Appendix "L" Item No.20

B.Sc. (Honors)+1 Year M.Sc. Food Science & Technology

Food, Nutrition & Dietetics

4 Year B.Sc. (Honors)+1 Year M.Sc. Food Science & Technology Programme (Multiple Entry and Exit Mode)

on first year completion (2 semesters) certificate Programme, on first two years completion (4 semesters) diploma Programme, on first three years completion (6 semesters) B.Sc. Programme, on first four years completion (8 semesters) B.Sc. Hons. Programme and, first five years completion (10 semesters) M.Sc. Programme, (with effect from the admitted batch of 2022-23 onwards), Framed According to the National Educational Policy (NEP 2020), To be implemented from the Academic Year 2022-2023

<table>
<thead>
<tr>
<th>I Year - I Semester</th>
<th>Course code</th>
<th>Category</th>
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<th>Course Title</th>
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<tr>
<td></td>
<td>CH-1101</td>
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<td>4</td>
<td>Maths – I</td>
<td>0</td>
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<td></td>
<td>CH-1102</td>
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<td></td>
<td>CH-1103</td>
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<td>Organic Chemistry</td>
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<td></td>
<td>CH-1104</td>
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<td>Organic Chemistry Lab.</td>
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<td></td>
<td></td>
<td></td>
<td>(Mechanical Engineering &amp; Electrical Engineering)</td>
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<td>Total Credits</td>
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REGULATIONS & STRUCTURE OF THE PROGRAMME

1.0 ADMISSIONS : Admissions into B.Sc. (Hons.) Food Science & Technology Programme are governed by Andhra University admission regulations.

2.0 ELIGIBILITY CRITERIA :

2.1 A pass in Intermediate or +2 with Physics, Chemistry and Mathematics or Biology with a minimum aggregate of 50% marks or any other equivalent examinations.

2.2 Admissions into B.Sc. (Hons.) Food Science & Technology will be based on the marks obtained in Intermediate following the rule of reservation.
order to promote:
* Student centered learning
* Cafeteria approach
* Inter-disciplinary learning

Learning goals/objectives and outcomes are specified leading to what a student should be able to do at the end of the program.

4.0 STRUCTURE OF THE PROGRAM:

4.1 The program consists of:
(i) Ability enhancement compulsory core courses (AECC)
(ii) Core courses (compulsory) (CC)
(iii) Discipline specific electives (DSE)
(iv) Generic electives (GE)
(v) Skill enhancement courses (SEC) are of general nature either related or unrelated to the discipline
(vi) Practical Proficiency Courses (PPC): Laboratory work

4.2 Each course is assigned a certain number of credits depending upon the number of contact hours (lectures/tutorials/practical) per week.

4.3 In general, credits are assigned to the courses based on the following contact hours per week per semester as specified in the syllabi

5.0 MEDIUM OF INSTRUCTION: The medium of instruction (including examinations and project reports) shall be English.

6.0 REGISTRATION: Every student has to register himself/herself for each year individually at the time specified by the University.

7.0 TOTAL NO. OF SEATS: 40 + 4 (EWS):

8.0 FEES: Annual fees is Rs.65,000/- (for both semesters)

9.0 ATTENDANCE REQUIREMENTS

9.1 A student whose attendance is less than 75% in all the courses put together in any semester will not be permitted to attend the end - semester examination and he/she will not be allowed to register for subsequent semester of study. He/She has to repeat the semester along with his/her juniors.

9.2 However, the Vice Chancellor on the recommendation of the Principal/Director of the University College/Institute may condone the shortage of attendance to the students whose attendance is between 66% to 74% on genuine medical grounds and on payment of prescribed fee.

10.0 EVALUATION:

10.1 The assessment of the student’s performance in a Theory course shall be based on two components: Continuous Evaluation (30 marks) and Semester-end examination (70 marks).

10.2 A student has to secure an aggregate of 40% in the course in the two components put together to be declared to have passed the course.

11.0 STRUCTURE OF THE PROGRAMME

Students are provided with various options for entry and exit to the course under NEP program.

<table>
<thead>
<tr>
<th>Course</th>
<th>Years/Semester</th>
<th>Exit option with an award</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor of Science in Food Science &amp; Technology</td>
<td>1 (I – II semester)</td>
<td>Certificate</td>
</tr>
<tr>
<td></td>
<td>2 (I – IV semester)</td>
<td>Diploma</td>
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<tr>
<td></td>
<td>3 (I – VI semester)</td>
<td>Bachelor's Degree</td>
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<td></td>
<td>4 (I – VIII semester)</td>
<td>Bachelor's Degree with Honours</td>
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<tr>
<td>M.Sc. Food Science &amp; Technology</td>
<td>5 (IX – X semester)</td>
<td>Master's Degree</td>
</tr>
</tbody>
</table>

Program Outcomes (POs)

PO1 Encompass exceptional knowledge in core areas of Food Science, Food Processing Technology, Food Preservation, Food Analysis and Food Product development

PO2 Achieve cognizance in interdisciplinary fields of Food Microbiology, Food Biotechnology, Food safety, Quality control and Molecular biology through knowledge fortification

PO3 Develop multidisciplinary proficiency in contemporary domains through Skill Enhancement and Vocational courses

PO4 Accomplish dexterity in all the fields under the umbrella of Food Science and Technology to attain practical competency

PO5 Impregnate adept expertise and hands on experience through Dissertation, project work, industrial training, field trips, food institutional and industrial visits

PO6 Amass exploratory research skills with innovative ideas, lab to field food technology and systemic approach towards achieving sustainable nutrition goals

PO7 Employ critical thinking towards innovation, synthesis of novel ideas, knowledge dissemination and community interaction for the benefit of the community and society at large

PO8 Develop problem solving, decision making and communication skills to emerge as a potential leader

PO9 Evolve as a professionally sound wellbeing with societal responsibility fortified with moral and ethical values well equipped for nation building
Program Specific Outcomes (PSOs)
PSO1 Emanate as an adept in all the core spheres of Food Science, Food Processing and Preservation theory as well as practical aspects
PSO2 Competent to pursue career in integrated areas of Food Biotechnology, Food Microbiology and Nutraceutical technology
PSO3 Become a successful professional and entrepreneur to start a food industry and food business
PSO4 Ability to create value added products, synthesize novel approaches relating to diet formulations in the prevention and management of disease
PSO5 Well-equipped with current scenario in the field of Food Science & Technology with reference to nutrigenetics and Bioinformatics and take up research
PSO6 Acquire exhaustive skills in planning, monitoring and evaluation of Food Technology with reference to nutrigenetics and Bioinformatics and take up research
PSO7 Capability to develop distinctive functional food based products for different age groups to nurture healthy society
PSO8 Take up professions in food quality control and regulations
PSO9 Transcend as Academicians and Researchers in reputed academic and research institutions

B.Sc. (Honors) Food Science & Technology Course structure

**SEMESTER I**

<table>
<thead>
<tr>
<th>Category</th>
<th>Course Code</th>
<th>Course Marks</th>
<th>Total</th>
<th>Internal</th>
<th>End Exam</th>
<th>Teaching Credits</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability Enhancement compulsory Courses</td>
<td>FSTL1.1 First Language (Telugu/Hindi)</td>
<td>100</td>
<td>30</td>
<td>70</td>
<td>3</td>
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<tr>
<td>DSCC (Discipline Core Course)</td>
<td>FSTL1.2 Second Language English</td>
<td>100</td>
<td>30</td>
<td>70</td>
<td>3</td>
<td>3</td>
<td></td>
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<tr>
<td></td>
<td>FSTL1.1 Fundamentals of Food Technology (Th)</td>
<td>100</td>
<td>30</td>
<td>70</td>
<td>4</td>
<td>4</td>
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<tr>
<td></td>
<td>FST1.2 Principles of Food Science (Th)</td>
<td>100</td>
<td>30</td>
<td>70</td>
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<td>4</td>
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</tr>
<tr>
<td></td>
<td>FST1.3 Sensory Evaluation of Food (Th)</td>
<td>100</td>
<td>30</td>
<td>70</td>
<td>4</td>
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<tr>
<td></td>
<td>FST1.4 Fundamentals of Food Technology (Pr)</td>
<td>50</td>
<td>15</td>
<td>35</td>
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<td></td>
<td>FST1.5 Principles of Food Science (Pr)</td>
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<td>15</td>
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<tr>
<td>Open Elective Skill Enhancement Courses</td>
<td>SEC1 Digital Fluency</td>
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Total 750

(Exit Option with *Certificate in Food Science & Technology with 50 Credits)

* Certificate: Students who opt to exit after completion of the first year and have secured 50 credits will be awarded a certificate if, in addition, they complete one vocational course/One month Internship of 4 credits during the summer vacation of the first year. These students are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

L: Lecture, T: Tutorial, P: Practical

**SEMESTER II**

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<tr>
<th>Category</th>
<th>Course Code</th>
<th>Course Marks</th>
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<th>End Exam</th>
<th>Teaching Credits</th>
<th>Hours</th>
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<tbody>
<tr>
<td>Ability Enhancement compulsory Courses</td>
<td>FSTL1.1 First Language (Telugu/Hindi)</td>
<td>100</td>
<td>30</td>
<td>70</td>
<td>3</td>
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<tr>
<td>Multi-Disciplinary Courses</td>
<td>FSTL2.2 Second Language English</td>
<td>100</td>
<td>30</td>
<td>70</td>
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<tr>
<td>DSCC (Discipline Core Course)</td>
<td>MD1 Environmental Studies</td>
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<tr>
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<td>FST2.1 Food Chemistry (Th)</td>
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<td>70</td>
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<tr>
<td></td>
<td>FST2.2 Technology of Food Processing &amp; Preservation(Th)</td>
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<td>70</td>
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<td>FST2.3 Food Chemistry (Pr)</td>
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<td>FST2.4 Technology of Food Processing &amp; Preservation(Pr)</td>
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<td>Skill Enhancement Courses Value added</td>
<td>SEC2 Solar Energy</td>
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<td></td>
<td>VA1 Human Values &amp; Professional Ethics</td>
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Total 650

**SEMESTER III**

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<th>End Exam</th>
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<th>Hours</th>
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<tbody>
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<td>Ability Enhancement compulsory Courses</td>
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<td>FSTL3.2 Second Language English</td>
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**Semester IV**

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<td>FST4.1</td>
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<td>FST4.2</td>
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<td>35</td>
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</table>

**Skill Enhancement Courses**

| Course | SEC4 | Food Packaging & Labelling | 50 | 15 | 35 | 2 | 2 |
| VA2 | Organic farming | 50 | 15 | 35 | 2 | 2 |

**Total**

| | | | | | | |
| | | | 550 | 18 | 6 | 22 |

*MG Diploma with B.G Diploma in Food Science & Technology with 94 Credits*

UG Diploma: Students who opt to exit after completion of the second year and have secured 94 credits will be awarded the UG Diploma if, in addition, they complete one vocational course / One month Internship for 4 credits during the summer vacation of the second year. These students are allowed to re-enter within a period of three years and complete the degree programme within the maximum period of seven years.

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**Semester V**

<table>
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<td>FST 5.1</td>
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<td>Food Microbiology &amp; Toxicology Pr</td>
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<tr>
<td>FST5.4</td>
<td>Bakery &amp; Confectionary Technology Pr</td>
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<td>Discipline Specific Elective Skill Enhancement Courses</td>
<td>DSE2A</td>
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<td>Value added</td>
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<td>Nutrition for healthy living (Th)</td>
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<td>VA3</td>
<td>Entrepreneurship &amp; management of start ups</td>
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**Total**

| | | | | | | |
| | | | 550 | - | - | 18 | 6 | 22 |

**Semester VI**

<table>
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<tr>
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<th>Sem End</th>
<th>Teaching</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>DSCC (Discipline Core Course)</td>
<td>FST 6.1</td>
<td>Processing of oils and fats (Th)</td>
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<td>FST 6.2</td>
<td>Dairy Technology (Th)</td>
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<tr>
<td>FST6.3</td>
<td>Processing of Oils and Fats (Pr)</td>
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<td>FST6.4</td>
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</table>

**Total**

| | | | | | | |
| | | | 550 | - | 12 | 6 | 22 |

A student who completes Summer Internship / Industrial training for 45 days (which is mandatory) and having secured 138 credits, after completion of third year, will be awarded B.Sc Food Science & Technology.
### Semester VII

<table>
<thead>
<tr>
<th>Category</th>
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<th>Teaching Credits</th>
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</thead>
<tbody>
<tr>
<td>DSCC (Discipline Core Course)</td>
<td>FST 7.1</td>
<td>Unit operations in Food Industry (Th)</td>
<td>100</td>
<td>30</td>
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<td></td>
<td>FST 7.2</td>
<td>Enzymes in Food Processing (Th)</td>
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<td>30</td>
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<td>FST 7.3</td>
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<td>FST 7.4</td>
<td>Unit operations in Food Industry (Pr)</td>
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<td>3 2</td>
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<td></td>
<td>FST 7.5</td>
<td>Enzymes in Food Processing (Pr)</td>
<td>50</td>
<td>15</td>
<td>35</td>
<td>3 2</td>
</tr>
</tbody>
</table>

**Community engagement & Service**

| Field based project work         | FST 7.7     | Field based project work              | 50    | 50       | 3 2          |

**Total**

|        |        |        | 500   | 12       | 12           | 20               |

### Semester VIII

<table>
<thead>
<tr>
<th>Category</th>
<th>Course Code</th>
<th>Course Marks</th>
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<tbody>
<tr>
<td>DSCC (Discipline Core Course)</td>
<td>FST 8.1</td>
<td>Applied Statistics (Th)</td>
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<td>4 4</td>
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**Total**

|        |        |        | 400   | 400      | 4            | 24               | 20               |

A student who completes, Dissertation based on Project work (which is mandatory) and having secured 178 credits, after completion of Fourth year, will be awarded Bachelor of Honours Degree in B.Sc Food Science & Technology. These students are eligible to pursue One year M.Sc program in Food Science & Technology.

### ANNEXURE-1A

**DISCIPLINE SPECIFIC ELECTIVE (DSE)**

*Student has to choose Any Three DSEs (one each from DSE-1, DSE2 & DSE-3 in semester IV, V and VI respectively)*

- **DSE-1**: (Any One) (Semester -IV)
- **DSE-1A**: Technology of Meat, poultry & egg
- **DSE-1B**: Fermentation Technology
- **DSE-1C**: Food Laws and Standards
- **DSE-2**: (Any One) (Semester -V)
- **DSE-2A**: Food Biotechnology
- **DSE-2B**: Food Sanitation Hygiene & Waste Management
- **DSE-2C**: Food Adulteration
- **DSE-3**: (Any One) (Semester -VI)
- **DSE-3A**: Beverage Technology
- **DSE-3B**: Food Plant Layout & Design
- **DSE-3C**: Food Extrusion Technology

**M.Sc. Food Science & Technology (Two Semesters)**

### Semester IX

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<th>Teaching Hours</th>
<th>Credits</th>
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**Discipline Specific Elective**

- **PGDSE1**: Any One to be chosen
  - A. Snack Food Technology
  - B. Industrial Microbiology
  - C. Flavour chemistry & Technology

**Total**

|        |        |        | 500   | 22       | 20           |                  |        |

110
Semester X

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</table>

Award of Post Graduate degree in Food Science & Technology- 42

B.Sc. (Honors) Food Science & Technology Course structure

THEORY : SEMESTER I

FST1.1. FUNDAMENTALS OF FOOD TECHNOLOGY

Course Outcomes

CO1. To enable the students to understand the importance of food technology

CO2. To understand the relationship between Food technology and Food science

CO3. Comprehend the structure, composition and nutritive value of different types of food

CO4. Comprehensive know how of changes during cooking

CO5. Understand the newer applications of food technology

Course Specific Outcomes

CSO1. Inculcate knowledge about different properties of food

CSO2. To study the structure and composition food grains

CSO3. Discuss the composition and Classification of fruits and vegetables

CSO4. To study the structure and composition of various animal foods

CSO5. Understand the composition of sugars

Learning Outcomes

LO1. Enable students to understand the applications of food technology in food industry

LO2. Apply the concepts of food technology in food preparation

LO3. Familiarise students with how changes in food impacts quality

LO4. Understand the importance of millets and their composition

LO5. Explore the nuances in food technology applications

THEORY : SEMESTER II

FST1.1. FUNDAMENTALS OF FOOD TECHNOLOGY

Course Content

Unit I: Introduction to food technology, definition, history, growth and scope, role of food technology in food processing industries, relationship between food technology and food science, properties of food - physical, rheological, thermal, mass transfer and electrical properties.

