

**ACADEMIC CURRICULA**  
**POST GRADUATE DEGREE**  
**PROGRAMMES**

**Master of Technology**

**(Choice Based Flexible Credit System)**

**Regulations 2021**

**Volume – 22**

**Syllabi for School of Bioengineering Programme**

**Professional Core and Elective Courses**



**SRM**

INSTITUTE OF SCIENCE & TECHNOLOGY  
(Deemed to be University u/s 3 of UGC Act, 1956)

**SRM INSTITUTE OF SCIENCE AND TECHNOLOGY**

**(Deemed to be University u/s 3 of UGC Act, 1956)**

**Kattankulathur, Chengalpattu District 603203, Tamil Nadu,  
India**

# ACADEMIC CURRICULA

**Food and Nutritional Biotechnology**

**Professional Core Courses**

**Regulations 2021**

**SRM INSTITUTE OF SCIENCE AND TECHNOLOGY**

**(Deemed to be University u/s 3 of UGC Act, 1956)**

Kattankulathur, Chengalpattu District 603203, Tamil Nadu,  
India

|                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                  |             |                                           |                               |                 |                     |                   |  |  |   |                         |   |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-------------|-------------------------------------------|-------------------------------|-----------------|---------------------|-------------------|--|--|---|-------------------------|---|---|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                        | 21FPC501J                                                                        | Course Name | FOOD SAFETY SYSTEM AND QUALITY MONITORING |                               | Course Category | C                   | PROFESSIONAL CORE |  |  | L | T                       | P | C |
|                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                  |             |                                           |                               |                 |                     |                   |  |  | 3 | 0                       | 2 | 4 |
| Pre-requisite Courses                                                                                                                                                                                                                                                                                                                                                                                                              | Nil                                                                              |             | Co- requisite Courses                     | Nil                           |                 | Progressive Courses | Nil               |  |  |   |                         |   |   |
| Course Offering Department                                                                                                                                                                                                                                                                                                                                                                                                         | Food Process Engineering                                                         |             |                                           | Data Book / Codes / Standards |                 | Nil                 |                   |  |  |   |                         |   |   |
| Course Learning Rationale (CLR):                                                                                                                                                                                                                                                                                                                                                                                                   | The purpose of learning this course is to:                                       |             |                                           |                               |                 |                     |                   |  |  |   |                         |   |   |
| CLR-1:                                                                                                                                                                                                                                                                                                                                                                                                                             | impart knowledge on food safety and quality                                      |             |                                           |                               |                 |                     |                   |  |  |   |                         |   |   |
| CLR-2:                                                                                                                                                                                                                                                                                                                                                                                                                             | create and enhance awareness on food safety issues and its monitoring activities |             |                                           |                               |                 |                     |                   |  |  |   |                         |   |   |
| CLR-3:                                                                                                                                                                                                                                                                                                                                                                                                                             | make an awareness and knowledge in food labeling                                 |             |                                           |                               |                 |                     |                   |  |  |   |                         |   |   |
| CLR-4:                                                                                                                                                                                                                                                                                                                                                                                                                             | know and implement good manufacturing practices in industries                    |             |                                           |                               |                 |                     |                   |  |  |   |                         |   |   |
| CLR-5:                                                                                                                                                                                                                                                                                                                                                                                                                             | implement good health and hygiene practices                                      |             |                                           |                               |                 |                     |                   |  |  |   |                         |   |   |
| Course Outcomes (CO):                                                                                                                                                                                                                                                                                                                                                                                                              | At the end of this course, learners will be able to:                             |             |                                           |                               |                 |                     |                   |  |  |   | Programme Outcomes (PO) |   |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                  |             |                                           |                               |                 |                     |                   |  |  |   | 1                       | 2 | 3 |
| CO-1:                                                                                                                                                                                                                                                                                                                                                                                                                              | understand the basic principles and concepts of food safety and quality.         |             |                                           |                               |                 |                     |                   |  |  |   |                         | √ |   |
| CO-2:                                                                                                                                                                                                                                                                                                                                                                                                                              | know more on contaminants and toxicants.                                         |             |                                           |                               |                 |                     |                   |  |  |   | √                       |   |   |
| CO-3:                                                                                                                                                                                                                                                                                                                                                                                                                              | enhance the knowledge on food additives and adulterants.                         |             |                                           |                               |                 |                     |                   |  |  |   |                         |   | √ |
| CO-4:                                                                                                                                                                                                                                                                                                                                                                                                                              | understand the concept on monitoring and implementing FSSAI regulations.         |             |                                           |                               |                 |                     |                   |  |  |   |                         |   | √ |
| CO-5:                                                                                                                                                                                                                                                                                                                                                                                                                              | implement risk assessment and risk management.                                   |             |                                           |                               |                 |                     |                   |  |  |   |                         | √ |   |
| Module-1 – Introduction to Food Safety 10 Hour                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                  |             |                                           |                               |                 |                     |                   |  |  |   |                         |   |   |
| Overview of food quality and food safety; Scope of food quality and food safety; Responsibility for food quality and food safety; The distinction between food quality and food safety; Food safety as part of food quality; Food quality.                                                                                                                                                                                         |                                                                                  |             |                                           |                               |                 |                     |                   |  |  |   |                         |   |   |
| Module-2 – Food Safety and Hazards in Foods 10 Hour                                                                                                                                                                                                                                                                                                                                                                                |                                                                                  |             |                                           |                               |                 |                     |                   |  |  |   |                         |   |   |
| Introduction and overview - Food safety hazards and health risk; Biological hazards in foods; Chemical hazards in foods; Physical hazards in foods; Other food safety concerns.                                                                                                                                                                                                                                                    |                                                                                  |             |                                           |                               |                 |                     |                   |  |  |   |                         |   |   |
| Module-3 – Quality Programs and Quality Systems for the Food Industry 15 Hour                                                                                                                                                                                                                                                                                                                                                      |                                                                                  |             |                                           |                               |                 |                     |                   |  |  |   |                         |   |   |
| Introduction and overview: The distinction between quality programs and quality systems; Quality control programs; Quality assurance systems; Quality management systems; Total quality management; Quality system standards; The ISO 9000 quality system standards; The evolution of the ISO 9000 quality system standards; ISO 9000:2000 quality management systems — fundamentals; ISO 9000:2000 quality management principles. |                                                                                  |             |                                           |                               |                 |                     |                   |  |  |   |                         |   |   |
| Module-4 – GMP and HACCP Requirements 15 Hour                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                  |             |                                           |                               |                 |                     |                   |  |  |   |                         |   |   |
| Introduction and overview: The distinction between quality programs and quality systems; Quality control programs; Quality assurance systems; Quality management systems; Total quality management; Quality system standards; The ISO 9000 quality system standards; The evolution of the ISO 9000 quality system standards; ISO 9000:2000 quality management systems — fundamentals; ISO 9000:2000 quality management principles. |                                                                                  |             |                                           |                               |                 |                     |                   |  |  |   |                         |   |   |
| Module-5 – Total Quality Management 10 Hour                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                  |             |                                           |                               |                 |                     |                   |  |  |   |                         |   |   |
| Quality Management; Understanding Some Basic Concepts; Safety Management; Statistical Quality Control, Statistical Product control; Risk Assessment through Hazard Identification and Job Safety Analysis. Assessment and mitigation of risk.                                                                                                                                                                                      |                                                                                  |             |                                           |                               |                 |                     |                   |  |  |   |                         |   |   |

