinued from previous regulations, CBCSS 2013, can pursue their studies in “Regulations for Under Graduate Programmes under Choice Based Credit System 2016” after obtaining readmission. These students have to complete the programme as per “Regulations for Under Graduate Programmes under Choice Based Credit System 2016”.
- viii. Practical examination will be conducted only at the end of even semesters for all Model I/II/III programmes

PROGRAMME STRUCTURE

Model III: B Sc Food Technology & Quality Assurance

a	Programme Duration	6 Semesters
b	Total Credits required for successful completion of the Programme	120
c	Credits required from Common Course I	8
d	Credits required from Core + Complementary + Vocational Courses including Project	109
e	Generic Elective (GE)	3
f	Minimum attendance required	75%

B. Sc. Food Technology and Quality Assurance is a U.G. Model III programme offering 4 courses comprising 29 Theory & 7 Practical papers, 2 Industrial Training Reports & 1 Project

Sl No	Type of Course	Credit per course	No of papers per course
1	Common course	8	2 Theory

2	Complementary courses	1	14	4 Theory + 2 Practical
		2	14	4 Theory + 2 Practical
3	Core courses along with choice based paper		81	18 Theory + 3 Practical + 2 Industrial Training (OJT) + 1 Project
4	Generic Elective (GE)		3	1 out of 3

Generic Elective Course

Students can opt for any one of the **Generic Elective Papers** offered by different departments of the college in fifth semester (subject to the availability of vacancy in the concerned discipline). If the number of applications exceeds the number of vacancies for a particular Generic elective paper, priority will be given to the students from the parent department (core subject). Selection of students in the generic elective paper will be done in the college based on merit and interest of the students.

Department of Food Technology offers three generic elective papers to the students of parent/other departments:

Generic Elective Course for Fifth Semester

No	Semester	Title of generic elective paper
1	V	FT5GET18-Basic Nutrition
2	V	FT5GET19-Fermentation Technology
3	V	FT5GET20-FTFood Hygiene & Sanitation

Choice Based Core Course

The choice based core papers available for the students of B Sc. Food Technology & Quality Assurance Programme in the sixth semester are given as:

Choice Based Core Papers for Sixth Semester

No	Semester	Title of choice based core elective paper
1	VI	FT6CBT26-Equipment & Material Design for Food Processing Plant
2	VI	FT6CBT27-Food Biotechnology
3	VI	FT6CBT28- Technology of Flavors & Fragrances

The detailed scheme of B Sc Food Technology & Quality Assurance course (Table 1) and detailed scheme for the distribution of credits and period of instruction for B Sc Food Technology & Quality Assurance (Table 2), detailed scheme for the distribution of credits and period of instruction of the core courses (Table 3) and list of elective courses with detailed scheme of instruction available for fifth semester (Table 4) and sixth semester (Table 5) are given in the tables below.

Table 2: Detailed Scheme for the Distribution of Credits and Period of Instruction for B Sc Food Technology & Quality Assurance

Sl No	Type of course	Title of course	Exam duration	Credit per course	Contact hours per week	Total contact hours for the course	Total credits for the semester
First Semester							
1	CORE	Introduction to Food Technology-FT1CRT01	3	3	4	72	19
2	CORE	Biochemistry-FT1CRT02	3	4	4	72	
3	CORE	Food Processing Technology-FT1CRT03	3	4	4	72	
4	COMMON	Communication skills in English	3	4	5	90	
5	COMPLEMENTARY	Basic Theoretical & Analytical Chemistry	3	2	2	36	
6	COMPLEMENTARY	Animal Diversity: Non-Chordata	3	2	2	36	
Second semester							
7	CORE	Food Engineering-FT2CRT04	3	4	4	72	21
8	CORE	Food Microbiology-FT2CRT05	3	3	4	72	
9	COMMON	Critical Thinking, Academic Writing & Presentation	3	4	5	90	
10	COMPLEMENTARY	Basic Organic Chemistry	3	2	2	36	
11	COMPLEMENTARY	Animal Diversity: Chordata	3	2	2	36	

Sl No	Type of course	Title of course	Exam duration	Credit per course	Contact hours per week	Total contact hours for the course	Total credits for the semester
Third Semester							
12	CORE	Dairy Technology-FT3CRT07	3	4	5	90	19
13	CORE	Food Analytical Instrumentation-FT3CRT08	3	4	5	90	
14	CORE	Food Packaging Technology-FT3CRT09	3	3	5	90	
15	OJT	On-the-Job Industrial Training-IFT3OJP10	Internal evaluation	2			
16	COMPLEMENTARY	Advanced Inorganic & Organic Chemistry	3	3	3	54	
17	COMPLEMENTARY	Human Physiology & Immunology	3	3	3	54	
Fourth semester							
18	CORE	Principles of Food Spoilage & Preservation-FT4CRT11	3	4	4	72	21
19	CORE	Food Chemistry-FT4CRT12	3	4	5	90	
20	COMPLEMENTARY	Advanced Bio-organic Chemistry	3	3	3	54	
21	COMPLEMENTARY	Applied Zoology (Aquaculture, Sericulture, Vermiculture & Apiculture)	3	3	3	54	

Sl. No	Type of course	Title of course	Exam duration	Credit per course	Contact hours per week	Total contact hours for the course	Total credits for the semester
Fifth Semester							
22	CORE	Technology of Beverages & Confectionaries-FT5CRT14	3	4	5	90	20
23	CORE	Technology of Fruits & Vegetables-FT5CRT15	3	4	5	90	
24	CORE	Cereal Chemistry-FT5CRT16	3	4	6	108	
25	CORE	Sensory Evaluation of Food-FT5CRT17	3	3	5	90	
26	GE	Generic Elective-FT5GET18, FT5GET19, FT5GET20	3	3	4	72	
27	OJT	On-the-Job Industrial Training-II-FT5OJP21	Internal evaluation	2			
Sixth semester							
28	CORE	Food Safety & Quality Assurance-FT6CRT22	3	4	5	90	20
29	CORE	Technology of Meat, Fish & Poultry Products-FT6CRT23	3	4	4	72	
30	CORE	Food Analysis-FT6CRT24	3	4	5	90	
31	CBC ELECTIVE	Choice Based Core Elective-FT6CBT26, FT6CBT27, FT6CBT28	3	3	5	90	
32		Project/Dissertation-FT6DSP29	0	2			

Consolidated Scheme for Practical's

Sl.No	Semester	Course	Hours Per Week	Credit
1.	I & II	Practical Complementary Chemistry- Volumetric Analysis	2+2	2
2.	I & II	Practical Complementary Zoology- Animal Diversity: Non- Chordata & Chordata	2+2	2
3.	II	Practical Core – Food Microbiology- FT2CRP06	4	2
4.	III & IV	Practical Complementary Chemistry- Organic Chemistry	2+2	2
5.	III & IV	Practical Complementary- Human Physiology & Immunology and Applied Zoology	2+2	2
6.	IV	Practical Core – Food Chemistry-FT4CRP13	6	3
7.	VI	Practical Core – Food Analysis-FT6CRP25	6	3

List of Generic Elective Course Papers available for Fifth Semester for Other Departments

No	Title of course	Exam duration (hours)	Credit per course	Contact hours per week
1	FT5GET18-Basic Nutrition	3	3	4
2	FT5GET19-Fermentation Technology	3	3	4
3	FT5GET20-FTFood Hygiene & Sanitation	3	3	4

List of Choice Based Core Elective Course Papers available for Sixth Semester

No	Title of course	Exam duration (hours)	Credit per course	Contact hours per week
1	FT6CBT26-Equipment & Material Design for Food Processing Plant	3	3	5
2	FT6CBT27-Food Biotechnology	3	3	5
3	FT6CBT28- Technology of Flavors & Fragrances	3	3	5

EXAMINATIONS

The evaluation of each course shall contain two parts:

- (i) Internal or In-Semester Assessment (ISA)
- (ii) External or End-Semester Assessment (ESA)

The internal to external assessment ratio shall be 1:4. There shall be a maximum of 80 marks for external evaluation and maximum of 20 marks for internal evaluation. Both internal and external marks are to be mathematically rounded to the nearest integer.

For all papers (theory & practical), grades are given on a 10-point scale based on the total percentage of marks. (ISA+ESA) as given below:-

Percentage of Marks	Grade	Grade point
95 and above	S Outstanding	10
85 to below 95	A ⁺ Excellent	9
75 to below 85	A Very Good	8
65 to below 75	B ⁺ Good	7
55 to below 65	B Above Average	6
45 to below 55	C Satisfactory	5
40 to below 45	D Pass	4
Below 40	F Failure	0
	Ab Absent	0

GRADING SYSTEM

Credit Point

Credit Point (CP) of a course is calculated using the formula

CP = C × GP, where C = Credit; GP = Grade point

Semester Grade Point Average

Semester Grade Point Average (SGPA) of a Semester is calculated using the formula

SGPA = TCP/TC, where TCP = Total Credit Point of that semester ie, $\sum_1^n CP_i$ and

TC = Total Credit of that semester ie, $\sum_1^n C_i$ where n is the number of papers in that semester

Cumulative Grade Point Average

Cumulative Grade Point Average (CGPA) of a programme is calculated using the formula

CGPA=TCP/TC, where **TCP = Total Credit Point of that programme ie, $\sum_1^n CPI$** and **TC= Total Credit of that programme ie, $\sum_1^n Ci$** where **n** is the number of papers in that programme.

Grade Point Average

Grade Point Average (GPA) of a Course (Common course I, Complementary Course I, Complementary Course II, Core Course, Vocational Course) is calculated using the formula

GPA = TCP/TC, where TCP = Total Credit Point of that course ie, $\sum_1^n CPI$ and **TC = Total Credit of that course ie, $\sum_1^n Ci$** where **n** is the number of papers in that course.