Unit II: Composition and nutritive value of plant foods – Cereals -types, Structure of wheat and types, Composition & Nutritive value, Rice - Structure, Composition & Nutritive value. Millets – types, structure, composition & nutritive value, ragi, sorghum, maize, bajra, kodo, proso and foxtail. Pulses and legumes: Types, Composition, Nutritive value, Antinutritional factors. Nuts & Oil-seeds: types, Composition and nutritive value

UNIT III: Fruits and vegetables: Classification, structure - tissue systems, types of cells, structural constituents - cellulose, hemicellulose, pectic substances and lignin. Composition & Nutritive value, pigments – chlorophyll, carotenoids, flavonoids and flavour compounds. Spices - Definition, Classification, Chemical composition, uses of spices. Beverages – Classification, Tea, Coffee & Cocoa, Composition & Nutritive value

Unit IV: Meat – Classification, Structure – muscle tissue, connective tissue, adipose tissue, pigments, Composition & Nutritive value. Poultry- Desi birds, structure, classification, composition and nutritive value. Fish: Structure, Types, Composition & Nutritive value.


Recommended References

THEORY : SEMESTER I

FST1.2. PRINCIPLES OF FOOD SCIENCE

Course Outcomes
1. Understand the food groups and their functions
2. Acquire knowledge on principles of cereal cookery
3. Gain knowledge on changes during cooking of pulses
4. Comprehend the knowledge on use of meats in cooking
5. Acquire knowledge on solar and micro wave cooking

Course Specific Outcomes
1. List and classify foods based on its nutritive value and understand the properties of food
2. Criticize the factors affecting cooking quality
3. Understand the importance of stages of sugar cookery
4. Evaluate the nutrient losses during cooking
5. Learn methods of preparing milk products

Learning Outcomes
1. Enable students to use the theoretical knowledge in various food preparations
2. Develop skills in cooking and apply the scientific principles while making new recipes
3. Familiarise students with changes occurring during cooking.
4. Design and create novel value-added products and recipes
5. Learn about factors affecting selection of fish

THEORY : SEMESTER I

FST1.2. PRINCIPLES OF FOOD SCIENCE

Course Content
UNIT-I : Food Science- Introduction, scope, Different Food groups, food in relation to health, evolution of cooking techniques. Cooking media, General Methods of cooking- dry and moist heat methods, microwave and solar cooking, advantages and disadvantages, Nutrient losses during cooking.

UNIT-II : Cereals & Millets- Cereal and millet cookery and changes during cooking, gelatinization, dextrinization, retrogradation and syneresis. Principles of baking, different types of flours for baking, Role of leavening agents in baking, methods of preparation of breads, biscuits, cakes and pastry. Sugar cookery- stages of sugar cookery, amorphous and crystalline candies, Sugar related products.


Recommended References

THEORY : SEMESTER I

FST1.3. SENSORY EVALUATION OF FOOD

Course Outcomes
CO1. Enable the students to provide theoretical background of sensory evaluation
CO2. Understand the role of sensory evaluation in food quality evaluation
CO3. Comprehend the sensory evaluation methods for assessing food quality
CO4. Comprehensive know how of assessment of texture of foods
CO5. Analyse and interpret the sensory evaluation data.
Course Specific Outcomes
CSO1. Inculcate knowledge about consumer acceptability of foods
CSO2. To study the panel selection and training methods
CSO3. Learn about specific methods of assessment of quality attributes of food
CSO4. To study the texture profile analysis of food
CSO5. Understand the applications of questionnaires and score boards in sensory evaluation

Learning Outcomes
LO1. Enable students to understand the sensory attributes in consumer acceptability
LO2. Apply the concepts of sensory attributes in food preparation
LO3. Familiarise students with rating for sensory profile
LO4. Understand the importance of sensory applications in food
LO5. Explore the statistical analysis in sensory evaluation

THEORY: SEMESTER I

FST1.3. SENSORY EVALUATION OF FOOD

Course Content


UNIT – 4: Sensory evaluation tests - Threshold and dilution test for trained/untrained panelists; Difference (Qualitative) test - paired comparison test for trained panelists and untrained panelists, duo-trio test for trained panelists and triangle (triad) test for trained panelists. Rating (Quantitative differences) test - ranking test, single sample (monadic) test, two sample difference test, multiple sample and quality difference test, hedonic test, numerical scoring test and composite test for trained/semi-trained/untrained panelists. Descriptive Tests: Rating for sensory profile, consensus profiling, conventional profiling, free choice profiling.


Recommended References

PRACTICAL: SEMESTER I

FST1.4. FUNDAMENTALS OF FOOD TECHNOLOGY

1. Survey of locally available plant foods in the market
2. Survey of locally available animal foods in the market
3. Microscopic observation of food grains and starches
4. Microscopic observation of tissue systems
5. Identification of pigments in fruits and vegetables and influence of pH on them.
6. Gluten content of various flours
7. Market survey of locally available meat, poultry and eggs in the market
8. Market survey of different types of fish and their local names
9. Market survey of different types of milks and their composition
10. Survey of different types of sugars available in the market
11. Estimation of salt content of butter
12. Survey of beverages available in the market

**FST1.5.PRINCIPLES OF FOOD SCIENCE**

1. Preparation of recipes using different cooking methods: Boiling, pressure cooking, grilling, simmering, poaching, stewing, frying, roasting and baking
2. Factors affecting Gelatinization & Dextrinization of cereal starches. Preparation of recipes based on gelatinization & Dextrinization
3. Preparation of bread, cookies and cakes
4. Study of Stages of sugar cookery. Preparation of recipes using different stages of sugar cookery.
5. Study of malting and germination of whole pulses.
6. Fermentation in cereals and pulses. Preparation of recipes using fermentation method
7. Factors affecting coagulation of milk proteins. Recipes using milk and preparation of milk products
8. Gel formation in foods, preparation of recipes using gelatine and egg protein
9. Effect of different methods of cooking on flavour, colour, texture and palatability of flesh foods
10. Study of cuts of meat
11. Recognition and sensory tests for four basic tests
12. Preparation of casein and calculation of yield

**THEORY : SEMESTER I**

**OE1. FOOD SAFETY**

**Course Outcomes**

CO1. Understand the concept and meaning of Food Safety
CO2. Acquire knowledge on Food Laws & Regulations
CO3. Gain knowledge on HACCP and its role in Food Safety
CO4. Comprehend knowledge on prevention of contamination
CO5. Acquire knowledge on Food safety Assessment

**Course Specific Outcomes**

CSO1. List and classify food borne diseases
CSO2. Criticize the factors affecting safety of water
CSO3. Understand the safety features of food processing equipment
CSO4. Understand the principles of Sanitation
CSO5. Learn food safety management procedures

**Learning Outcomes**

LO1. Enable students to understand the sensory attributes in consumer acceptability
LO2. Develop skills in Hazard analysis of foods
LO3. Familiarise students with Food standards
LO4. Design protocols for food workers education and training
LO5. Develop skills in safety assessment of pesticide residues

**THEORY : SEMESTER I**

**OE1. FOOD SAFETY**

**Course Content**

UNIT I : Introduction to food safety, Concept, meaning, scope and factors affecting food safety, Historical aspects of food safety, epidemiologic investigations and surveillance: Origins and contribution of epidemiology, public health and disease surveillance. Classification of food borne diseases and etiologic agents, risk factors.


UNIT III : HACCP – History, hazards - types, critical point, control points, critical control points (CCP) principles of HACCP, benefits of HACCP – to consumers, industry & government, difficulties and barriers for implementation of HACCP, Risk analysis- risk management, risk assessment and risk communication.

UNIT IV : Food contamination and principles of prevention: Types of food contamination, principles of prevention: reduction of microbial contamination and growth, elimination of source of contamination from chemical pollutants and toxins, principles and purposes of sanitation, Importance of personal hygiene of food handlers, significance of educating and training food workers. Safety aspects of water and beverages, Safety assessment of food contaminants and pesticide residues.

UNIT V : Food Safety Assessment, importance of food safety, Food safety management procedures, Terms relating to process and product, characteristics and conformity, Terms relating to documentation, examination and audit. Role of food safety officer.

Recommended References


THEORY : SEMESTER I
SEC1. DIGITAL FLUENCY

Course Outcomes
CO1. Understand the importance of digital fluency
CO2. Be aware of different parts of computer and their uses
CO3. Understand the importance of internet usage at present

Course Specific Outcomes
CSO1. Learn the importance of use of computers in current world
CSO2. Get insights into word processing of documents
CSO3. Know about web browsing

Learning Outcomes
LO1. Learn the functions of different components of a computer
LO2. Get insights into document formatting and manipulation
LO3. Learn about popular search engines

THEORY : SEMESTER I
SEC1. DIGITAL FLUENCY

Course Content


UNIT III: Internet: Introduction – Objectives – Internet - protocols: HTTP, HTTPS, FSTP, Concept of Internet & WWW -Website Address and URL - Applications, advantages and disadvantages internet - Modes of Connecting Internet (Hotspot, Wi-Fi, LAN Cable, Broadband, USB Tethering) - Popular Web Browsers (Internet Explorer/Edge, Chrome, Mozilla Firefox) - Exploring the Internet - Surfing the web - Popular Search Engines - Searching on Internet.

Recommended References
1. Rajaraman V, Adabala N. Fundamentals of Computers
2. Manoj Wadhwa, Fundamentals of Computers
3. Rohit Khurana, Learning MS-Word and MS-Excel
4. Joan Lambert, MicrosoFST Word 2019 Step by Step

Semester II
(Exit Option with *Certificate in Food Science & Technology with 50 Credits)
* Certificate: Students who opt to exit after completion of the first year and have secured 50 credits will be awarded a certificate if, in addition, they complete one vocational course/One month Internship of 4 credits during the summer vacation of the first year. These students are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

L- Lecture, T- Tutorial, P- Practical

THEORY : SEMESTER II
MD1. ENVIRONMENTAL STUDIES

Course Outcomes
CO1. Understand the importance and scope of environmental studies
CO2. Be aware of the concept of Biodiversity
CO3. Understand the environment pollution issues and management

Course Specific Outcomes
CSO1. Learn about bio geographical classification of India
CSO2. Get insights into different environment movements
CSO3. Know about the global warming and its consequences

Learning Outcomes
LO1. Understand the segregation of domestic waste and create consumer awareness
LO2. Get insights into impact of plastic on human health
LO3. Learn the skills of rain water harvesting

THEORY: SEMESTER II
MD1. ENVIRONMENTAL STUDIES

Course Content


Unit III: Natural resources and management: Types of natural resources and energy resources. Water conservation - rain water harvesting; water shed management – Meaning and importance. Wasteland reclamation, soil conservation, afforestation – Meaning and importance. Disaster – Definition and types (Natural and Man-made); Self-protection during disasters (Fire, Floods, Earthquakes)

Recommended References

THEORY: SEMESTER II
FST2.1. FOOD CHEMISTRY

Course Outcomes
CO1. Assimilate the synergistic integration of food physics and food chemistry
CO2. Acquire knowledge on carbohydrate, fruit and vegetable chemistry
CO3. Gain knowledge on chemistry of plant and animal foods
CO4. Comprehensive know-how on the identification of rancidity of oils and fats
CO5. Explore the molecular mechanisms in perception of flavours and colours

Course Specific Outcomes
CSO1. Understand the molecular composition and chemistry of major and minor components in foods
CSO2. Understand the uses of novel enzymes in food industry
CSO3. Perceive the importance of gums and non-nutritive sweeteners in food and health industry
CSO4. Evaluate and compare the industrial uses of plant and animal proteins
CSO5. Grasp the current innovative technologies for structured lipids

Learning Outcomes
LO1. Enable students to better understand the role of chemistry in food
LO2. Apply the concepts of food chemistry in food preparation
LO3. Familiarise students with how chemistry impacts quality and highlights its role in creating novel foods
LO4. Understand the interaction of food and medium of cooking
LO5. Explore the importance of phytochemicals in food industry

THEORY: SEMESTER II
FST2.1. FOOD CHEMISTRY

Course Content

UNIT II: Carbohydrate chemistry – Classification, chemical reactions of carbohydrates, structure, Types of starches, physical and chemical properties of starches, structure, Modified starches, non-starch polysaccharides- Cellulose, hemicellulose, pectin & Gums, types of gums and their uses in food industry, Commercial sugars &Non-nutritive sweeteners, non enzymatic browning.

UNIT III: Protein Chemistry - Chemical and physical properties of proteins, structure, denaturation & coagulation, theories of gel formation, collagen and gelatine, extraction of pure proteins from foods, Plant proteins, Animal Proteins. Mechanism of post mortem changes, colour of meat, tender-
ness and juiciness. Pigments in Animal tissues – Haemoglobin, myoglobin and effect of cooking on animal pigments

UNIT IV : Lipid chemistry- Fatty acids, structures, fatty acids in edible fats and oils, crystallinity of solid fats, physical and chemical properties of fats, flavour changes, rancidity, methods of evaluation of rancidity, reversal, shortening value of fats, Fat substitutes & Structured lipids

UNIT V : Vegetables and fruits: Changes during maturation, changes in structure of pectic substances, effect of cooking on structure of pigments - chlorophyll, carotenoids and flavonoids, post-harvest changes, browning reactions, Phytochemical constituents in food and its role in food industry.

Recommended References

THEORY : SEMESTER II
FST2.2. TECHNOLOGY OF FOOD PROCESSING AND PRESERVATION

Course Outcomes
CO1. Understand the principles of Food Processing & preservation Technology.
CO2. Understand the objectives of food preservation
CO3. Acquire knowledge on methods of processing and preservation
CO4. Gain awareness on shelf life of foods
CO5. Get insights into newer concepts of technology of food preservation

Course Specific Outcomes
CSO1. Gain expertise in recent food processing and preservation technologies
CSO2. Ability to choose appropriate food preservative techniques for better preservation
CSO3. Evaluate the advantages of different processing and preservative methods
CSO4. Comprehend the knowledge on food preservatives and limits prescribed by FSSAI
CSO5. Elucidate the nutritional and safety aspects of food irradiation

Learning Outcomes
LO1. Apply the Knowledge of basic and applied aspects of food preservation in preserving foods
LO2. Choose appropriate food processing and preservative method suitable for specific foods
LO3. Relate the theoretical Knowledge of Preservation Techniques in food product development
LO4. Compare the novel technologies with the traditional methods in food processing and preservation
LO5. Knowledge of potential use of chemical preservatives

THEORY : SEMESTER II
FST2.2. TECHNOLOGY OF FOOD PROCESSING AND PRESERVATION

Course Content

UNIT I : Introduction to technology of food preservation and processing, difference between Food Processing and Food Preservation; Benefits and Drawbacks of Food Processing. Status of food processing industries in India and abroad, magnitude, prospects for future growth in India. Basic Processing Techniques – dicing, slicing, mincing, macerating, liquefaction, emulsification, Various techniques of food preservation.

