File Ref.No.5802/GA - IV - J1/2012/CU

UNIVERSITY OF CALICUT

Abstract

General and Academic - Faculty of Science - Scheme and Syllabus of M Sc Food Science and Technology Programme under CBCSS PG Regulations 2019 - Incorporating Outcome Based Education (OBE) with effect from 2020 Admission - Implemented - Subject to ratification by the Academic Council - Orders Issued.

G & A - IV - J

U.O.No. 5808/2021/Admn Dated, Calicut University.P.O, 31.05.2021

Read:-1. UO No: 9209/2019/Admn, Dated 12.07.2019.

2. Item No.1 in the minutes of the meeting of the Board of Studies in Food Technology (SB) held on 24.05.2021.
3. Remarks of the Dean Faculty of Sciences, Dated 29.05.2021.
4. Orders of the Vice Chancellor, in the file of even no; Dated 31.05.2021.

ORDER

1. The Scheme and Syllabus of MSc Food Science and Technology Programme under CBCSS PG Regulations 2019, w.e.f 2019 admission, has been implemented in the University, vide paper read (1) above.
2. The meeting of the Board of Studies in Food Technology (SB) held on 24.05.2021, has resolved to approve the Outcome Based Education (OBE) in the existing syllabus of MSc Food Science and Technology Programme w.e.f. 2020 admission, vide paper read (2) above.
3. The Scheme and Syllabus of MSc Food Science and Technology Programme (CBCSS PG 2019), incorporating Outcome Based Education(OBE) in the existing syllabus, has been approved by the Dean, Faculty of Science, vide paper read (3) above and by the Vice Chancellor, subject to ratification by the Academic Council, vide paper read (4) above.
4. The Scheme and Syllabus of MSc Food Science and Technology Programme under CBCSS PG Regulations 2019, incorporating Outcome Based Education (OBE), in the existing syllabus, is therefore implemented with effect from 2020 Admission , subject to ratification by the Academic Council.
5. Orders are issued accordingly.
6. UO No: 9209/2019/Admn, Dated 12.07.2019 stands modified to this extend. (Syllabus appended)

Ajitha P.P

Joint Registrar

To

The Principal , Affiliated Colleges.

Copy to: PS to VC/PA to PVC/ PA to Registrar/PA to CE/JCE I/JCE V /EX and EG Sections/GA I F/ CHMK Library/Information Centres/IQAC/SF/DF/FC

Forwarded / By Order

Section Officer

UNIVERSITY OF CALICUT

OUTCOME BASED EDUCATION
(OBE)

IN

M.Sc. FOOD SCIENCE AND TECHNOLOGY PROGRAMME

(CBCSS PG 2019)
Under Choice Based Credit Semester System
(w.e.f. 2020 Admission)

UNIVERSITY OF CALICUT

SYLLABUS

for

M.Sc. FOOD SCIENCE AND TECHNOLOGY PROGRAMME

(CBCSS PG 2019)
Under Choice Based Credit Semester System
(w.e.f. 2020 Admission)

Board of Studies in Food Technology
University of Calicut

LIST OF EXPERT COMMITTEE MEMBERS

M.Sc Food Science & Technology

Mrs. Cibia George (Chairperson)
H.O.D, Department of Food Technology
DGM MES Mampad College
Malappuram Dist.
+919446646528
cibiageorge@gmail.com

Dr. T.K Sreenivasa Gopal
Scientist Emeritus
CIFT, Kochi

Dr. K.K Vijayan
Professor (Rtd), Principal,
Baby Memorial College of Allied Medical Sciences, Calicut

Dr. B.P Nisha
Scientist – Agro Processing & Natural Product division
NIIST, Trivandrum

Dr. C.D Sebastian
Former Director, SHSc
Dept.of Zoology
University of Calicut

Dr. Sudheer KP
Professor, National Fellow Coordinator
Centre for Excellence in PHT
College of Horticulture, Vellanikkara

Dr. P.T Mathew
Principal Scientist
Fish Processing Department
CIFT, Kochi

Mr. A Jawahar
Assistant Professor
Department of Food Technology
DGM MES Mampad College
Malappuram Dist.

Mr. Hasker E
Assistant Professor
Department of Food Technology
DGM MES Mampad College
Malappuram Dist.

Mr. Muhammed Safeer M
Assistant Professor
Department of Food Science & Technology
School of Health Sciences
University of Calicut.

Mrs Suitha.A.P
Assistant Professor
Department of Food Technology
SAFI Institute of Advanced Study
Malappuram Dist.

UNIVERSITY OF CALICUT

M.Sc. FOOD SCIENCE AND TECHNOLOGY PROGRAMME

(CBCSS PG-2019)

PROGRAMME STRUCTURE

The programme shall include three types of courses, Core courses, Elective Courses and Audit Courses. There shall be a Project /Dissertation undertaken by all students. The parent department shall offer the appropriate elective courses for a specific program me.
.

ADMISSION

- The admission to the M.Sc Food Science & Technology programme shall be as per the rules and regulations of the University
- The norms of admission as per the existing university regulations will be followed.
- The eligibility criteria for admission shall be as announced by the University from time to time.
- Separate rank lists shall be drawn up for reserved seats as per the existing rules.

DURATION OF THE COURSE:

- Four semesters (2 years).
- Semester means a term consisting of minimum 90 working days, inclusive of examination, distributed over a minimum of 18 weeks of 5 working days each.

ACADEMIC WEEK

- Academic week is a unit of 5 working days in which distribution of work is organized from day 1 to 5, with 5 contact hours of 1 hour duration in each day. A sequence of 18 such academic week constitutes a semester.

ATTENDANCE

- The minimum requirement of attendance during a semester shall be 75% for each course.
- Condonation of shortage of attendance to a maximum of 10% (9 days) in a semester subject to a maximum of two times during the whole period of post graduate programme may be granted by the University.

NUMBER OF COURSES AND CREDITS REQUIRED:

Total credits required for the completion of the programme is 15+15+18+20+12= 80 credits.

First, Second and Third and fourth semester with 15,15,18 and 20 credits respectively and at the end of each even semesters 3 practical each carry 2 credits. Fourth semester with 3 papers, Project and course viva for 8 credits (total 20 credits in the semester).

SEMESTER I

Sl. No	Course code	Title of courses	No of credits	Total credits
1	FST1C01	Food Microbiology	4	15
		Food Microbiology Practical		
2	FST1C02	Food Chemistry and Analysis	5	
		Food Chemistry and Analysis Practical		
3	FST1C03	Research Methodology and Statistics	2	
4	FST1C04	Basic Principles of Engineering	4	
		Basic Principles of Engineering Practical		
	FST1A01	In-Plant Training	4	

SEMESTER II

Sl. No	Course code	Title of courses	No of credits	Total credits
5	FST2C05	Biochemistry and Nutrition	4	15
		Food chemistry, biochemistry and Nutrition practical		
6	FST2C06	Food Storage and infestation control	4	
7	FST2C07	Industrial Microbiology & Biochemical Engineering	4	
		Industrial Microbiology & Biochemical Engineering Practical		
8	FST2C08	Food Engineering	3	
		Food Engineering Practical		
	FST2A02	Computer Software packages in Food Industry	4	

YEAR I PRACTICALS

Sl. No	Course code	Title of courses	No of credits	Total credits
9	FST2L09	Food Microbiology, Fermentation & Biotechnology	2	6
10	FST2L10	Food Chemistry, Biochemistry and Nutrition	2	
11	FST2L11	Food Process Engineering	2	

SEMESTER III

Sl. No	Course code	Title of courses	No of credits	Total credits
12	FST3C12	Technology of Fruits, Vegetables, Spices &Plantation Products	4	18
		Technology of Fruits, Vegetables, Spices &Plantation Products Practical		
13	FST3C13	Principles of Food Processing and Preservation	4	
		Principles of Food Processing and Preservation Practical		
14	FST3C14	Technology of Cereals, Legumes and oil seeds	5	
		Technology of Cereals, Legumes and Oil Seeds Practical		
15	FST3C15	Packaging Technology	5	
		Packaging Technology Practical		

SEMESTER IV

Sl. No	Course code	Title of courses	No of credits	Total credits
16	FST4E16	Food Plant and Quality Management	4	20
17	FST4E17	Technology of Animal products	4	
		Technology of Animal products Practical		
18	FST4E18	Dairy Technology	4	
		Dairy Technology Practical		
19	FST4E19	Sugar and Confectionary Technology		
		Sugar and Confectionary Technology		
20	FST4Pr19	Project work and Course Viva	8	

YEAR II PRACTICALS

Sl. No	Course code	Title of courses	No of credits	Total credits
22	FST4L21	Food Processing, Preservation and Packaging	2	6
23	FST4L22	Technology of Plant Food Products	2	
24	FST4L23	Technology of Animal Food Products	2	

Abbreviation of Codes:

FST: Food Science and Technology.

C: Core Course

L: Practical/Lab

A- Audit Course

Pr: Project Work,

V: Course Viva

E- Elective Course

PROJECT WORK AND VIVA VOCE

Students of M. Sc Food Science Technology should undergo a project work for a period of **3 months**, during the third/ fourth semester. The programme is arranged by the department in consultation with the food research institutions inside and outside Kerala. A subject to be selected by each student for dissertation based on the facilities available under the guidance of an expert person (must be a PhD holder). Each student should prepare a project report duly certified by the supervisor. Consequently, a seminar should be conducted in the department to present the finding of the project work. The bonafide project report attested by the head of the department will be evaluated by the external examiner and a viva voce will be conducted.

EXAMINATIONS

- There shall be University examination at end of each semester.
- Practical examinations shall be conducted by the university at the end of even semesters.
- Project evaluation shall be conducted at the end of the programme only. Practical examination, Project evaluation shall be conducted by two external examiners.

EVALUATION AND GRADING

The evaluation scheme for each course shall contain two parts; (a) internal evaluation and (b) external evaluation. 20% Weightage shall be given to internal evaluation and the remaining 80% to external evaluation. Therefore the ratio and Weightage between internal and external is 1:4. Both internal and external evaluation shall be carried out using Direct Grading system.

A, Internal evaluation:

The internal evaluation shall be based on predetermined transparent system involving periodic written tests, assignments, seminars and attendance in respect of theory courses and based on written tests, lab skill/records/viva and attendance in respect of practical courses. The Weightage assigned to various components for internal evaluation is a follows.

Theory course

Components	Weightage
Assignment	1
Seminar/ Presentation	1
Attendance	1
Test Paper	2

- A minimum of three test papers/ viva for each courses have to be conducted of which the best two performances shall be counted for internal evaluation in each semester.
- One seminar/ Presentation for each course is compulsory.

Practical course

Components	Weightage
Record/Viva	3
Lab skill	4
Practical Test	3

- To ensure transparency of the evaluation process, the internal assessment Mark awarded to the students in each course in a semester shall be published on the notice board at least one week before the commencement of external examination.
- There shall not be any chance for improvement for internal Mark.
- The internal assessments marks are to be tabulated and forwarded to the controller of examination at the end of even semesters by head of the department, through Principal/ Director of the college.

B, External evaluation

Theory courses

- The external Examination in theory courses is to be conducted by the University with question papers set by external experts. The evaluation of the answer scripts shall be done by examiners based on a well-defined scheme of valuation. The external evaluation shall be done immediately after the examination preferably in a Centralized Valuation Camp.
- Weightage for each core and elective theory courses will be 30 for the external examination
- Duration of theory examinations will be 3 hours.
- Theory examination question paper shall contain 4 short answer type questions with 2 Weightage each, 4 Short essay type questions with 3 Weightage each and 2 essay type questions with 5 Weightage each.

Practical courses

- Weightage for each core and elective practical courses will be 30 in the external examination and 10 in the internal examinations.
- Practical Examinations Shall be conducted by the University at the end of even Semester.

Mark distribution for the external practical examination will be as follows

Max 30 Weightage

Components	Weightage
Procedure writing	2
Major experiment	6
Minor experiment	4
Viva	8
Record	4
Spotters	6

- A candidate has to submit the practical record at the time of external examination.
- If a candidate fails to submit the practical record no Mark will be awarded

Evaluation of project work

- Project report should be presented using power point option.
- There Shall be External and internal evaluation (4:1) for project work

The scheme of the project report evaluation is as given below.

Components	Weightage External	Weightage Internal
Relevance of the Topic and statement of problem	8	2
Methodology & Analysis	8	2
Quality of report & Presentation (15 minutes)	8	2
Viva – Voce (5 minutes)	16	4
Total	**40**	**10**

AWARD OF DEGREE

The successful completion of all the courses with 'P' (Pass) grade shall be the minimum requirement for the award of the degree.

DISTRIBUTION OF WORK BASED ON CREDITS

Theory-1 credit = 1.5 hours of teaching per week.

Practicals-1 credit = 2 hours of teaching per week.