Grades

Grades for the different courses, semesters and overall programme are given based on the corresponding GPA as shown below:

GPA	Grade
9.5 and above	S Outstanding
8.5 to below 9.5	A⁺ Excellent
7.5 to below 8.5	A Very Good
6.5 to below 7.5	B⁺ Good
5.5 to below 6.5	B Above Average
4.5 to below 5.5	C Satisfactory
4.0 to below 4.5	D Pass
Below 4.0	F Failure
	Ab Absent

Note: A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 40% are required for a pass for a paper. For a pass in a programme, a separate minimum of **Grade D** is required for all the individual papers. If a candidate secures **F Grade** for any one of the paper offered in a Semester/Programme, **only F grade** will be awarded for that Semester/ Programme until he/she improves this to **D Grade** or above within the permitted period. (See Clause 3. iv)

MARKS DISTRIBUTION FOR EXTERNAL EXAMINATION AND INTERNAL EVALUATION

The external theory examination of all semesters shall be conducted by the University at the end of each semester. Internal evaluation is to be done by continuous assessment.

Marks distribution for external and internal assessments and the components for internal evaluation with their marks are shown below:

Theory Papers (All)

a) Marks of External Examination : 80

b) Marks of Internal Evaluation : 20

Components of Internal Evaluation of Theory Papers

All the three components of the internal assessment are mandatory.

SI No	Components of Theory Internal Evaluation	Marks
1	Attendance	5
2	Assignment/Seminar/Viva	5
3	Test paper/s (1 or 2) [1×10=10; 2×5=10]	10
	Total	20

Practical Papers (All)

a) Marks of External Examination : 80

b) Marks of Internal Evaluation : 20

Components of Internal Evaluation of Practical Papers

All the four components of the internal assessment are mandatory. Practical examinations are conducted only at the end of even semesters.

Components Internal evaluation of Practical	Marks
Attendance	5
Test paper	5
Record*	5
Lab involvement	5
Total	20

*Marks awarded for Record should be related to number of experiments recorded and duly signed by the concerned teacher in charge.

Project Evaluation

a) Marks of External Examination : 80

b) Marks of Internal Evaluation : 20

Components of External Evaluation of Project

SI No	Components of External Project Evaluation	Marks
1	Dissertation (External)	50
2	Viva-Voce (External)	30
	Total	80

Components Internal Evaluation of Project

All the four components of the internal assessment are mandatory.

SI No	Components of Internal Project Evaluation	Marks
1	Punctuality	5
2	Experimentation/ Data Collection	5
3	Knowledge	5
4	Report	5
	Total	20

Internal Evaluation of On-the-Job Industrial Training (OJT)

Marks of Internal Evaluation : 100

The students registered for B Sc Food Technology & Quality Assurance Programme are to undergo **two On-the Job Industrial Training (OJT)** in any of the companies (private or public) of food industry in fields such as food processing, food analysis, evaluation of food quality, food quality assurance and management.

The responsibility for evaluation of industrial training report is vested on Department Co-ordinator (Department of Food Technology/ Food Science) and the evaluation report should reach the University at the **end of third and fifth semester** respectively along with other internal, as per current rules and regulations of University. The marks assigned to various components are as follows.

All the three components of the internal assessment are mandatory.

Components of Internal Evaluation of Industrial Training Report	Marks
Punctuality	25
Compilation of Report	25
Content	50
Total	100

ATTENDANCE EVALUATION

Percentage of Attendance (%) For ALL Papers	Grade
90 and above	5
85 -89	4
80-84	3
76-79	2
75	1

Decimals are to be rounded to the next higher whole number.

ASSIGNMENTS

Assignments are to be done from 1st to 4th Semesters. At least one assignment should be done in each semester for all papers.

SEMINAR/VIVA

A student shall present a seminar in the 5th semester and appear for Viva-voce in the 6th semester.

INTERNAL ASSESSMENT TEST PAPERS

At least one internal test-paper is to be attended in each semester for each paper. The evaluations of all components are to be published and are to be acknowledged by the candidates. All documents of internal assessments are to be kept in the college for two years and shall be made available for verification by the University. The responsibility of evaluating the internal assessment is vested on the teacher(s), who teach the paper.

Grievance Redressal Mechanism

Internal assessment shall not be used as a tool for personal or other type of vengeance. A student has all rights to know, how the teacher arrived at the marks. In order to address the grievance of students a three-level Grievance Redressal mechanism is envisaged. A student can approach the upper level only if grievance is not addressed at the lower level.

Level 1:Dept. Level: The department cell chaired by the Head; and Dept. coordinator and teacher in-charge, as members.

Level 2: College level: A committee with the Principal as Chairman, Dept. Coordinator, HOD of concerned Department and a senior teacher nominated by the College council as members.

Level 3: University Level: A Committee constituted by the Vice-Chancellor as Chairman and Pro-Vice-Chancellor, Convener - Syndicate sub-committee on Students Discipline and Welfare, Chairman- Board of Examinations as members and the Controller of Examination as member-secretary.

The college council shall nominate a senior teacher as coordinator of internal evaluations. This coordinator shall make arrangements for giving awareness of the internal evaluation components to students immediately after commencement of I semester.

The internal evaluation report in the prescribed format should reach the University before the 4th week of October and March in every academic year.

EXTERNAL EXAMINATION

The external examination of all semesters shall be conducted by the University at the end of each semester.

Students having a minimum of 75% average attendance for all the courses only can register for the examination. Condonation of shortage of attendance to a maximum of 10 days or 50 hours in a semester subject to a maximum of 2 times during the whole period of the programme may be granted by the University on valid grounds. This condonation shall not be counted for internal assessment.

Benefit of attendance may be granted to students attending University/College union/Co-curricular activities by treating them as present for the days of absence, on production of participation/attendance certificates, within one week, from competent authorities and endorsed by the Head of the institution. This is limited to a maximum of 10 days per semester and this benefit shall be considered for internal assessment also.

Those students who are not eligible even with condonation of shortage of attendance shall repeat the course along with the next batch.

All students are to do a project. This project can be done individually or as a group of 3 students. The projects are to be identified during the II semester of the programme with the help of the supervising teacher. The report of the project in duplicate is to be submitted to the department at the sixth semester and are to be produced before the examiners appointed by the University.

There will be no supplementary exams. For reappearance/ improvement, the students can appear along with the next batch.

A student who registers his/her name for the external exam for a semester will be eligible for promotion to the next semester.

A student who has completed the entire curriculum requirement, but could not register for the Semester examination can register notionally, for getting eligibility for promotion to the next semester.

A candidate who has not secured minimum marks/credits in internal examinations can re-do the same registering along with the University examination for the same semester, subsequently.

All programmes and courses shall have unique alphanumeric code. Each teacher working in affiliated institutions shall have a unique identification number and this number is to be attached with the codes of the courses for which he/she can perform examination duty.

PATTERN OF QUESTIONS

Questions shall be set to assess knowledge acquired, standard application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge. The question setter shall ensure that questions covering all skills are set. He/She shall also submit a detailed scheme of evaluation along with the question paper.

A question paper shall be a judicious mix of very short answer type, short answer type, short essay type /problem solving type and long essay type questions.

Pattern of questions for external examination for theory paper

Pattern	Marks	Choice of questions	Total marks	Length of answers
Very Short Answer	2	9/12	18	50 words
Paragraph answer (Short answer)	4	6/9	24	150 words
Problem/ Short Essay	6	3/5	18	2 pages
Long Essay	10	2/4	20	4 pages
		20/30	80	

Each BOS shall specify the length of the answers in terms of number of words. Pattern of questions for external examination of practical papers will be decided by the concerned Board of Studies/Expert Committees.

MARK CUM GRADE CARD

The University under its seal shall issue to the students a MARK CUM GRADE CARD on completion of each semester, which shall contain the following information:

- a. Name of the University
- b. Name of the College
- c. Title & Model of the Undergraduate Programme
- d. Name of the Semester
- e. Name and Register Number of the student
- f. Date of publication of result
- g. Code, Title, Credits and Maximum Marks (Internal, External & Total) of each paper opted in the semester.
- h. Internal, External and Total Marks awarded, Grade, Grade point and Credit point in each paper opted in the semester
- i. Institutional average (IA) of the marks of all papers and University Average (UA) of the marks of all papers.
- j. The total credits, total marks (Maximum & Awarded) and total credit points in the semester
- k. Semester Grade Point Average (SGPA) and corresponding Grade.
- l. Cumulative Grade Point Average (CGPA), GPA corresponding to Common Courses I and II, Core Course, Complementary Courses, Vocational Courses and Generic Elective paper.
- m. The final Mark cum Grade Card issued at the end of the final semester shall contain the details of all papers taken during the final semester examination and shall include the final Grade/Marks(SGPA) scored by the candidate from **1st to 5th** semesters, and the overall Grade/Marks for the total programme.

MONITORING COMMITTEES FOR SCHEME

There shall be **3 level monitoring** committees for the successful conduct of the scheme. They are –

- 1. Department Level Monitoring Committee (DLMC)**, comprising HOD and two senior-most teachers as members.
- 2. College Level Monitoring Committee (CLMC)**, comprising Principal, College Council secretary and A.O/Superintendent as members.
- 3. University Level Monitoring Committee (ULMC)**, headed by the Vice-Chancellor, Pro-Vice-Chancellor, Conveners of Syndicate Standing Committee on Examination, Academic Affairs and Registrar as members and the Controller of Examinations as member-secretary.

TRANSITORY PROVISION

Notwithstanding anything contained in these regulations, the Vice-Chancellor shall, for a period of one year from the date of coming into force of these regulations, have the power to provide by order that these regulations shall be applied to any programme with such modifications as may be necessary.

The Vice Chancellor is authorized to make necessary criteria for eligibility for higher education in the grading scheme, if necessary, in consultation with other Universities. The Vice Chancellor is also authorized to issue orders for the perfect realization of the Regulations.