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Learning Resources</b> | 1. <i>Inteaz Ali: Food Safety Quality Assurance: Principles and Practices</i> , CRC Press, 2004.<br>2. <i>Carol A. Wallace, William H. Sperber, Sara E. Mortimore. (2011) Food safety for the 21st century: managing HACCP and food safety throughout the global supply chain. Ames, Iowa : Blackwell Pub.,</i><br>3. <i>Schmidt, R.H. and Rodrick, G.E. (2005). Food Safety handbook. John Wiley &amp; Sons, Inc.</i><br>4. <i>Mortimore, S., and Wallace, C., (2005) HACCP: A practical approach, 2nd Ed, Aspen Publication</i> |
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| Learning Assessment |                           |                                              |          |                                |          |                                             |          |
|---------------------|---------------------------|----------------------------------------------|----------|--------------------------------|----------|---------------------------------------------|----------|
|                     | Bloom's Level of Thinking | Continuous Learning Assessment (CLA)         |          |                                |          | Summative Final Examination (40% weightage) |          |
|                     |                           | Formative CLA-1 Average of Module test (45%) |          | Life-Long Learning CLA-2 (15%) |          |                                             |          |
|                     |                           | Theory                                       | Practice | Theory                         | Practice | Theory                                      | Practice |
| Level 1             | Remember                  | 15%                                          | -        | -                              | -        | 15%                                         | -        |
| Level 2             | Understand                | 25%                                          | -        | -                              | -        | 25%                                         | -        |
| Level 3             | Apply                     | 30%                                          | -        | -                              | 15%      | 30%                                         | -        |
| Level 4             | Analyze                   | 30%                                          | -        | -                              | 25%      | 30%                                         | -        |
| Level 5             | Evaluate                  | -                                            | -        | -                              | 30%      | -                                           | -        |
| Level 6             | Create                    | -                                            | -        | -                              | 30%      | -                                           | -        |
|                     | Total                     | 100 %                                        |          | 100 %                          |          | 100 %                                       |          |