DIRECT GRADING SYSTEM

Direct Grading System based on a 10 – Point scale is used to evaluate the performance (External and Internal Examination of students)

For all courses (Theory & Practical)/ Semester/ Overall Programme, Letter grades and **GPA/ SGPA/ CGPA** are given on the following way:

a) First Stage Evaluation for both Internal and External done by the Teachers concerned in the following Scale:

Grade	Grade Points
A+	5
A	4
B	3
C	2
D	1
E	0

b) The Grade Range for both Internal & External shall be:

Letter Grade	Grade Range	Range of Percentage (%)	Merit / Indicator
O	4.25 – 5.00	85.00 – 100.00	Outstanding
A+	3.75 – 4.24	75.00 – 84.99	Excellent
A	3.25 – 3.74	65.00 – 74.99	Very Good
B+	2.75 – 3.24	55.00 – 64.99	Good
B	2.50 – 2.74	50.00 – 54.99	Above Average
C	2.25 – 2.49	45.00 – 49.99	Average
P	2.00 -2.24	40.00 – 44.99	Pass
F	< 2.00	Below 40	Fail
I	0	-	Incomplete
Ab	0	-	Absent

a) No separate minimum is required for Internal evaluation for a pass, but a minimum **P** Grade is required for a pass in the external evaluation. However, a minimum **P grade** is required for pass in a course.

b) A student who fails to secure a minimum grade for a pass in a course will be permitted to write the examination along with the next batch.

c) **Improvement of Course-** The candidates who wish to improve the grade / grade point of the external examination of a course/s they have passed already can do the same by appearing in the external examination of the concerned semester along with the immediate junior batch.

d) **Betterment Programme One time-** A candidate will be permitted to improve the **CGPA** of the Programme within a continuous period of four semesters immediately following the completion of the programme allowing only once for a particular semester. The **CGPA** for the betterment appearance will be computed based on the **SGPA** secured in the original or betterment appearance of each semester whichever is higher.

Audit Courses:

In addition to the above courses there will be two Audit Courses ***(Ability Enhancement Course;* In-Plant Training *& Professional Competency Course;* Computer Software packages in Food Industry*)*** with **4** credits each. These have to be done one each in the first two semesters (Within a maximum of 5 Days for each Course). The credits will not be counted for evaluating the overall SGPA & CGPA. The colleges shall conduct examination for these courses and have to intimate /upload the results of the same to the University on the stipulated date during the III Semester. Students should have to obtain minimum pass requirements in the Audit Courses.

AIM & OBJECTIVES OF THE PROGRAMME

1. To provide In-depth knowledge in an area of specialization in engineering or the natural sciences

2. To show the ability to plan, execute and evaluate experiments in both the laboratory and on a large scale

3. To give the ability to use theoretical models to describe physical, biological and chemical processes

4. To provide the ability to assess the applicability and limitations of these models in various contexts

5. To show the ability to choose and design technologies for the industrial manufacture of bio based products, especially food products, with due regard to raw materials, energy, economics and sustainability in the system of industrial food technology

6. To have the ability to create and develop products

7. To have the ability to benefit from specialized literature

8. To have the ability to develop an enterprise of his own

9. To help students gain a better understanding of food science and the technological aspects in it.

10. To make student capable of dealing the microbiological aspects of food

11. To understand the processing and preservation methods involved on the field of food technology

12. To develop and evaluate quality of new food products using objective and subjective methodologies.

13. To make aware of the chemistry of food, analysis of food and the nutritional applications in food

14. To acquire a thorough knowledge on animal foods and plant foods and their processing and preservation

15. To have idea on application of engineering in food industry

16. To understand the basic food safety rules and laws in the food market

17. To equip the students in the food science research area

18. To motivate the students for taking higher studies bin the field of Food Science and Technology

PROGRAMME OUTCOME

1. They demonstrate in-depth knowledge of the scientific foundations of the disciplines in engineering and the natural sciences that constitute the field of food technology

2. They demonstrate an ability to analyze both complete systems and the constituent parts of the industrial manufacture of food products

3. They demonstrate an insight into how different sub-systems co-operate with each other

4. They demonstrate an insight into current research and development in the field

5. They demonstrate enterprising skills

6. They demonstrate an ability to identify, formulate and treat complex issues in the field of food technology from a holistic perspective and in an independent manner

7. They able to analyze and evaluate critically various technical solutions in the field

8. They demonstrate an ability to be able to participate in research and development projects in food technology

9. They demonstrate an ability to acquire new knowledge in the field and to integrate this with existing knowledge

10. They demonstrate an ability to plan and execute advanced assignments in the field in an independent manner

11. They demonstrate an ability to develop and design industrial food product systems and processes with regard to human needs and conditions, and the goals of society both local and global, for sustainable development

12. They demonstrate an ability to give a clear account of his/her level of knowledge and various types of project work, both orally and in writing, in an international context

13. They demonstrate an ability to make judgments with regard to relevant scientific, social and ethical aspects in the field

14. They demonstrate an ability for working in a team and for cooperation with variously constituted groups

15. They demonstrate an ability to identify his/her need of further knowledge in the field and continuously deepen

16. Demonstrate practical proficiency in a food analysis laboratory

SEMESTER I

Sl. No	Course code	Title of courses	No of credits	Total Hours Allotted	Total credits
1	FST1C01	Food Microbiology	4	108	15
		Food Microbiology Practical			
2	FST1C02	Food Chemistry and Analysis	5	135	
		Food Chemistry and Analysis Practical			
3	FST1C03	Research Methodology and Statistics	2	54	
4	FST1C04	Basic Principles of Engineering	4	108	
		Basic Principles of Engineering Practical			
	FST1A01	In-Plant Training	4		

FST1C01 - FOOD MICROBIOLOGY

(Credit – 4)

Course Objectives:

1. To provide the basics of microbiology to build a foundation for more advanced studies in microbiology
2. To understand the microorganisms, morphology, classification, nomenclature and their growth
3. To get the knowledge of spoilage of foods and illness caused through food borne

Course outcome:

1. Knowledge on historical perspective of Microbiology and idea on different types of microscopic techniques and its importance.
2. Better understanding on the general morphology, cytology, classification of microorganisms and importance of bacteria, fungi, virus and algae.
3. Information regarding culture media and different culturing techniques and brief study on food borne viral diseases, their control and preventive measures.
4. Awareness on bacterial genetics, gene transfer mechanisms and genetic recombination in microbiology.
5. Knowledge on growth of microorganisms, quantification and control with special emphasis to sterilization techniques.
6. Study about the microbiology of food, water, animal and plant food products, better understanding of microbes in food spoilage and food preservation techniques.
7. Understanding the food borne illness and also about the beneficial aspect of microorganisms giving special importance to fermentation process.

Module 1: Historical development of Microbiology & Microscopy

Contributions of Antony Van Leeuwenhoek, Louis Pasteur ,Robert Koch, Alexander Fleming, Winogradsky, Nicolas Appert, Joseph Lister, Edward Jenner, Paul Ehrlich, Salman A.Wakman, Anand Mohan Chakravarthi, Biogenesis and abiogenesis- scientists who disapproved and support the theory.

Microscopes: Bright field, Dark field, Phase contrast, Fluorescence and Electrone microscope

Module 2: Morphology and General cytology of Microorganisms

Bacteria: Reproduction, Microbial nutrition, Identification of bacteria- Staining, cultural characteristics and Biochemical properties, Culture media and methods, Environmental factors affecting the growth of microorganisms.

Fungi: Structure, Reproduction, Classification- Zygomycota, Ascomycota, Basidiomycota, Deuteromycota

Importance of Bacteria and Fungi in Food.

Module 3: Virus, Yeast & Algae

Virus: General properties, Structure and replication of food borne viruses- Hepatitis, Norwalk virus, Rota virus, Astroviruses, Control and preventive measures

Yeast: Structure and Reproduction

Algae: Structure and Classification

Importance of Yeast and Algae in Food.

Module 4: Bacterial Genetics

Bacterial genome structure and replication, Genetic recombination- Site specific and Homologous recombination, Gene transfer mechanisms- transformation, transduction and conjugation

Module 5: Growth and Control of Microorganisms

Growth curves and Methods of measuring of growth-Direct and Indirect methods

Sterilization and Disinfection. Destruction of microorganism's concepts including Z, F and D value.

Module 6: Microbiology of Water, Animal and Plant Food Products

Contamination, Spoilage and Preservation of-

Animal food Products- Dairy, Meat, Fish, Poultry and Egg.

Plant Food Products- Fruits, Vegetables, Sugar and Spices

Bakery, Salted and canned foods.

General principles of food preservation.

Bacteriology of Water

Beneficial Aspects of Microorganisms: Fermented Food Products- Sauerkraut, Acidophilus Milk, Wine, Yoghurt. GM Food, Prebiotics and Probiotics

Module 7: Food borne illness

Bacterial: Food borne Infections and Intoxications.

Mycotoxins, Food borne parasites, Sea food toxicants and Poisoning by chemicals

FOOD MICROBIOLOGY –PRACTICAL

Course outcome:

1. Expertise in basic techniques of microbiology
2. Knowledge on pure culture techniques, microbial growth, culture media, staining techniques, culturing methods and conditions affecting it.
3. Understanding on microbial analysis of food and utensils.
4. Knowledge in relationship between food and microbes, techniques used in food processing

Microscopy: Care and handling of microscope

Cleaning and sterilization of glass wares: Autoclave, Hot air oven

Preparation of nutrient media: Simple Medias, Enriched Medias, Selective and Differential medias, Anaerobic medias, Sabouraud's Dextrose Agar.

Culture Methods: Streak culture method, Stroke culture method, Stab culture method, lawn culture method, Pour plate method, Liquid culture method, Anaerobic culture method, Slide culture method ,Antibiotic sensitivity test.

Staining Techniques: Monochrome staining, Negative staining, Gram staining, Capsule staining, Volutin granule staining, Endospore staining, Staining of yeast cells, Fungal staining

Isolation of pure cultures and identification of bacteria: Cultural characteristics, Morphological characteristics and Biochemical characteristics.

Anaerobic culture methods: Candle jar method

Growth characteristics of bacteria: Determination of microbial numbers-direct and plate count method and generation time.

Factors affecting growth of microorganisms-Ph, Temperature, Osmotic pressure, Thermal death time, Growth curves of bacteria and yeast.

Microbiological examinations of food and utensils : Microbiological examinations of table ware and container, water, milk and milk products, cereals and cereal products, Poultry and egg, sugar, spices, meat, fish and fish products. MBRT.

Tests used for checking efficiency of disinfectant-Inuse test.

REFERENCES

- Banawart GJ ,1989. Basic Food Microbiology. AVI publishers
- Jay JM, Loessner MJ & Golden D A 2005. Modern Food Microbiology .Springer Verlag
- Ananthanarayanan R Jayaram Paniker CK 2009 Text book of microbiology.University Press Pvt Ltd, Hyderabad
- Prescott, L.M, Harley, J.P and Klein, D.A Microbiology . McGraw Hill New York
- Frazier J& Westhoff DC . 1988. Food Microbiology. McGraw Hill, New York.
- Bernard R. Glick. Molecular Biotechnology. Principles and applications of recombinant DNA
- Pelczar JM & Reid RD . Microbiology. Tata McGraw Hill

- Stainer R. General Microbiology. MacMillan
- Black, JG. Microbiology .Principles and Explorations John Wiley

FST1C02 – FOOD CHEMISTRY AND ANALYSIS

(Credit - 5)

Course Objectives:

1. To understand the food in relationship with chemical aspects of foods and food ingredients with respect to physical, nutritional, and toxicological..
2. To get the knowledge of Food chemistry builds a relationship between the structure and functional properties of food molecules and to improve the nutritional, safety and organoleptic aspects of food
3. To understand the instrumental analysis of foods and their principle and its application

Course outcome:

1. Understand and describe the chemical structure & classification of food components
2. Analyse the relationship between the composition of the individual food components and their chemical and physical properties
3. understand about food emulsion ,Food Pigments & Flavours
4. Illustrate the principle and mechanism of analytical instruments.
5. Develop an understanding and methodologies of instrumental techniques in food analysis

Module 1: Introduction to chemistry of foods

Composition and Factors affecting the composition of foods, Moisture in foods

Carbohydrates: Monosaccharide, their occurrence and classification, Isomerism in hexoses, principles of structure determination, diagrammatic representation of optical isomers, absolute configuration, properties of sugars, sugar derivatives, caramelisation and maillard reaction. Disaccharides and Trisaccharides, their classification and commercial sources. Chemistry of cellulose, starch and other polysaccharides, starch enzymes, gel formation and starch retro gradation. Pectic substances, their occurrence, structure, properties and use in foods.

Amino acids and Proteins : Chemistry of amino acids and proteins. Classification of proteins, Chemical and Physical properties of proteins. Structure of proteins and Forces involved in protein conformation, Functional properties of proteins in foods, hydrolysis of proteins, major food proteins and their sources. Changes in protein during processing.

Oils and Fats: Chemistry, Occurrence, Classification, Composition. Physical and chemical properties of fats. Rancidity and Flavor reversion, Processing of oil bearing materials, Refining of oils and fats, Fat hydrolysis and interesterification , hydrogenation, shortenings and spreads.

Vitamins: Chemistry, sources, changes during processing.

Module 2: Food Pigments & Flavours

Plant pigments: Occurrence, chemistry, functions and changes during processing, Plant acids, Flavonoids and tannins.

Essential oils: Chemistry, occurrence and extraction. Terpeneless oils and their use in foods.

Food Emulsions: definition, surface activity, surface films, theory of emulsions, properties and types of emulsions, emulsifying agents.

Module 3: Chemical and Instrumental analysis of Food

Determination of Moisture: Hot air and vacuum oven methods, toluene distillation and karl-Fischer titration, Determination of Ash and mineral matter: total ash, acid soluble, and insoluble ash and alkalinity of ash, Estimation of crude fat, Determination of proteins.

Principles and instrumentation of colorimentry, spectrophotometry, flourimetry, atomic absorption spectroscopy.

Chromatography- Principles, Paper chromatography, Thin layer chromatography, Column chromatography, Gas chromatography, HPLC

Detectors- Thermal conductivity detector, Flame ionization detector, Flame photometric device, Electron capture detector, U.V visible detector, Fluorescence detector.

FOOD CHEMISTRY AND ANALYSIS PRACTICAL

Course outcome:

1. Describe bio-chemical analysis of food components
2. Developing practical skills of proximate & basic food compositions including carbohydrates, proteins, fats and minerals.