Restructured Syllabus 2016
I, II, III, IV, V & VI
Semesters

I Semester

FT1CRT01 - INTRODUCTION TO FOOD TECHNOLOGY

Credits - 3

72 h

OBJECTIVES

- ❖ To acquire an overall concept about food technology
- ❖ To enable students to apply scientific methods independently

12 h

Unit I

Introduction to food science

Food science concept- Basic SI unit of length, volume and weight, temperature, relative density, pH or potential hydrogen, Physico-chemical properties of food- boiling point, evaporation, melting point, smoke point, surface tension, osmosis, humidity, freezing point and specific gravity.

15 h

Unit II

Colloidal systems in foods

Constituents of food, true solution, suspension, stability of colloidal system, Type of colloidal system in food- sol, gel, emulsion, foam

Classification of food

Health food, ethnic food, organic food, functional food, nutraceuticals, fabricated foods, convenience foods, GM foods, space foods

Unit III

Food additive and adulteration

Food additives, antioxidants – natural and artificial, sequestrants, preservatives- Class I and II, nutrient supplement, emulsifiers, stabilizers and thickening agents, bleaching and maturing agent, sweeteners- nutritive and non nutritive, humectants and anti-caking agents, coloring- natural and artificial and flavoring substance – natural and synthetic flavoring agents and flavor enhancers.

Food adulteration: Types of adulterants- intentional and incidental adulterants, methods of detection

20 h

Unit IV

Sampling and sample preparation

Population and sample, Methods of sampling-simple random sampling, systematic sampling, stratified random sampling, Measures of central Tendency – arithmetic mean, geometric mean, harmonic mean, median, mode

Unit V

10 h

Food safety, quality and evaluation

Food safety and quality assurance- definition, Codex Alimentarius Commission, HACCP and ISO 22000 FSMS.

Evaluation of food- subjective and objective methods

Food standards - FSSAI

REFERENCES

- ❖ Blackburn, C. W. and McClure, P.J Food borne Pathogens Woodhead Publishing Limited Cambridge England 2005.
- ❖ Frederick, J.F. Encyclopedia of Food Science and Technology. Second edition vol 1-4, a Wiley Interscience publication, 2000
- ❖ Goldberg, I. Functional foods, designer foods, pharma foods and nutraceuticals. An Aspen publication, Gaithersburg, Maryland, 1999.
- ❖ Roday, S., Food science and nutrition. Third edition, Oxford University Press, New Delhi, 2008.
- ❖ Joseph, K.X. Statistics third edition, Calicut University, Central co-operative stores Ltd. 2004.
- ❖ Khader, V. Text book of Food science and Technology. Published by India Council of Agricultural Research, New Delhi 110012, 2001
- ❖ Kothari, C.R, Research Methodology- Methods and Techniques, 2nd edition, New age International (P) Ltd publishers, New Delhi. 2000
- ❖ Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
- ❖ Srilakshmi, B. Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.
- ❖ Reddy Y.S, Newer concept and applications for food industry. Gene Tech Books, New Delhi 110002, 2006

FT1CRT02 - BIOCHEMISTRY

Credits 4

Objectives

72 h

- ❖ To understand the basic and applied aspects of biochemistry
- ❖ Enable the students to understand the biochemical pathways and how they are relevant to their lives

Unit I

15 h

Carbohydrates

Classification, monosaccharides, oligosaccharides, polysaccharides, structure and configuration of aldose, ketoses, triose, tetrose, pentose, hexose, Polysaccharides- Homo-starch, inulin, glycogen, cellulose, Heteropolysaccharides

Unit II

15 h

Lipids

Classification of lipids, fatty acids, essential fatty acids, triglycerols, phospholipids, glycolipids, lipoprotein, sterols, amphipathic lipids, fatty acid oxidation (β -oxidation), Functions, sources and requirements.

Unit III

10 h

Amino acids and Proteins

Amino acid, classification, properties, essential amino acid, structure of proteins- primary, secondary, tertiary, quaternary structure of proteins; protein denaturation.

Unit IV

22 h

Enzymes and Vitamins

Enzymes: Nomenclature and classification, kinetics of enzymic reactions, types of enzymes, enzyme inhibition, reversible inhibition, irreversible inhibition, conditions affecting enzymatic reactions, co-enzymes.

Vitamins: classification, functions, requirement and deficiency conditions, vitamin A, D, E, K, Ascorbic acid, Thiamine, Riboflavin, Niacin, Pyridoxine, Folic acid, Pantothenic acid, cyanocobalamine

10 h

Unit V

Metabolism of Carbohydrates and Proteins

Glycolysis and Tricarboxylic acid (TCA) cycle, HMP shunt, Gluconeogenesis
Transamination, deamination, urea cycle.

REFERENCES

- ❖ Berg, J. M., Tymoczko, J. L, Biochemistry, Sixth edition, W H Freeman and Company, New York, 2007
- ❖ Das, D. Biochemistry, Seventh Edition, Academic publishers, Calcutta, 1992
- ❖ Jain, J. L., Fundamentals of Biochemistry, Fifth Edition, S. Chand and Company Ltd, 2001
- ❖ Satyanarayana, U. and Chakrapani, U. Biochemistry, Third edition, Books and Allied Pvt Ltd, Kolkata, 2006

FT1CRT03- FOOD PROCESSING TECHNOLOGY

Credits 4

72 h

Objectives

- ❖ A logical basic sequence of steps to produce an acceptable and quality food product from raw materials.
- ❖ Study of scientific and technological advancements in food processing.

Unit I

12 h

Fundamentals of Food Manufacturing

Raw materials handling, cleaning, separating, disintegrating and forming.

Processing and preservation techniques: heat application- heat exchangers for liquid foods, tanks or kettles for liquid foods, pressure cooker or retorts for packaged foods, tunnel ovens; heat removal or cold preservation- chilling and refrigeration process, freezing and frozen storage; water removal- evaporation and drying.

Unit II

16 h

Processing of Coconuts and coconut Products

Coconut Processing, Introduction; Copra manufacture, grades of copra; Methods of Manufacture- traditional sun drying, smoke drying, hot air modern dryers; coconut oil extraction.

Products: coconut milk cream manufacture, Desiccated coconut, spray dried coconut milk powder, packed tender coconut water, vinegar from coconut, Toddy fermentation, Neera and other products from coconut.

Unit III

16 h

Spices and Oleoresins

Indian Spices: Introduction; General function of spices; Different types of spices- Ginger, Garlic, Cardamom, Pepper, Cinnamon, Clove, Chilies, Coriander, and Turmeric; Processing of cardamom and pepper.

Spice oil and oleoresins: Introduction, Technology of manufacturing oleoresins and spice oils, application of spice oils and oleoresins in food industry

Unit IV

16 h

Ethnic Foods and Its Processing

Processing of Ethnic Foods: Banana products- banana puree, banana chips, banana powder, Banana figs, banana flour; Tapioca products- Tapioca chips, tapioca powder; Fermented Products- Dosa, Idli, Appam

Processing of Modern Foods: Pasta, Noodles, Mayonnaise, Salad Dressing, Margarine, Potato chips, Corn flakes, Pop corn.

Novel Technologies of Food Processing

Micro wave and radio frequency processing, ohmic and inductive heating, high pressure processing, pulsed electric fields, pulse light technology, high voltage arc discharge, oscillating magnetic fields, ultra sound, ultra violet light, Pulsed X- rays

REFERENCES

- ❖ Brian E. Grimwood, Coconut Palm Products: Their Processing in Developing Countries, 1979.
- ❖ Hui, Y H and Associate Editors; Hand Book of Food Products Manufacturing Vol I, Wiley-Interscience, New Jersey 2007.
- ❖ Hui, Y H and Associate Editors; Hand Book of Food Products Manufacturing Vol II, wiley- Interscience, New Jersey 2007.
- ❖ Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
- ❖ Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
- ❖ Srilakshmi, B. Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.

II Semester

FT2CRT04- FOOD ENGINEERING

Credits 4

72 h

Objectives

- ❖ Students will know the basic concepts of thermodynamics, heat and mass transfer.
- ❖ Students will be able to apply material balances and energy balances to the field of food engineering.
- ❖ Students will be able to understand equipment used in the food industry.

Unit I

10 h

Engineering Units

Dimensions – Primary, secondary

Engineering units- Base units, derived and supplementary units.

System – state of system, extensive properties and intensive properties. Phase diagram of water

Unit II

20 h

Heat Transfer in Food Processing

Systems for heating and cooling food products, plate heat exchanger, tubular heat exchanger, scraped surface heat exchanger, steam infusion and steam injection heat exchanger

Thermal properties of foods- specific heat, thermal conductivity and thermal diffusivity

Modes of heat transfer (conductive, convective and radiative heat transfer), steady state heat transfer and role of insulation in reducing heat loss from process equipment.

Unit III

15 h

Fluid Flow in Food Processing

Types of pumps, Properties of Liquids- Density and viscosity, the Continuity Equation, Reynolds number and Flow measurement – Pitot tube, orifice meter and venture meter.

Unit IV

15 h

Mechanical Separation

Different types of equipments used for Mixing, clarification and evaporation.

Membrane separation techniques – reverse osmosis, ultra filtration, microfiltration

Concentration – freeze concentration. Sedimentation, Filtration and Distillation

Unit V

12 h

Food Dehydration and Freezing systems

Freezing – freezing curve, changes during freezing and types of freezers

Drying – drying curve, changes during drying and types of driers – kiln, cabinet, drum, spray, fluidized bed dryer

REFERENCES

- ❖ Dincer, I. Heat Transfer Food Cooling Applications. Taylor and Francis Publishers, USA. 1997.
- ❖ Heldman, D. R. and Lund, D.B. Handbook of Food Engineering 2nd edition. CRC press, Newyork. 2007.
- ❖ Singh, R.P. Introduction to Food Engineering 3rd edition. Academic Press, London. 2004.