| <b>Course Designers</b>      |                                                   |                                    |
|------------------------------|---------------------------------------------------|------------------------------------|
| <i>Experts from Industry</i> | <i>Experts from Higher Technical Institutions</i> | <i>Internal Experts</i>            |
|                              |                                                   | <i>Dr. P. Gurumoorthi, SRM IST</i> |
|                              |                                                   |                                    |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                          |             |                                |                               |                 |                     |                   |  |                         |   |   |   |   |
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| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 21FPC502T                                                                                | Course Name | NUTRITION AND CLINICAL STUDIES |                               | Course Category | C                   | PROFESSIONAL CORE |  |                         | L | T | P | C |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                          |             |                                |                               |                 |                     |                   |  |                         | 3 | 0 | 0 | 3 |
| Pre-requisite Courses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Nil                                                                                      |             | Co-requisite Courses           | Nil                           |                 | Progressive Courses | Nil               |  |                         |   |   |   |   |
| Course Offering Department                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Food Process Engineering                                                                 |             |                                | Data Book / Codes / Standards |                 |                     | Nil               |  |                         |   |   |   |   |
| Course Learning Rationale (CLR):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | The purpose of learning this course is to:                                               |             |                                |                               |                 |                     |                   |  |                         |   |   |   |   |
| CLR-1:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | socially committed nutritional educators in various institutions.                        |             |                                |                               |                 |                     |                   |  |                         |   |   |   |   |
| CLR-2:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | train on innovative recipe development considering the science of food                   |             |                                |                               |                 |                     |                   |  |                         |   |   |   |   |
| CLR-3:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | develop feasible solutions against major nutrition related health issues in the country. |             |                                |                               |                 |                     |                   |  |                         |   |   |   |   |
| CLR-4:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | gain a deeper understanding of critical conditions and treatment routine                 |             |                                |                               |                 |                     |                   |  |                         |   |   |   |   |
| CLR-5:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | gain knowledge on hospital management                                                    |             |                                |                               |                 |                     |                   |  |                         |   |   |   |   |
| Course Outcomes (CO):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | At the end of this course, learners will be able to:                                     |             |                                |                               |                 |                     |                   |  | Programme Outcomes (PO) |   |   |   |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                          |             |                                |                               |                 |                     |                   |  | 1                       | 2 | 3 |   |   |
| CO-1:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | equip and inculcate an interest in research in the field of nutrition.                   |             |                                |                               |                 |                     |                   |  |                         |   |   | √ |   |
| CO-2:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | give opportunity and job experience through hospital internships                         |             |                                |                               |                 |                     |                   |  |                         | √ |   |   |   |
| CO-3:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | proficiency in lifestyle disease management                                              |             |                                |                               |                 |                     |                   |  |                         |   |   | √ |   |
| CO-4:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | independent to access, analyze and plan nutritional management for disease               |             |                                |                               |                 |                     |                   |  |                         |   |   | √ |   |
| CO-5:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | understand the nutrients in terms of changes during digestion, absorption etc.           |             |                                |                               |                 |                     |                   |  |                         | √ |   |   |   |
| Module-1 Human Nutrient Requirements 10 Hour                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                          |             |                                |                               |                 |                     |                   |  |                         |   |   |   |   |
| Macronutrients, methods of assessment of nutrient needs – a critical review, Critical evaluation of sensitive methods and derivations of requirements and recommended dietary allowances of macronutrients for all age groups: - Energy - Carbohydrates and dietary fibre - Proteins and amino acids - Lipids – Water, critical evaluation of National and International nutrient allowances; factors affecting the requirements.                                                                                 |                                                                                          |             |                                |                               |                 |                     |                   |  |                         |   |   |   |   |
| Module-2 Diet Associated Diseases 10 Hour                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                          |             |                                |                               |                 |                     |                   |  |                         |   |   |   |   |
| Nutritional Aspects of Eating Disorders and Nutritional management of eating disorders - Anorexia Nervosa, Bulimia Nervosa, Binge eating disorders, Anorexia athletic, Body dysmorphic disorder, Muscle dysmorphic disorder (bigorexia), Orthorexia nervosa, Pregorexia, Drunkorexia, Infection-triggered, auto immune subtype of anorexia nervosa in young children, Night-eating syndrome, Rumination syndrome, Gourmand syndrome, Prader-Willi syndrome, Pica, Cyclic vomiting syndrome, Chewing and spitting. |                                                                                          |             |                                |                               |                 |                     |                   |  |                         |   |   |   |   |
| Module-3 Nutrigenetics and Nutrigenomics 12 Hour                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                          |             |                                |                               |                 |                     |                   |  |                         |   |   |   |   |
| Introduction, Definition, Gene Expression, role of specific nutrients in controlling gene expression: Proteins, Lipids, Fuel molecules and lipogenesis, Minerals, Vitamins, Genes and diseases. Genetic variation and dietary response. Human genome Project, Epigenomics and Types of diet: liquid, semi solid, solid.                                                                                                                                                                                           |                                                                                          |             |                                |                               |                 |                     |                   |  |                         |   |   |   |   |
| Module-4 Medical Nutrition Therapy 13 Hour                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                          |             |                                |                               |                 |                     |                   |  |                         |   |   |   |   |
| Introduction to MNT, MNT for Nutritional Anemia, MNT for Diabetes Mellitus and MNT for Gastrointestinal Tract Disorders. MNT for Liver and Gall Bladder disease, MNT for Cardiovascular Diseases, MNT for Renal Diseases, MNT for Respiratory diseases, MNT for Fever and Infectious Diseases. Balanced Meal Designing; Diet chart preparation for anemia, Diet chart preparation for Renal Diseases, Diet chart preparation for diabetes                                                                         |                                                                                          |             |                                |                               |                 |                     |                   |  |                         |   |   |   |   |