UNIT II : Ambient temperature processing: Raw material preparation - cleaning – types, Sorting - types, Grading, Peeling -types. Size reduction of solid and liquid foods - concept, Equipment and effect on foods. Mixing and forming - Mixing - concept of solids and liquids mixing, equipment and effect on foods. Forming: Bread moulders, pie and biscuit formers, confectionery moulders. Separation and concentration of food components - centrifugation, expression and extraction using solvents, Post processing operations – coating or enrobing – coating materials, enrobers, dusting or breading

UNIT III : Food processing and preservation by high temperature: Thermal Processing- Commercial heat preservation methods - Sterilization, Pasteurization, evaporation, distillation, extrusion and blanching. Heat processing by using hot air – dehydration, baking and roasting; heat processing using hot oils; heat processing by using direct and radiated energy – dielectric, ohmic and infrared heating.Drying - factors affecting rate of drying, normal drying curve, types of driers used in the food industry. Canning as a preservation method, steps in canning, spoilage in canned foods
UNIT IV: Food processing and preservation by Low temperature: Chilling, Freezing and Refrigeration: Introduction to refrigeration, cool storage and freezing, definition, principle of freezing, freezing curve, changes occurring during freezing, types of freezing i.e. slow freezing, quick freezing, introduction to thawing, changes during thawing and its effect on food.

UNIT V: Food Irradiation: Introduction, Modules of radiation, kinds of ionizing radiations used in food irradiation, mechanism of action, uses of radiation processing in food industry, Preservation by fermentation - curing and pickling. Preservation by Food additives- types of food additives, food preservatives, classification and uses

Recommended References

PRACTICAL: SEMESTER II

FST2.3. FOOD CHEMISTRY
1. Qualitative tests for identification of different sugars
2. Experiment on Properties of Starch and dextrin
3. Gelatinization temperature range and % sag of various cereal starches
4. Experiment on Hydrolysis of starch from different sources
5. Precipitation reactions of proteins, colour reactions of proteins, Reactions of Albumin, Casein and Gelatine.
6. Determination of Specific gravity and acidity of foods (Milk & Oils)
7. Quality/Platform tests in Milk (Alcohol test, COB, MBRT, SNF)
8. Estimation of Fat, Protein and Lactose in milk
9. Study different types of browning reactions- enzymatic and non enzymatic
10. Estimation of Chlorophyll, carotenoids and lycopene content in vegetables
11. Estimation of Pectin content of fruits and vegetables
12. Estimation of COD, BOD & hardness in water

FST2.4. TECHNOLOGY OF FOOD PROCESSING AND PRESERVATION
1. Determination of shelf life of different foods
2. Water activity measurement of different foods
3. Determination of pH of different foods using pH meter
4. Quality characteristics of foods preserved by drying/dehydration/ freezing (Freezing of yolk, fruits)
5. Pasteurization of fluids using different methods
6. Blanching of different plant foods and observation
7. Preparation of dehydrated products using traditional methods & solar drier
8. Preparation of fruit and vegetable based preserved products
9. Preparation of food products by adding preservatives
10. Preparation of products by curing & pickling
11. Preservation of foods by non thermal process
12. Preservation of foods by coating

THEORY: SEMESTER II

SEC 2. SOLAR ENERGY

Course Outcomes
CO1. Understand the concept of solar radiation.
CO2. Understand the applications of solar energy
CO3. Learn about measurement of solar radiation

Course Specific Outcomes
CSO1. Acquire knowledge on solar radiation principles.
CSO2. Get familiarised with various collecting techniques of solar energy and its storage
CSO3. Learn about collectors used for solar thermal system

Learning Outcomes
LO1. Learn the solar photovoltaic technology principles and applications.
LO2. Learn about different types of solar cells for energy conversion
LO3. Understand the working principles of several solar appliances

THEORY: SEMESTER II

SEC 2. SOLAR ENERGY

Course Content
UNIT I: Solar Radiation: Sun as a source of energy. Solar Radiation, Solar


UNIT III : Solar Photovoltaic systems: Conversion of Solar energy in to Electricity- Photo voltaic effect, Solar photovoltaic cell and its working principle, Different types of solar cells, series and parallel connections, photo voltaic applications, battery chargers, domestic lighting, street lighting and water pumping

Co-curricular activities(Hands on exercises)
1. Plot sun chart and locate the sun at your location for a given time of the day
2. Analyse shadow effect on incident solar radiation and find out contributors
3. Connect solar panels in series and parallel and measure voltage and current
4. Measure intensity of solar radiation using Pyranometer and Radiometers
5. Construct a solar lantern using solar PV panel
6. Assemble Solar cooker
7. Designing and constructing photo voltaic system for a domestic house requiring 5kVA power
8. Get hands on experience in handling solar drier
9. Assignments

Recommended References
5. Science and Technology of Photovoltaics, P Jayarama Reddy, BS Publication, 2004

THEORY: SEMESTER II

VA1. HUMAN VALUES AND PROFESSIONAL ETHICS

Course Outcomes
CO1. Understand the significance of value inputs in a classroom.
CO2. Understand the value of harmonious relationship based on trust and respect in life and profession
CO3. Understand the Self and the Body, Intention and Competence of an individual, etc

Course Specific Outcomes
CSO1. Understand the significance of practical applications of ethics and values in real life
CSO2. Distinguish between values and skills, happiness and accumulation of physical facilities
CSO3. Get an insight into comprehensive human goals

Learning Outcomes
LO1. Understand the role of a human being in ensuring harmony in society and nature.
LO2. Distinguish between ethical and unethical practices
LO3. Start working out the strategy to actualize a harmonious environment in workplace

THEORY: SEMESTER II

VA1. HUMAN VALUES AND PROFESSIONAL ETHICS

Course Content
UNIT I : Introduction – Definition, Importance, Process & Classifications of Value Education - Understanding the need, basic guidelines, content and process for Value Education, Understanding the thought-provoking issues; need for Values in our daily life, Choices making – Choosing, Cherishing &Acting, Classification of Value Education: understanding Personal Values, Social Values, Moral Values & Spiritual Values.

UNIT II : Harmony in the Family – Understanding Values in Human Relationships, Understanding harmony in the Family- the basic unit of human interaction, Understanding the set of proposals to verify the Harmony in the Family; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Present Scenario: Differentiation (Disrespect) in relationships on the basis of body, physical facilities, or beliefs. Understanding the Problems faced due to differentiation in Relationships, Understanding the harmony in the society (society being an extension of family: Samadhan, Samridhi, Abhay, Sah-asitva as comprehensive Human Goals Visualizing a universal harmonious order in society: Undivided Society (Akhand Samaj), Universal
Order (Sarvabhaum Vyawastha) from family to world family.

UNIT II : Professional Ethics in Education- Understanding about Professional Integrity, Respect & Equality, Privacy, Building Trusting Relationships, Understanding the concepts; Positive co-operation, Respecting the competence of other professions, Understanding about Taking initiative and Promoting the culture of openness, Depicting Loyalty towards Goals and objectives.

Co curricular Activities:
1. Visit to an Old Age Home and spending with the inmates for a day.
2. Conduct of Group Discussions on the topics related to the syllabus.
3. Participation in community service activities.
4. Working with a NGO like Rotary Club or Lions International, etc.

Recommended References

THEORY : SEMESTER III
MD2. INDIAN CONSTITUTION

Course Outcomes
CO1. Gain knowledge on Indian Constitution
CO2. Understand the Government of Union and State
CO3. Understand the features of judicial systems in India

Course Specific Outcomes
CSO1. Outline of the salient features of Indian Constitution
CSO2. Get insights into Election of Prime minister and Chief Minister
CSO3. Know about the structure and Jurisdiction of Supreme court and high court

Learning Outcomes
LO1. Understand the Fundamental Rights and Directive Principles
LO2. Learn about the composition and powers of Lok Sabha and Rajya Sabha
LO3. Learn about the functions of Election Commission of India

THEORY : SEMESTER III
MD3. INDIAN CONSTITUTION

Course Content

Unit II: Government of the Union: President of India – Election and Powers, Prime Minister and Council of Ministers, Lok Sabha – Composition and Powers, Rajya Sabha – Composition and Powers

Government of the States: Governor – Powers, Chief Minister and Council of Ministers, Legislative Assembly – Composition and powers, Legislative Council – Composition and powers


Recommended References
4. Constitution of India, India.gov.in., National Portal of India,
5. Durga Das Basu (2015) Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa,

THEORY : SEMESTER III
FST3.1. TECHNOLOGY OF PLANT FOODS

Course Outcomes
CO1. Understand the Knowledge of structure and composition of plant foods
CO2. Understand the processing technologies of cereals
CO3. Comprehend the processing technologies of legumes and oil seeds
CO4. Get awareness on processing technologies of fruits and vegetables
CO5. Get insights into processing technologies of spices and plantation products

Course Specific Outcomes
CSO1. Gain expertise in utilization of plant products
CSO2. Ability to choose appropriate plant processing techniques for better preservation
CSO3. Evaluate the advantages of different plant processing methods
CSO4. Comprehend the knowledge on physico-chemical properties of fruits and vegetables
CSO5. Elucidate the nutritional aspects of extrusion technology in foods

Learning Outcomes
LO1. Apply the Knowledge of basic and applied aspects of plant processing and technology
LO2. Choose appropriate processing methods suitable for plant products
LO3. Relate the theoretical Knowledge of Processing Techniques in food product development
LO4. Compare the novel technologies with the traditional methods in plant processing
LO5. Knowledge of potential use of various by-products of plant foods

THEORY: SEMESTER III
FST3.1. TECHNOLOGY OF PLANT FOODS

Course Content

UNIT-I : Production and utilization of cereals and cereal products. Processing technology for Cereals - Rice - Types and physicochemical characteristics; nutritive value, rice milling. Wheat - Types and physicochemical characteristics; nutritive value, wheat milling; whole wheat atta; production of starch and vital wheat gluten and bakery products. Breakfast cereal foods: flaked, puffed, expanded, extruded and shredded. Millets and millet processing.

UNIT-II : Processing technology of pulses - Production and utilization of pulses, Processing - soaking, germination, fermentation, flaking, decortication, milling types, technology of pulse products - dal, puffed legumes, convenience foods - papad, cereal pulse mixes, protein concentrates and isolates. Traditional and non-traditional soya products in India. Extrusion cooking technology.

UNIT-III : Processing technology of nuts and oil seeds - Production and utilization of coconut, groundnut and cashewnut. Methods of processing, dehydrated coconut, dessicated coconut. Processing for production of edible oil, preparation of edible cake and oil, cleaning and dehusking, different types of pressing, oil extraction process, mechanism, solvent, SCE, oil refining; utilization of by-products of nut and oil seeds

UNIT-IV : Processing technology of fruits and vegetables – Production and processing of fruits and vegetables; freezing, dehydration, canning, preparation of juices and concentrates. Different products of fruits and vegetables - jams, marmalades, squashes, cordials, ketch up and sauces. Fruit and vegetable fibres. Fruit candies and crystallized fruits. Pickles and chutneys - types, preparation, shelf life and quality control. Commercial processing of fruits and vegetables for production of value-added products. By-products of fruit and vegetable processing industry.


Recommended References

THEORY: SEMESTER III
FST3.2. TECHNOLOGY OF SEA FOODS

Course Outcomes
CO1. Understand the need and importance of fishery industry
CO2. Know the compositional and technological aspects of fish
CO3. Gain knowledge on processed fish products
CO4. Understand about the status of fishery in India
CO5. Comprehend different storage options for the fishes.

Course Specific Outcomes
CSO1. Understand the processing of fish by curing agents, drying and salting
CSO2. Acquire skills in fish quality management
CSO3. Understand preserving fish by smoking.
CSO4. Gain knowledge about processing of fish by canning
CSO5. Understand about fish by-products processing and potential benefits.
Learning Outcomes

LO1. Potential to comprehend research and development in fish processing
LO2. Relate the climate change aspects to fish processing
LO3. Learn about fish industry waste management
LO4. Acquire the knowledge on handling of fish
LO5. Recognise the factors affecting quality of fish

THEORY : SEMESTER III

FST3.2 TECHNOLOGY OF SEA FOODS

Course Content

UNIT I : Sea foods - Introduction – Sources, commonly cultivated fish, shrimp and prawns, Per capita consumption of fish. Importance and status of fishery industry in India. Present scenario in National and International economy. Research and development activities on fishery products. Blue revolution in India. Entrepreneurship opportunities in sea food industry


UNIT III : Present status of Fish, Shrimp and Prawns processing in India. Processing and preservation of fish, shell fish and their products sun drying, Canning, smoking, freezing, curing, salting & pickling and dehydration of fish. by-products - Production of fish meal, fish protein concentrates, fish protein extracts (FPE), fish protein hydrolysates (FPH), fish liver oil. Value Added Sea Food Products.

UNIT IV : Structure, post-mortal changes in fish. Advanced freezing technology for fish storage and deodorization of transport system. Types of contamination of fish. Waste management-utilization of fish waste such as fish silage, compost, sauces, protein hydrolysates, fish meal etc. Packaging of fishery products, FSSAI regulations on packaging and labelling.


Recommended References


PRACTICAL : SEMESTER III

FST3.3. TECHNOLOGY OF PLANT FOODS

1. Physical characteristics of Wheat, corn, Barley & oats, millets, pulses and oilseeds
2. Physicochemical tests and evaluation of cooking quality of cereals, millets, pulses and oilseeds
3. Estimation of Pelschenke Value, Hagberg’s Falling number & Potassium Bromate in flour
4. Milling and parboiling of paddy
5. Determination of percentage impurities in grain by aspirator and seed blower
6. Pre-treatments for milling of pulses a) Application of water b) Application of oil c) Application red earth slurry) Application of steam
7. Dhal milling and visit to dhal mills
9. Solvent extraction of selected oilseeds, Visit to oil extraction & refining units
10. Detection of adulteration in fats and oil.
11. Canning of fruits and vegetables
12. Estimation of capsaicin content in chillies & curcumin content in Turmeric

FST3.4. TECHNOLOGY OF SEA FOODS

1. Quality evaluation of fish/prawn.
2. Subjective evaluation of Fresh Fish.
3. Cut out examination of canned fish (Sardine, Mackerel, Tuna)
4. Fish product formulation/canning.
5. Determination of total volatile bases in frozen fish
6. Determination of moisture in dried fish
7. Determination of sodium chloride in dried fish
8. Determination of Ash insoluble in dilute hydrochloric acid
9. Determination of total volatile acids in fish product
10. Dressing of Fish.
11. Preparation of value-added fish products
12. Visit to Fish processing industry

THEORY: SEMESTER III

SEC3. MUSHROOM CULTIVATION TECHNOLOGY

Course Outcomes
CO1. Gain knowledge of cultivation of different types of edible mushrooms
CO2. Understand the importance and problems in mushroom cultivation
CO3. Gain knowledge on Composting

Course Specific Outcomes
CSO1.Gain the knowledge of spawn production
CSO2.Acquire skills in managing the diseases and pests of mushrooms
CSO3.Comprehend the technical aspects of Packaging, Storing and grading of mushroom

Learning Outcomes
LO1. Ability to identify edible and poisonous mushrooms
LO2. Gain hands on training for the preparation of bed for mushroom cultivation and spawn production
LO3. Get industrial exposure in understanding the establishment and functioning of mushroom farm

THEORY: SEMESTER III

SEC3. MUSHROOM CULTIVATION TECHNOLOGY

Course Content

Unit I : Commercial Mushroom Cultivation- Present scenario and prospects for Mushroom Cultivation, Description of edible types, natural growth aspects and climatic requirements, Selection of types of Mushroom and Sites, Methods used for commercial cultivation - mushroom substrate selection, substrate soaking, pasteurization etc. Design and construction of Mushroom farm

Unit II : Composting in Mushroom cultivation- Role of composting in Mushroom cultivation, appropriate materials to prepare different types of compost, Methods of composting – preparation and pasteurization, Determination of quality of compost, Hazards & risks associated with composting and how to control injury to self, Mushroom cultivation – methods, preparation of spawn substrate, process of spawn culture, selection of correct spawn, culture maintenance, mother spawn production and storage of spawn.