FT2CRT05- FOOD MICROBIOLOGY

Credits 3

72 h

Objectives

- ❖ To acquire an elementary knowledge about the aspects of interaction between micro-organisms, food borne illness and food fermentation

Unit I

15 h

Introduction to Microbiology

History of Microbiology, Characteristics and morphology of bacteria, fungi, protozoa & virus. Control of micro-organisms- Growth curve; Influence of environmental factors on growth- pH, Water activity, O₂ availability, Temperature, Pressure and Radiation

Unit II

15 h

Cultures and Media

Different type of media- Selective media and differential media; Preparation of media- PDA media, Nutrient agar, Mac Conkey agar; Culturing techniques- Spread plate and streak plate, pour plate. Indicator microorganisms: Sources, methods of detection, growth & survival; significance of coliforms, faecal streptococci, Enterobacteriaceae

Unit III

15 h

Contamination and Spoilage of Foods

Cereals, sugar and their products, Milk & milk products, Fruits and vegetables, canned foods, Meat, fish, egg and poultry

Unit IV

12 h

Food Borne Diseases

Food intoxication- Staphylococcal intoxication, botulism, *Bacillus cereus* gastroenteritis Food infection- *Salmonellosis*, *Clostridium perfringens*, *Shigella dysenteriae*, *Listeria monocytogenes* *E. coli* infection and others

Unit V

15 h

Food fermentation

Dairy based fermented foods, - Kefir, yoghurt, cheese and butter; lactic acid bacteria fermented food- sauerkraut and pickles, Yeast based fermented foods- bread, wine and beer; vinegar, Oriental food fermentation- tempeh, soya sauce production SCP- Microorganisms, growth and production, nutritive value and use of SCP;

REFERENCES

- ❖ Frazier, W.C. Food Microbiology. 4th edition. Mc Graw Hill. New York, 2008
- ❖ Khetarpaul, N. Food microbiology, Daya publishing house, New Delhi, 2009
- ❖ Narayanan, L.M. and Mani, L. Microbiology. Saras Publications, Nagercoil.
- ❖ Pelzar, H.J. and Rober, D. Microbiology 5th edition Mc Graw Hill. New York, 2009
- ❖ Prescott, L.M., Harley, J.P. and Klein, D.A. Microbiology. 4th edition McGraw-Hill, New York. 1999

FT2CRT06- FOOD MICROBIOLOGY PRACTICALS

Credits 2

72 h

Objectives

- ❖ To study the basic rules and requirements of a microbiology laboratory.
- ❖ Give emphasis towards the preparation of biological stains, reagents, media and their composition.
- ❖ To get thorough different methods for staining of microorganisms.

- 1. Microbiology laboratory basic rules and requirements: 12 h**

Laboratory rules- basic rules of a microbiology lab
Basic requirements of a microbiological lab- common glass ware; test tube, culture tube and screw capped tubes, Petri dish, pipette, Pasteur pipette, glass spreader, inoculation needle, Bunsen burner, water bath, autoclave, laminar air flow, incubator, hot air oven, Quebec colony counter, centrifuge, microscope.
Disposal of laboratory waste and culture.
- 2. Staining of microorganisms 16 h**

Methods for detection of specific bacteria:
Wet mount preparation for motile bacteria by hanging drop mount method,
Petri dish culture method for detection bacteria.
Methods for staining of micro organism:
Simple staining (Monochrome staining)
Gram staining for differentiation of bacteria
Negative staining of bacteria
Endospore staining
- 3. Composition, preparation and sterilization of media: 14 h**

PDA media
Nutrient agar media
Mac-Conkey agar media
- 4. Demonstration of techniques for pure culture of microorganisms: 14 h**

Streak plate method
Pour plate method
Serial dilution agar plate method
- 5. Microbiology of Milk: 14 h**
 - Standard plate count method,
 - Methylene blue reduction test (MBRT)

REFERENCES

- ❖ Dubey, R.C. and Maheshwari, D.K. Practical microbiology. S.Chand and Company Limited, Ramnagar. New Delhi 2002.

III Semester

FT3CRT07- DAIRY TECHNOLOGY

Credits 4

90 h

Objectives

To enable the students

- ❖ To know the importance of milk as an agricultural commodity
- ❖ To be innovative in exploring various traditional and non traditional milk products

Unit I

18 h

Introduction

Definition, different sources of milk and their composition, factors affecting composition of milk. Physico-chemical properties of milk constituents. Microbiology of milk, Collection and transportation of milk. Grading of milk, flavor defects, causes and prevention.

Special Milk Products:

Pasteurized milk, Sterilized milk, Homogenized milk, Flavored milk, frozen concentrated milk, Fermented milk, Reconstituted milk, Recombined milk, Toned milk, double toned milk, Vitaminised/ Irradiated milk.

Unit II

18 h

Butter and cream

Cream: definition, classification, composition, manufacture of cream, packaging & storage. Uses of cream and its defects.

Butter: definition, classification, composition and nutritive value, method of manufacture, packaging & storage. Uses of butter and its defects

Unit III

18 h

Cheese and Ice cream

Cheese: Introduction, definition, classification, composition and nutritive value, Manufacture of cheddar cheese and cottage cheese, defects in cheese, their causes and prevention, uses of cheese.

Ice-cream: Definition, composition and nutritive value, role of constituents, method of manufacture & storage. Uses of ice-cream, defects in ice-cream

Unit IV

18 h

Condensed and Evaporated Milk

Condensed milk: Introduction, definition, classification, composition, nutritive value, method of manufacture.

Evaporated milk: Introduction, definition, classification, composition, nutritive value, method of manufacture.

Defects and uses of condensed and evaporated milk

Unit V

18 h

Indigenous Dairy Products

- Fat rich products : Ghee, Makkan and Malai
- Concentrated Products : Khoa , Rabri and Basundi
- Coagulated Products : Chhana and Paneer
- Fermented Products : Dahi , Chakka, Shrikhand and Lassi
- Frozen Products : Kulfi and Kulfa

REFERENCES

- ❖ Godbole, N.N; Milk – The Most Perfect Food ; Biotechnology books, 2007
- ❖ Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
- ❖ Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
- ❖ Spreer E and Mixa, A; Milk and Dairy Product Technology; Marcel Dekker, 2005
- ❖ Srilakshmi, B. Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.
- ❖ Sukumar De; Outlines of dairy technology; Oxford University Press; 2001
Walstra A, Geurts T.J and Noomen, A; Dairy Technology – Principles of milk and Properties and Processes; Marcel Dekker, 2005

FT3CRT08- FOOD ANALYTICAL INSTRUMENTATION

Credits 4

90 h

Objectives

- ❖ To know the principles and applications of different techniques used in food and nutrition research
- ❖ To gain knowledge about different instruments used in food analysis.
- ❖ To understand different aspects of sensory science and its application

Unit I

18 h

Chromatography

Introduction, principles of chromatography; Techniques and working principle and application in food industries of- Paper chromatography, GC, GLC, HPLC, TLC

Unit II

18 h

Spectroscopy

Principles of spectroscopy, properties; Techniques and working of-Infrared spectroscopy, UV spectrophotometer, Atomic absorption, Atomic emission, Fluorimetry and NMR

Unit III

18 h

Radiotracer Techniques

Radiotracer techniques: Introduction, Nature of radioactivity, units, radioactive counters, solid, gas and liquid scintillation.

Unit IV

18 h

Electrophoresis:

Definition, types of electrophoresis methods, free solution electrophoresis, paper or gel electrophoresis, SDS-PAGE. Agarose gel electrophoresis

Unit V

18 h

Centrifugation

Centrifugation- principle, relative centrifugal force, types of centrifuges, rotor heads and modes of centrifugation

REFERENCES

- ❖ Jellinek, G., Sensory Evaluation of Food-Theory and Practice., Elis Horwood Ltd., England, 1985.
- ❖ Lawless H.T, Sensory Evaluation of Food, Food Science Text series, Springer Science, 2010
- ❖ Mahindru, S.N. Food additives. Characteristics, detection and estimation. Tata McGraw-Hill Publishing Company Limited, New Delhi. 2000
- ❖ Nielsen, S.S. Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London. 2004.
- ❖ Pearson, D. The Chemical Analysis of Foods, Churchill Livingstone, New York, 2002.
- ❖ Sharma, B.K. Instrumental Methods of Chemical Analysis. Goel Publishing House, New Delhi. 2004.
- ❖ Srilakshmi, B., Food Science., New Age International (P) Limited., New Delhi, 2005

FT3CRT09- FOOD PACKAGING TECHNOLOGY

Credits 3

90 h

Objectives

- ❖ To enable students
- ❖ To be familiar with different methods and materials used for packaging.
- ❖ To understand the technology behind packaging.
- ❖ To understand interaction of food with packaging.

Unit I

15 h

Introduction to food packaging

Definition, functions and requirements for effective packaging, packaging criteria

Classification of packaging

Primary, secondary and tertiary packaging.

Flexible, rigid and Semi- rigid packaging.

Unit II

20 h

Materials for food packaging – types, various uses, merits & drawbacks.

Paper, Glass, Tin, Aluminium: TFS, Polymer coated tin free steel cans, cellophane, plastics-LDPE, HDPE, LLDPE, HMHDPE, Polypropylene, polystyrene, polyamide, polyester, polyvinyl chloride

Unit III

15 h

Different forms of food containers

Boxes, jars, cans, bottle. Packaging requirements for various products- fish, meat, spices, vegetables & fruits, canned foods, dehydrated foods

Unit IV

15 h

Modern concepts of packaging technology.

Aseptic packaging, Form-Fill-Seal packaging, Edible Films, Retort pouch packaging, Easy-Open-End, Boil-In-Bags, Closures, tetra-pack, vacuum-packaging, MAP & CAP, Hyper baric storage, insect resistant packaging, intelligent packaging

Unit V

25 h

Food packaging Laws & Specifications

Food packaging Laws & Specifications

Quality testing of packaging materials

- ❖ Paper & paper boards-thickness, bursting strength, grammage, puncture resistance, Cobbs test, tearing resistance
- ❖ Flexible packaging materials (plastics)-yield, density, tensile strength, elongation, impact resistance, WVTR, GTR, Overall Migration Rate, seal strength.

- ❖ Transportation hazards and testing
- ❖ Oxygen interactions, moisture interchanges and aroma permeability.