|                           |                                                                                                                                                                                                                                    |                                                                                                                                                                                 |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Learning Resources</b> | 1. Bharat B. Aggarwal, David Heber, (2014), "Immunonutrition: Interactions of Diet, Genetics, and Inflammation", CRC Press.<br>2. Sareen Gropper, Jack Smith, (2012), "Advanced Nutrition and Human Metabolism", Cengage Learning. | 3. Anne Payne, Helen M. Barker, (2011), "Advancing Dietetics and Clinical Nutrition", Elsevier Health Sciences.<br>4. Krause's Food and Nutrition Therapy, (2010), 12th Edition |
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| Learning Assessment |                              |                                                    |          |                                      |          |                                                   |          |
|---------------------|------------------------------|----------------------------------------------------|----------|--------------------------------------|----------|---------------------------------------------------|----------|
|                     | Bloom's<br>Level of Thinking | Continuous Learning Assessment (CLA)               |          |                                      |          | Summative<br>Final Examination<br>(40% weightage) |          |
|                     |                              | Formative<br>CLA-1 Average of Module test<br>(50%) |          | Life-Long Learning<br>CLA-2<br>(10%) |          |                                                   |          |
|                     |                              | Theory                                             | Practice | Theory                               | Practice | Theory                                            | Practice |
| Level 1             | Remember                     | 15%                                                | -        | 15%                                  | -        | 15%                                               | -        |
| Level 2             | Understand                   | 25%                                                | -        | 20%                                  | -        | 25%                                               | -        |
| Level 3             | Apply                        | 30%                                                | -        | 25%                                  | -        | 30%                                               | -        |
| Level 4             | Analyze                      | 30%                                                | -        | 25%                                  | -        | 30%                                               | -        |
| Level 5             | Evaluate                     | -                                                  | -        | 10%                                  | -        | -                                                 | -        |
| Level 6             | Create                       | -                                                  | -        | 5%                                   | -        | -                                                 | -        |
|                     | Total                        | 100 %                                              |          | 100 %                                |          | 100 %                                             |          |

| Course Designers      |                                            |                         |
|-----------------------|--------------------------------------------|-------------------------|
| Experts from Industry | Experts from Higher Technical Institutions | Internal Experts        |
|                       |                                            | Dr. R. Preetha, SRM IST |

|             |           |             |                    |                 |   |                   |  |  |  |   |   |   |   |
|-------------|-----------|-------------|--------------------|-----------------|---|-------------------|--|--|--|---|---|---|---|
| Course Code | 21FPC503J | Course Name | FOOD BIOTECHNOLOGY | Course Category | C | PROFESSIONAL CORE |  |  |  | L | T | P | C |
|             |           |             |                    |                 |   |                   |  |  |  | 3 | 0 | 2 | 4 |