- Determination of Moisture: Hot air oven and toluene distillation methods
- Determination of ash content
- Qualitative and Quantitative analysis proteins and amino acids:
  Ninhydrin test, Biuret test, Lowry's Method of estimation, Kjeldhal's methods
- Qualitative and quantitative analysis of carbohydrates:
  Molisch's test, Benedict's test, Barfoed's test, Seliwanoff's test, Iodin test, Phenyl hydrazine osazone formation test, Lane and Eynon's method of estimation
  Determination of phosphorus, calcium, iron, lead, copper, Manganese and tin
- Analysis of oils
- Estimation of crude fat
- Determination of pH.
- Estimation of plant pigments by Spectrophotometric method.
- A visit to food analytical lab.

REFERENCES

- Ranganna S 2001.Hand book of analysis and quality control of fruits and vegetable products Tata- McGraw- Hill. .
- Meyer, L.H 1987 Food Chemistry CBS publishers.
- Belitz, H.D 1999 Food Chemistry Springer Verlag
- Fennema,OR. 1996 Food Chemistry Marcel Dekker
- Nielson S 1994 Introduction to Chemical Analysis of Foods Jones & Bartlett
- Pomrenz Y& Meloan CE 1996 Food Analysis Theory and Practice CBS
- Manay,N.S,Shadaksharaswamy,M.,Foods:Facts andPrinciples New Age International Publishers
- Miller, Dennis D. Food Chemistry John Wiley and sons
- Wong, Dominic W.S Mechanism and Theory in Food Chemistry. CBS publishers.
- Vasudevan, D.M. Textbook of Biochemistry . Jaypee Publication.
- Sharma B.K. 2004, Instrumental Methods of Chemical Analysis. Goel Publishing House, New Delhi.

FST1CO3 – RESEARCH METHODOLOGY AND STATISTICS

(Credit-2)

Course Objectives:

1. To gain familiarity with a phenomenon or to achieve new insights into it (studies with this object in view are termed as *exploratory* or *formulative* research studies)
2. To portray accurately the characteristics of a particular individual, situation or a group (studies with this object in view are known as *descriptive* research studies)
3. To determine the frequency with which something occurs or with which it is associated with something else (studies with this object in view are known as *diagnostic* research studies)
4. To test a hypothesis of a causal relationship between variables (such studies are known as *hypothesis-testing* research studies).

Course outcome:

1. Desire to get a research degree along with its consequential benefits;
2. Desire to face the challenge in solving the unsolved problems, i.e., concern over practical problems initiates research;
3. Desire to get intellectual joy of doing some creative work;
4. Desire to be of service to society;
5. Desire to get respectability

Module 1: RESEARCH METHODOLOGY

Research: Meaning, objectives and types of research, Significance of research: Definition and identification of a good research problem- Selection of research problem, Limitations and delimitations of the problem, Principles of experimentation, Design of experiments and testing of hypothesis, Intellectual property and Ethics in research.

Scientific Documentation: Types of report- Technical reports and thesis, Literature collection and documentation. Layout- Introduction, Review of Literature, Methods, Results, Discussion, Conclusion, References, Oral presentation.

Framing proposals for acquiring grants, Representation of pilot study, Research proposal and time frame, Budgeting- Available infra structure and resources.

Module 2: MATHEMATICS

Revision of elementary mathematics. Concept of differentiation, successive differentiation, maxima Integration, concept, indefinite and definite integrals

Module 3: STATISTICS

Preliminary ideas, Population and sample- types of stastical data- collection and classification of data- frequency distribution, Diagrammatic representation of data, Measures of central tendencies- Mean, Median and Mode, Measures of dispersion- Range, Quartile deviation, Standard deviation, Sampling techniques- Simple and Stratified random sampling.

Test of significance, chi-square test, t-test, analysis of variance, statistical quality and sampling. Statistical quality control.

Random variables and probability distribution- Binomial, Poisson and Normal. Study of relationship between variables – Correlation; Simple, Partial Multiple. Regression; Simple, Multiple.

REFERENCES

- Aggarwal BL. (2003). Basic statistics. New age Publications.
- Guptha SC & Kapoor VK. (2003). Fundamentals of mathematical statistics. S Chand.
- Vijayalakshmi G. (2009). Research Mthods, MJP Publishers
- Gurumani N. (2010). Scientific thesis writing and paper presentation. MJP Publishers
- Bandarkar, P.L. and Wilkinson T.S. (2000): Methodology and Techniques of Social Research, Himalaya Publishing House, Mumbai
- Harman, E & Montages, I. (Eds.) (2007). The thesis and the book, New Delhi: Vistar

FST1C04 - BASIC PRINCIPLES OF ENGINEERING

(Credit-4)

Course Objectives:

1. To understand the unit operation underlying various food processing operation
2. To get the knowledge of Food plant construction and their requirement as per standards
3. To know the important accessories like refrigeration ,boilers, motors and their design and applications

Course outcome:

1. Describes physical,mechanical,rheological,frictional and aerodynamic properties of solid food materials
2. Learn about different modes of heat transfer and extrusion technology
3. Explain the principle, method of drying and different drying equipments used in food industries
4. Describe the construction and operating principles of refrigeration systems using engineering terminology.
5. Determine heat loads and heat losses in heating and cooling food process systems.
6. Apply the principles of mass and energy balance to food processing systems.
7. Describe the construction and operating principles of boilers, pumps and heat exchangers
8. Describe the construction and operating principles of mechanical power transmission.
9. Design characteristics of food process equipment with sanitary design features.

Module 1: Basic units

Engineering units- Imperical (English) and metric system. Dimensions and conversions-SI system of units and English units.

Module 2: Thermodynamics

First law of thermodynamics, second law of thermodynamics, zeroth law of thermodynamics, Differentiation between heat engine and refrigerator, heat pump.

Module 3: Materials and energy balances

Simple calculations / estimation of energy requirement in pasteurization, evaporation and dehydration operations.

Module 4: Psychometrics and air conditioning

Psychometrics and air conditioning: Moist air, properties- DB, WB and dew point temperatures, specific humidity, relative humidity, degree of saturation, enthalpy, humid, specific heat. Psychometric chart, psychometric process-sensible heat , sensible cooling and humidification and de-humidification. adiabatic mixing, cooling and dehumidification, heating and humidification, air conditioning loads, simple air conditioning systems, state and rate of supply of air, summer air conditioning system, winter air conditioning system, cooling load calculations, By pass factor.

Steam table: Properties of steam and moist air, Steam table and mollier chart, calculation of steam properties.

Module 5: Materials for food plant construction

MS, SS and plastics- Grades used in food industries; corrosion in metals-mechanism, types and prevention. Design of food process equipment- sanitary considerations, sanitary design features of tanks.

Module 6: Instrumentation

Elements of measuring instruments, basic requirements, control and measurement of temperature (methods- thermometer, thermo couple), pressure (manometer, bourdon pressure gauge, diaphram) and pH.

Module 7: Mechanical power transmission

Force ,work, power, torque and speed, relationship and calculations. Power transmission systems- Belt drive and pulleys- flat and v-belt, materials, care of belts. Concept of idlers in belts Effect of belt thickness, slip, open and closed belt drives, ratio of belt tensions, centrifugal tension. Chain drives (Introduction only). Gear drives-types, gear trains, velocity ratio. Shaft, couplings types (Introduction only). Clutches- description. Spindles and keys. Bearings- types and description. Lubrication-principles of hydrodynamic lubrication, properties of lubricants, types.

Module 8: Boilers

Boilers and their rating, boiler hp. Classification- fire tube ,water tube, Horizontal tube and Vertical tube boilers. Package boilers, mounting and accessories. Steam distribution, pipes, valves fittings and insulation. Pressure losses, pressure reduction, condensate return and culinary steam.

Module 9: Refrigeration

Refrigeration, pasteurization, freezing, freeze drying. Heat exchangers- types and classification, pipes, valves and fittings.

Refrigeration and air conditioning: Principles of refrigeration, definitions and unit of refrigeration, COP, Commonly used refrigerants and their properties.

Refrigeration systems - Carnot refrigeration cycle .Air refrigeration cycle working on bell colemen cycle- open cycle and close or dense cycle.Mechanical refrigeration cycle- simple and multiple stage vapour compression refrigeration system and vapour absorption refrigerationsystem, their COP, components and control. Steam jet refrigeration. Domestic Electrolux (ammonium hydrogen) system. Lithium bromide absorption refrigeration system. Steam jet refrigeration system. Comparison between vapour compression and absorption systems.

BASIC PRINCIPLES OF ENGINEERING PRACTICAL

Course outcome:

1. Familiarize with different drawing equipment, technical standards and procedures for construction of geometric figures
2. Develop imagination and ability to represent the shape, size and specifications of physical objects
3. Construct and Interpret appropriate drawing scale as per the situation
4. Improving technical communication skill in the form of communicative drawings.
5. Draw simple curves like ellipse, cycloid and spiral and draw Orthographic projections of points, lines and planes.
6. Draw orthographic projection of solids like cylinders, cones, prisms and pyramids and draw isometric projections of simple objects.
7. Familiarize with engineering accessories like boiler house, Electrical laboratory and workshop, refrigeration equipment.

Blue printing reading and drawing, geometrical drawing principles,

Orthographic and isometric projections. Projection of solids- simple section and developments, blue printing reading, machine elements, simple assembly drawings, flow chart, lay out, drawings and piping drawings. Electrical laboratory, instrumental laboratory, refrigeration laboratory, boiler house and workshop, refrigeration equipment.

REFERENCES

- Sahay KM &. Singh KK, 1994. Unit operations of Agricultural processing Vikas Publishing House
- Kurmy p & Guptha Refrigeration & Air conditioning-
- Singh RP, Heldman DR1993 Introduction to Food Engineering Academic Press
- Romeo. Toledo T Fundamentals Food Process Engineering CBSPublishers
- Charm SE,Macabe, WL Smith JC & Hariot P 1993. Unit Operations of Chemical Engineering. McGraw Hills.

SEMESTER II

Sl. No	Course code	Title of courses	No of credits	Total Hours Allotted	Total credits
5	FST2C05	Biochemistry and Nutrition	4	108	15
		Food chemistry biochemistry and Nutrition practical			
6	FST2C06	Food Storage and infestation control	4	108	
7	FST2C07	Industrial Microbiology & Biochemical Engineering	4	108	
		Industrial Microbiology & Biochemical Engineering Practical			
8	FST2C08	Food Engineering	3	81	
		Food Engineering Practical			
	FST2A02	Computer Software packages in Food Industry	4		

FST2C05 - BIOCHEMISTRY AND NUTRITION

(Credit – 4)

Course Objectives:

1. To understanding the fundamental & advanced techniques in biochemistry
2. To get the knowledge of cell components and their functions
3. To know the different bimolecular pathways
4. To understand the body nutritional function requirements and calculations

Course outcome:

1. Understanding the relevance of biochemistry in food science and technology.
2. Knowledge on enzyme nomenclature, enzyme classification and kinetics, enzyme inhibition, mechanism of enzyme action
3. Awareness on biomolecules, in the living system and their functions.
4. Information on carbohydrate metabolism, amino acid metabolism, Lipid metabolism, nucleic acids, minerals and vitamins.
5. Study of biochemical pathways that sustain life and disorders due to inborn errors of metabolism.
6. Brief study on Dietetics and Health foods

Module 1: Introduction

Relevance of Biochemistry in Food Science and Technology. Cell Structure, Separation of Sub cellular organelles and their Biochemical functions

Module 2: Enzymology

Introduction to Enzyme, Definition, Apoenzymes, holoenzymes, Coenzymes and Co-factors. Nomenclature and Classification. Enzyme inhibition. Theories of Enzyme Substrate complex formation.

Module 3: Metabolism & Nutrition

1. CARBOHYDRATES:

   Nutritional and Functional aspects of carbohydrates, Digestion (digestive fluids and enzymes), and Absorption of carbohydrates. Glycolysis, Kreb'scycle, Hexose monophosphate shunt, Gluconeogenesis. Deficiency, Recommended dietary intake and food sources. Role of dietary fibre (Types, food sources and action in the GI tract)

2. LIPIDS: Functions in the body,lipid metabolism,transport storage and mobilization of fat in the body and oxidation of fattyacid. Biosynthesis of fatty acids, fats, phospholipids and cholesterol
3. PROTEINS: Nutritional aspects of proteins. Digestion (digestive fluids and enzymes), and Absorption. Protein requirement and protein deficiency diseases (Marasmus, Kwashiorkor and Marasmic Kwashiorkor), Protein metabolism, mechanism of aminoacid metabolism, deamination, transamination, decarboxylation and aminoacid oxidation, Intermediatory metabolism of aminoacids and urea cycle, inborn errors in aminoacid metabolism
4. NUCLEIC ACIDS: Nucleic acids, structure of DNA and RNA.
5. VITAMINS & MINERALS : Classification, Functions, Requirement and Deficiency conditions

Module 4: Dietetics & Health Foods

Introduction, Energy value of foods and energy requirement- Calorimeter, Proximate composition, Energy needs of the body- reference man and reference woman, Basal metabolic rate, factors affecting the BMR, Respiratory quotient, Specific Dynamic Action of food, Body mass index (BMI).

Balanced diet, Recommended daily Allowances for nutrients (RDA), Nutrition of weaned infants and Pre-school children, Nutrition of expectant and nursing mothers, Nutrition of Industrial workers and Athletes. Nutritional requirements in diabetics, atherosclerosis and obesity.

Supplementary foods, Nutraceuticals, Therapeutic foods, Functional foods: Definitions, Examples and applications. Nutrition programs in India.

BIOCHEMISTRY AND NUTRITION PRACTICALS

Course outcome:

1. Knowledge on the quantification and estimation of biological macro and micro molecules in different samples eg: blood.
2. Demonstration and understanding of separation techniques in biochemistry.