Unit III : Harvesting of Mushroom- Identification of right stage of Mushroom, Methods of harvesting, use of approved cutting techniques for harvesting, Packaging storing and grading of Mushroom & post harvest procedures, Packaging Mushrooms with labels, Use of spent Mushroom in vermi-composting and in organic farming, Preparation of value added products of Mushroom, Disease control and pest Management

Co-curricular activities (Hands on exercises)
1. Study of external, Internal characters and identification of edible mushroom
2. Nutritional values & Medicinal usages of mushrooms
3. Field Visit & Interaction with Mushroom cultivators and other Support Agencies
4. Learn Media preparation for Spawn culture, Preparation of different types of compost, Seeding technique of spawn in compost, Packaging and labelling process
5. Preparation of recipes and Value added mushroom products
6. The standard specifications in the designing and construction of mushroom farm

Recommended References
5. Anupam Mishra, SRK Singh and MP Thakur: Training Manual on Cultivation of Tropical Mushroom and its Value addition. Agricultural Technology Application Research Institute – ICAR - Zone VII, JNKVV, Jabalpur
THEORY : SEMESTER IV
MD3. CYBER SECURITY

Course Outcomes
CO1. Understanding the key issues associated with protecting information assets
CO2. Overview of the field of information security and assurance
CO3. Acquire knowledge on the cyber security practices

Course Specific Outcomes
CSO1. Understand the broad set of technical, social & political aspects of Cyber Security.
CSO2. Appreciate the vulnerabilities and threats posed by criminals
CSO3. Understand the importance of ethical hacking tool.

Learning Outcomes
LO1. Learn the ethical hacking process.
LO2. Comprehend cyber laws
LO3. Decipher cyber security strategies and policies.

THEORY : SEMESTER IV
MD3. CYBER SECURITY


Recommended References
4. Cyber Law (2000) Bare Act, Govt of India

THEORY : SEMESTER IV
FST4.1. FOOD ANALYSIS

Course Outcomes
CO1. Obtain knowledge in various methods of food analysis
CO2. Learn the analysis of carbohydrates and fats
CO3. Understand basic principles of protein and vitamin analysis
CO4. Comprehend various aspects of food analysis
CO5. Understand the principles of spectroscopy and chromatography in food analysis

Course Specific Outcomes
CSO1. Analyse the nutritional quality of the food products.
CSO2. Understand the need for analysis and instrumentation
CSO3. Decipher the methods of fiber component analysis in foods
CSO4. Have an insight into instrumental measure of texture of foods
CSO5. Update knowledge on analytical instruments by visiting laboratories

Learning Outcomes
LO1. Identify an appropriate technique for analysing specific components in food substances
LO2. Hands on experience in analysis of nutritional quality of food products
LO3. Competent to estimate vitamins and minerals in food sample
LO4. Have an insight into the advanced techniques in food and nutrient analysis
LO5. Apply the knowledge of food analysis in establishing standards for food quality

THEORY: SEMESTER IV
FST4.1. FOOD ANALYSIS

Course Content
UNIT-I: Introduction to Food Analysis-Steps in food analysis, criteria for choice of food analysis methods, General principles of sampling of foods for analysis, Sampling methods and sample preparation. Principles and methods of estimation of moisture, Methods of estimation of As, Estimation of Calcium, phosphorus & iron from ash solution.


UNIT IV: Total fat - methods and principles of estimation of fats, methods of separation of lipid fraction and determination of neutral glycerol, fatty acids, phospholipids and cholesterol in foods.

Vitamins - General methods of estimation of Vitamins from foods, Estimation of Vitamin A, thiamine, riboflavin and Vitamin C.

UNIT V: Food analysis Instrumentation - Principles and application of colorimetry, spectroscopy, flame photometry, atomic absorptometry, Principles and Application of Chromatographic procedures in food analysis: Ion exchange, thin layer, solid, liquid, gas, column, paper and high-performance liquid chromatography with suitable examples.

Recommended References:
4. Sathe AYA (1999) First Course In Food Analysis

THEORY: SEMESTER IV
FST4.2. FOOD PRODUCT DEVELOPMENT

Course Outcomes

CO1. Understand the need for new food product development
CO2. Acquire systematic knowledge on product design
CO3. Understand Food Product commercialization and Marketing
CO4. Decipher basics of development of health-related food products
CO5. Understand the factors affecting Food Product development

Course Specific Outcomes

CSO1. Understand the classification of new food products
CSO2. Insight into prototype development and scale up
CSO3. Acquire knowledge on designer foods
CSO4. Know the importance of product performance testing
CSO5. Understand the ethics in Food Product development

Learning Outcomes

LO1. Potential to differentiate existing products and new food products
LO2. Learn about success and failure of new food products
LO3. Learn about shelf-life testing of food products
LO4. Acquire the knowledge on product life cycle
LO5. Recognise the importance of healthy food products

THEORY: SEMESTER IV
FST4.2. FOOD PRODUCT DEVELOPMENT

Course Content


Recommended References

PRACTICAL: SEMESTER IV

FST4.3. FOOD ANALYSIS
1. Determination of moisture in different foods
2. Estimation of Ash value in different foods and preparation of Ash solution
3. Estimation of Fibre in foods
4. Estimation of Protein content in foods by different methods
5. Estimation of Fat content in foods by Soxhlet method
6. Estimation of total sugars and reducing sugars
7. Estimation Calcium, Phosphorus and Iron content of foods
8. Estimation of Vitamin A/Beta carotene in foods
9. Estimation of Vitamin C in foods
10. Determination Sapronification value iodine value, Free fatty acid value and Peroxide value of fats
11. Determination of Lipid peroxidation in fats and oils by ThioBarbituric Acid reactive substances assay
12. Estimation of Phospho lipid and cholesterol content of foods

FST4.4. FOOD PRODUCT DEVELOPMENT
1. Survey on types of convenience foods / consumer behaviour / food labelling
2. Market & literature survey to identify the concepts of new products based on special dietary requirements, functionality, convenience and improvisation of existing traditional Indian foods
3. Screening of product concept on the basis of techno-economic feasibility
4. Development of design and Product Specification
5. Development of prototype product and Standardization of formulation process
6. Sensory Evaluation of new product
7. Proximate Analysis of new Product
8. Packaging and labelling design
9. Shelf-life studies of new product
10. Cost analysis and Final Project Report

THEORY: SEMESTER IV

DSE1A. TECHNOLOGY OF MEAT, POULTRY & EGG

Course Outcomes
CO1. Understand need and importance of livestock, egg and poultry industry
CO2. Study structure, composition and nutritional quality of animal products
CO3. Study processing and preservation of animal foods
CO4. To understand technology behind preparation of various animal food products.
CO5. To understand technology behind by-product utilization.

Course Specific Outcomes
CSO1. Understand the sources and developments of meat and poultry industries in India
CSO2. Acquire skills in meat quality management
CSO3. Know about the importance of meat production in national economy.
CSO4. Gain knowledge about muscle structure, chemical composition and CSO5. Understand about physico-chemical properties of meat

Learning Outcomes
LO1. Comprehend the developments of meat and poultry industry in India
LO2. Learn about FSMS compliance for meat products
LO3. Learn about processing and preservation of meat
LO4. Acquire the knowledge on post-harvest handling of poultry
LO5. Recognise the factors affecting egg quality

THEORY: SEMESTER IV

DSE1A. TECHNOLOGY OF MEAT, POULTRY & EGG

Course Content
Unit – I: Livestock and poultry population in India, Development of meat

Unit – II: Premortem inspection and care of animals, slaughtering of animals, inspection and grading of meat, stunning types, slaughtering types, Slaughter house operations, dressing, ante and postmortem changes in carcass composition, grading of meat and meat cuts. Factors affecting post-mortem changes, properties and shelf-life of meat. Meat quality evaluation. MFPO /Kosher/Halal, Comminuted and non- comminuted meat products. FSSAI guidelines on FSMS compliance for meat and meat products.

Unit – III: Processing and preservation of meat– characteristics of meat for processing – water holding capacity, protein and emulsifying capacity, PSE and DFD meat, ingredients in meat processing, canning, freezing, salting, Dehydration, Aging, pickling and smoking of meat, Spoilage and its control, Meat by-products

Unit – IV: Poultry: Classes of poultry meat, Commercial methods of slaughtering, dressing, pre and post-slaughter handling, poultry carcass evaluation, poultry packaging, quality characteristics of poultry products, chemical residues in poultry, HACCP in poultry slaughter house, Poultry related food borne diseases, storage, preservation of poultry meat, Spoilage and its control, Freezing of poultry (whole and cuts)

Unit – V: Eggs - Factors affecting egg quality and measures of egg quality. Handling, candling, washing, Refrigeration and freezing, thermal processing, dehydration, coating, packaging and storage, Egg processing (Egg powder manufacturing), Spoilage and its control. The egg industry, its techniques of working, General management

Recommended References

THEORY : SEMESTER - IV
DSE 1B. FERMENTATION TECHNOLOGY

Course Outcomes
CO1. Understand the history and development of fermentation technology
CO2. Understand the fermentation media
CO3. Comprehend the fermenter designs
CO4. Acquire knowledge on scale up of fermentation
CO5. Gain knowledge on fermented foods

Course Specific Outcomes
CSO1. Acquire the knowledge on types of fermentation systems
CSO2. Understand the basic components of fermentation medium
CSO3. Comprehend the technology of solid-state Fermentation
CSO4. Acquire skills on development of fermentation products
CSO5. Comprehend the concept of solid-state fermentation

Learning Outcomes
LO1. Learn about isolation and screening of industrially important microorganisms.
LO2. Get knowledge on problems associated with strain improvement
LO3. Assess the quality standards of fermented foods
LO4. Understand Bioreactor for specialized applications
LO5. Learn about preparation of traditional fermented products

THEORY : SEMESTER IV
DSE 1B. FERMENTATION TECHNOLOGY

Course Content
UNIT-I: Introduction to Fermentation technology - History, scope and development of fermentation technology, Fermentation kinetics, types of fermentation systems- batch, fed batch& continuous systems. Isolation and screening of industrially important microorganisms - primary and secondary metabolites

UNIT-II: Fermentation media - Natural and synthetic media, basic components of a medium - carbon & nitrogen sources, vitamins, minerals, anti-foaming agents, role of buffers in media, process of aeration and agitation. Maintenance of strains, Strain improvement, Problems associated with strain improvement. Mutant selection and Recombinant DNA technology

UNIT-III: Fermenter design - Basic design of Fermenter, body construction, agitator, sparger, baffles, stirrer glands and bearings. Direct, dual or multiple fermentations. Type of fermenter - tower, deep jet, cyclone column, packed tower and airlipFST fermenter. Bioreactor for specialized applications, stirred tank reactors, packed bed reactors, fluidized bed reactors & trickle flow reactor. Overview of Solid-State Fermentation (SSF) - Advantages and applications

UNIT-IV: Scale-up of fermentation and product development, Down-stream processing and product recovery, evaporation and crystallization, regulation and safety. Assay of fermentation products. Industrial production of amino
acids, enzymes, alcohols, antibiotics. General methods of industrial production; basic calculations, analysis of the final product. Types of contaminants, removal of contaminants from the product stream, product potency.


Recommended References

THEORY: SEMESTER IV

DSE1C. FOOD LAWS & STANDARDS

CO1. Understand the history of food regulations in India
CO2. Acquire knowledge on Food laws and standards in controlling quality
CO3. Gain insight on International Laws and regulation in establishing quality
CO4. Decipher food safety regulations to ensure quality
CO5. Understand the importance of other regulatory agencies

Course Specific Outcomes
CSO1. Know different food laws and their importance
CSO2. Insight into FDA functioning
CSO3. Acquire knowledge on international food laws and their implementation criteria
CSO4. Know the guidelines with respect to food safety
CSO5. Understand the concepts and trends in food legislation

Learning Outcomes
LO1. Amass knowledge on food regulations of India
LO2. Learn about Licensing and Registration of Food Units
LO3. Learn about role of International organisations working for food safety
LO4. Comprehend the functions of FSSAI

LO5. Recognise the Nutrition labelling guidelines

THEORY: SEMESTER IV

DSE1C. FOOD LAWS & STANDARDS

Course Content

UNIT II: FDA - Structure and Function, Administrative Set-up, Roles and Responsibilities of Staff. FSSAI – Structure and Function, Administrative Set-up at the State Level, Licensing and Registration of Food Units – Central and State Licensing Authorities, Codex India


UNIT IV: Food Laws and Standards in India - Food Safety and Standards (FSS) Act, 2006, FSS Rules and Regulations, Agricultural Produce Act, 1937 (Grading and Marketing), Bureau of Indian Standards relevant to food safety, Regulations and Standards & Guidelines with regard to Food Safety: CODEX (SPS/TBT), OIE, IPPC.


Recommended References
3. Jessica Vapnek, Melvin Sprei (2005) Perspectives and guidelines on food legislation, with a new model food law, FAO.
THEORY: SEMESTER IV

SEC4. FOOD PACKAGING & LABELLING

Course Outcomes

CO1. Understand the scientific and technical aspects of food packaging
CO2. Nutrition label format, bar coding, FSSAI and codex guidelines. Labelling requirements as per Food Safety Standards (Packaging and Labelling) Regulations 2011. Health claims, nutrition claims, Misleading health claims, consumer understanding of nutrition labels, effect of nutrition labelling on food choice and diet.

Recommended References
1. Preeti Singh et al. (2017), Food Packaging Materials: Testing & Quality Assurance

THEORY: SEMESTER IV

VA2. ORGANIC FARMING

Course Outcomes

CO1. Gain knowledge on various principles Organic Farming
CO2. Get insight into cultivation practices for various crops cultivated using organic farming methods
CO3. Understand the importance of soil microbes in farming

Course Specific Outcomes

CSO1. Ability to design, execute and manage an organic farm for a crop
CSO2. Ability to identify and control different pests and diseases of plants in an organic farm
CSO3. Understand the production and use of biofertilizers and biopesticides

Learning Outcomes

LO1. Ability to cultivate crops using principles of organic farming
LO2. Develop competency to become an employ in the Organic farming sector
LO3. Develop expertise to become an entrepreneur by taking up organic farming

THEORY: SEMESTER IV

VA2. ORGANIC FARMING

Course Content

UNIT I: Introduction to Organic farming- Detrimental effects of chemical dependant farming. Types of Farming Advantage & disadvantage of each system, Pure Organic Farming, Integrated Farming systems & Mixed Farming.
Organic Farming (Process), Concept of farming system, Developing organic farms, Important steps & methods, Soil types and Soil conditioners


UNIT II: Preparation of Compost: Different Methods, Enrichment of compost, Preparation of vermicompost, Pit construction, Raw materials, Availability of specific species of earth worm, Method of preparation, Quality improvement of finished vermin compost, Preparation of seed bed and raising of seedlings

Recommended References
1. Organic farming-Theory and Practice by S.P. Palaniappan and K. Annadurai
2. Organic crop production (Principles and practices Vol-I: Principles and General Aspects) by J. P. Sharma

Co-curricular activities (Hands on exercises) 
1. Field Visit & Interaction with organic farmers
2. Learn methods of organic farming
3. Growing crops using organic farming
4. Learn the preparation of vermi compost
5. Learn how to prepare seed beds and raising of seedlings

Semester V
THEORY: SEMESTER - V
MD4. ARTIFICIAL INTELLIGENCE

Course Specific Outcomes
CSO1. Outline of the application of cyber security in national security
CSO2. Get insights into Characteristics of Intelligent Agents
CSO3. Know about the Architecture for Intelligent Agents

Learning Outcomes
LO1. Understand the Future of Artificial Intelligence
LO2. Analyze the different Problem-Solving Approaches.
LO3. Evaluate the security issues of web applications, services and servers.