REFERENCES

- ❖ Cruess, W.V. Commercial Fruit & Vegetable Products. Allied Scientific Publishers, New Delhi. 2003
- ❖ Davis, E.G. Evaluation of tin & plastic containers for foods. CBS Publishers, New Delhi. 2004
- ❖ Gopal T.K.S. Seafood packaging, CIFT, Matsyapuri Cochin,2007
- ❖ Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
- ❖ Sacharow, S., Griffin, R.C. Food Packaging. AVI Publishing Company, West Port, Connecticut. 2000
- ❖ Srilakshmi, B. Food Science. New Age International Publishers, New Delhi, 2003

**FT30JP10-
INDUSTRIAL
TRAINING – I**

IV Semester

FT4CRT11- PRINCIPLES OF FOOD SPOILAGE AND PRESERVATION

Credits 4

72 h

Objectives

- ❖ The main objective of this is to study the different mode of spoilage in foods and minimize the contamination by different preservation technology.

Unit I

12 h

Introduction

Food as a substrate for microorganisms- Hydrogen ion concentration, concept of water activity, oxidation-reduction potential, nutrient content;

Basic principles of food preservation, importance of preservation

Unit II

15 h

Food Spoilage

Definition; Classification of foods according to the ease of spoilage; Types of spoilage- microbial spoilage, enzymatic spoilage, mechanical damage, spoilage by insects, parasites and rodents;

Characteristics and storage conditions of foods- carbohydrate fermenting microorganisms, proteolytic and lipolytic microorganism, acidity, moisture, temperature, humidity, oxygen, light and duration

Unit III

15 h

Spoilage of Different Category of foods

Spoilage of meat- vacuum packed meats, fresh liver, ham and bacon

Spoilage of poultry; Spoilage of fish and shell fish;

Spoilage of Miscellaneous foods- Eggs, cereals, bakery products and dairy products

15 h

Unit IV

Methods Of Food Preservation

Preservation by using high temperature- Pasteurization, sterilization, canning;

Preservation by low temperature- Cellar storage, refrigeration or chilling;

Preservation by very low temperature- freezing, type of freezing- slow freezing, quick freezing, IQF, cryogenic freezing.

Preservation by removal of moisture- Drying and concentration

Unit V

15 h

Irradiation and Hurdle Technology

Preservation by using ionizing radiation- sources, unit, merits and demerits, application of irradiation in food industry, photo electric effect of radiation, Hurdle technology

REFERENCES

- ❖ Cruess, W.V. Commercial fruits and vegetable products, Anees Offset press, New Delhi, 1997
- ❖ Frazier, W.C. Food Microbiology. 4th edition. Mc Graw Hill. New York, 2008
- ❖ Khetarpaul, N. Food microbiology, Daya publishing house, New Delhi, 2009
- ❖ McWilliams, M and Paine, H. Modern Food preservation. Surjeet Publications, Delhi, 1984.
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- ❖ Srivastava, R.PO and Kumar, S. Fruit and vegetable preservation, International Book distribution Company, Lucknow, 1994.
- ❖ Srilakshmi, B. Food Science. New Age International Publishers, New Delhi, 2003.
- ❖ Subalakshmi, G and Udipi, S.A. Food processing and preservation. New Age International Publishers, New Delhi, 2001.

FT4CRT12- FOOD CHEMISTRY

Credits 4

90 h

Objectives

- ❖ Know the structure and chemical characteristics of constituents of food
- ❖ To study the composition and properties of foods and its chemical changes during handling, processing and storage

Unit I

15 h

Introduction

Physical properties of water, structure of water, water solute interactions – Macroscopic and molecular level, water activity – definition and measurement, and moisture sorption isotherms.

Unit II

15 h

Carbohydrates

Monosaccharides- isomerization, ring forms and reactions. Oligosaccharides – maltose, lactose and sucrose.

Polysaccharides: starch – structure, granule gelatinization and pasting, retrogradation and staling, hydrolysis of starch, modified food starch and dextrinisation; cellulose- modified forms.

Unit III

20 h

Proteins

Classification, Protein structure – primary, secondary, tertiary and quaternary; protein denaturation and denaturing agents; functional properties of proteins, Nutritional properties of proteins and changes of proteins during processing

Unit IV

20 h

Chemistry of Oils and Fats

Classification, Chemical aspects of lipids- lipolysis, flavor reversion and auto-oxidation and methods of measuring lipid oxidation.

Chemistry of frying – behavior of frying oil, behavior of food during frying & chemical and physical changes during frying.

Chemistry of fat and oil processing – rendering, refining, Hydrogenation, interesterification and winterization

20 h

Unit V

Enzymes

Enzyme nomenclature, Role of endogenous enzymes in food quality, immobilized enzymes, specificity of enzymes and Browning reaction in foods-Enzymatic and non-enzymatic browning reaction in foods.

REFERENCES

- ❖ Campbell, M K and Farrell, S O-Biochemistry 5th edition-international student, 2006
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- ❖ Fennema, O R. -Food Chemistry 3rd edition, Marcel Dekker Inc, New York., 1996.
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- ❖ Meyer, L H-Food Chemistry. CBS publishers & distributors, New Delhi. 2002
- ❖ Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
- ❖ Srilakshmi, B. Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.

FT4CRT13- FOOD CHEMISTRY PRACTICALS

Credits 3

108 h

Objectives

- ❖ To test the presence of carbohydrates and proteins in food samples
- ❖ To estimate the nutrients in different food samples
- ❖ To standardize the solution

Qualitative Test

20 h

- Qualitative tests for carbohydrates
- Qualitative tests for proteins.

Standardization of Solutions

20 h

Standardization of Fehling's solution.
Standardization of Sodium hydroxide with standard oxalic acid.

Estimation of Sugar Solutions

20 h

- Estimation of Glucose by Lane and Eynon's method.
- Estimation of Sucrose by Lane and Eynon's method.
- Estimation of Aldose by Willstalter's Iodometric titration.

Estimation of Protein

20 h

- Biuret method
- Lowry's method

Estimation of Starch

14 h

Estimation of crude fibre by Weende's method.

14 h

REFERENCES

- ❖ Nielsen, S.S. Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London. 2003
- ❖ Sadasivam, S. Manickam, A. Biochemical Methods, 2nd edition. New Age International (P) Limited, New Delhi. 2001

V Semester

FT5CRT14-TECHNOLOGY OF BEVERAGES & CONFECTIONERIES

Credits 4

90 h

Objectives

To enable the students

- ❖ To get an up to date knowledge about fermented foods and beverages
- ❖ To be creative in exploring new shapes, aromas and flavors and the science behind the confectionary making.

Unit I

20 h

Alcoholic Beverages

Beer Making and Types of Beer: ale, lager, pilsner, stout and porter beer.

Wine making and Types of wine: white wine, red wine, dry wine, sweet wine and sparkling wine.

Whisky manufacture and types of whisky: Scotch whisky, malt whisky, Irish whisky and Canadian whisky. Manufacture of rum, vodka, brandy and gin.

Unit II

15 h

Carbonated Beverages

Carbonated soft drinks: Ingredients and preservatives used in carbonation. Syrup room operation and equipments involved and Types of packaging materials used

Unit III

10 h

Mineral Water

Water source and deionization of mineral water. Water treatment process: Filtration, Adsorption, ion exchange, Chemical oxidation and Biological process. Microbiology of bottled water

Unit IV

20 h

Tea and Coffee

Steps involved in processing of tea and coffee. Types of tea: Black tea, Green tea and Oolong tea.

Types of coffee: Vacuum coffee, drip coffee, percolator coffee, steeped coffee, espresso coffee, iced coffee and Instant coffee. Decaffeination of coffee and types of decaffeination: Roselius process, Swiss water process, direct and indirect method, triglyceride method, carbon dioxide method

Unit V**Confectionery Science**

Introduction, Classification of confections: rock candy, hard candy, fondants and creams, marshmallows, caramel and fudge. Chocolate: steps involved in making of chocolate and production of cocoa powder and cocoa butter. Types: milk chocolate, sweet chocolate, white chocolate and wafer coated chocolate. Defects in chocolate: Fat bloom.

Indian confectionery: Khoa, Peda, Gulab Jamun, Rasogolla, Rasa malai. Colors and flavors used in confectionery, reactions of sugars in confectionery making: caramelisation, hydrolysis and crystallization.

REFERENCES

- ❖ Bernard W Minifie, Chocolate, cocoa and confectionary : Science and Technology., Aspen publications., 1999
- ❖ Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
- ❖ Nicholas Dege. Technology of Bottled water. Blackwell publishing Ltd, UK.,2011
- ❖ Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
- ❖ Srilakshmi, B. Food Science. New Age International Publishers, New Delhi, 2003
- ❖ Varnam A. H and Sutherland P.J., Beverages: Technology, Chemistry and Microbiology, Aspen Publications, 1999.

FT5CRT15- TECHNOLOGY OF FRUITS AND VEGETABLES

Credits 4

90 h

Objectives:

- ❖ To provide a knowledge on the pre- and post-harvest technology of fresh fruits and vegetables
- ❖ To introduce the emerging trends in minimal processing of fruits and vegetables.

Unit I

18 h

Introduction

Nutritive value and Pigments. Antinutritional and toxic factors, health benefits of fruits and vegetables. Stability of nutrients – chemical changes, flavor changes, changes in nutritive value (Physical and biological changes). Post-harvest losses in fruits and vegetables, Control of post-harvest losses. Freezing injury, chilling injury and heat injury

Unit II

18 h

Maturity, ripening and harvesting of fruits and vegetables

Ripening – Changes during ripening, Classification of fruits – climacteric and non climacteric fruits. Maturity indices and its importance, determination of harvest maturity indices – Computational methods, physical methods, chemical methods and physiological methods. Harvesting of fruits and vegetable- manual and mechanical methods and mode of transportation

Unit III

18 h

Packing house operations and storage

Post harvest operations– reception, drenching, washing, cleaning, pre-cooling, trimming, presorting, sorting/ grading, waxing, physical treatments, chemical treatments, packaging and labeling.