Estimation of glucose in blood

Estimation of cholesterol level in blood.

Estimation of total protein in blood.

Estimation of triglycerides in blood.

Separation of aminoacids – ascending paper chromatography

Estimation of Ascorbic Acid by volumetric method

Estimation of calcium

Estimation of chloride

REFERENCES

- Vasudevan, D.M. Textbook of Biochemistry Jaypee Publication
- Lehninger Nelson, David L Principles of Biochemistry Macmillan
- Mathews, Christopher K. Biochemistry The Benjamin/Cummings Publishing Co.
- 2Stryer, Lubert Biochemistry WH Freeman and Company
- Das, Debajyot , 1992. Biochemistry Academic Publishers
- Jain. JL.2001. Fundamentals of Bio chemistry. S. Chand and company ltd.
- Gajalakshmi Nutrition Science CBSPublishers
- Swaminathan M. Handbook of Food and Nutrition BOPPCO
- Abraham white. 1973, Principles of Biochemistry, Mc Graw Hill.
- Sathyanarayana U. and Chakrapani. U, 2006. Biochemistry. Books and Allied Pvt ltd.

FST2C06 - FOOD STORAGE AND INFESTATION CONTROL

(Credit -4)

Course Objectives:

1. To get familiarize with different types and characteristics of infestation occur during the storage
2. To get exposure on the different pest controlling methods.
3. To get information on the food storage godown in indian scenario.
4. To acquire knowledge on the characteristics of different storage infestations.

Course outcome:

1. Understand about the food storage infestation,sources,factors affecting food commodities.
2. Describe different types infestation control methods.
3. Know about types of pest on food commodities and mode of attack on food.
4. Explain sanitation and safety measures in food storage.
5. Give detailed structure about godown.
6. Assess the damage in storage premises
7. understand the physical, chemical and biological control of pest
8. Acquire the knowledge about sanitation and safety measures in food storage premises
9. Know about state ware house corporation, food corporation of India

Module I: Storage Infestations

Types of damage & spoilages on stored foods, Microbial spoilage (moulds & yeast, bacteria & viruses), Enzymatic spoilage, spoilage by insect, parasites & rodents, mechanical spoilage, chemical spoilage, physical damage. Factors affecting the storage commodity (temperature, moisture, oxygen, light, duration). source of infestation, cross, horizontal, vertical, latent infestation.

Module II: Insects Pests Infestation & Control

Insect pest their biology, food performance, effect of pests on food commodities, defection, monitoring techniques, controls, fumigants & fumigation methods & procedure.

Module III: Rodent, other Vertribrate & non Vertribrate Pest Infection & Control

Rodents: Types, detection, sources, control measures (Baits, trap, rodenticides)

Aves: Types, damages & their control

Spider & Mites: Types, damage & control

Module IV: Control of Pests on Stored Foods

Damage assessment, sampling, physical, chemical (pesticides), biological method of control. Insect growth regulator (Juvenile hormone & molting hormone), Integument plant material, repellent, anti-feedant, integrated pest management, concept of organic food.

Module V: Sanitation & Safety Measures in Food Storage Premises

Disinfestation of storage premises & appliances (duster, hand & power operated sprayer, fogging machines), safety devices (gas mask,canister, halide detector, eye shields & respirator). Storage structures- Rat proof, moisture proof, air tight, inlet & out let, raised plat form, brushing and cleaning, spoilage & sweeping, sub-standard shock declaration, management of wet & damage stock, turn over stock, release of stock, monsoon precaution. Prophylatic method for grain, bag & storage premises, ballooning techniques.

Module VI: Godowns

Layout of a ware house, food corporations of India (FCI) godowns, state ware house corporation, stacking, types of stacks, height, tonnage, stack lines, size of stacks. Visit to warehouses, regulated markets, and storage structures.

REFERENCES

- Dennis. S. Hill Pest and stored foods stuff
- Vijaya Kadar Food storage and preservation
- Central warehouse corporation, New Delhi Manual of storage practices
- Manual of pest management in processed foods and food industries – CFTRI, Mysore.
- Manual of storage practices – Central warehouse corporation, New Delhi
- Panda, H. The Complete Technology Book on Pesticides, Insecticides, Fungicides and Herbicides. NIIR.

FST2C07 - INDUSTRIAL MICROBIOLOGY AND BIOCHEMICAL ENGINEERING

Course Objectives:

1. To acquire the knowledge microbiology is applied in manufacture of industrial products.
2. To know how to source microorganisms of industrial importance from the environment.
3. To know about design of bioreactors, factors affecting growth and production,
4. To understand the rationale in medium formulation & design for microbial fermentation, sterilization of medium and air.
5. To appreciate the different types of fermentation processes.
6. To understand the biochemistry of various fermentations.
7. To understand comprehend the techniques and the underlying principles in downstream processing

Course outcome:

1. Detailed study on fermentation process, microbial growth kinetics and types of fermentation processes.
2. Knowledge on upstream and downstream processes in fermentation.
3. Understanding the application of rDNA technology in fermentation process.
4. Awareness about the microbial production of substances for food application including amino acids, enzymes, organic acids, polysaccharides, vitamins etc.
5. Study of bioreactors, operations of bioreactors and scale-up o bioprocess and equipments.
6. Knowledge on the application of immobilization technology in fermentation and study of effluent treatment methods.

(Credit – 4)

Module 1: Fermentation process

Introduction, Microbial growth kinetics, Isolation, Preservation and Improvement of industrially important microorganisms. Types of fermentation processes, their advantages and disadvantages. Component parts of fermentation process- Formulation and sterilization of media, Inoculum preparation and development, Extraction and purification of product, ETP

Module 2: R-DNA Technology

R-DNA Technology- Restriction enzymes, Modifying enzymes and Ligase. Overview of Gene cloning, Molecular basis of mutation- Site directed mutation and its application in Food industry

Module 3: Bioreactors for microbial, plant and animal cell cultures

Define bioreactors, the basic factors involved in fermentation design, general features of an ideal industrial fermentor, aeration and agitation, foaming, instrumentation and process control Operations of bioreactors. Scale-up of bioprocesses and equipments

Module 4: Types of bioreactors

Types of Batch, fed batch and continuous bioreactors. Bioreactors using in Solid State Fermentation and in immobilization technology

Module 5: Microbial production of substances for food applications

Amino acids & SCP: L-Glutamic acid, L-Lysine & SCP Production by Bacteria, Yeast, Fungi and Algae

Enzymes: General Aspects of Enzyme production- Amylases, Amyloglucosidase, Proteases, Pectinases, Lipases

Organic acids: Citric acid, Lactic acid, Itaconic acid, Acetic acid and Gluconic acid

Food additives and Microbial Fat

Polysaccharides: Xanthan, Pullulan, Dextran and Gellan

Vitamins: B12, B2, C

Mycoprotein, Baker's yeast, Ethanol & Antibiotics- Penicillin, Streptomycin, Cephalosporin

Module 6: Fermented foods and Beverages

Fermented Dairy products, Bread, Sauerkraut, Wine and Beer

Oriental fermented products- Soy sauce, Miso, Tempeh, Sufu

Module 7: Immobilized Enzyme Technology.

Methods of enzyme immobilization – Carrier binding, Cross linking and Entrapment, Advantages and disadvantages of immobilization

Module 8: Down stream processing of biological materials

Removal of microbial cells and other solid matter, foam separation, centrifugation, precipitation, dialysis, filtration. Cell distruption - physico-mechanical method and chemical method, liquid-liquid extraction, chromatography, membrane process, drying, crystallization, whole broth processing

Module 9: Effluent treatment

An overview of treatment process- Physical Chemical and Biological processes, Sewage system, Effluent Treatment Plant. BOD and COD, Single dwelling system, Muncipal waste water treatment.

INDUSTRIAL MICROBIOLOGY AND BIOCHEMICAL ENGINEERING PRACTICAL

Course outcome:

1. Study of bacterial growth kinetics.
2. Understanding of enzyme immobilization technique.
3. Production of fermented food products
4. Knowledge on the testing of BOD and COD.

- Isolation and maintenance of cultures, growth kinetics
- Enzymes and whole cell immobilization
- Aeration efficiency (mass transfer coefficient)
- Fermentation monitoring and control
- Alcoholic fermentation. Production of foods – wine, beer, Tempe, yoghurt, vinegar.
- Measurement of COD and BOD.
- Visit to fermentation Industry.

REFERENCES

- .Patel, AH 2004. Industrial Microbiology. Macmillan India ltd
- .Casida LE, Industrial Microbiology New Age international Publishers
- Prescott & Dunn, 1959. Industrial Microbiology .Mc Graw Hill.
- Whitaker,Stanbury Principles of fermentation technology 2nd edition Butterworth Heinemann
- JoshyVK , Pandey. A 1999. Biotechnology :Food Fermentation Vols.. I & II . Panima publications
- Wulf Crueger &Anneliese Crueger. Biotechnology:A text book of Industrial Microbiology.

FST2C08 – FOOD ENGINEERING

(Credit-3)

Course Objectives:

1. To impart knowledge and skills related to various unit operations such as drying and size reduction.
2. To provide the basic understanding of engineering properties of foods.
3. To get the knowledge of material handling

Course outcome:

1. Describes physical,mechanical,rheological,frictional and aerodynamic properties of solid food materials
2. Learn about different modes of heat transfer and extrusion technology
3. Describes several seperation techniques
4. demonstrate of mass transfer operations
5. Explain the principle, method of drying and different drying equipments used in food industries
6. Demonstrate of milling equipments, material handling and transportation methods

Module 1: Properties of solid food materials

Shape, density, porosity, angles of friction/repose, relations and simple calculations. Pressure drop and pressure head and energy relationships. Flow properties of liquid foods pulps and slurries. Viscosity, consistency, simple rheological models. Pumps, pipes and valves-classifications and uses. Rheological and aerodynamic properties.

Module 2: Heat transfer

Heat transfer, conduction, convection and radiation with examples, steady and unsteady heat transfer, overall heat transfer coefficient and its significance. Fin heat transfer, Boiling and condensation, Dimensionless numbers in heat transfer.

Radiation heating, infra red and solar heating-principles, applications and equipments.

Extrusion technology, membrane process, supercritical extraction, high pressure technology, cryogenic and Ohmic heating.

Separation methods: Equipment and applications-Sedimentation, Centrifugation, Filtration and Crystallization.

Distillation: Principles, equipment and applications. Steam distillation and molecular distillation.

Extraction and leaching: Theory and applications in food processing. Equipments- batch extractor, soxhlet extractor, Hildebrand extractor and Ballman extractor.

Module 3: Mass transfer operations

Principles, applications and equipments. Mass transfer, diffusion, Ficks law, heizler charts.

Module 4: Drying

Theory of drying, drying rate curves, EMC models. types of driers- deep bed dryer, flat bed dryer, continuous flow dryer, re-circulating dryer, LSU dryer, fluidized bed dryer, rotary dryer, spout bed dryer, tray dryer, tunnel dryer and solar dryer and their applications.

Module 5: Milling

Average size of particle in a ground product,screen analysis,fineness modules. Principles of size reduction, Size reduction procedure- compression or crushing, impact, shearing, and cutting.size reduction machineries- crushers, grinders, fine grinders, and cutting machines.

Dry and wet grinders, slicers/dicers, pulpers and granulators, types and applications. Homoginizers and Colloid mills,mixing and kneading equipments.

Module 6: Material handling and transportation

Conveyors and elevators for food industry, types- belt conveyor, bucket conveyor, screw conveyor and pneumatic conveyor and their applications. Design and HP considerations of conveyors.

Module 7: Elementary of food engineering

Freezing and thawing-principles, application and equipments.

Evaporation- single effect and multi effect evaporator, principle and applications.

Heat exchanger- plate heat, double pipe, shell and tube, plate fin type heat exchangers, principles and application.

FOOD ENGINEERING PRACTICAL

Course outcome:

1. Understand various physical properties of solid foods like angle of repose of grains, bulk density, true density, and porosity.
2. Analysis of drying characteristics of foods and plotting of drying curve
3. Determination of average size of the particle in ground food grains by sieve analysis or screen analysis

Experiments and demonstrations in unsteady state heating, non-isothermal cooling, heat exchangers, drum drying, spray drying, evaporation, sieve analysis, size reduction, sedimentation, filtration, centrifugation, fluidization.

REFERENCES

- Sahay K.M & Singh K.K Unit operations of Agricultural processing
- Paul singh R, Dennis R Heldman Introduction to Food Engineering Academic press
- Romeo . Toledo T Fundamentals of Food Process Engineering CBS publishers
- McCabe WL, Smith JC,1971 Fundamental of Food Engineering AVI Publ
- Ojha TP , Michael AM Principles of agricultural engineering
- McCabe & Smith 2001 Unit operations of Chemical Engineering McGraw hill
- Heldman & Singh 1980 Food Process Engineering AVI Publication.