THEORY SEMESTER V
MD4. ARTIFICIAL INTELLIGENCE

Course Content


UNIT III: Ethics of artificial intelligence: role of artificial intelligence in Human life, ethical considerations of AI, current initiatives in AI and ethics. Ethics of AI in Military, Biomedical research, Patient care, Public health, Robot teaching, Pedagogy, Policy, Smart City Ethics.

Recommended References
UNIT III : Microbiological techniques-Sterilisation and disinfection: Sterilisation by physical agents- heat, moist heat, fractional sterilisation, pasteurisation, other types of sterilisations, chemical sterilisation. Methods of Isolation and detection of microorganisms in food and water (general outline of different methods).

UNIT IV : Toxicology Definition, classification of food toxicants, Factors effecting toxicity of foods and disease out breaks. Food toxins and implications on human health: Neurotoxicity, Hepato toxicity, Nephron toxicity, Haemotoxicity, skeletal toxicity, reproductive toxicity, allergenicity, Teratogenic effects,

UNIT V : Non-organic and organic metallic contaminants, Endogenous toxicants in food derived from plants: classification of toxic plant metabolites in food, cyanogenic glycosides, Vasoactive amines, Psychoactive compounds, Lathyrogens.. Toxic mushrooms and other macro fungi, Toxicology of marine foods: Molluscs, Fish and marine algae.

Recommended References
5. Hand Book of Food Toxicology by Deshpande, 2002

THEORY : SEMESTER V
FST5.2. BAKERY& CONFECTIONARY TECHNOLOGY

Course Outcomes
CO1. Understand the concepts of baking technology
CO2. Get the knowledge on bread manufacturing process
CO3. Comprehend the method of production of biscuits and cakes
CO4. Acquire knowledge on confectionary products
CO5. Gain knowledge on quality control of bakery products

Course Specific Outcomes
CSO1. Acquire the knowledge on raw material required for baking
CSO2. Understand the stages in processing of bread
CSO3. Comprehend the problems of baking
CSO4. Acquire skills on preparation of bakery and confectionary products
CSO5. Comprehend the functional tests for bakery products
**Learning Outcomes**

**LO1.** Learn about baking equipment

**LO2.** Get knowledge on faults and remedies in baking

**LO3.** Assess the quality standards of fermented foods

**LO4.** Learn Good manufacturing practices of baking and confectionary industries

**LO5.** Learn about specifications of baking and confectionary products

**THEORY: SEMESTER V**

**FST5.2. BAKERY & CONFECTIONARY TECHNOLOGY**

**Course Content**


UNIT-III: Biscuits and Cakes - Production of biscuits, cookies and cakes, types of biscuit doughs, developed dough, short dough, semi-sweet, enzyme modified dough and batters. Importance of consistency of dough. Ingredients, their function and structure, builders, tenderizers, moisteners and flavour enhancers. Selection and preparation of mould temperature and time for making different types of cakes. Problems of baking.

UNIT-IV: Confectionary products - Definition, importance of sugar confectionary and flour confectionary. Types of confectionary products - chocolate, boiled sweets, caramels, toffees, fondants and their manufacturing process, spoilage of confectionary products, quality control, sanitation and safety.


**Recommended References**


**PRACTICAL : SEMESTER V**

**FST5.3. FOOD MICROBIOLOGY**

1. Introduction to the Basic Microbiology Laboratory Practices and Equipment
2. Study of principles and types of compound microscope.
3. Preparation of common laboratory media for cultivation of bacteria, yeast and moulds.
4. Inoculation techniques and different methods of isolation of microorganisms.
5. Staining of bacteria: Gram’s staining acid fast,
6. Staining of yeasts and moulds.
7. Study of microbiological analysis in the food preparation area.
8. Study of microbiological flora of both processed and unprocessed foods like vegetables and fruits, cereals, spices and canned foods.
10. Compare the growth of microorganisms: -
    (a) In jams/ sauces (hypotonic).
    (b) Temperature zones (cold, hot and room temperature).

**FST5.4. BAKERY & CONFECTIONARY TECHNOLOGY**

1. Quality tests on wheat flour for baking (Moisture, gluten content and Sedimentation value)
2. Experiment on leavening action of baking powder, sodium bicarbonate and ammonium bicarbonate
3. Determination of yeast-ferment test and dough rising capacity of atta and maida.
4. Preparation of Bread by different methods and assessment of quality
5. Preparation of cakes and assessment of quality
6. Quality tests of fat/butter for different parameters for bakery applications
7. Preparation of different types of biscuits & cookies and assessment of faults and quality
8. Preparation of various types of toffees and sensory evaluation
9. Preparation of sugar boiled confectionary and sensory evaluation
10. Preparation of candies and chocolates and sensory evaluation

THEORY: SEMESTER V
DSE2A. FOOD BIOTECHNOLOGY

Course Outcomes
CO1. Understand the concept of Food Biotechnology
CO2. Understand the impact of biotechnology on the nutritional quality of foods
CO3. Understand the application of enzyme technology
CO4. Acquire knowledge in Animal Cell Cultures methods
CO5. Comprehend tissue and bacterial cultures

Course Specific Outcomes
CSO1. Understand the Biotechnology in food production
CSO2. Gain knowledge on regulatory aspects for biotechnological methods
CSO3. Acquire knowledge on Single cell protein
CSO4. Comprehend the knowledge on microbial lipases
CSO5. Gain knowledge in genetic engineering

Learning Outcomes
LO1. Recognize the scientific advancements in biotechnology and its applications
LO2. Learn different fermentation technologies for the production of enzymes
LO3. Acquire skill in tissue culture methods
LO4. Acquire skills in genetic engineering
LO5. Learn the applications of transgenic fish technology

THEORY: SEMESTER V
DSE2A. FOOD BIOTECHNOLOGY

Course Content
UNIT – I: Food Biotechnology – introduction, history, applications of genetics to food production. Impact of biotechnology in food industry and nutritional quality of foods. Regulatory aspects for biotechnological methods. GMO/GEO role in Food industries. Institutions involved in biotechnological research in India. Applications of Biotechnology in Agriculture – post harvest technology, plants at their genetic level, To develop nitrogen fixation, production of disease resistant plants

UNIT – II: Cell and Tissue culture- Animal cell culture, Media and propagation of cell lines, primary cell lines, secondary cell lines, Minimal essential medium, Amino acid assay medium. Plant cell culture, Plasticity, Totipotency, MSmedium, micro propagation, callus formation, Organ development, tissue transformation, uses of tissue culture


UNIT-V: Recent developments in food biotechnology and applications – production of vitamins, minerals, essential amino acids, phytochemicals, non nutritive sweeteners. Bioengineered animals and transgenic poultry, application of transgenic fish technology in sea food production, biotechnological approaches to improve nutritional quality and shelf life of fruits and vegetables.

Recommended References
THEORY: SEMESTER V

DSE2B. FOOD SANITATION HYGIENE & WASTE MANAGEMENT

Course Outcomes
CO1. Assimilate the synergistic integration of food sanitation, hygiene and waste management
CO2. Acquire knowledge on poor food safety practices
CO3. Gain knowledge on hygiene and sanitation in food service institutions
CO4. Comprehensive know-how on hygiene and sanitation in food industries
CO5. Explore the sanitation methods in food processing units

Course Specific Outcomes
CSO1. Understand the symptoms of food borne illnesses
CSO2. Understand the importance of personal hygiene
CSO3. Perceive the importance of cleaning and disinfection
CSO4. Evaluate the requirement of sanitation in storage areas
CSO5. Grasp the current technologies in waste management

Learning Outcomes
LO1. Enable students to better understand food safety management procedures
LO2. Apply the principles of safety for high-risk foods
LO3. Familiarise students with good hygienic practices
LO4. Understand the importance of food plant sanitation
LO5. Explore the nuances in waste management

THEORY: SEMESTER V

DSE2B. FOOD SANITATION HYGIENE & WASTE MANAGEMENT

Course Content
UNIT I: The importance of food safety. Food safety management procedures, causes & symptoms of food borne illness, effects of food borne illness on consumers and retailers, effect of poor safety practices on food products, Food safety procedures in retail stores, Preventing food borne illness, Food hazards, The four C’s, Record keeping, Due diligence, Reporting procedures, Legal responsibilities.

UNIT II: Personal Hygiene - Importance of personal hygiene. Basic rules regarding personal hygiene, hygienic food handling, employee health, training, principal food safety hazards on the human body. Appropriate protective clothing, Effective personal hygiene practices, Good Manufacturing Practice.

UNIT III: Sanitation in Food industries and Service Institutions - Plant maintenance - Hygiene and sanitation requirement in food processing and fermentation industries; Cleaning, sanitizing and pest control in food processing; storage and service areas. Cleaning compounds, choosing, handling and storage of cleaning compounds, food spoilage and food handling. Special requirements for high-risk foods, Safe food cooking temperature and pest control methods.


UNIT V: Solid waste from food processing industries – introduction, treatment methods. Waste management of cereals, fruits & vegetables, dairy, meat and fish processing industries.

Recommended References

THEORY: SEMESTER V

DSE2C. FOOD ADULTERATION

Course Outcomes
CO1. Gain knowledge on common adulterants present in food
CO2. Be aware of the methods of detection of adulterants
CO3. Understand the present laws on adulteration
CO4. Outline of the different standards of quality for food products
CO5. Get insights into the modes of consumer protection

Course Specific Outcomes
CSO1. Understand the impact of food adulterants on health
CSO2. Gain knowledge on common foods which are adulterated
CSO3. Know about the consumer’s problems with respect to Food Adulteration
CSO4. Have an insight into the standards of quality for different food products
CSO5. Familiarize various organizations involved in prevention of food adulteration
Learning Outcomes
LO1. Learn about types of food adulteration
LO2. Distinguish between additives and adulterants.
LO3. Correlate the consumption of adulterated food on health of consumers
LO4. Apply techniques of detection of adulterants in assuring safety of food products
LO5. Learn about procedures to complain and compensation to victims

THEORY: SEMESTER III
DSE2C. FOOD ADULTERATION

Course Content


UNIT-III : Common food adulterants found in cereals, pulses, milk & milk products, oils & fats, spices & condiments, sweetening agents, soft drinks, beverages, miscellaneous products.


Recommended References
2. Ramesh. V. Bhat (1992) Food Safety, case studies, NIN
3. DART, FSSAI

THEORY : SEMESTER V
SEC5. NUTRITION FOR HEALTHY LIVING

Course Outcomes
CO1. Understand the relationship between food, nutrition and health.
CO2. Understand the functions of food.
CO3. Learn about various food groups and balanced diet.
CO4. Understand digestion, absorption and function of various nutrients and their sources.
CO5. Understand the knowledge on functions of food

Course Specific Outcomes
CSO1. Understand the role of different nutrients in normal health.
CSO2. Comprehend the functions of vitamin like molecules
CSO3. Understand the importance of RDA in nutrition
CSO4. Comprehend the deficiencies and symptoms of vitamins
CSO5. Comprehend the deficiencies and symptoms of minerals

Learning Outcomes
LO1. Relate metabolism of macro and micro nutrients with health
LO2. Understand the reasons for malnutrition, under nutrition and over nutrition
LO3. Associate knowledge of nutrients with their deficiencies.
LO4. Apply the knowledge in determining the nutritional requirements
LO5. Acquire skills to overcome nutritional deficiency diseases

THEORY: SEMESTER V
SEC5. NUTRITION FOR HEALTHY LIVING

Course Content
UNIT I : Introduction to Food, Nutrition and Health, Balanced Diet, Food
groups, Food Pyramid, food exchange list. Menu planning principles, factors to be considered, Food security, Standardization of recipes and portions. BMR, Factors affecting BMR, energy requirements for various age groups. Therapeutic diets: Modification of normal diet to suit special needs


Recommended References

Co-curricular activities (Hands on exercises)
1. Learn to standardise recipes and calculate nutritive value
2. Learn menu planning principles and plan menus for different age groups
3. Visit to Anganwadi centres
4. Preparation of questionnaire to assess dietary intakes
5. Conducting nutrition education sessions to vulnerable groups

THEORY: SEMESTER V

VA3. ENTREPRENEURSHIP AND MANAGEMENT OF STARTUPS

Course Outcomes
CO1. Understanding the dynamic role of entrepreneurship and small businesses.
CO2. Acquire knowledge on Organizing and Managing a Small Business.
CO3. Understand a New Product or Service Development

Course Specific Outcomes
CSO1. Get insights in to Business Plan Creation.
CSO2. Gain knowledge on Small Business Growth and Performance
CSO3. Evaluate the process of becoming a start-up with current trends and Regulatory environment

Learning Outcomes
LO1. Understand entrepreneurial behaviours and entrepreneurial motivation
LO2. Understand managerial problems of new enterprises: production, financing and labour & marketing
LO3. Ability to create a business plan for a food business idea

THEORY: SEMESTER V

UNIT I: Entrepreneurship and Management of Startups


UNIT II: Feasibility Studies: Technical, marketing and financial: managerial problems of new enterprises: production, financing and labor and marketing problems, Preparation of Feasibility reports and legal process and documentation, establishing entrepreneur systems.

UNIT II: The new model of Entrepreneurship - Business incubators and startups, Start up’s- Concepts, models, characteristics, startup communities, startup terminologies and funding options of start-up’s. Startups in India: Profile, Causes, Effects, Process of becoming a startup, Current trends, Regulatory environment, Budget, Plans and Policies, Government initiatives: assistance towards Startup’s, women initiatives and other backward groups. Startup India program

Recommended References

THEORY : SEMESTER VI
FST 6.1. PROCESSING OF OILS AND FATS

Course outcomes
CO1. Gain knowledge on edible oils and fats from animal and vegetable sources
CO2. Understand the physico-chemical characteristics of oils and fats
CO3. Acquire knowledge on utilization of oils fats
CO4. Gain knowledge of processing techniques of oils and fats
CO5. Decipher the applications of plastic fats in food industry

Course Specific Outcomes
CSO1. Assess the suitability of individual oils/fats for edible purpose
CSO2. Analyse the composition of oils & fats for their Nutrition value
CSO3. Understand the specifications of oils and fats
CSO4. Acquire knowledge on storage and handling of oils and oil-seeds
CSO5. Understand the relevance of oil technology innovation in economy boosting

Learning Outcomes
LO1. Analyse the application of individual oils/fats for industrial application
LO2. Learn the extraction techniques of oils
LO3. Comprehend the refining process of oils
LO4. Understand the specifications of refined oils
LO5. Learn about hydrogenation of oils and fats

THEORY: SEMESTER VI
FST 6.1. PROCESSING OF OILS AND FATS

Course Content


UNIT-III : Expression and extraction of oil-bearing seeds- Raw material preparation, handling, drying, storage. production of oil by hydraulic press, Ghanis, mechanical expression- types of mechanical press, advantages and disadvantages. Solvent extraction techniques, advantages and limitations, desolvationization of meals and cake in Food Formulations, production of protein products, concentrates and isolates.

UNIT-IV : Refining of Oils-chemical and physical methods, mechanism, methods of degumming of oils and fats, de-acidification of oils and fats- use of alkalis, batch and continuous methods, washing & drying, bleaching- choice of adsorbent, batch and continuous bleaching, dewaxing and deodorization. Use of membrane technology, biotechnology and other separation processes for refining oils. Specifications of refined oils as per FSSAI, permissible limits of additives.