|                            |                          |                      |     |                               |     |
|----------------------------|--------------------------|----------------------|-----|-------------------------------|-----|
| Pre-requisite Courses      | NIL                      | Co-requisite Courses | NIL | Progressive Courses           | NIL |
| Course Offering Department | Food Process Engineering |                      |     | Data Book / Codes / Standards | NIL |

|                                  |                                                                                    |
|----------------------------------|------------------------------------------------------------------------------------|
| Course Learning Rationale (CLR): | The purpose of learning this course is to:                                         |
| CLR-1:                           | apply the concepts in biotechnology in food                                        |
| CLR-2:                           | use biotechnological products in food                                              |
| CLR-3:                           | design of large-scale production of biotechnological products for food application |
| CLR-4:                           | apply the concepts of fermentation in fermented food preparation                   |
| CLR-5:                           | explain about design of biosensors and its application in food analysis            |

| Course Outcomes (CO): | At the end of this course, learners will be able to:                                                 | Programme Outcomes (PO) |   |   |
|-----------------------|------------------------------------------------------------------------------------------------------|-------------------------|---|---|
|                       |                                                                                                      | 1                       | 2 | 3 |
| CO-1:                 | apply the knowledge of biotechnology in food                                                         |                         |   | √ |
| CO-2:                 | gain familiarity in applications of biotechnological products in food                                |                         |   | √ |
| CO-3:                 | analyze possibility of industrial scale production of biotechnological products for food application |                         | √ |   |
| CO-4:                 | sustain in biotechnological product development industry                                             |                         | √ |   |
| CO-5:                 | demonstrate Design of biosensors and its application in food analysis                                |                         |   | √ |

**Module-1 Food Biotechnology and Bioprocess Technology** **15 Hour**  
 Different biotechnological products. Biotechnological products applications in Food. Bio process engineering for biotechnological product development. Scale up and downstream process in bioprocess technology. Stain improvement and selection, optimization of product preparation using statistical models. Types of fermenters, Fermenters for preparation of wine and beer. Drying, filtration, precipitation, centrifugation methods to isolate, concentrate and purify intracellular metabolites concentration and purification of intracellular metabolites. Regulatory aspects of biotechnology in foods. Social aspects of biotechnology in foods. Scope and development of fermented products benefits of fermentation.

**Module-2 Biotechnological Products and Its Industrial Scale Production** **15 Hour**  
 Natural Food flavors, Natural Food colors, Bio-preservatives, acidulants, types of organic acids, Enzymes in food processing. Enzymes in food preservation and food industry waste water treatment, Bacteriocins. Probiotics. Mode of action of probiotic, Probiotic food products preparation guidelines and criteria. Prebiotics, Bio surfactants as, emulsifier, Biosurfactants as emulsifier Industrial production of following products –wine, industrial production of different types of wine. Technological aspects of industrial production of following products –beer. Types of beer and its ingredients, baker's yeast production. SCP types, advantages, disadvantages, industrial production of single cell protein, industrial production of enzymes, industrial production of organic acids, industrial production of organic acids, natural flavors production. Biocatalytic synthesis of food flavors. Biotechnological production of vitamins. Experiment on Natural colors isolation and preparation methods; Isolation of probiotic and evaluation of probiotic properties, Experiment on bacteriocin assay;

**Module-3 GM Food** **15 Hour**  
 Genetically modified Foods. Advantages of GM foods — Insect resistance – Virus resistance. Herbicide tolerant crops. Frost resistance – Drought and salinity resistant crops. Plants – Transformation methods –Agrobacterium transformation and Direct gene transfer. Transgenic plants - Commercially available GM crops. Golden rice. Transgenic animals. Genetically engineered bacteria. Risk associated

with GM foods – soil. Allergens, toxins, antibiotic resistance, contamination - Creation of superbugs and superweeds. Regulatory aspects of GMO. Social aspects of GMO. Experiment of Probiotic fermented food product development and Shelf-life analysis