Storage-factors affecting storage, methods of storage – Traditional storage (on site storage, pit storage, high altitude storage, clamp storage, under-ground storage and evaporative cool storage) and improved storage methods (MAP, CAP, active packaging, vacuum packaging and hypobaric storage)

Unit IV

18 h

Processing of fruits and vegetables

Peeling, slicing/ dicing, blanching and nutritional quality of blanched food. Canning of fruits and vegetables

18 h

Unit V

Processed Products from fruits and vegetables

Jam, jelly and marmalade – definition, standards and processing.

Tomato products – juice, ketchup, sauce – definition, standards and processing

Candied fruits, glazed and crystallized fruits – definition, standards and processing

Fruit juice, squash, crushes and cordials - definition, standards and processing

Pickles - definition, standards and processing

REFERENCE

- ❖ Post Harvest Technology of Horticultural Crops; K. P. Sudheer, V. Indira; Series – 7; New India Publishing Agency; 2007.
- ❖ David Arthey; Fruit Processing; Second edition, 2001; Springer publishers.
- ❖ Girdhari Lal; Siddappa G, S. Tandon G.L;1999; Preservation of fruits and vegetables ICAR ,New Delhi
- ❖ Achaya KT; 1986, Every day indian processed foods; National Book Trust India
- ❖ Desrosier N W; 1999; Technology of food preservation, the AVI Publishing Co, west fort.

FT5CRT16- CEREAL CHEMISTRY

Credits 4

108 h

Objectives

- ❖ To give a general outline about the principles, structure and composition, economic importance and storage of different cereals and their products.

Unit I

20 h

Rice Chemistry and Technology

Cereal grain structure, composition of rice, Processing of cereals- Milling of rice, parboiling– Avorio process, conversion process, Malek process and Fernandez process and its advantages, by-products of cereals – starch, gluten, dextrose, dextrin, bran, broken grains, parched rice, puffed rice, flaked rice, popped rice, hulls, rice pollards, bran oil, germ and germ oil, husk, straw.

Unit II

20 h

Wheat Chemistry and Technology

Classification of wheat, structure and composition of wheat, Harvesting and storage: Harvesting the grain, cleaning the grain and storage, wheat milling, wheat products: whole wheat flour, maida, semolina, macaroni products and its method of preparation: macaroni, spaghetti and vermicelli

Unit III

20 h

Corn Chemistry and Technology

Origin, types of corn, structure and composition of corn, nutritive value, processing of corn: dry milling, wet milling and alkali processing, products of corn: degerminated flour, corn germ oil, pop corn, corn starch.

Unit IV

20 h

Breakfast cereals

Breakfast cereals: Definition, Nutritive value of breakfast cereals, classification of breakfast cereals: uncooked breakfast cereals and ready to eat cereals: processing of ready –to-eat cereals (Batch cooking, continuous cooking and extrusion cookers) and products (flaked cereals, puffed cereals, shredded products, granular products)

28 h

Unit V

Fermented and unfermented products

Fermented products: Biscuits and Bread

Ingredients and its role in making bread and Method of preparation of bread (straight dough and sponge dough method) and biscuits. Defects of bread and biscuits

Unfermented Products: Cakes and role of ingredients in cake making and method of manufacture and its defects.

REFERENCES

- ❖ David Dendy A.V, etal; Cereals and Cereal Products: Technology and Chemistry, - 2000
- ❖ Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
- ❖ Potter, N.N. and Hotchkiss J. H. Food Science. CBS publishers and distributors. 1996.
- ❖ Srilakshmi, B. Food Science. New Age International Publishers, New Delhi, 2003.
- ❖ Subalakshmi, G and Udipi, S.A. Food processing and preservation. New Age International Publishers, New Delhi, 2001.

FT5CRT17-SENSORY EVALUATION OF FOOD

Credits 3

90 h

OBJECTIVES

- ❖ To enlighten the students on the fundamental aspects of sensory science
- ❖ To provide an updated knowledge on sensory measurements and various sensory factors affecting subjective evaluation

Unit I

18 h

Introduction

Subjective evaluation, Sensory evaluation: Definition, and applications, Sensory attributes of food: Appearance, Texture and Flavor;

Difference between objective and subjective evaluation

Sensory perception of food flavor: mechanism of taste, smell, retronasal smell, somesthesia, kinesthesia, chemesthesia- pepper heat, carbonation, metallic taste etc

Multimodal perception.

Unit II

18 h

Sensory evaluation requirements

Requirements of sensory evaluation: Sensory laboratory design, Sensory booths, Sensory panels- Types of panels, Requirements, Recruitment Criteria & Selection, Training. Sample preparation and serving procedures such as sample size, sample serving temperature, palate cleansers, swallowing and expectoration, Score card, Sensory scaling- Line scales, Numeric scales, Hedonic scales;

Unit III

18 h

Sensory measurement

Kinds of sensory tests- Difference:- Triangle, Duo-trio tests, Paired comparison test, Descriptive tests:- Texture profile, Flavor profile, Affective tests:- Preference test, Ranking, Hedonic tests.

Factors affecting sensory measurements: Psychological- Expectation error, Mutual suggestion effect, Distraction error etc; Physiological: Adaptation, Mixture interactions-Enhancement, Synergy & Suppression, Health& Environmental factors

18 h

Unit IV

Food texture

Definition, Kinds of Texture: Visual texture, Auditory texture- crunchiness, crumbliness, Oral tactile texture- Size and shape, Mouth feel, Phase changes, Oral crispiness, crumbliness and crunchiness, Hand tactile feel, Texture measurement- Texture Profile

Unit V

18 h

Food appearance

Normal human color vision mechanism and color blindness, Measurement of Appearance & Color attributes, Appearance attributes such as turbidity, glossiness, translucency; Visual Color Measurement. Instrumental Color Measurement: Munsell Color Solids, Tricolorimetry, Standard observer.

REFERENCE

1. Harry T Lawless, Hildegard Heymann (2010) Sensory evaluation of Food: Principles and Practices, Second Edition, Springer, New York.
2. Sarah Kemp, Tracey Hollywood, Joanne Hort (2011) Sensory evaluation: A Practical Handbook, Wiley-Blackwell, New York
3. Nielsen, S.S, 2004 Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London.
4. Srilakshmi, B., 2005, Food Science., New Age International (P) Limited., New Delhi

GENERIC ELECTIVES

FT5GET18- BASIC NUTRITION

Credits 3

72 h

Objectives

- ❖ To enable the students to understand the general principles of nutrition as well as the practical aspects involved in nutritional planning and management.

Unit I

12 h

Introduction to Nutrition

Definition, optimum nutrition, nutritional status, good nutritional status, poor nutritional status, malnutrition, under nutrition, signs of good nutritional status, signs of poor nutritional status, definition and functions of nutrients

Unit II

12 h

Food and Our Body

Food and its functions, digestion, absorption and metabolism of food
Buccal digestion, gastric digestion and intestinal digestion, factors that affect digestion, absorption and metabolism, Five food groups.

Unit III

14 h

Energy Metabolism and Carbohydrates

Introduction, unit of measurement, energy value of food- calorimetry or bi proximate composition; energy needs of the body- reference man and reference woman; basal metabolic rate, factors affecting the BMR

Carbohydrates

Introduction, classification of carbohydrates, digestion, absorption and metabolism, functions, deficiency, recommended dietary intake and sources.
Role of dietary fibre in prevention and treatment of diseases

Unit IV

14 h

Lipids and Proteins

Lipids

Introduction , classification of lipids, saturated and unsaturated fatty acid, functions of fat, digestion, absorption and metabolism of fat, deficiency, food sources and RDA

Proteins

Introduction, classifications of proteins, nutritional classification of amino acids protein quality - biological value, net protein utilization, protein efficiency ratio.
Function, deficiency, sources and requirements.

20 h

Unit V

Vitamins, Minerals and Water

Vitamins: Classification- fat soluble and water soluble vitamins;

Fat soluble vitamins, A, D, E and K - introduction, function, deficiency, sources, RDA

Water soluble vitamins- B complex and C-introduction, functions, deficiency, sources, RDA

Minerals: major or macro minerals- General functions of minerals, deficiency, sources and RDA

Major minerals- calcium, phosphorus, sodium, potassium, iron

Minor minerals- iron and manganese

Trace elements – iodine, fluorine, zinc

Water: Introduction, functions, water, daily intake of water, daily loss of water, body water, water balance, deficiency of water, retention of water, daily requirements, fat.

REFERENCES

- ❖ Begum, R. A text book of Foods, Nutrition and Dietetics. Second revised edition, Sterling Publishers (P) Ltd, New Delhi, 1991.
- ❖ Joshi, S. A Nutrition and dietetics. Third edition, Tata McGraw Hill education pvt ltd, New Delhi, 2010
- ❖ Mudambi, S. R., Rajagopal M. V., Fundamentals of food and Nutritions, 2nd edition, Wiley Eastern Ltd, New Delhi 1990.
- ❖ Roday, S., Food science and nutrition. Third edition, Oxford University Press, New Delhi, 2008.
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- ❖ Swaminathan, M., Hand book of Food & Nutrition, Bappco Ltd, Bangalore, 1978.
- ❖ Swaminathan, M. Essential of Food and Nutrition, Vol.I. Bangalore Printing and Publishing Co. Ltd Bangalore.

FT5GET19-FERMENTATION TECHNOLOGY

Credits 3

72 h

OBJECTIVES

- ❖ To enlighten the students on the fundamental aspects of fermentation technology, microbial growth and design and control of bioreactors
- ❖ To give a brief introduction on down-stream processing and details on various food fermentations & their manufacture.

Unit I

14 h

Microbial growth kinetics

Introduction on fermentation, Growth curve- Lag, Exponential, Stationary & Decline Phases
Growth kinetics:- Batch culture: Growth rate, Specific growth rate, Generation time,
Continuous culture: Chemostat and Turbidostat.