YEAR-I PRACTICALS

Sl. No	Course code	Title of courses	No of credits	Total Hours Allotted	Total credits
9	FST2CP09	Food Microbiology, Fermentation & Biotechnology	2	72	6
10	FST2CP10	Food Chemistry, Biochemistry and Nutrition	2	72	
11	FST2CP11	Food Process Engineering	2	72	

SEMESTER III

Sl. No	Course code	Title of courses	No of credits	Total Hours Allotted	Total credits
12	FST3C12	Technology of Fruits, Vegetables, Spices &Plantation Products	4	108	18
		Technology of Fruits, Vegetables, Spices &Plantation Products Practical			
13	FST3C13	Principles of Food Processing and Preservation	4	108	
		Principles of Food Processing and Preservation Practical			
14	FST3C14	Technology of Cereals, Legumes and oil seeds	5	135	
		Technology of Cereals, Legumes and Oil Seeds Practical			
15	FST3C15	Packaging Technology	5	135	
		Packaging Technology Practical			

FST3C12 - TECHNOLOGY OF FRUITS, VEGETABLES, SPICES & PLANTATION PRODUCTS

(Credit – 4)

Course Objectives:

1. To understand the science and technology associated with fruits and vegetables and their transformation into food products
2. To acquire the principles of different techniques used in processing and preservation of fruits and vegetables
3. To get the knowledge of quality specifications of different fruits and vegetable products
4. To understand the post-harvest technology of spices

Course outcome:

1. Equip students with advanced knowledge of processing and preservation of fruits and vegetables.
2. Familiarize different aspects of post-harvest technology along with storage practices & Storage disorders
3. Understand the preparation and FSSAI specifications of Beverages, Tomato products c.
4. Understand the Technology of Jam Jelly and Marmalade
5. Illustrate the production and preservation methods of fruit juices.
6. Understand processing of plantation crops.
7. understand different water treatment

Module-1: Post harvest technology of fruits and vegetables

Pre and post harvest physiology, maturation changes, and maturity indices for harvesting. Post harvest treatments to hasten and delay ripening.

Post harvest handling: Sorting, grading, packing storage and transportation

Storage disorders: Physiological disorder, chilling injury, freezing injury.

Storage practices: Cold storage, controlled/ modified atmosphere storage and hypobaric storage, cellar storage, Zero energy cool chamber.

Module-2: Frozen product

Raw material preparation, treatments and processing methods of frozen fruits and vegetables (peas, mango pulp) and IQF. Restructured fruits and Vegetables.

Module-3: Beverages and other fruit products

RTS, Squashes, cordials, Syrups, Sherbet, crush. It's preparation, quality standards and FSSAI specifications.

Fruit juice and concentrates:

Unit operations & equipment, aroma recovery & restoration; aroma recovery systems. Fruit juice powder.

Pickles and chutneys, Types and production, packaging of pickles and chutneys, spoilage.

Technology of Jam Jelly and Marmalade

Pectin, Source, Chemistry, Theory of gel formation, role of pectinases. Quality control and Specifications

Processing of jam, jelly, marmalade, Preserves, candy, Glazed and Crystallized Fruits. It's quality control and FSSAI specification.

Module-4: Tomato products

Raw material quality for different types of products, preparation of product- juice, puree, paste, ketchup, soup and sauces, storage, quality control and FSSAI specifications.

Module-5: Spices

Chemical composition, classification, therapeutic value. Processing of major spices- technology of spice oils and oleoresins. Quality control of spices, standards and FSSAI specifications.

Module-6: Tea, Coffee, cocoa

Chemistry and processing of tea, coffee, cocoa. Tea-black tea, green tea, oolong tea. Tea products like, organic tea,, Instant Tea decaffeinated tea and flavored tea.

Coffee- Instant coffee, Soluble Coffee, decaffeinated coffee, chicory.

Module-7: Mineral Water

Water treatment –Filtration methods, Deionizing, ozonisation, reverse osmosis, additions and substitutions.

TECHNOLOGY OF FRUITS, VEGETABLES AND SPICES PRACTICAL

Course outcome:

1. Demonstrate various fruit & vegetable products preparation
2. Demonstrate FSSA specifications of fruit and vegetable products
3. Demonstrate various post harvest operation of fruits & vegetables

- Determination of acidity of Fruit juice
- Determination of pH and acidity of fruits and vegetable products

- Determination of TSS
- Different methods of peeling of Fruit and vegetables
- Extraction and Preservation of fruit juices
- Preparation ofJam ,jelly RTS, Squash and Crush
- Preparation of Tomato Products
- Preparation of Candy , preserve and glazed fruits
- Estimation of Salt content in pickle
- Fruit juice powder preparation
- Instrumental measurement of texture and colour in Fruit & vegetables
- Wax emulsion treatment
- Measurement of respiration of fruit and vegetables
- Analysis of spices
    - Moisture
    - Total ash and acid insoluble ash
    - Volatile oil
    - Spice oleo resins
- Raw material analysis
    - a)Mammalian excreta b)Other excreta,c)insects d)mold e)Insect defiled/infested f) light berries in black pepper
- A visit to tea/coffee/ chocolate industry
- A visit to Fruit and Vegetable Processing industry.
- A visit to Spices and condiments industry.

REFERENCES

- Kadar AA . 1992. Post Harvest Technology of Horticultural crops University of California
- Satish Kumar Sharma Post harvest Management and processing of fruit and vegetables-Instant notes
- Pandey PH Principle of Practices of post harvest Technology Kalyani publication
- Cruess WV., 1997. Commercial fruit and vegetables Products. Anees offset press, New delhi.
- Lal,G Siddappa S and Tandon GL. Presrvation of fruit and vegetables. ICAR
- Thompson AK 1995 Post harvest Technology of Fruits and Vegetables Black well Sci
- Verma LR& Joshi V.K .,2000 Post Harvest Technology of Fruits & Vegetables. Indus Publ
- Amit Krishna De. Spices; Traditional uses and Medicinal Properties
- Pruthi JS Major Spices of India
- Pruthi JS Quality Assurance in Spices and Spice Products
- Banerjee B 2002 Tea production and Processing Oxford university press

- Minifie BW . 1999 Chocolate , Cocoa and Confectionery Technology Aspen Publ
- Sivetz M& Foote HE 1963 Coffee Processing Technology. AVI Publ.
- Potter NN , Hotchkiss JH. Food Science. CBS
- S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers
- Srivastava RP & Kumar S .2003 Fruit and Vegetable preservation Principles and Practices. Interntional Book Distributors

FST3C13-PRINCIPLES OF FOOD PROCESSING AND PRESERVATION

(Credit-4)

Course Objectives:

1. To familiarize various basic preservation techniques.
2. To get the knowledge of food adulteration and food additives
3. To understand the advanced preservation technique

Course outcome:

1. Identify the different causes of food spoilage
2. Understand the basic principles of food preservation
3. Describe the different types of preservation methods– thermal , low temperature techniques, dehydration, and chemical preservation and natural fermentation.
4. understand about the process of canning, heat penetration of microorganisms in containers and process time evaluation for canned products.
5. Describe the recent trends in food preservation techniques which include high pressure processing, microwave processing, pulsed electric field processing, ohmic heating .
6. Familiarize about sensory evaluation of food and new product development

Module 1: Introduction

Classification of food: Type of foods and causes for food spoilage,

Module 2: Methods of Food processing and preservation

Basic principles of food preservation, methods of preservation

Thermal processing: cooking, blanching, pasteurization, sterilization

Canning: History, Principles of canning, steps involved in canning, Types of containers used for canning. Heat penetration into containers, pH classification of Foods, Heat resistance of micro organism, process time evaluation for canned products, corrosion of cans

Quality requirements for processing, raw material preparation, preparation of syrups and brines, canning of orange, pineapple, carrot and peas.

Low Temperature Techniques: Preservation by chilling, freezing, Slow Freezing and quick freezing

Dehydration: Drying and dehydration and associated quality changes during drying and storage of dehydrated products and solar drying.

Chemical Preservation: Sulphur di oxide , benzoic acid, sorbates, propionates, antioxidants, and antibiotics, FSSAI Regulations for various Food Products.

Preservation by controlling water activity, high sugar products and intermediate moisture foods. Curing and effect of salt on food preservation.

Food additives: Definition , types , and functions

Food adulteration: Analysis of adulterants by FSSAI DART analysis

Preservation by fermentation: Alcoholic, acetic and lactic fermentation, applications in food processing.

Hydrostatic pressure technology and microwave processing: Principles, applications and advantages

Non thermal technologies: Microfiltration, bactofugation, ultra high voltage electric fields, pulsed electric field, high pressure processing, irradiation,

Alternate thermal technologies: Ohmic heating, dielectric heating, infrared and induction heating.

Hurdle Technology: Principles, applications and advantages.

Module 3: Subjective analysis:

Sensory evaluation, panel selection, various methods and its relevance in new product development. Instrumental methods of Sensory analysis.

PRINCIPLES OF FOOD PROCESSING AND PRESERVATION PRACTICAL

Course outcome:

1. Describe the process of can fabrication and seam technology
2. Demonstrate primary processing of foods

3. Determine the acidity, P H and salt content of food samples
4. Carryout water quality analysis
5. Conduct sensory evaluation of food

- Can fabrication, dimension and seam technology, tin plate testing- tin coating, weight and porosity.
- Primary processing of foods.
- Experiments in thermal processing, refrigeration, freezing, drying and dehydration.
- Preservation of food product using chemical preservatives.
- Estimation of SO_2 and benzoic acid.
- Water quality analysis.
- Determination of acidity and pH.
- Determination of salt content.
- Sensory evaluation methods.
- Visits to food processing industries.

REFERENCES

- Murano, Peter S. Understanding Food Science and Technology .Thomson
- Pand PH Principles and practices of Post harvest Technology Kalyani Publishers
- Sudheer KP, Indira. V Post harvest technology of Horticultural corps New India Publications.
- Khader, Vijaya Textbook on Food Storage and Preservation Kalyani Publishers
- Pruthi JS Quick Freezing Preservation of Foods Allied publishers Limited
- Potter N N.& Hotchkiss 1997 Food Science CBS Publishers
- Richardson, Thomas Chemical Changes in Food During Processing Champman
- Desrosier NW James N,1977 Technology of Food Preservation CBS Publishers
- Ohlsson, Thomas Minimal Processing Technologies in the Food Industry CRC Publishers
- Arti Sanhla Food Preservation. Principles and practices
- Manay,N.S,Shadaksharaswamy,M.,Foods:New Age international (P) publishers, New Delhi 2004
- Shafiur Rahman M., 1999, Hand book of food preservation. Marcel Dekker, Inc, New York.
- Subbulakshmi G and Udippi S.A Food Processing and PreservstionI Foods:New Age international (P) publishers, New Delhi 2001

FST3C14 – TECHNOLOGY OF CEREALS, LEGUMES AND OIL SEEDS

(CREDIT – 5)

Course Objectives:

1. To understand the science & technology associated with cereals, pulses & oil seeds.
2. To get the knowledge of various baking technologies including bread, cake, biscuits and extruded products.
3. To make exposure on processing technologies related to rice, wheat, maize, millets, pulses, nuts and oilseeds.

Course outcome:

1. Learn to appreciate the complex nature of flour and the complexity of modern baking technology
2. develop competency to critically evaluate quality of product formulation and processing.
3. Analyse the processing methods of pulses and legumes, nuts and oilseeds including coconut.

Module 1 : Cereals

Introduction, types of cereals, composition and structure, functions

Wheat

Introduction to wheat chemistry and baking technology. Wheat varieties and uses. Criteria of wheat –physcial and chemical. Structure of wheat grain – chemical composition, kernel structure and their composition. Criteria of flour quality,. Starch damage, composition and function ability of wheat flour components. Rheology and chemistry of dough., influence on flour constituents on dough Rheology. Dough testing Instruments such as farinograph, mixograph, extensograph, amylograph, alveograph and rapid visco analyzer.

Wheat based bakery products: Technology and FSSAI specifications of bread, cake, biscuit, cookie, cracker and wafer manufacture. Baking additives, Technology of Indian traditional products. Technology and FSSAI specifications of pasta goods, Extruded products, Premixes for bakery and traditional products from cereals and legumes

Rice

Varieties, chemical composition, grain structure, distribution of nutrients and effect of processing. Physical properties of paddy and rice, Morphology, dimension of grain, L/B importance, density, porosity, angle of repose –importance in handling processing, physico-chemical properties of rice. Cooking quality of rice. Classification of rice. Factors affecting

milling quality and degree of milling. Cracking effect of parboiling Drying of paddy. Occurrence and prevention of crack formation.

Rice Milling: Unit operation and machineries modern rice milling and mini rice milling, parboiling of rice –methods, properties of parboiled rice, changes during parboiling advantages and disadvantages of parboiling. By products of rice milling and their benefits. Factors affecting bran quality and stabilization of bran. Industrial uses of bran. Husk as source of energy. ageing and curing of rice.

Maize and Millets :

Chemistry and technology of maize. Chemical, technological and nutritional aspects of sorghum and millets. Cereal and millet based nutritional food.

Module 2: Pulses and Legumes

Types of legumes and Pulses , chemical aspects and quality of Pulses. Nutritional quality. Anti nutritional factors in pulses and it's removal. Sprouting of pulses, Pulse processing –traditional and modern, Secondary processing of pulses. Utllization of minor pulses.

Module 3: Oilseeds

Oilseeds as source of protein and oil. Ghanni and expeller pressing, solvent extraction, super critical extraction, extrusion technology processing of oilseeds for protein concentrates and isolates. Utillzation of oilseeds and cakes for infant foods, weaning foods and supplementary foods. Anti- nutritional factors and their removal, Nutritional quality. Functional and nutritional properties of oilseed proteins - uses of oilseed meals or flours. Technology of vegetable protein isolates and Texturised Vegetable Proteins .

Coconut processing:

Introduction. Products from coconut palm - toddy, arrack, jiggery, Coconut vinegar, Neera, Copra Manufacture, Grades of copra. Quality standards, drying and smoking, Coconut oil extraction. Virgin coconut oil. Desiccated coconut. Coconut milk & spray dried coconut milk powder.

TECHNOLOGY OF CEREALS LEGUMES AND OIL SEEDS PRACTICAL

Course outcome:

1. Evaluation of properties of wheat and rice –physical, chemical and rheological.
2. Processing and evaluation of bread, biscuit and cake.
3. Experimental milling of wheat and rice.