Recommended References
5. Handbook of Oil Technology by AOCS

THEORY: SEMESTER VI
FST 6.2. DAIRY TECHNOLOGY

Course Outcomes
CO1. Know the need and importance of dairy industry
CO2. Understand the compositional aspects of milk and Processed milk products.
CO3. Understand the technological aspects of Processed milk products.
CO4. know the utilization of by-product of dairy industry
CO5. Develop young entrepreneurs for self-employment through dairy technology
Course Specific Outcomes
CSO1. Understand the recent developments in dairy industry in India
CSO2. Decipher the information about equipment in dairy industry
CSO3. Understand the stages of milk processing
CSO4. Knowledge on methods of preparation of milk products
CSO5. Familiarize the technological aspects of quality control in milk

Learning Outcomes
LO1. Perceive physico-chemical properties of milk
LO2. Gain knowledge on cold storage of milk
LO3. Learn about thermal processing of milk
LO4. Learn about preparation of milk products
LO5. Gain knowledge on new technologies in dairy by-product utilization

THEORY : SEMESTER VI
FST 6.2. DAIRY TECHNOLOGY (THEORY)

Course Content


Recommended References

PRACTICAL: SEMESTER VI
FST 6.3. PROCESSING OF OILS AND FATS

1. Analysis of oilseeds and cakes as per FSSAI methods- Moisture Content, Ash Content
2. Analysis of oilseeds and cakes as per FSSAI methods -Oil Content, Nitrogen/ Protein Content, Crude fiber
3. Determination of physical characteristics of oils and fats as per BIS-Specific gravity, Refractive Index, Colour, & Viscosity
4. Determination of chemical characteristics of oils and fats as per FSSAI - Acid value, Saponification value, Iodine Value, & Peroxide value
5. Degumming of oils
6. Refining of oils - alkali neutralization
7. Bleaching of vegetable oils
8. Determination of DOBI value for palm oil
9. Preparation of peanut butter and Cocoa butter substitute
10. Preparation of mayonnaise and salad dressings

PRACTICAL: SEMESTER - VI
FST 6.4. DAIRY TECHNOLOGY

1) To conduct the platform Test of Milk and its products
2) Determination of physico-chemical properties of milk
3) Testing efficiency of
4) Detection of adulteration of milk
5) Separation of cream

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6) Standardization of milk
7) Preparation of flavored
8) Preparation of all Indian Traditional Dairy Products
9) Preparation of White and Salted butter and ghee
10) To assess suitability of milk for heat processing

FST 6.5. INTERNSHIP

Every candidate shall undergo professional training for 45 days in a Food Industry during Sixth semester of the course. At the end of professional training the student has to submit a report for which Viva will be conducted both by internal and external examiner.

THEORY : SEMESTER VI
DSE3A. BEVERAGE TECHNOLOGY

Course Outcomes
CO1. Acquire knowledge on basic raw materials applied in the beverage production.
CO2. Understand various technologies of beverage making
CO3. Evaluate various methods of water treatments in food industry
CO4. Acquire knowledge on types of sweeteners and adjuncts in beverages
CO5. Understand the difference between alcoholic and non-alcoholic beverages

Course Specific Outcomes
CSO1. Understand the processing of fruit-based beverages
CSO2. Decipher the technologies involved in making carbonated beverages
CSO3. Differentiate between various fruit beverages
CSO4. Knowledge on additives in beverage production
CSO5. Familiarize the technological phases of alcoholic and non-alcoholic beverages.

Learning Outcomes
LO1. Describe the functions and types of sweeteners in beverages
LO2. Gain knowledge on fortified beverages and food adjuncts
LO3. Compare and contrast natural sweeteners from artificial sweeteners
LO4. Learn the processing of honey
LO5. Able to classify beverages

THEORY: SEMESTER VI
DSE3B. FOOD PLANT LAYOUT AND DESIGN

Course Outcomes
CO1. Awareness regarding equipment used in food industries
CO2. Design the plant layout for different food processing units
CO3. Evaluate the problems faced during construction of a food processing plant
CO4. Incorporate the safety standards during building a process plan
CO5. Comprehend techniques of project planning

Course Specific Outcomes

CSO1. Understand stages of plant design
CSO2. The processes involved in layout design
CSO3. Understand factors involved in the site selection for food plant.
CSO4. The concept of preparing cost estimate and economics
CSO5. The development and design consideration in different food industries

Learning Outcomes

LO1. Execute the concepts, principles and theories for the location of food processing plant
LO2. Demonstrate plant layout problems by using different tools and techniques
LO3. Execute techniques of project planning by using scheduling methods
LO4. Implement the knowledge of materials applied for construction of food equipment
LO5. Design and setting up of new food processing plant as entrepreneur and/or consultant

THEORY : SEMESTER VI

DSE3B. FOOD PLANT LAYOUT AND DESIGN

Course Content

UNIT I: Introduction to plant design - Plant design concepts, General design considerations for food processing industries, stages of plant design, general plant design procedure, feasibility study and analysis, sales planning for plant design, various equipment and machineries for food processing plant.

UNIT II: Plant Location- levels of Plant location, Location of layout- location factors, plant site selection, Territory and site-specific factors, Influence of location on plant layout, Subjective, qualitative and semi-quantitative techniques for evaluating plant location, Location Theory and models, Classification of Dairy and Food Plants, farm level collection and chilling centre

UNIT III: Plant Layout - Importance, objectives, classical types of layouts. Evaluation of Plant Layout. Tools and techniques for plant lay out- process charts, process flow diagram, Travel chart, machine data cards, material movement patterns. Space requirement for machines, work stations and storage, symbols used for plant design and layout, plant layout procedures. Layout of different industries- Considerations in different types of food industries such as cereal, pulses and oilseed industry, dairy, Bakery, soft drinks and Canning

UNIT IV: Project planning, Techniques of project planning, Project scheduling, Methods of project scheduling: Gantt charts and Network scheduling, Basic terms, objectives and advantages of Network analysis, various Network techniques like PERT and CPM and related numerical problems. Cost analysis, Classification of costs, analysis of production costs, depreciation and different methods of calculation, break-even analysis


Recommended References


THEORY: SEMESTER VI

DSE3C. FOOD EXTRUSION TECHNOLOGY

Course Outcomes

CO1. Understand fundamentals of food extrusion technology
CO2. Understand processing of different extruded products
CO3. Comprehend design considerations of different extruded products
CO4. Gain knowledge on methods of extrusion technology
CO5. Understand the applications of extrusion technology

Course Specific Outcomes

CSO1. Gain knowledge on selection of food extrusion equipment
CSO2. Gain insight in to extruder types and its impact on extrusion process
CSO3. Understand suitability of raw materials for extrusion technology
CSO4. Learn chemical and nutritional changes occurring in extrusion process
CSO5. Comprehend packaging requirement of extruded products.
Learning Outcomes
LO1. Inculcate skills in extrusion technology
LO2. Learn the extrusion technology of breakfast cereals
LO3. Acquire the skills on quality testing of pasta products
LO4. Understand the hurdles in application of extrusion technology
LO5. Gain knowledge on recent trends and future prospects of food extrusion

THEORY : SEMESTER VI
DSE3C. FOOD EXTRUSION TECHNOLOGY

Course Content
UNIT I : Extrusion: definition, Extruder Selection, Design, and Operation for Different Food Applications, Rheological properties of materials during the extrusion Process, effect of extrusion on food products: Chemical and nutritional changes in food during extrusion, factors affecting extrusion, Net Flow, Packaging materials for extruded product

UNIT II : Introduction to extruders, principles and types, Components, functions and classification of extruder, Uses of extruders in the food industry, Single screw extruder- principle of working, net flow, factors affecting extrusion process, Twin screw extruder- counter rotating and co-rotating, process characteristics, pre-conditioning of raw materials used in extrusion process. Use of dry extruders in extrusion

UNIT III : Extruded food product development- Objectives and importance of extrusion in product development, advantages and disadvantages, Extruded food product, Change of functional properties of food components during extrusion, Pre and post extrusion treatments, use of extruder as bioreactor, manufacturing process of extruded products, Application of extrusion technologies in food industries

UNIT IV : Breakfast cereals by extrusion technology- Classification of Breakfast cereals, Raw materials, process and quality testing of vermicelli, spaghetti- Raw materials, process and quality testing of pasta and macaronic products, Ready to eat breakfast cereals by extrusion cooking

UNIT V : Texturized vegetable protein: Definition, processing techniques, Manufacturing process and quality parameters of TVP Recent Advances in extrusion technology, Carbon dioxide or Nitrogen assisted extrusion technology, Extrusion in confectionary technology, Non-thermal Extrusion of Protein Products

Recommended References
2. N.D. Frame (2012) Technology of Extrusion Cooking Springer


Semester VII
THEORY: SEMESTER VII
FST 7.1 UNIT OPERATIONS IN FOOD INDUSTRY

Course Outcomes
CO1. Understand the principles of Unit operations
CO2. Acquaint with fundamentals of food engineering and its processes
CO3. Get technical know-how on refrigeration and freezing
CO4. Understand the basics of distillation
CO5. Comprehend the concept of filtration techniques

Course Specific Outcomes
CSO1. Inculcate knowledge about size reduction.
CSO2. Acquire the skills needed for material handling systems
CSO3. Understand the usage of refrigerants
CSO4. Able to apply the knowledge of unit operations in food processing
CSO5. Get hands on experience in use of solar driers

Learning Outcomes
LO1. Know about the concept and utility of unit operations in food processing
LO2. Learn about the theory of mixing
LO3. Learn about the principles of fluid flow
LO4. Know about heat transfer technologies
LO5. Get skills in steam and flash distillations

THEORY : SEMESTER VII
FST 7.1 UNIT OPERATIONS IN FOOD INDUSTRY

Course Content
UNIT I : Screening; types of screens ; Grizzly; Revolving screen; Shaking screen; Rotary screen; Vibratory screen; Horizontal screen; Perforated metal screens; wire mesh screen; Ideal and Actual screen; Effectiveness of screen; Air screen cleaners;

UNIT II : Definition and Introduction to Separation; Types of Separator-Disk, Indented cylinder, Spiral, Specific Gravity, Destoner, Inclined Draper, Veltex roll, Pneumatic & aspirator, separation based fluidisation technique, Magnetic and Cyclone Separator.

UNIT III : Size reduction procedures- Crushing, Impact, Shearing, Cutting; Cereal grinding, Degree of grinding; Size reduction machinery- crusher, grinder, attrition mills, hammer mill, ball mills, rietz mill & oil expression and extractions- hydraulic press, screw press
UNIT IV: Utilities of Drying; thermal properties; Equilibrium moisture content (EMC); Drying theories; methods of drying: Contact drying, Convective drying, freeze drying, radiation drying, Superheated steam, Drying rate period; types of dryers–Deep bed, Flat bed, Continuous, Recirculating, LSU, Fluidised bed, Rotary, Tray, Tunnel and solar, etc. Evaporation Basic principle, need for evaporation, thermodynamics of evaporation; boiling point elevation, heat transfer during evaporation, heat transfer coefficients, design of evaporation system; retention time; single effect evaporator, multiple effect evaporator, thermo compression system.

UNIT V: Material handling & transportation- Belt conveyor, bucket elevator, screw conveyor, pneumatic conveyor; transportation. Applications of Unit operations to the food industry. Distillation: Theory and principles, liquid vapor equilibrium, distillation of binary mixtures, simple distillation, steam distillation, vacuum distillation, and fractional distillation. Crystallization: Principle, nuclei formation- equipment and applications in food industries.

Recommended References
2. Fellos PJ 2005 Food Processing Technology: Principle & Practice 2nd Ed. CRC.
3. Potter NN & Hochkiss 1997 Food Science 5th Ed. CBS.

THEORY: SEMESTER VII
FST 7.2. ENZYMES IN FOOD PROCESSING

Course Outcomes
CO1. Gain knowledge on the concept of enzymes in food
CO2. Understand the role of enzymes in dairy industry
CO3. Acquire knowledge on enzymes used in baking industry
CO4. Attain knowledge on enzymes used in Meat industry
CO5. Understand the role of enzymes in sugar industry

Course Specific Outcomes
CSO1. Acquire knowledge in undesirable enzyme reactions in food
CSO2. Understand the mechanism of action of enzymes
CSO3. Learn about synergistic effect of enzymes
CSO4. Ability to relate the theoretical knowledge on enzymes to food industry applications
CSO5. Comprehend the role of lipases in meat processing

Learning Outcomes
LO1. Learn about purification and assay of enzymes.
LO2. Learn about enzymes in fruit and vegetable processing
LO3. Acquire skills on use of enzymes in beverage production
LO4. Understand the application of enzymes in oil and fat industry
LO5. Learn the application of immobilized enzyme technology in food industry

THEORY: SEMESTER VII
FST 7.2. ENZYMES IN FOOD PROCESSING

Course Content
UNIT I: Introduction- classification, properties and nomenclature, Sources of enzymes, mechanism of enzyme action, factors affecting the rate of enzymic reactions, Enzyme Kinetics: enzyme concentration, substrate concentration, environmental conditions, inhibitors, co-enzymes & cofactors, Undesirable and desirable enzymic reactions in foods, extraction, purification and assay of enzymes.

UNIT II: Enzymes in dairy industry- natural enzymes in milk, Role of lipase and protease in cheese making, sources & mechanism of action. Production of lactose free milk, role of enzymes in processing of whey. Enzymes in production of fruit juices – Sources & mechanism of Catalase, Glucose oxidase & other enzymes. Enzymes in Fruit and vegetable processing.


UNIT IV: Enzymes in Meat industry- Effect of enzymes on meat, enzymes in meat tenderization, egg processing, use of enzymes in meat processing with their source, mechanism of action and benefits. Application of enzymes in fat and oil industry.

UNIT V: Enzymes in sugar industry- Types of enzymes in sugar industry, sources- mechanism of action, isolation, purification and assay of enzymes. Enzymes for production of maltodextrins and corn syrup solids - liquefaction, saccharification, dextrinization, isomerization, production of high-fructose-corn syrup, fructose and fructo-oligosaccharides. Enzyme immobilization techniques and its application in food industry.

Recommended References
THEORY: SEMESTER VII
FST 7.3. RESEARCH METHODOLOGY

Course Content

UNIT I: Meaning, significance and objectives of research, criteria of good research, merits and demerits, Different types of research, Current research areas in Food science and Technology, Research process- selection and statement of research problem, statement of hypothesis and types of hypotheses, principles and formulation of hypothesis, formulation of research designs.