Unit II

16 h

Design of fermenters & Sterilization

Basic function, design & control, Control in fermentors: Aeration, pH, Agitation, Types of fermentors.

Sterilization of vessels; Media sterilization: Different methods of media sterilization for batch & continuous cultures; Air sterilization: types of air filters

Unit III

14 h

Factors affecting fermentation & its control

Media: Energy & carbon source requirement, Carbon: Nitrogen ratio, Oxygen demand and supply, stationary & agitation methods, Effect of temperature & pH on growth & metabolism and their control.

Unit IV

14 h

Downstream Processing

Recovery & purification of fermentation products, removal of microbial cells and other solids, distillation, filtration: factors affecting filtration, precipitation, centrifugation, chemical cell disruption, liquid extraction, drying & crystallization.

Unit V

14 h

Fermented and unfermented products

Fermentation methods, production mechanism, micro-organisms involved and main changes during development of following fermented products: Ethanol; Organic acids; Fermented meat; Fermented fish products; Fermented dairy products; Fermented vegetables; Fermented bakery products: bread, Fermented fruit & malt beverages. Fermented products of orient.

REFERENCES

- ❖ Stanbury P F, Whitaker A, Hall S J (1995) *Principles of Fermentation Technology*, Butterworth-Heinemann, Massachusetts, United States.
- ❖ James M. Jay, Martin J. Loessner, David A. Golden (2005) *Modern Food Microbiology*, 7th edn. Springer.
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- ❖ L E Casida Jr (1968) *Industrial Microbiology*, John Wiley & Sons Inc
- ❖ L E Casida Jr (1968) *Industrial Microbiology*, John Wiley & Sons Inc

FT5GET20- FOOD INDUSTRIAL SANITATION & HYGIENE

Credits 3

72 h

Objectives:

- ❖ To provide a basic understanding of sanitary concepts and practice in food industry
- ❖ To give a basic acquaintance with sanitary standards and agents.

Unit I

14 h

Introduction

Sanitation: Definition. Sources of food contamination, Prevention and control of contamination of food. Physical and chemical agents used in food industry.

Unit II

16 h

Sanitizers and methods of sanitation

Sanitizers, Chemical and physical properties of sanitizers, Mechanism of activity of most frequently used sanitizers. Sanitizing methods, Sanitation equipments and systems, Mechanized sweepers and scrubbers, high pressure cleaners, CIP and COP equipment.

Unit III

14 h

Cleaning compounds

Cleaning compounds, Classification of cleaning compounds, Sequestrants, Chemical and physical characteristics of detergents

Unit IV

14 h

Personal hygiene and pest control

Food handling and personal hygiene. Hygienic food handling. Hand-washing. GMP for Personal Hygiene. Pest control methods

Unit V

14 h

Waste water treatment

Criteria for evaluating quality of water used for food processing, Water quality standards. Waste product handling, Suspended solids, Total solids, BOD & COD requirements. Wastewater treatment and disposal.

REFERENCES:

- ❖ Marriot N G, Gravani R B (2006) Principles of Food Sanitation, 5th edition, Springer, New York
- ❖ Roday S (2011) Food Hygiene and Sanitation with case studies, 2nd edition, Tata Mc Graw Hill, New York.
- ❖ Marriot N G (1997) Essentials of Food Sanitation, Robertson G (Ed.) Chapman & Hall, New York.

**FT50JP21-
INDUSTRIAL
TRAINING – II**

VI Semester

FT6CRT22- FOOD SAFETY & QUALITY ASSURANCE

Credits 4

90 h

Objectives:

- ❖ To provide a basic understanding of quality concepts and practice in food companies.
- ❖ To provide approaches to the planning and organization of a quality control system.
- ❖ To provide a basic acquaintance with standards and specifications.

Unit I

14 h

Basic Quality Concepts

Basic concepts of Quality control & Quality Assurance, Total Quality Management, Current Good Manufacturing Practices (GMP), Standard Sanitary Operation Procedures, Good Laboratory Practices (GLP), ISO 22000 FSMS

Unit II

18 h

Physical and Chemical Hazards

Definition of food safety and concept of safe food; characterization of food hazards- Physical hazards (Glass, Wood, Stones, Metal Fragments, Insulation Materials, Plastic and Bones)

Chemical hazards:

1. Naturally occurring chemical hazards – Natural occurring toxicants in foods and antinutritional factors in foods.
2. Unintentional Chemicals: Pesticides, Fertilizers, Pollutants, Toxic metals (Lead, Cadmium, Mercury, Aluminium and Arsenic)
3. Intentional Chemicals (Food preservatives Food additives)

Unit III

18h

Microbial Hazards

Microbial Hazards

1. Bacterial

Food Infections: *Salmonella*, *Shigella* and *Listeria monocytogenes*

Food Intoxications: *Clostridium botulinum*, *Clostridium perfringens*, *Bacillus cereus* and *Staphylococcus aureus*

Toxin mediated infections: *Vibrio cholerae*, *E.coli*

Sources, diseases and symptoms and prevention and control

2. Fungal : Aflatoxin, Ochratoxin, Patulin , Sterigmatocystin and Tricothecenes

Sources, diseases and symptoms and prevention and control

Unit IV

20 h

Monitoring and Regulation

HACCP – definition, principles, steps involved

Food standards - Voluntary and mandatory food laws and Food Safety and Standards Act of India, 2006.

Unit V

20 h

Quality Assessment & Quality Control

Microbiological Tests, Tests for Adulterants, Tests for Filth, Tests for Moisture & Ash Definition, Statistical Quality Control: Definition, Seven tools for SQC- Flow chart, Check sheet, Fishbonediagram, Pareto charts, Histogram, Runcharts & Control chart – definition, uses, process control. Attributes & Variable Sampling.

REFERENCES

- ❖ Bhatia, R. and Ichhpujan, R.L. Quality assurance in Microbiology. CBS Publishers and Distributors, New Delhi. 2004.
- ❖ Kher, C.P. Quality control for the food industry. ITC Publishers, Geneva. 2000.
- ❖ Philip, A.C. Reconceptualizing quality. New Age International Publishers, Bangalore. 2001.

FT6CRT23- TECHNOLOGY OF MEAT, FISH & POULTRY PRODUCTS

Credits 4

72 h

Objectives

- ❖ To provide an extensive description of meat, fish and poultry processing
- ❖ To introduce the latest technologies , manufacturing processes and tools for effective control of safety and quality during processing

Unit I

14 h

Meat

Basic meat science: Chemical composition & structure of meat, Post-mortem changes in muscle & meat quality Classification. Meat preservation methods- Chilling, freezing, curing, salting, pickling, smoking and canning. Abattoir practices. PSE and DFD meat

Unit II

16 h

Fish

Composition of fish, Preservation of fish by drying, salting and smoking, Chilling and freezing of fish and seafood. Application of freezing system in fish processing- IQF method. Canning of fish and fish products. Packaging of fish products.

Unit III

14 h

Egg

Egg formation and structure, composition, preservation: Refrigeration,drying and freezing. Egg quality parameters: interior and exterior. By-products and waste utilization.

Unit IV

14 h

Poultry

Poultry composition, classification, slaughtering techniques, preservation of poultry meat. Byproducts and waste utilization.

Unit V

14 h

Quality Control in Meat and Fish

Meat: Test for assessment of raw meat-TVN, FFA, PV, Nitrate & nitrite in cured meat, Establishment of HACCP in meat industry.

Fish: Quality assurance in sea food processing: GMP, HACCP

REFERENCES

- ❖ Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
- ❖ Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
- ❖ Subalakshmi, G and Udipi, S.A. Food processing and preservation. New Age International Publishers, New Delhi, 2001.
- ❖ Srilakshmi, B. Food Science. New Age International Publishers, New Delhi, 2003
- ❖ Warriss P. D, Meat Science: An Introductory Text, Cambridge university press – 2010

FT6CRT24--FOOD ANALYSIS

Credits 4

90 h

Objectives

To enable the students

- ❖ To understand different sampling techniques employed in chemical analysis of foods.
- ❖ To learn various chemical methods of food analysis.

Unit I

10 h

Introduction

Introduction to food analysis: Official methods of analysis, Regulations and recommendations related to food analysis, Evaluation of analytical data and nutritional labeling

Unit II

20 h

Compositional Analysis of Foods

Moisture and Total solids- Importance of moisture assay, Oven drying methods, Distillation Procedures, Physical and chemical methods of moisture analysis

Ash analysis: Importance of ash in food analysis and different ashing methods

Carbohydrate analysis: Importance, Method of analysis- Phenol – Sulphuric acid method, Lane and Eynon method, Somogyi – Nelson method and Anthrone method

Crude fat analysis: Semicontinuous Solvent Extraction Methods (Soxhlet method) and Non solvent Wet extraction Methods (Babcock method, Gerber method and detergent method).

Protein analysis- Methods of protein analysis: Kjeldahl method, Dumas method, Biuret method, Ninhydrin method and Lowry method

Vitamin analysis- Chemical methods of analysis of Vitamin A and C

Mineral analysis: EDTA Complexometric Titration, Precipitation titration and colorimetric methods

Unit III

20 h

Physical Properties and Characterisation of Foods

Densitometry: hydrometer, pycnometer, buoyance.

Refractometry: Refractive index, Lorenz equation, refractometers- Abbe, Pulfrich and immersion
Colour measurement- CIE system, visual colorimeters, tristimulus, photoelectric colorimeters, applications.

Rheology- capillary viscometer, falling ball viscometer, rotational viscometer; texture meter.

20 h

Unit IV

Chemical Properties and Characterisation of Foods

Fat Characterization: refractive index, melting point, smoke, flash and fire points, cold test, cloud point, iodine value, Saponification value, FFA, peroxide value.