- Evaluation of properties of wheat and rice –physical, chemical and rheolofical.
- Test baking of bread, biscuit, cookies and cakes.
- Experimental milling of wheat.
- Quality parameters of rice and wheat flour.
- Processing and evaluation of pasta good.
- Cooking quality of rice.
- Experimental parboiling and quality evaluation.

- Experimental milling of rice.
- Estimation of FFA, crude oil, fiber and minerals in bran.
- cooking quality of pluses,
- Milling and puffing experimental expeller pressing.
- Experimental solvent extraction.
- Production of protein concentrates and isolates.
- Visit to pulse, rice or wheat and oil mills.
- Visit to a baking industry.

REFERENCES

- Hui, Y.H, Bakery products, Science and Technology , Black Well publishing, 2006
- Matz S.A; Bakery Technology and Engineering; 3 edn, CBS Publications, New Delhi
- Faridi H, The science of cookie and cracker production; CBS Publications ; New Delhi
- Dendy D A V & Dobraszczyk BJ Cereals and cereal products, Aspen
- Kent NL 1983Technology of cereals Pergamon press
- E J Pyler. Bakery science Technology. Vol I, II. Sosland Publications.
- Manley D. 2000. Technology of Biscuits, Crackers and Cookies. CRC press.
- Faridi H. Science of Cookie & Cracker Production
- Banson JA and Valesco Jr, Coconut production & Utilization.
- Thampan , P K, Processing of Coconut products in India

FST3C15 - PACKAGING TECHNOLOGY

(Credit – 5)

Course Objectives:

1. To understand the basic principles of packaging
2. To familiarize packaging materials,
3. To understand link the packaging materials to safety, quality and shelf life of foods
4. To compare packaging materials to each other

Course outcome:

1. Understand food packaging principles , packaging materials, types related to use with various food systems and packaging permeability.
2. understand about Passive and active packaging including modified atmosphere packaging and controlled atmosphere storage of foods, Reuse, disposability and printing of packaging, Labeling techniques and legislative requirements for labeling food and beverage products.
3. Familiarize the purpose and principles of food packaging and examine the operations involved in packaging material manufacture.
4. Critique environmental issues, regulations and quality control associated with food packaging.
5. Identify and evaluate the suitability of processing and packaging techniques for various foods

Module 1: Introduction

Definition, Functions of Packaging, Packaging Design Consideration, Packaging and Eco-System

Module 2: Packaging materials

Cellulosic Packaging Materials:

Paper: Pulp, Pulping Methods, Mechanical Pulping, Chemical pulping, Beating and Refining, Fourdriener machine, Cylindrical machine, Twin wire formers, Presser and Driers. Type of Papers and Cellophane.

Corrugated Fiber Board (CFB): Material, components of corrugated board, liners, fluting, adhesive, Board and box manufacture. Major attributes of CFB, Inserts and cushioning materials, Plastic corrugated boxes.

Manufacturing of Folding cartons, set up boxes, Paper Sacks and Paper bags, Food items which packaged in these containers.

Wooden containers: Material, Requirements of wooden containers, Effect of moisture on properties of wood.

Glass Packaging: Manufacturing methods, Types of glass packages and Uses in Food industry

Plastic films and rigid plastics: Classification of polymers, Polymerisation process, Physical and chemical characteristics, LDPE,LLDPE,HDPE,PE, PP, Metallocene, EVA, EVAOH,EAA,PS(HIPS,EPS),PVOH, PVC, PVdC, PET, PEN, PC, PA, Acrylonitriles.

Additives in plastics, Plastic manufacturing process- Injection molding and Blow molding. Calendring, Lamination, Metallisation and Orientation.

Manufacturing Methods and Materials used for Plastic Containers: Sacks, bags, Pouches, wraps, bottles, cans, Retortable plastic can, jars, cups, tube, cartons and bulk containers. Food items which packaged in these containers.

Collapsible tubes Materials, processing of food in collapsible tubes.

Metal packaging: Tin plate containers, Aluminium foil, composite can.

Module 3: Packaging Systems and methods

Purposes of Modified and controlled atmosphere packaging, Active and Intelligent packaging, Aseptic and retort pouch packaging, Shrink and Stretch packaging, Insect resistant packaging, Vacuum packaging, Edible packaging

Module 4: Packaging and Labeling of food

Fresh fruit and vegetables, meat, fish, poultry, fat and oils, spice products, bakery and confectionery, dairy products, beverages.

Module 5: Quality Assurance & Specifications

Laws: Packaging standards, laws and regulations. Packaging specifications, Quality control

Package- Product compatibility; Tainting, toxicity & migration in food packaging

FSSAI Regulations for food packaging and labeling.

PACKAGING TECHNOLOGY PRACTICAL

Course outcome:

1. Apply and examine the knowledge of properties for selection of packaging materials for food products.
2. Understand various properties of packaging materials and determination of properties like bursting strength, tearing resistance, puncture resistance, impact strength, and tear strength of packaging materials by various packaging testing equipments.
3. Identification of packaging materials and knowledge on Chemical and physical tests of packaging materials.

- Identification of packaging materials.
- Strength properties of packaging materials,
    - Grammage
    - Bursting strength
    - Migration rate
    - Tearing strength
    - water vapor transmission rate,
    - Gas transmission rate.
    - Chemical resistance of packaging materials.
- Shelf-life of packaged foods. Vacuum and gas packaging.
- Pre-packaging of fresh produce.
- Chemical and physical tests of packaging materials.
- A visit to Packaging Industry or Institutional departments.

REFERENCES

- Mathlouthi, M Food Packaging and Preservation . Aspen
- Larousse, Jean Food Canning Technology Wiley-VCH
- Mahadeviah M & Gowramma RV 1996 Food Packaging Materials. Tata McGraw Hill
- Painy FA.1992 A Hand Book of Food Packaging. Blackie Academic

- Stanley S & Roger CG 1970 FoodPackaging AVIPubl
- Srinivasa Gopal TK Sea Food Packaging CIFT.Cochin
- Robertson, Gordon L. Food Packaging Marcel Dekker Inc.
- Gupta, Ajay KR Handbook on Modern Packaging Industries
  Asia Pacific Business Press Inc.
- Hand book of Packaging Technology. Engineering India Research Institute.

SEMESTER IV

Sl. No	Course code	Title of courses	No of credits	Total Hours Allotted	Total credits
16	FST4E16	Food Plant and Quality Management	4	108	20
17	FST4E17	Technology of Animal Food products	4	108	
		Technology of Animal Food products Practical			
18	FST4E18	Dairy Technology	4	108	
		Dairy Technology Practical			
19	FST4E19	Sugar and Confectionary Technology			
		Sugar and Confectionary Technology			
20	FST4Pr20	Project work and Course Viva	8		

FST4E16 FOOD PLANT AND QUALITY MANAGEMENT

(Credit – 4)

Course Objectives:

1. To study the theory and practice of food safety in food, beverage and allied industries.
2. To understand quality management, its role, its implementation in process management, and the integration of management systems for product quality, safety and environmental care

Course outcome:

1. Evaluate the recent developments in the control of food safety.
2. Have an integrated view of the issues involved.
3. conduct risk assessments of food safety problems in food industry
4. Demonstrate detailed knowledge of the requirements for compliance with national and international food safety legislation.
5. Explore the history and basic ideas underlying quality management and have a detailed knowledge of the role of Quality Management (QM) in modern management.
6. Demonstrate knowledge of quality management systems, their implementation and the practical steps needed for implementation.
7. Know how to control and maintain a quality management system.
8. Have detailed knowledge of certification and accreditation.
9. Have knowledge and insight of different quality management systems i.e. product quality management, safety and environmental management

MODULE 1: Concept of Quality

Quality- Definition, Quality attributes- On physical, chemical, nutritional, microbial and sensory aspects.

MODULE 2: TOTAL QUALITY MANAGEMENT

Total quality management in food industry- Food quality assurance programme. Quality control, Quality evaluation and Quality audits. ISO 9000 Series, ISO 14000:2015, ISO 22000:2018, Pre-Requisite Programs, FSSC 22000 and HACCP systems. GMP, GHP, SSOP, SOP, GLP and ISO 17025.

Ingredient specification, Product formulation, Research and Development programs in Food industries, Product traceability and recall, Pest Control Programs, In-process monitoring and records.

MODULE 3: FOOD LAWS AND STANDARDS

FSSAI: Repealed acts before FSSA, Salient features of the act, Scope of the act, Functions and Authority, Regulatory enforcement at state, Licensing and Registration for Food Business Operations, Adjudication and Food Safety Tribunals, Offences and Penalties, Roles and Responsibilities of Food Safety Commissioner- Assistant Food Safety Commissioner- Food Safety Officer & Food Analysts, Food Import Regulations, Food Adulteration and Detection.

Codex Alimentarius protocols, USFDA and EPA regulations, Food safety aspects in WHO and FAO, GCC and European Union Food Regulations, BIS, AGMARK, WTO, Export Regulations and Export promotion bodies.

MODULE 4: Marketing and Management

Marketing aspects of products and management of food industry. Evolution and role of management, Planning, organising and controlling. Patent and IPR, Market Research, Sale forecasting and Advertisements, Purchase and Stores procedures.

Break even analysis, Industrial cost accounting, Cost factors in fixation of prices, Factory overheads, Budget and budgetory control.

REFERENCES

- The Food Safety and Standards Act, 2006. Professional books
- Mahindru, S.N. Food Safety Concept and Reality APH
- Krammer A & Twigg B A 1973 Quality control in Food Industry AVI Publ
- Hutchings, John B. Food Color and Appearance Aspen
- McSwane, David Essentials of Food Safety & Sanitation Prentice Hall
- Birchfield, John C. Design and Layout of Food service Facilities Wiley
- Ahmed, Farid E. Seafood Safety. National Academy Press
- Baker, Gregory A. Introduction to Food and Agribusiness Management Prentice Hall
- Grimme, L.H Food Quality, Nutrition and Health Springer
- Schroder, M.J.A Food Quality and Consumer Value Springer
- Springett, Mark B Raw Ingredient Quality in Processed Foods Aspen
- Rogers, Erika Kress Instrumentation and Sensors for the Food Industry CRC
- Earle, Richard Food Product Development CRC

FST4E17 TECHNOLOGY OF ANIMAL FOOD PRODUCTS

(Credit-4)

Course Objectives:

1. To study meat, fish and egg and their byproducts in relation to their utilization and safety through the use of biological, chemical and physical sciences.
2. To give knowledge on the basic principles involving in animal food industry which includes selection of raw materials, slaughtering techniques, preservation technologies and the various use of products and by products.

Course outcome:

1. Understand the importance of safe slaughtering methods and its significance in food safety.
2. Demonstrate Innovative ideas on the production of various products
3. Describe the methods of preservation of different animal products based on their shelflife
4. Demonstrate Quality parameters of egg and the preservation methods from ancient to modern technologies
5. Give a idea about fish processing technology.

Introduction : Introduction to meat ,fish and poultry processing industries in India

Module 1: Technology of Meat

Chemistry and microscopic structure of meat tissue. Nutritional status. Poultry Processing.

Modern abattoir, Typical lay out and features, Hygiene practice at abattoir, Slaughtering methods.

Module 2:Meat animals

Ante mortem Handling-Stunning methods- Steps in slaughtering and dressing of Pig, Sheep, Poultry.

Post mortem inspection and Carcass evaluation- Rigor mortis-Post mortem biochemical changes

Module 3: Ageing of meat

Factors affecting ageing. Mechanism of ageing. Methods of ageing, Tenderisation, Pre slaughter methods and post slaughter methods. Role of enzymes in meat processing.

Module 4: Preservation and processing

Curing, Smoking, Freezing, Canning & Dehydration, Irradiation, Chemical preservation of meat.

Technology of Restructured meat, Comminuted meat product-Sausage, and Non-comminuted meat products-ham & bacon.

Intermediate moisture meat processing, Hurdle Technology.

Contaminants and naturally occurring poisons in meat

Module 5: Technology of Fish

Composition, Nutritive value, biochemical changes in fish after fishing. Quality of Fish, Minced fish technology and surimi.

Canning, smoking and Freezing of Fish, Additives used in fish processing.

Technology of Fish oil, Fish meal, Fish protein concentrate, Fish paste, sauce, fish ensilage. Chitosan

Module 6: Egg and Egg Products

Structure and composition of egg, Factors affecting quality. Quality measurement. Technology of egg Products- egg powder, Albumin flakes and Calcium tablets. Spoilage of egg, preservation of raw egg, preservation of opened egg. Functional properties of egg. Industrial application of egg.

Quality, By Product Utilization and Spoilage characteristics of meat, fish and poultry products

TECHNOLOGY OF TECHNOLOGY OF ANIMAL FOOD PRODUCTS PRACTICAL

Course outcome:

1. Determine the acidity of milk, curd, butter
2. Quality analysis of egg
3. Proximate composition of meat and fish

- Hygienic Meat Production and carcass evaluation
- Evaluation of Fish Quality,
- Detection of spoilage in meat and Fish
- Processing of Ham and Bacon, Sausage and Corned Beef
- Curing of Fish
- Thermal Processing of Meat,Fish and Poultry Products.
- Commercial sterility of canned meat Products
- Freezing of meat and fish
- Measurement of meat texture
- Meat Structure
- Preparation of Traditional Products such as Tandoori Chicken and Kababs
- Measurement of egg quality
- Fish Meal and Fish oils

- Casings from Intestines
- Rendering
- Visit to Local abattoir and Poultry Farm

REFERENCES

- Gracey JF Collins DS Meat Hygiene ELBS
- Person AM Gillet T A Processed Meats. CBS publishers
- Lawrie R A Lawries Meat Science Tata McGrawHhill
- Mountney T. Carmen G Prakhurst R Poultry Products Technology CBS Publishers
- Ockerman H W Hancen C L Animal Byproduct Processing Elis Horwood
- Gopakumar K Tropical Fishery Products Oxford
- Jhingran VG Fish & Fisheries of India Hindustan Publishing Company
- Biswas KP A Text Book of Fish and Fisheries Technology Tata McGraw hill
- Stadelman, William J.. .Egg Science and Technology. CBS.
- Parkhurst, Carmen R .Poultry Meat and Egg Production.. CBS.