UNIT II: Research data collection and presentation- Techniques and methods of data collection., Tabulation of Research Data, Graphical Presentation of Data, Sampling, types of sampling methods, merits and demerits of sampling methods, Research variables- meaning and their significance in research, types of variables

UNIT III: Research Design, Need for a research design, features of a good design, Types of research designs- Explorative/ descriptive/ experimental/ Survey/ Case Study, Measurement and scaling techniques- Measurement scales: Nominal, Ordinal Interval, Ratio, Validity, Reliability and Practicality, Scaling, scaling techniques, Rating scales (paired comparison, rank order), Likert scales


Recommended References
PRACTICAL : SEMESTER VII
FST 7.4. UNIT OPERATIONS IN FOOD INDUSTRY
1. Determination of density and porosity of food grains.
2. Determination of Size reduction in Ball Mill
3. Determination of particle size of granular mill by sieve analysis.
4. Estimation of thermal conductivity.
5. Analysis of flow rate through flow through pipes.
6. Estimation of Diffusion Coefficient
7. Estimation of vaporization efficiency and thermal efficiency of Steam Distillation
8. Visit to food processing industries

PRACTICAL : SEMESTER VII
FST 7.5. ENZYMES IN FOOD PROCESSING
Practical
1. To study the effect of temperature & pH on enzyme activity.
2. To study the effect of substrate concentration on enzyme activity.
3. Determination of enzyme activity of α-amylase in starch hydrolysis.
5. To demonstrate the effects of papain enzymes in meat tenderization.
7. Determination of oxidase activity of given sample.
9. To determine the adequacy of pasteurization in milk.
10. Assay of alpha amylose in the germinating barley

SEMESTER VII
FST 7.6. COMMUNITY ENGAGEMENT AND SERVICE
The curricular component of ‘community engagement and service’ seeks to expose students to the socio-economic issues in society related to the field, so that the theoretical learnings can be supplemented by actual life experiences to generate solutions to real-life problems. This can be part of summer term activity or part of a major or minor course depending upon the major discipline. Student has to undertake 2 activities and submit a report towards end semester

Any Two activities from the following
1. Teaching hygiene and sanitation to food handlers
2. Teaching food safety and FSSAI regulations to local food vendors
3. Understand the technical problems of food vendors
4. Study the problems in food storage faced by small scale food industries
5. Any other related activity

FST 7.7. FIELD BASED PROJECT WORK
The field-based learning/ minor project will attempt to provide opportunities for students to understand the different socio-economic contexts. It will aim at giving students exposure to development-related issues in rural and urban settings. It will provide opportunities for students to observe situations in rural and urban contexts, and to observe and study actual field situations regarding issues related to socioeconomic development.

A minor Project work may be undertaken in the relevant field preferably on current issues and students are expected to submit a report

Semester VIII
THEORY : SEMESTER VIII
FST 8.1. APPLIED STATISTICS
Course Outcomes
CO1. Understand the Significance of statistics in food technology
CO2. Acquire skill to apply the statistical tools in Food science and technology.
CO3. Study the basic statistical techniques in relation to food analysis
CO4. Understand the applications of computers in Statistics
CO5. Interpret the applications of statistical packages in research

Course Specific Outcomes
CSO1. Inculcate knowledge about measures of central value.
CSO2. Learn the skills needed to test hypothesis by different statistical tests
CSO3. Understand the graphical representation of data
CSO4. Develop skills in statistical analysis of data
CSO5. Apply statistical knowledge for interpretation of data

Learning Outcomes
LO1. Able to analyse statistical data using statistical tests
LO2. Use control charts to interpret problems in statistical quality control.
LO3. Apply statistical techniques in food analysis
LO4. Understand the compilation of data using latest statistical software
LO5. Explore the innovative methods of data representation
THEORY : SEMESTER VIII
FST 8.1. APPLIED STATISTICS

Course Content

UNIT I : Applied Statistics- Introduction, Meaning and scope, origin and growth of statistics, functions of statistics, applications of statistics, statistical methods vs Experimental methods, role of statistics in research, significance and applications of statistics in food technology, Statistical data analysis in food technology, Variability, Accuracy and Precision.

UNIT II : Statistical representation of data- Meaning, types and objectives of classification, Discrete and continuous frequency distribution, tabulation of data, difference between classification and tabulation, Parts of a table, types of tables, general rules of tabulation, Diagrammatic and graphical representation - significance, types of diagrams& graphs, graphs of frequency distribution

UNIT III : Measures of central tendency- Introduction, Calculation of Arithmetic mean, Median& Mode. Merits and limitations of Mean, Median and Mode. Measures of dispersion and variation- significance, methods of studying variation, Tests of skewness and kurtosis, concept of probability and normal distribution

UNIT IV : Analysis and Interpretation of statistical data- Testing of hypothesis, Parametric tests, Chi-square test, application of Students 't' test, Correlation, Regression and prediction, ANOVA- Analysis of variance- One way and two-way classification, Non parametric tests- Sign test, Wilcoxon signed-ranks test, Mann-Whitney U test and Kruskal-Wallis test

UNIT V : Statistics and Computer – Fundamentals of computer, History of computer, Generation of computer, Language, Components, Applications of Computers. Operating System & Internet: MS-DOS, MS-Windows, and Internet, MS-Office: MS-Word, MS Excel and Power Point. Introduction to Data-base, Application of modern tools such as statistical packages (SPSS, Lotus 123, Access, Excel, Visual Fox pro etc.) in research

Recommended References

PRACTICAL : SEMESTER - VIII
FST 8.2. DISSERTATION BASED ON PROJECT WORK

Project work may be undertaken in the relevant field preferably on current issues. The Dissertation should be typed in Times New Roman in 12 font size with 1.5 line spacing from the beginning including titles to the chapters and sections. Bold font may be used where ever necessary. The students are expected to follow scientific grammar for writing in vivo etc. which should be in italics.

Guidelines for writing the Dissertation: The Dissertation should have the following pages in order:
* Title page highlighting the title, name of the candidate, Reg.no. Guide name, College name and month and year of submission and the inner title page containing the same details on white background.
* Certificate from the Head of the institute & Guide
* Certificate from the ethical committees for approval of study, if any
* Declaration by the student
* Acknowledgements
* Index highlighting chapter titles and sections titles
* Index for tables, figures and plates, if any
* Abbreviations and symbols
* Materials used in the investigation with their procurement details like name of the company, batch number etc.
* Equipment used in the study with the model number and other details.
* Aim and objectives of the investigation.
* Introduction and literature survey
* Materials & Methods
* Result
* Discussion
* Summary and conclusion
* References

FDN 8.3. COMPREHENSIVE VIVA-VOCE

Viva-voce will be conducted to test the knowledge gained by the student in all the four semesters (both theory & practical) and other relevant issues in the area of specialization
M.Sc. Food Science & Technology (Two Semesters)  
Semester IX  
THEORY: SEMESTER IX  
PGFST 9.1. CEREAL, LEGUME AND OILSEED PROCESSING TECHNOLOGY

Course Outcomes
CO1. Understand technology of milling of various cereals
CO2. Technical knowhow of pulses and oilseeds refining
CO3. Comprehend production of different processed products and by-products
CO4. In-depth understanding of the technology associated with post-harvest technology
CO5. Get insights into advanced processing technologies

Course Specific Outcomes
CSO1. Gain knowledge about basic composition of cereal grains, pulses and oilseeds.
CSO2. Acquire the skills needed in processing of cereals, pulses and oilseeds
CSO3. Understand machinery and tools required for processing of cereals, pulses and oilseeds
CSO4. Ability to operate and handle the equipment of processing
CSO5. Gain knowledge on the production of different processed products and by-products

Learning Outcomes
LO1. Know about the various processing steps of major cereals after harvesting.
LO2. Prepare various food products including the by-products of cereal, pulses & oilseeds.
LO3. Learn about the various processing steps and methods of major legumes after harvesting
LO4. Know about the production of different processed products and fermented products.
LO5. Learn about the various processing steps of major oilseeds after harvesting

THEORY: SEMESTER IX  
PGFST9.1. CEREALS, LEGUME AND OILSEED PROCESSING TECHNOLOGY

Course Content

UNIT II : Processing Technology of Millets – Production & utilization of Millets, Composition & Physicochemical properties of commonly consumed Millets - Traditional & advanced processing methods of Millets, By-products of millets, Millets as functional foods, Value addition & Health benefits of millets. Processing Technology of Pseudo cereals- Amaranth seeds, Buck Wheat, Quinoa & Chia seeds, general characteristics, Composition, traditional & advanced processing methods, Health benefits of Pseudo cereals.


UNIT IV : Technology of oil seeds- Composition, production & utilization of oilseeds, traditional processing methods, Alternative extraction and green extraction techniques- Principle & advantages, supercritical fluid extraction, liquefied gases, aqueous extraction, enzymatic extraction, microwave-assisted & ultrasonic-assisted extraction. Microencapsulation techniques for oils. Vegetable oil powders, Technologies for valorization of de-oiled cakes, formulation of oilseeds based dairy analogues, Food safety and standards for oils, fats and oilseeds.

THEORY: SEMESTER IX
PGFST 9.2. FUNDAMENTALS OF MOLECULAR BIOLOGY & BIOINFORMATICS

Course Outcomes
CO1. Understand advanced knowledge of cell biology
CO2. Comprehend the concepts of molecular biology.
CO3. Get technical state of the art technologies in Bioinformatics
CO4. Understand the basics of Genomics
CO5. Understand the basics of Proteomics

Course Specific Outcomes
CSO1. Comprehend the basics of nucleus and chromosome
CSO2. Get insights into biochemical basis of Inheritance
CSO3. Understand the concept of Gene expression
CSO4. Acquire skills in bioinformatics
CSO5. Comprehend the applications of bioinformatics in food technology research

Learning Outcomes
LO1. Develop basic knowledge and skills in cell & molecular biology
LO2. Become aware of the complexity and harmony of the cells.
LO3. Conduct research in the frontier and multi-disciplinary areas of modern biology
LO4. Conduct research in the multi-disciplinary areas of Genomics
LO5. Apply the knowledge of Proteomics in Food science and technology research

THEORY: SEMESTER IX
PGFST 9.3. NUTRACEUTICALS AND FUNCTIONAL FOODS

Course Outcomes
CO1. To develop comprehensive understanding of different nutraceuticals
CO2. To understand the potential of various functional foods in promoting
human health

CO3. Get knowledge on phytochemicals in plant foods
CO4. Decipher the recent developments in nutraceutical research
CO5. Interpret and understand the applications of nutraceuticals in disease conditions

Course Specific Outcomes
CSO1. Understand the market for nutraceutical products
CSO2. Able to differentiate nutraceuticals from functional foods
CSO3. Comprehend the classification of nutraceuticals
CSO4. Acquire skills on formulation of functional foods
CSO5. Explore the methods of testing stability of nutraceutical compounds

Learning Outcomes
LO1. Learn about Nutrigenomics and its relation to nutraceuticals.
LO2. Comprehend the dosage of nutraceuticals for effective control of disease
LO3. Understand the importance of Fermented foods as functional foods
LO4. Comprehend the Microbial and algal nutraceuticals
LO5. Explore the research on meat analogues as nutraceuticals

THEORY : SEMESTER IX
PGFST 9.3. NUTRACEUTICALS AND FUNCTIONAL FOODS

Course Content
UNIT I : Introduction- Nutraceutical and functional foods, definition, difference between nutraceuticals and functional foods, market for nutraceuticals, Indian and global scenario, Recent developments and advances in the research area of Nutraceuticals and functional foods, Nutrigenomics and its relation to nutraceuticals.

UNIT II : Nutraceutical compounds- Classification of nutraceuticals, Antioxidants, Phytochemicals, natural pigments, phytoestrogens, phytoesters, peptides and proteins, carbohydrates- dietary fibers, oligosaccharides & resistant starch, prebiotics, probiotics and symbiotic, structured lipids, Conjugated Linoleic Acid, omega-3 fatty acids, fat replacers, vitamins and minerals, Sources of nutraceuticals and role in promoting human health, dosage for effective control of disease


UNIT IV : Animal based Functional Foods - Milk and milk products, egg, meat and products, sea foods- , sources, extraction and application of chitin, chitosan, glucosamine, chondroitin sulphate and other polysaccharides of animal origin, health benefits of animal based functional Foods and role in conditions like cardiovascular diseases, hypertension, diabetes etc. Microbial and algal nutraceuticals

UNIT V : Stability of nutraceuticals, Safety, Consumer acceptance and assessment of health claims, labelling, marketing and regulatory issues related to nutraceuticals and functional foods, Legal aspects of Nutraceuticals & Functional foods Effects of processing and storage, interaction of various environmental factors with nutraceuticals and functional foods

Recommended readings

PRACTICAL : SEMESTER IX
PGFST 9.4. CEREALS, LEGUME AND OILSEED PROCESSING TECHNOLOGY

1. Physical characteristics of Cereals, Pseudo cereals, millets, pulses and oilseed
2. Determination of sedimentation value, alcoholicidity, water absorption capacity and NaHCO3 in wheat flour/ Maida
3. Determination of amylase content of selected cereals and germinated grains
4. Fermenting power of yeast
5. Rice bran stabilisation
6. Estimation of protein content of Cereals, Pseudo cereals, millets, pulses and oilseeds
7. Assessment of market samples of Cereals, Pseudo cereals, millets, pulses and oilseeds for conforming to some PFA /FSSAI specifications
8. Storage studies of cereal and legume grains having different moisture levels
9. Preparation of expanded & puffed rice from raw and parboiled materials and assessment of quality of products including expansion in volume.
10. Preparation of noodles and its quality evaluation
11. Visit to working rice mill, collection of samples at various steps of milling and analysis for efficiency of cleaning, shelling, paddy separation, and degree of polish
12. Visit to a working modern roller mill and FCI godowns

PRACTICAL : SEMESTER IX

PGFST 9.5. FUNDAMENTALS OF MOLECULAR BIOLOGY & BIOINFORMATICS
1. Isolation of DNA from microbial, plant and animal source
2. Estimation of DNA using diphenylamine reagent and by UV spectrophotometry.
3. Digestion of plasmid DNA with restriction endonucleases.
4. Separation of DNA fragments by Agarose gel electrophoresis
5. Amplification of a specific region on DNA by PCR
6. Genome Map viewer from NCBI.
7. Searching Data from NCBI Database.
8. Retrieving nucleotide sequence from NCBI Database.
9. Working on EMBL.
10. Searching structural data from PDB.

THEORY: SEMESTER IX

PGDSE1.A. SNACK FOOD TECHNOLOGY

Course Outcomes

CO1. Understand the principle involved in the manufacture of commercial snack foods
CO2. Ability to handle the equipment of importance in the snack food industry
CO3. Understand the processing techniques used to make snack foods
CO4. Comprehend the use of additives in preparation of snack foods
CO5. Comprehend the packaging requirements for snack foods

Course Specific Outcomes

CSO1. Inculcate knowledge about technological aspects of traditional snacks
CSO2. Introduce students to the skills needed in preparation of modern snack foods.
CSO3. Acquaint students with processing techniques utilized for snack foods
CSO4. Familiarize students with evaluation methods for the quality of snack foods
CSO5. Comprehend the snack food market in India

Learning Outcomes

LO1. Comprehend snack food consumption patterns in India
LO2. Acquire the knowledge of preparation of nutraceutical-based snacks
LO3. Understand the preparation of horticulture-based snacks
LO4. Comprehend the technology of healthy snacks
LO5. Acquire skills in determination of quality of snacks

THEORY: SEMESTER IX

PGDSE1.A. SNACK FOOD TECHNOLOGY

Course Content

UNIT I : Introduction to Snack food technology, Snack food consumption patterns, factors driving the newer snack food trends, Classification of snacks, methods and equipments used in processing and preparation of snack foods, snack food market in India. Packaging and labelling requirements of snack foods in India

UNIT II : Technology for Whole Grains based Snacks – Whole Grains roasted, toasted, puffed, popped, flaked, technology for Coated Grain Snacks – salted, spiced, sweetened, technology for Batter-Based and Dough-Based Products, technology of savoury and farsans, formulated products – chips, wafers, papads, instant premixes and traditional snack foods

UNIT III : Technology of horticulture-based snacks - Technology for Fruit-Based Snacks, Technology for Vegetable-Based Snacks, chips, wafers, Technology for Coated Nut, salted, spicy and sweetened, Chikkis and snack bars, functional properties, processing and packing

UNIT IV : Extruded snacks -Types, Formulation and Processing Technology, common ingredients used, Coloring and Flavoring, other extruded snakcs– Expanded snacks, fried and baked collets, Third generation snacks, coextruded snacks, popularity of extruded snacks among consumers, , packaging, Machinery and Equipment

UNIT V : Development of functional food-based snacks- Characteristics, functional ingredients for development of snacks, nutrient composition, health uses, processing methods, Determination of Shelf-Life and Quality

Recommended References


THEORY: SEMESTER IX
PGDSE1.B. INDUSTRIAL MICROBIOLOGY

Course Outcomes
CO1. Comprehend the history of Industrial microbiology
CO2. Learn about Industrial sterilizations
CO3. Understand the types of fermenters in food industry
CO4. Gain knowledge on industrially important secondary metabolites
CO5. Gain knowledge on industrially important bacteriocins

Course Specific Outcomes
CSO1. Comprehend knowledge on Microbial screening.
CSO2. Gain knowledge on preparation of alcoholic beverages
CSO3. Get insights into production of microbial enzymes
CSO4. Gain knowledge on production of citric acid
CSO5. Understand the preparation of bio colours.