Protein separation and characterization: Separation by differential solubility characteristics, separation by size, separation by adsorption and separation by electrophoresis

Titrateable acidity

Unit V

20 h

Analysis of Dietary fiber

Definition, importance of dietary fiber, gravimetric and chemical methods of crude fiber estimation

REFERENCES

- ❖ Kalia, M. Food Analysis and Quality Control. Kalyani Publishers, New Delhi. 2002.
- ❖ Winton, A.L and Winton, K.B. Techniques of food analysis. Allied Scientific Publishers, New Delhi. 1999.
- ❖ Nielsen, S.S. Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London. 2003.
- ❖ Connell, J.J. Control of fish quality. Blackwell Scientific Publications, Cambridge.2000.

FT6CRP25- FOOD ANALYSIS PRACTICALS

Credits 3

108 h

Objectives

- ❖ To understand the principles behind analytical techniques and to select appropriate method for analysis.
- ❖ To demonstrate practical proficiency in food analysis laboratory

Analysis of Squash

30 h

- ❖ Estimation of Titratable Acidity
- ❖ Estimation of Reducing and Non Reducing sugar
- ❖ Estimation of Total Solids
- ❖ Estimation of Vitamin C
- ❖ Qualitative test for preservatives – KMS , Sulphur dioxide, Sodium benzoate

Analysis of Jam

10 h

- ❖ Estimation of Titratable Acidity
- ❖ Estimation of Reducing and Non Reducing sugar
- ❖ Estimation of Total Solids

Analysis of Honey

20 h

- ❖ Estimation of Titratable Acidity
- ❖ Estimation of Reducing and Non Reducing sugar
- ❖ Estimation of Total Solids
- ❖ Qualitative test –
 1. Test for Commercial glucose
 2. Test for Artificial invert sugar

Analysis of Wheat Flour

8 h

- ❖ Estimation of gluten content

Analysis of Vinegar

20 h

- ❖ Estimation of total solids
- ❖ Estimation of Titratable Acidity

Analysis of Milk and milk products

20 h

- ❖ Alkaline Phosphatase test
- ❖ Estimation of acidity
- ❖ Estimation of non reducing sugar

- ❖ Estimation of protein by Sorenson's formol titration
- ❖ Estimation of salt content in butter
- ❖ Adulteration tests

REFERENCES

- ❖ Nielsen, S.S. Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London. 2003.
- ❖ Plummer D T (1998) An Introduction to Practical Biochemistry, Third edition, Tata McGraw Hill, New Delhi
- ❖ Sadasivam S, Manickam A (1996) Biochemical Methods, Second edition, New Age International Ltd, New Delhi.

CHOICE-BASED ELECTIVES

FT6CBT26- EQUIPMENT AND MATERIAL DESIGN FOR FOOD PROCESSING PLANT

Credits 3

90 h

Objectives

- ❖ To gain the empirical knowledge and practical experience on design of processes, process equipment and processing plants in the food industry.

Unit I

15 h

Introduction

Process design: Definition, Types of process design, Material and Energy balance, design of equipments, plant layout and buildings, Economic analysis in plant design: fixed capital investment, Cost of Equipment, Engineering cost indices, Manufacturing cost and profitability: manufacturing cost, profitability and break-even point

Elements of food plant design: General aspects, new food plants, plant improvements, plant expansion, mobile food plants and advanced food plants.

Unit II

20 h

Design and Selection of Food Processing Equipments

Sizing and costing of equipments, Materials of construction: Metals (steel, stainless steel, aluminium, copper), plastic rubbers, glass ceramics and wood.

Fabrication of equipment: Strength of construction (general aspects, sensitive construction points, proper engineering), Fabrication and installation of equipment (general process equipment, food processing equipment and installation of process equipments)

Hygienic design of food processing equipments: Hygienic standards and regulations, cleaning of food equipment

Selection of food processing equipments: Selection of equipment, construction characteristics, operational characteristics, testing of equipments.

Unit III

20 h

Mechanical Processing Equipments

Size Reduction Equipments: Size reduction of fibrous foods, dry foods and liquid foods and its effect on foods.

Mixing and Forming Equipments: Mixers for dry powders and particulate solids, mixers for low or medium viscosity liquids and mixers for high viscosity liquids and pastes. Forming equipments: bread moulders, pie and biscuit formers and confectionery moulders.

Unit IV

15 h

Thermal Processing Equipments

Blanching: Steam blanchers, hot water blanchers and their effect on foods

Extrusion: I) Method of operation: cold extruders and extruder cookers II) Method of construction: single and twin screw extruders. Application of extrusion in food industry and its effect on food.

Unit V

20 h

Post Processing Operations

Coating or Enrobing: Coating materials – batters, powders and bread crumbs, chocolate and compound coatings. Enrobers, Dusting or Breading and Pan coating – hard coatings, soft coatings and chocolate coatings

REFERENCES

- ❖ Fellows P,J; Food Processing Technology, Principles and Practice, Third edition, Woodhead publishing, 2009
- ❖ Saravacos, G.D and Kostaropoulos, A.E ; Handbook of Food Processing Equipments, Springer publications, 2006
- ❖ Subalakshmi, G and Udipi, S.A. Food processing and preservation. New Age International Publishers, New Delhi, 2001.

FT6CBT27-FOOD BIOTECHNOLOGY

Credits - 3

72 h

OBJECTIVES

- ❖ To acquire an elementary knowledge about the aspects of applications of biotechnology to food products

UNIT I:

Structure of Genetic material:-

12 Hrs.

DNA, Structure of DNA Watson and Crick model of DNA, types of DNA, RNA, types of RNA, functions of nucleic acids, codons, deciphering genetic code.

UNIT II:

Fundamentals of Genetic Engineering:-

15 Hrs

Concept of Recombinant DNA Technology, Gene cloning, Restriction Endonucleases, Choice of organism for genetic experimentation, cloning vectors, types of vectors: plasmid, cosmids, and phagemids.

Unit III:

Expression of Genetic Material:-

15Hrs

Mechanism of DNA replication, transcription and translation. Extraction, isolation and sequencing of genetic material, Polymerase chain reaction.

Unit IV:

Food biotechnology and Food science:-

10Hrs

Biotechnological approaches to improve nutritional quality and shelf life of fruits and vegetables. Solution to peanut allergy, Recombinant lipoxygenases and oxylipin metabolism. International aspects of the quality and safety assessment of foods, patenting inventions in food biotechnology.

Unit V:

Application of genetic engineering in food science:-

20Hrs

Transgenesis, GMO (Micro organism, plants and animals and their products), Genomic basis for food improvement, genetic modification of plant starches for food applications, Plant oils for food uses, Nutraceutical enrichment of food crops. Production of traits in farm animals. Recombinant milk. Transgenic fish technology in sea food production. Fish protein hydrolysates.

REFERENCES

- ❖ Modern Food Microbiology by James M Jay, Aspen Publishers
- ❖ Essentials of Food Sciences Vickie A. Vaclavik, Elizabeth W. Christian, Springer.
- ❖ Food Science by N. Potter & Hotchkiss, ASPEN Publication.
- ❖ An introduction to Food Science by Rick Parker and Delmar, Thomson Learning.
- ❖ Food Technology by N W Desroisier, Springer.
- ❖ Food Science & Nutrition by Sunitha Reddy, Publishing House Pvt. Ltd., Delhi.
- ❖ Enzymes in Food Processing by Paramjit S Paneswar, IK Intl. Ltd.
- ❖ Food Biotechnology by Kalidas Shetty, Gopinadhan Paliyath, Anthony Pometto Robert E. Levin, Taylor & Francis.
- ❖ Biotechnology-Fermented foods and their processing by Naduka Okafor

FT6CBT28-TECHNOLOGY OF FLAVORS AND FRAGRANCES

Credits 3

72 h

Objectives

To enable the students

- ❖ To give a broad introduction to the formulation, origins, analysis and performance of flavours
- ❖ To provide an understanding of all aspects of flavour, in the food, the production chain, the perception by consumers and their contentment during and after eating

Unit I

12 h

An overview of flavour perception

Flavour perception, taste perception, anatomy of taste, chemesthesis: chemesthesis responses, tactile response, olfaction, anatomy of olfaction and signal encoding.

Unit II

15 h

Flavouring Materials

Definitions: flavouring, natural flavouring and artificial flavouring. Natural flavouring materials (plant sources): Herbs and spices, derivatives of spices (essential oils by distillation, oleoresins by solvent extraction, expressed essential oils (citrus oils), cocoa, coffee and tea flavourings and aromatic vegetables

Unit III

15 h

Flavouring Materials Made by Processing

Process flavours (meat flavours): Evolution of process meat like flavourings, creation of process flavourings, Hydrolysed Vegetable Protein (HVP) and Autolysed Yeast Extracts (AYE).

Enzymatically derived flavourings: Enzyme modified butter/ butter oil, enzyme modified cheese and enzymes used

Flavours developed by fermentation: Yeasts, vinegar and derived inactive yeast powder.

Flavours made by pyrolysis (smoke flavours): Natural liquid smoke flavourings, pyroligneous acid and smoke condensate.

Production of natural flavouring materials by enzymatic and microbial action

Unit IV

15 h

Artificial Flavouring Materials

Artificial flavourings, classification of aroma compounds by molecular structure and sensory characteristics of odour compounds like hydrocarbons, carboxylic acids, acetals, alcohols, carbonyls (aldehydes and ketones), esters, ethers, heterocyclic compounds, lactones, phenols, sulphur and nitrogen containing compounds.

Unit V

15 h

Flavour Applications

Culinary and meat products: soups and stocks, sauces, seasonings and marinades and meat products

Baked goods and bakery products: problems in flavouring baked goods, flavouring baked goods and heat resistant flavourings.

Snack foods: problems in flavouring snack goods, snack flavourings, flavouring materials and means of applying flavours

Sugar based confectionery products and chewing gum: Hard candies, Toffees and chewing gum

Dairy products: Flavoured milk, flavoured yoghurt and flavoured dairy desserts

Soft drinks: Carbonated beverages

REFERENCES

- ❖ Reineccius.G; Flavor Chemistry and Technology; CRC press; 2006
- ❖ Reineccius.G; Source books of flavors; 2nd edition; CBS publishers, 1999

**FT6DSP29-
PROJECT/
DISSERTATION**