FST4E18 - DAIRY TECHNOLOGY

(Credit- 4)

Course Objectives:

1. To understand composition, physico-chemical properties and nutritive value of milk.
2. To analyze the characteristics of quality control tests in milk.
3. To distinguish between different types of milk.
4. To get knowledge about dairy plant operations,dairy plant sanitation and hygiene.
5. To understand the processing of milk related products, fermented milk products

Course outcome:

1. Compare different types of milk
2. Understand about the platform quality test conducted for milk
3. Describe in detail, the dairy plant operations
4. Understand in detail about different milk products like cream, butter, ghee, ice cream, butter oil, condensed milk etc.
5. Understand the fermented dairy products like yoghurt, acidophilus milk, butter milk etc.
6. Demonstrate cheese, its classification and different processing methods adopted
7. Understanding about dairy plant sanitation and hygiene

Module I : Introduction

Definition. Milk and milk production in India- Composition of milk of various species, Physico-chemical properties, Nutritive value. Platform tests. Quality control

Module 2 : Market Milk

Dairy plant operations- Receiving, Separation, Clarification, Pasteurization, Standardization, Homogenization, Storage, Transportation and distribution of milk.

Special milk- UHT, Toned, Double toned, Homogenized milk, flavored milk, Reconstituted milk, recombined milk. Fortified milk, sterilized milk. Filled milk. Vegetable tonned milk.

Module 3: Technology & FSSAI Specifications for Milk products

Milk products- cream, Butter, Ghee, Evaporated milk, Condensed milk, Whole and skim milk powder, Butter oil, Ice cream

Fermented milk-Yoghurt, Acidophilus milk, butter milk, Khoa, Channa, Paneer and similar products

Cheese- Classification, Cottage cheese, Cheddar cheese, Processed cheese- manufacturing methods.

Module 4: Dairy Plant Sanitation and Hygiene.

Dairy plant sanitation- Selection and use of dairy cleaner and sanitizer in plant cleaning system, Waste disposal methods.

Module 5: grading and Quality

Specifications and standards in milk processing industry

Judging and grading of milk

contections made from khoa- Burfi, peda, kalkanad, Gulabjamun

Nutritive value of khoa and khoa based confections

REFERENCES

- Prajapati, J.B. Fundamentals of Dairy Microbiology Akta Prakashan
- De, Sukumar Outlines of Dairy Technology Oxford University Press.
- Johnson, Webb .Fundamentals of Dairy Chemistry..CBS
- Eckles, Clarence, Henry Milk and Milk Products Tata MCGraw Hill publishers
- Kurmann, Joseph A. Encyclopedia of Fermented Fresh Milk Products CBS Publishers
- Atherton, Henry V. Chemistry and Testing of Dairy Products CBS Publishers
- Johnson, Webb Fundamentals of Dairy Chemistry CBS Publishers

DAIRY TECHNOLOGY PRACTICAL

Course outcome:

1. Conduct platform tests for milk
2. Evaluate the quality of milk by analysis of fat, SNF, TS, specific gravity and acidity
3. Estimate the FFA content in ghee
4. Detect adulteration in milk
5. Conduct phosphatase test and methylene blue reduction test to check milk quality
6. Determine the quality of cream, butter, ghee, condensed milk and dried milk
7. Prepare milk products like khoa, paneer, chana and shrikhand
8. Analyze khoa for total solids, moisture, fat and acidity
9. Examine microbiological quality of milk

- Plat form tests for milks
- Routine analysis of milk – Fat, SNF, TS, Specific gravity, Acidity etc
- FFA in ghee.
- Detection of adulteration in milk
- Phosphatase test
- MBRT
- Quality determination of cream, butter and Ghee, Condensed and dried milk.
- Preparation of khoa from cow, buffalo milk.
- Analysis of khoa for total solids, moisture, fat, acidity.
- Preparation of Paneer, preparation of chana and shrikhand.
- Microbiological examination of milk.

Visit to dairy plants

Study on basis of reception of milk at the plant; Platform tests in milk, Estimation of Fat and SNF in milk, preparation and evaluation of table butter, ice-cream, cheese and indigenous milk products such as Khoa, Chhana, Paneer, Ghee, Rassogolla, Gulabjamun, Shrikhand, Lassi, Burfi; Visit to dairy plant.

FST4E19- SUGAR AND CONFECTIONARY TECHNOLOGY

(Credit –4)

Course Objectives:

1. To improve the existing confectionery products by adopting modern machines & technology
2. To understand the process of chocolate
3. To study the different sugar confectionery products

Course outcome:

1. Get knowledge on the overview of the relevant physical chemical properties of sweetners.
2. Understand the different types of sugar confectionary products and their process.
3. Expertise in the processing and preparation of various type sugar confectioneries.
4. Evaluate the product quality and shelf life of the products
5. Acquiring depth knowledge on the manufacturing leads to stable position in the research and development of the versatile confectionery products

Module 1: Introduction

Sources of sugar manufacture –chemical composition of sugar cane, manufacture of table sugar, double sulfitation process, molasses, and utilization of molasses.

Module 2: types and forms of sugar

Types of sugars –white sugar, refined sugar, gur-khandahari sugar, crystalline sugar

Forms of sugar –beet sugar, liquid sweetener, cane sugar, cane syrup, corn syrup, fructose syrup, maple syrup, honey.

Module 3: Confectionery

Raw materials for confectionery manufacture, comprehensive understanding of raw materials used in the confectionery manufacturing and processing industry, including quality control methods.

Sugar confectionery manufacture, general technical aspects of industrial sugar confectionery manufacture, manufacture of high boiled sweets-ingredients methods of manufacture-types-centre-filled, lollipops, co-extruded products manufacture or gums and jellies-quality aspects.

Manufacture of miscellaneous products, caramel, Toffee and fudge-Liquororices paste and aerated confectionery, lozenges, sugar panning and chewing gum count lines Quality aspects, fruit confections.

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

Module 4: chocolate processing

Cocoa, sugar, dried milk products, special fats, emulsifiers, Nut kernels, alcoholic ingredients, the production of cocoa liqueur from the cocoa bean, Dark, milk and white chocolate, manufacturing processes.

Chocolate processing technology, compound coatings & candy Bars, Tempering technology, chocolate hollow figures, chocolate shells, enrobing technology manufacture of candy bars, presentation and application of vegetable facts production of chocolate mass.

REFERENCES

- Minifie, Bernard W..Chocolate, Cocoa, and Confectionery Science and Technology. CBS
- Beckett, Stephen T .The Science of Chocolate.. RS.C.
- Bernad VM.1989. Chocolate, Cocoa and confectionery , science and Technology. Avi publications.
- Bernad , Minfie., Chocolate, cocoa & confectionery Science & Technology. Advnce Books , Jaipur
- Lee R and EB Jackson ,1973,. Sugar, confectionery and Chocolate manufacture. Leonard Hill Books
- Jackson R Sugar confectionery marketing

SUGAR AND CONFECTIONARY TECHNOLOGY PRACTICAL

Quality assessment of flour, batter rheology, leavening agents, different tests for leavening action of baking powder, sodium-bicarbonate and ammonium-bicarbonate, preparation of different varieties of sugar, candies, chewing gums, and chocolate, flour confections, fruit confections, Indian traditional confections, chikki, etc. determination of sucrose content and SO2 content in white sugar.

YEAR-II PRACTICALS

Sl. No	Course code	Title of courses	No of credits	Total Hours Allotted	Total credits
22	FST4L22	Food Processing, Preservation and Packaging	2	72	6
23	FST4L23	Technology of Plant Food Products	2	72	
24	FST4L24	Technology of Animal Food Products	2	72	

MODEL QUESTION PAPER

FST1C01- FOOD MICROBIOLOGY

Time: 3hrs Maximum: 30 Weightage

Part A

Write short on 4 Out of 7 of following questions**:**

1. What are Endospores
2. Define D Value
3. What is a Bacteriophage
4. Define water activity
5. Transduction ?
6. Bacterial flagella
7. Starter culture

(4x2=8 Weightage)

Part B

Write Short essay on any **4 out of 7** of the following

8. Sauerkraut
9. Ascospores and Basidiospores
10. Irradiation of food
11. Lag phase and Log phase
12. Food infection
13. Mutation
14. Wet Sterilization

(4x3=12 Weightage)

Part C

Write essay on any **two** of the following

15. How the bacterial conjugation is helpful in gene transfer between bacteria?
16. How the food hygiene is achieved in the food processing plants?
17. What are the reproductive structures of fungi?
18. Explain the importance of lactic acid bacteria in food preservation with examples.

(2x5=10 Weightage)

MODEL QUESTION PAPER

FST1C02- FOOD CHEMISTRY AND ANALYSIS

Time: 3hrs Maximum: 30 Weightage

Part A

Write short on 4 Out of 7 of following questions**:**

1) Define Carbohydrates
2) Define flavor reversion
3) What are Antioxidants
4) What are terpeneless oils
5) Detectors used in Gas Chromatography.
6) What is invert sugar
7) Plant pigments

(4X2=8 Weightage)

Part B

Write Short essay on any **4 out of 7** of the following

1) What is Vanaspathi
2) State Beer Lamberts Law.
3) Diseases caused by the deficiency of Fat soluble Vitamins.
4) Define Emulsion
5) Define Hydrolytic Rancidity
6) Protein Denaturation
7) Starch Retrogradation

(4X3=12 Weightage)

PART-C

Write essay on any **two** of the following

1) Explain principle and working of HPLC Which are the detectors used
2) Moisture in foods & its determination
3) Refining of oils & fats
4) Explain classification, sources & deficiency diseases of vitamins

(2X5=10 Weightage)

MODEL QUESTION PAPER

FST1CO3 –RESEARCH METHODOLOGY AND STATISTICS

Time: 3hrs Maximum: 30 Weightage

Part A

Write short on 4 Out of 7 of following questions**:**

1. What you mean by methodology?
2. What is a research problem meant for?
3. What is hypothesis?
4. What are pilot studies?
5. Population study means?
6. Define median and mode
7. Define standard deviation

(4X2=8 Weightage)

Part B

Write Short essay on any **4 out of 7** of the following

1. Define normal distribution
2. What are the different measures of dispersion?
3. Write on different research approaches
4. What are the criteria for a good research proposal
5. Differentiate between correlation and regression
6. Write an account for Statistical quality control
7. Types of sampling techniques

(4X3=12 Weightage)

Part C

Answer any **two** questions out of 5 of the following

1. Calculate the correlation coefficient from the following data:

x:	78	89	97	69	59	79	68	57
y:	125	137	156	112	107	138	123	108

2. If the probability of a new born child is male in a typical family is 0.6, find the probability that in a family of 5 children there are exactly 5 boys.
3. Describe a Research proposal and time frame for a topic related to Food Science
4. Frame a Research proposals for acquiring government grants with a pilot study demonstration (2X5= 10 Weightage)

MODEL QUESTION PAPER

Food Science and Technology

FST1C04 – BASIC PRINCIPLES OF ENGINEERING

Time: Three Hours Maximum – 30 Weightage

Part A

Write short on 4 Out of 7 of following questions**:**

1. Refrigerants
2. Domestic Electrolux refrigeration system
3. Pressure detectors.
4. Thermo plastic materials
5. Pneumatic control devices
6. Winter air conditioning system.
7. Plate heat exchanger.

(4X2=8 Weightage)

PART-B

Write Short essay on any **4 out of 7** of the following

1. Discuss the principles and Carnot cycle.
2. Properties of steam.
3. Ratio of belt tensions.
4. Comparison between vapour absorption and compression refrigeration system.
5. Difference between dew point and wet bulb temperatures.
6. Water tube boiler.
7. Uses of capacitance.

(4X3 = 12 Weightage)

Part C

Write essay of any ***two*** of the following

1. Explain the refrigeration principle and vapour absorption refrigeration system.
2. Construct the Psychometric chart and explain all the properties.
3. Discuss the principles, types and importance of heat exchangers.
4. Write in detail about the mechanical power transmission systems.

(2X5 = 10 Weightage)

MODEL QUESTION PAPER

Food Science and Technology

FST2C05 – BIOCHEMISTRY AND NUTRITION

Time: Three Hours Maximum – 30 Weightage

Part A

Answer any 4 questions. Each question carries **two** weightage

1. What do you mean by competitive inhibition of enzyme?
2. Briefly describe beta oxidation
3. What are coenzymes
4. Define Energy Balance
5. What is RDA ?
6. Name water soluble vitamins and their respective food sources
7. Name macro nutrients and their deficiency diseases

(4X2=8 Weightage)

PART-B

Answer any 4 questions. Each question carries **three** weightage

1. What do you mean by gluconeogenesis?
2. Define Dietary fibers?
3. Describe Nutrition of expectant and nursing mothers?
4. What are essential amino acids and their role in body?
5. What is Protein energy Malnutrition?
6. Define Carbohydrate digestion?
7. Give an account for Enzyme classification?

(4X3=12 Weightage)

Part C

Answer any **two** questions, each question carries **five** weightage

1. Describe the nutritional aspects of fats, essential fatty acids and their role in body?
2. Enzyme classification and types of Enzyme inhibition?
3. Write an essay about the source, functions and deficiency diseases of Fat Soluble Vitamins?
4. Give an account for Nutraceuticals and Therapeutic foods?