Learning Outcomes
LO1. Learn about downstream processing Cell disruption methods
LO2. Learn about extraction of enzymes
LO3. Comprehend the microbial cell products
LO4. Learn about purification of enzymes
LO5. Explore the methods of production and assay of nisin from lactic acid bacteria

THEORY: SEMESTER IX
PGDSE1.C. FLAVOUR CHEMISTRY & TECHNOLOGY

Course Content
UNIT I: History & scope of industrial microbiology, Primary and secondary metabolites produced by the microorganisms, Preservation of microorganisms. Exploitation of microorganisms and their products, screening, strain development strategies, immobilization methods, fermentation media, raw material used in media production, antifoaming agents, buffers, downstream processing

UNIT II: Fermentation equipment and its uses, fermentor design. Components of a fermentor, parts of fermentors, peripheral parts and accessories. Types of fermentors and fermentations- single, batch, continuous, multiple, surface, submerged and solid state. Industrially important secondary metabolites and microorganisms involved

UNIT III: Production of microbial enzymes; Downstream processing Cell disruption methods; Mechanical disruption methods and non-mechanical disruption methods; Extraction; Purification; Concentration; Product recovery. Enzymes from microbes: amylase, protease. Organic acids – production and applications of citric acid, fumaric acid, lactic acid, benzoic acid, gluconic acid, kojic acid, itaconic acid & acetic acid

UNIT IV: Industrial products from microorganisms- antibiotics: production of penicillin, streptomycin. Interferons, vaccines, hormones, vitamins,biopesticides. biopolymers, steroids, biomers, Isolation, identification of cultures producing bio-colours. Production and assay of nisin from lactic acid bacteria, beneficial effects of bacteriocins and Nisin

UNIT V: Ethanol production from lignocellulosic waste (feedstocks to fermentable sugars-sugars, starches and cellulose, Sugars to alcohol-Yeast, substrate range, substrate utilization. Ethanol tolerance. Use of Zymomonas mobilis and Clostridium for ethanol production-advantages and drawbacks. Production of industrial alcohol, acetone-butanol fermentation, glycerol from yeasts and bacteria, Microbial polysaccharides (xanthan, dextran, alginate, gellan, cellulose, curdlan, pullulan, scleroglucan) and bioplastics - biopolymers (polyhydroxyalkanoates)

Recommended Readings
5. Whitaker and Stanbury. Principles of Fermentation Technology

THEORY: SEMESTER IX
PGDSE1.D. INDUSTRIAL MICROBIOLOGY

Course Outcomes
CO1. Understand mechanisms of flavor perception
CO2. Be familiar with analytical methods of flavor analysis
CO3. Understand non-enzymatic mechanisms of flavor formation
CO4. Explain metabolic routes leading to flavor formation in plants
CO5. Recognize off-flavor defects in foods and strategies of identification
Course Specific Outcomes
CSO1. Describe procedures used to produce the common food flavoring materials.
CSO2. Understand mechanisms of flavor release
CSO3. Be familiar with analytical methods of policing flavor adulteration
CSO4. Ability to learn the method of extraction of flavor from Vanilla
CSO5. Comprehend the concept of flavour potentiation

Learning Outcomes
LO1. Understand the problems in flavour research.
LO2. Relate the knowledge of flavour technology to food industry
LO3. Assess the applications of spice essential oils
LO4. Acquire skills in instrumental analysis of flavour
LO5. Identify the adulterants in flavour

THEORY: SEMESTER IX
PGDSE1.C. FLAVOUR CHEMISTRY & TECHNOLOGY

Course Content
UNIT I: Introduction to flavour technology: Flavour Definition and Perception, Importance of food flavours, Classification of food flavours, chemical compounds responsible for flavour. Recent developments in food flavour industry, problems in flavour research, Perception of flavours- anatomy of the chemical senses, neural development of the chemical senses, receptor mechanisms and neural coding.

UNIT II: Flavour development during biogenesis- Mechanism of flavour-food interactions, flavour development during food processing, flavours during roasting of cocoa, non-enzymatic and enzymatic methods of flavour formation- Butter and cheese. Flavours made by fermentation – Biotechnological production of aroma chemicals, Lipid Oxidation methods of flavour formation, Objectionable flavour in foods and methods of detection


UNIT V: Flavour potentiators, Chemical properties, sensory properties, flavour potentiation in foods. Flavour Analysis- Subjective versus Objective methods of analysis, psychophysics and sensory evaluation. sample handling and artifacts. Instrumental Analysis of Flavour, adulteration of Flavours and its monitoring

Recommended References

Semester X
THEORY: SEMESTER X
PGFST 10.1. ADVANCED PROCESSING TECHNOLOGY OF ANIMAL FOODS

Course Outcomes
CO1. Understand the need and importance of meat, egg, dairy and fishery industry
CO2. Learn the compositional aspects of meat, egg, milk and fish
CO3. Learn the technological aspects of meat, egg, milk and fish
CO4. Empower in the field of value addition
CO5. Understand the by-products from animal food processing

Course Specific Outcomes
CSO1. Get insights into developments in meat industry
CSO2. Understand the advanced technologies in poultry processing
CSO3. Understand the advanced technologies in Egg processing
CSO4. Understand the advanced technologies in Milk processing
CSO5. Gain the knowledge in by-product utilization
Learning Outcomes
LO1. Understand modern abattoir practices
LO2. Acquire knowledge in commercial poultry products
LO3. Technical knowhow of dehydrated egg powders
LO4. Understand the packaging and labelling requirements in meat industry
LO5. Explore the small scale start up endeavours in this area

THEORY : SEMESTER X
PGFST 10.1. ADVANCED PROCESSING TECHNOLOGY OF ANIMAL FOODS

Course content


UNIT – III : Egg and Egg products: Composition and production of eggs, Traditional methods of processing and preservation of eggs. Advanced technologies to enhance egg shelf life - high hydrostatic pressure, pulsed electric fields, ultrasound, pulsed light, cold plasma and ozonation. Egg products- Dehydrated egg powder- whole, albumin and yolk powders, frozen liquid egg, Nutraceutical egg products. Designer eggs, novel applications of egg by-products - food additives, feeds, food packaging materials and nutraceuticals

UNIT – IV : Fish and shell fish processing technology- traditional processing and preservation methods. Advantages and disadvantages. Advanced processing technologies- high-pressure processing, pulsed light technology, ohmic heating, irradiation, application of bio preservatives-LAB, Modern preservation methods- vacuum packaging, gas packaging, ethanol vapour generation, hurdle barrier concept. Preservation and processing of Shell fishes, Value added fish products, fish food standards

UNIT – V : Dairy Technology- FSSAI Definition of Milk, Types of Market Milk, Biological and Physico-chemical aspects of milk processing, processing of Milk, Concept of Filtration, Clarification, Homogenization, Pasteurization, Dairy product technology- : Butter, ghee, flavoured milk, yoghurt, dahi, shrikhand, ice-cream, condensed milk, milk powder, channa, paneer & cheese

Recommended readings

THEORY: SEMESTER X
PGFST 10.2. FRUIT AND VEGETABLE PROCESSING TECHNOLOGY

Course Outcomes
CO1. Comprehend knowledge of different methods of fruits and vegetable processing
CO2. Learn the FSSAI standards for fruit and vegetable products
CO3. Comprehend the non thermal processing methods of fruit processing
CO4. Get acquaintance on post-harvest handling technologies of fruits and vegetables
CO5. Explore methods to reduce post-harvest losses and their value addition

Course Specific Outcomes
CSO1. Inculcate knowledge on recent advances in preservation
CSO2. Acquire knowledge on canning of vegetables
CSO3. Acquire skills in preparation of fruit products
CSO4. Learn about dehydration technologies
CSO5. Comprehend bioactive components in fruits and vegetables

Learning Outcomes
LO1. Learn about prevention of spoilage in canned foods
LO2. Acquire skills in processed tomato products
LO3. Acquire skills in preparation of fruit jams
LO4. Understand the skills in preparation of fruit preserves
LO5. Explore the opportunities for start-ups in fruits and vegetable processing

THEORY: SEMESTER X

PGFST 10.2. FRUIT AND VEGETABLE PROCESSING TECHNOLOGY

UNIT – I: Technology of Fruits and Vegetables - Introduction and importance of fruit and vegetable preservation, history and need of preservation. FSSAI standards for fruits and vegetable products. Canning and bottling of fruits and vegetables: Selection of fruits and vegetables, process of canning, containers of packing, spoilage in canned foods.

UNIT – II: Fruits beverages: Introduction, process and preservation of Jams, jellies and marmalades: Processing and technology, defects in jelly. Pickles, chutneys and sauces: Processing, types, causes of spoilage in pickling. Tomato products: Selection of tomatoes, processing of tomato juice, tomato puree, paste, ketchup, sauce and soup,

UNIT – III: Processing of fruit juices (selection, juice extraction, deaeration, straining, filtration and clarification), preservation of fruit juices (pasteurization, chemically preserved with sugars, freezing, drying, tetra-packing, carbonation), processing of squashes, cordials, nectars, concentrates and powders.


UNIT V: Advanced technologies in fruit and vegetable processing - Non thermal and energy saving technologies in fruit and vegetable processing, types, advantages and disadvantages. Impact of non thermal technologies on nutrient and phyto chemical composition of fruits and vegetables. Equipment, Safety and quality standards; Role of ozonation in fruit processing and preservation. By products of fruits and vegetable processing and their utilization- pomaceutilization, Bio active components from fruit and vegetable products.

Recommended Readings

THEORY: SEMESTER X

PGFST 10.3. DIET DESIGN AND FORMULATION OF SPECIAL FOODS

Course Outcomes
CO1. Comprehend the concept of special foods
CO2. Learn about RDA for different age groups
CO3. Understand the concept of diet planning
CO4. Gain knowledge on therapeutic diets
CO5. Gain knowledge on specific consumer-oriented foods

Course Specific Outcomes
CSO1. Comprehend knowledge on low cost foods
CSO2. Gain knowledge on concept of food groups
CSO3. Get insights into principle and objectives of diet therapy
CSO4. Gain knowledge on safety of genetically modified foods
CSO5. Understand the preparation of foods in emergencies

Learning Outcomes
LO1. Learn about diet planning and nutrient calculations
LO2. Learn about planning menus for different age groups meeting requirements
LO3. Learn about planning menus for different disease conditions
LO4. Understand the role of food in space
LO5. Explore the importance of organic foods

THEORY: SEMESTER X

PGFST 10.3. DIET DESIGN AND FORMULATION OF SPECIAL FOODS

UNIT I: Introduction to diet design & diet therapy, Menu planning- principles, factors to be considered, Balanced diet, Food security, Standardization of recipes and portions. Therapeutic diets- Modification of normal diet to suit special needs. Routine hospital diets, special feeding methods, Enteral and parenteral nutrition, tube feeds, home-made blenderized and commercial formula feeds, pre- and post-operative diets,

UNIT II: Nutritional Requirements and diet management through life cycle- Infancy, Preschool, School going, Adolescence, Adults, old age, Expect-
ant and Lactating Mothers, Importance of Colostrum, Advantages of Breast feeding & Complementary feeding. Special diets for sports persons. Nutrient requirements and menu planning for sports persons

UNIT III: Therapeutic diets – Principles & objectives of diet therapy, special diets for patients suffering from fevers, gastrointestinal disorders, Diabetes mellitus, Obesity, liver disorders, cardiovascular disorders and kidney disorders. Diet planning and use of exchange list in nutrient calculation. Recent trends in food formulation, antioxidant rich food products Functional foods and nutraceuticals for different disorders.

UNIT IV: Specialty foods based on Innovative process technology, Food additives basis, Bioactive components, Novel nutraceuticals products, Packaging techniques, Adaptable technology basis, Fast foods. Specialty food based on genetics- Genetically modified foods, Transgenic foods. Proprietary foods & Supplementary foods. Specialty food based on growing condition- organic farming & Organic foods, Micro greens

UNIT V: Special foods and nutrition in emergency conditions- Defence foods, Extreme temperatures - low and high temperatures, nutrition in high altitudes, Space nutrition and food systems, Nutrition in Emergency situations- Famine, drought, flood, earthquake and cyclones.

Recommended Readings

PRACTICAL: SEMESTER X

PGFST 10.4. ADVANCED PROCESSING TECHNOLOGY OF ANIMAL FOODS
1. Study the structure of the muscle under compound microscope.
2. Study the effect of low and high oxygen atmosphere on meat colour
3. Perform the slaughtering of the poultry birds, Identification of different internal organs of poultry birds and their utilization for product preparation.
4. Estimation of moisture, protein & fat content of meat, eggs and fish
5. Evaluation of eggs for quality parameters (market eggs, branded eggs)
6. Quality evaluation of fish/shell fish and meat
7. Cut out examination of canned meats, canned fish (Sardine, Mackeral, Tuna)/Meat.
8. Processing of animal foods – freezing, canning, curing, smoking, drying and pickling
9. Meat, Egg & Fish product formulations
10. Platform tests for milk
11. Adulteration tests for milk and milk products
12. Preparation of milk products

PRACTICAL: SEMESTER X

PGFST 10.5. FRUIT AND VEGETABLE PROCESSING TECHNOLOGY
1. Anatomy and structure of fruits and vegetables
2. Quantitative analysis of cut fruits and vegetable yields
3. Preparation of fruit and synthetic beverages
4. Effect of pre-treatment and process variables on quality of preserve/candied fruits
5. Comparison of juice/pulp extraction methods on quality and yield of tomato pulp, ketchup/Tomato soup
6. Canning and cut out analysis of fruit and vegetable 15. 16. Visit to fruit, vegetable and cereal processing Industry
7. Estimation of total soluble solids (TSS).
10. Preparation and evaluation of pectin products
11. Dehydration and rehydration of commonly available vegetables and fruits
12. Antioxidant assays- FRAP, DPPH, ABTS for fruits and vegetables

PRACTICAL: SEMESTER X

PGFST 10.6. RESEARCH PROJECT
Dissertation based on Project work may be undertaken in the relevant field preferably on current issues. The dissertation should be typed in Times New Roman in 12 font size with 1.5 line spacing from the beginning including titles to the chapters and sections. Bold font may be used where ever necessary. The students are expected to follow scientific grammar for writing in vivo etc. which should be in italics.

Guidelines for writing the Dissertation:
The Dissertation should have the following pages in order:
* Title page highlighting the title, name of the candidate, Reg.no. Guide
name, College name and month and year of submission and the inner titlepage containing the same
details on white background.
* Certificate from the Head of the institute & Guide
* Certificate from the ethical committees for approval of study, if any
* Declaration by the student
* Acknowledgements
* Index highlighting chapter titles and sections titles
* Index for tables, figures and plates, if any
* Abbreviations and symbols
* Materials used in the investigation with their procurement details like name of the company, batch
  number etc.
* Equipment used in the study with the model number and other details.
* Aim and objectives of the investigation.
* Introduction and literature survey
* Materials & Methods
* Result
* Discussion
* Summary and conclusion
* References