(2X5 = 10 Weightage)

MODEL QUESTION PAPER

Food Science and Technology

FST2C06 –FOOD STORAGE AND INFESTATION CONTROL

Time: 3 Hours Maximum: 30 Weightage

Part A

Answer **any 4 of** following questions, each questions carry **2** Weightage

1) Methoprene
2) Irradiation of spices
3) Concept of organic foods
4) Fumigant detectors
5) Prophylactic treatment.
6) Write about factors affecting storage commodity
7) Write about insect growth regulator

(4X2=8 Weightage)

Part B

Answer **any 4 of** following questions, each questions carry **3** Weightage

8) What are the merits and demerits of methyl bromide fumigant? In what form the fumigant is available?
9) What are the common methods used to control rodent infestation?
10) Name two fumigants commonly used for insect pest control in India. Mention their merits and demerits.
11) Explain various methods of fumigation process.
12) Write about different stacking methods?
13) What is IPM
14) devices used to disinfect the storage premises

(4X3=12 Weightage)

Part C

Answer **any two** questions, each question carry **5** Weightage

15) With a neat diagram explain the type of stacks used for storing food grains

16) Discuss factors affecting storage

17) What are insect, pest, infestation control measures, explain

18) Explain types of fumigants and the procedure involved in fumigation

(2X5=10 Weightage)

Model Question Paper

Food Science and Technology

FST2C07 –INDUSTRIAL MICROBIOLOGY AND BIOCHEMICAL ENGINEERING

Time: Three Hours Maximum: 30 Weightage

Part A

Write short on 4 out of 7 of the following

1. What is Biogas?
2. What are important stages in Microbial Growth?
3. Name the methods of Cell Disruption
4. What are Baffles?
5. Spirulina ?
6. Agitators and Impellers
7. Factors controlling Fermentation

(4x2 =8 Weightage)

Part B

Answer **any four** questions, each questions carry **3** Weightage

1. Fed batch culture
2. Turbidostat
3. Activated sludge process
4. Mutation
5. Proteases
6. Scale up process
7. Manufacture of Beer (4x3=12 Weightage)

Part C

Write essay on any **two** of the following

1. What are the important fermented foods? Describe the production of any one fermented beverages.
2. Explain the microbial kinetics of growth and death in a bioreactor.
3. Explain about the importance, construction, types and parts of the bioreactor.
4. Explain immobilization technology and its advantages and disadvantages.

(2x5=10 Weightage)

MODEL QUESTION PAPER

Food Science and Technology

FST2C08 –FOOD ENGINEERING

Time: Three Hours Maximum – 30 Weightage

Part A

Answer any 4 out of 7 questions. Each question carries **two** weightage

1. What is Kicks law
2. What is Filtration
3. What is angle of repose
4. What is Extraction
5. What is Distillation
6. Ohmic heating
7. Sprayers

(4x2 = 8 Weightage)

PART-B

Write a short essay on any **four** of the following, each question carries **three weightage**

1. Theory of drying
2. Rheological models
3. Super critical extraction
4. Principles of Sedimentation
5. Extrusion technology
6. Differentiate between conduction and convection
7. Describe the role of Milling equipments in a roller flour mill

(4x3= 12 Weightage)

Part C

Write essay of any **two** of the following, each question carries **five weightage**

1. Types of driers and their applications
2. Explain the separation methods and their equipments
3. Explain the solid food materials
4. With a neat sketch explain the working principles of evaporators

(2x5 = 10 Weightage)

MODEL QUESTION PAPER

Food Science and Technology

FST3C12 TECHNOLOGY OF FRUITS, VEGETABLES, SPICES &PLANTATION PRODUCTS

Time: 3 Hours Maximum: 30 Weightage

Part A

Answer **any four** questions, each questions carry **2** Weightage.

Write a short notes on

1) Decaffeinated coffee?
2) Classification of spices?
3) Reverse osmosis?
4) Zero energy cool chamber?
5) Differentiate climacteric fruits and non climacteric fruits?
6) Maturity indices in fruits?
7) Methods used to delay ripening of fruits?

(4X2=8 Weightage)

Part B

Answer **any four** questions, each questions carry **3** Weightage

8) Storage disorders in fruits and vegetables?
9) Note on processing of tea?
10) Role of pectin in gel formation?
11) Write about preparation of tomato ketchup with specification?
12) Write a note on RTS production?
13) Note on spice essential oil extraction?
14) Differentiate between Jam and Jelly

(4X3=12 Weightage)

Part C

Answer **any three** questions, each question carry **10** mark

24) Describe processing of coffee and types of coffee?

26) Elaborate on tomato based products with specification?

27) Note on various storage practices of fruits and vegetables?

28) Explain classification, composition and therapeutic value of major spices?

(2X5=10 Weightage)

MODEL QUESTION PAPER

Food Science and Technology

FST3C13 – PRINCIPLES OF FOOD PROCESSING AND PRESERVATION

Time: Three Hours Maximum – 30 Weightage

Part A

Answer 4 out of 7 questions. Each question carries **two** weightage

1. What are food adulterants
2. What is high sugar products
3. Define IQF
4. Define pasteurization
5. How can you classify food based on pH?
6. Define Food additives.
7. What is Curing

(4x2= 8 Weightage)

PART-B

Write a short essay on any **Four** of the following, each question carries 3 Weightage

1. What is Irradiation? Write its applications in food technology.
2. How Pulsed electric field technology is applicable in food processing?
3. Difference between drying & dehydration
4. Difference between MAP & CAP
5. How low temperature is effective on food preservation
6. What are the Basic principles of food preservation?
7. Write on Sensory Evaluation of food

(4x3= 12 Weightage)

Part C

Answer any **two** questions, each question carries **five** weightage

1. Action of SO2 & benzoic acid in food preservation
2. Define canning. Discuss the spoilage in thermally processed food
3. Discuss Non thermal technologies in food processing.
4. Describe the principle of Hurdle Technology and their applications

(2x5= 10 Weightage)

MODEL QUESTION PAPER

Food Science and Technology

FST3C14 -TECHNOLOGY OF CEREALS LEGUMES AND OIL SEEDS

Time: 3 Hours Maximum: 30 Weightage

Part A

Answer any 4 questions, each question carries 2 Weightage.

1. What are surfactants
2. Name the byproducts of rice.
3. Name the anti-nutritional factors in Legumes
4. Name the different varieties of corn
5. What are the advantages of parboiling of rice
6. Expeller pressing
7. Methods of oil Extraction

(4X2=8 Weightage)

Part B

Answer **any four** questions, each questions carry **3** Weightage

1. Wheat protein and its isolation
2. Parboiling of rice
3. Damaged and modified starches
4. Production of Weaning foods from malted grains
5. Structure of maize and its influence on milling.
6. Anti-nutritional factors in oil seeds.
7. Describe the manufacturing of biscuits.

(4X3 = 12 Weightage)

Part C

Write essay on any **three** of the following

1. How rice is classified on their physic chemical properties? Describe their role in cooking quality of rice.
2. Explain the essential steps in milling of legumes. How modern dhal milling is different from traditional one?
3. Describe the process of extraction of oil from rice bran and nutritional quality. Discuss about stabilization of rice bran.
4. Describe in detail about the Wheat kernel structure.

(2X5=10 Weightage)

MODEL QUESTION PAPER

Food Science and Technology

FST3C15 - PACKAGING TECHNOLOGY

Time: 3 Hours Maximum: 30 Weightage

Part A

Answer any 4 questions, each question carries 2 Weightage.

1) Vacuum packaging
2) Different Flutes in CFB
3) Palletisation and Containerisation
4) Half value period in shelf life estimation
5) MAP for fresh produce.
6) Blister packaging.
7) Inert gas packaging

(4X2=8 Weightage)

Part B

Answer **any four** questions, each questions carry **3** Weightage

8) Lamination in food packaging
9) Bursting strength
10) Differentiate between LDPE and HDPE
11) Shrink package and skin package
12) Lamination and coextrusion.
13) Mettalised and foil films.
14) Differentiate MAP and CAP

(4X3=12 Weightage)

Part C

Write essay on any **two** of the following

15) What is retort packaging? What are the various parameters deciding the selection of packaging material in the process?
16) Why do we require to evaluate safety of plastics for food contact application? What are the safe limits for each evaluation as per BIS?
17) Describe in details about various parameters of food and packaging material required in assessing shelf life.
18) Describe in detail about aseptic packaging of fruit juice. What are the chemical and non chemical agents used to sterilize packaging materials. (2X5=10 Weightage)

MODEL QUESTION PAPER

Food Science and Technology

FST4E16 – FOOD PLANT AND QUALITY MANAGEMENT

Time: 3 Hours Maximum: 30 Weightage

Part A

Answer any 4 questions, each question carry **2** Weightage

1) What are FSSAI regulations?
2) What you mean by Break even point?
3) Define the term Genetically Modified foods.
4) Explain the principle of microwave heating.
5) Define critical control Point
6) Give the importance of HACCP in meat industry
7) Define food contaminants and its types.

(4X2=8 Weightage)

Part B

Answer **any four** questions, each questions carry **3** Weightage

1) Define patent
2) Write an account about Costing
3) Give an account for USFDA Regulations
4) Write short note on pricing of food products
5) Differentiate between SOP and SSOP
6) What are GMP & GHP?
7) Explain the different types of Food adulteration

(4X3=12 Weightage)

Part C

Answer **any two** questions, each questions carry **5 Weightage**

1) Discus elaborately about purchase procedure of materials.
2) Illustrate pricing of processed fruit products
3) What are all the mandatory standards? Discuss codex alimentarius.
4) Write an essay about food industry planning, organizing and control

(2X5=10 Weightage)

MODEL QUESTION PAPER

Food Science and Technology

FST4E17 TECHNOLOGY OF ANIMAL PRODUCTS

Time: 3 Hours Maximum: 30 Weightage

Part A

Answer any 4 questions, each question carries **2** Weightage

1) Chemical composition of fish
2) Humane method of slaughter
3) Candling of eggs
4) Composition of egg
5) List out preservation methods of egg.
6) Role of curing agents in meat curing?
7) Technology of Sausage prepration?

(4X2=8 Weightage)

Part B

Answer **any 4** questions, each questions carry **2** Weightage

8) Differentiate Fish Sauce and Fish Paste
9) Comment on various types of additives used in meat and fish products.
10) What are the physical and chemical changes taken place during storage of eggs?
11) Explain briefly the major contaminants and naturally occurring poisons in meat and fish.
12) Describe the Egg structure with neat diagram
13) Discuss effect of processing and storage on quality of meat products.
14) Give an account of the HACCP implementation in a fish processing plant.

(4X3=12 Weightage)

Part C

Answer **any two** questions, each questions carry **5 Weightage**

15) Describe essential steps involved in poultry processing to obtain hygienic poultry meat.
16) With the help of necessary block diagram, explain modern abattoir designs and slaughter methods.
17) Explain post – mortem biochemical changes in meat, fish and poultry.
18) Write down the requirements and packaging materials used for meat, fish and poultry products. (2X5=10 Weightage)

MODEL QUESTION PAPER

Food Science and Technology

FST4E18 -DAIRY TECHNOLOGY

Time: 3 Hours maximum: 30 Weightage

Part A

Answer **any four** questions, each questions carry **2** Weightage.

1) Difference between condensed & evaporated milk
2) Adulterants in milk
3) Role of cream separator
4) What is Cheddaring
5) What is Paneer
6) Classify milk based on their fat content
7) What is pasteurization

(4X2=8 Weightage)

Part B

Answer **any four** questions, each questions carry **3** Weightage

8) Write about different fermented milk products
9) Discuss the theories of churning
10) Nutritive value of khoa and its preparation
11) Describe spray drying of milk
12) Draw the flow diagram for cheddar cheese preperation
13) Describe in detail about the production of Ice cream
14) Explain the preparation of any two special milks

(4X3=12 Weightage)

Part C

Answer **any two** questions, each questions carry **5 Weightage**

15) Explain the sanitation of diary plant & equipments

16) Explain diary plant operation

17) Explain the physico-chemical properties of milk & its nutritive value.

18) Write an essay about the FSMS plan in a dairy industry

(2X5=10 Weightage)

MODEL QUESTION PAPER

Food Science and Technology

FST4E19- SUGAR AND CONFECTIONARY TECHNOLOGY

Time: 3 Hours Maximum: 30 Weightage

Part A

Answer **any four** questions, each questions carry **2** Weightage.

Write short on

1) Conching
2) Cocoa Butter
3) Caramel
4) Role of Lecithin in confectionery
5) Enrober machine
6) High Fructose Corn Syrup
7) Major flavours used in confectionery

(4X2=8 Weightage)

Part B

Answer **any four** questions, each questions carry **3** Weightage

1) Differentiate Candy and Toffee
2) Invert Sugar and its roll in confectionary Industry.
3) Differentiate Caramelisation and crystallization
4) Liquid glucose and its importance in candy manufacture
5) Factors affecting Sugar Crystallisation
6) Various types of sugars available in market
7) What are the major forms of sugar?

(3X4=12 Weightage)

Part C

Answer **any two** questions, each questions carry **five Weightage**.

1) Describe with flowchart about the Manufacturing of good quality Chocolate.
2) Which are the major ingredients of confectionery? Differentiated Crystalline and Amorphous confectionary
3) Manufacture of candy with machinery involved
4) Write an essay about the FSMS plan in a confectionary industry

(2X5=10 Weightage)

MODEL QUESTION PAPER FOR PRACTICAL EXAMINATIONS

Food Science & Technology

Paper Name

Time: 3 hrs Total Weightage: 30

All the questions are compulsory.

Components	Weightage
Procedure writing	2
Major experiment	6
Minor experiment	4
Viva	8
Record	4
Spotters	6