**Module-4 Biosensors for Food Borne Pathogen Identification and Food Analysis**

**15 Hour**

Various methods for pathogen detection. Conventional methods for pathogen identification. Immunological methods for pathogen identification. ELISA polymerase chain reaction. Real-time PCR, multiplex PCR, reverse transcriptase PCR, general aspects of biosensors and their potential applications. Classification of biosensors, Components of biosensor and. Different types of bioreceptor. Different types of transducers, biosensors for food contaminant analysis, biosensors for food borne pathogen identification, commercially biosensors for food borne pathogens, commercially available biosensors for food analysis. Experiment on Identification of Pathogens in food and water samples, MPN method for water quality determination

|                           |                                                                                                              |                                                                                 |
|---------------------------|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| <b>Learning Resources</b> | 1. Sarah Elderidge. "Food Biotechnology; Current issues and perspectives". Nova science pub. Inc. 2003.      | 4. Rita Singh. Food Biotechnology. Global vision publication house, Delhi. 2004 |
|                           | 2. Stanbury, P.F., Allan Whitaker and S.J. Hall. "Principles of Fermentation Technology" Elsevier Ltd., 2016 | 5. Gustavo F. Gutierrez. "Food science and food biotechnology". GRC Pub. 2003.  |
|                           | 3. John, M. de Man. Principles of Food Chemistry, Third edition. Aspen Publishers. . 2009.                   |                                                                                 |

| Learning Assessment |                           |                                              |          |                                |          |                                             |          |
|---------------------|---------------------------|----------------------------------------------|----------|--------------------------------|----------|---------------------------------------------|----------|
|                     | Bloom's Level of Thinking | Continuous Learning Assessment (CLA)         |          |                                |          | Summative Final Examination (40% weightage) |          |
|                     |                           | Formative CLA-1 Average of Module test (45%) |          | Life-Long Learning CLA-2 (15%) |          |                                             |          |
|                     |                           | Theory                                       | Practice | Theory                         | Practice | Theory                                      | Practice |
| Level 1             | Remember                  | 15%                                          | -        | -                              | -        | 15%                                         | -        |
| Level 2             | Understand                | 25%                                          | -        | -                              | -        | 25%                                         | -        |
| Level 3             | Apply                     | 30%                                          | -        | -                              | 15%      | 30%                                         | -        |
| Level 4             | Analyze                   | 30%                                          | -        | -                              | 25%      | 30%                                         | -        |
| Level 5             | Evaluate                  | -                                            | -        | -                              | 30%      | -                                           | -        |
| Level 6             | Create                    | -                                            | -        | -                              | 30%      | -                                           | -        |
|                     | Total                     | 100 %                                        |          | 100 %                          |          | 100 %                                       |          |

|                        |                                            |                         |
|------------------------|--------------------------------------------|-------------------------|
| <b>Course designer</b> |                                            |                         |
| Experts from Industry  | Experts from Higher Technical Institutions | Internal Experts        |
|                        |                                            | Dr. R. Preetha, SRM IST |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |                                                                      |                  |                      |   |                             |   |                     |     |                         |         |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------------------------------------------------------------------|------------------|----------------------|---|-----------------------------|---|---------------------|-----|-------------------------|---------|---|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 21FPC504J | Course Name                                                          | FOOD ENGINEERING | Course Category      | C | PROFESSIONAL CORE           | L | T                   | P   | C                       |         |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |                                                                      |                  |                      |   |                             | 3 | 0                   | 2   | 4                       |         |   |
| Pre-requisite Courses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           | Nil                                                                  |                  | Co-requisite Courses |   | Nil                         |   | Progressive Courses |     | Nil                     |         |   |
| Course Offering Department                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           | Food Process Engineering                                             |                  |                      |   | Data Book / Codes/Standards |   |                     | Nil |                         |         |   |
| Course Learning Rationale (CLR):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           | The purpose of learning this course is to:                           |                  |                      |   |                             |   |                     |     |                         |         |   |
| CLR-1 :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | understand properties of the raw material used in food processing    |                  |                      |   |                             |   |                     |     |                         |         |   |
| CLR-2 :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | calculate mass and energy balance                                    |                  |                      |   |                             |   |                     |     |                         |         |   |
| CLR-3 :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | identify suitable processing equipment                               |                  |                      |   |                             |   |                     |     |                         |         |   |
| CLR-4 :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | know high temperature preservation techniques                        |                  |                      |   |                             |   |                     |     |                         |         |   |
| CLR-5 :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | understand low temperature preservation techniques                   |                  |                      |   |                             |   |                     |     |                         |         |   |
| Course Outcomes (CO):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           | At the end of this course, learners will be able to:                 |                  |                      |   |                             |   |                     |     | Programme Outcomes (PO) |         |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |                                                                      |                  |                      |   |                             |   |                     |     | 1                       | 2       | 3 |
| CO-1:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           | determine engineering properties of foods                            |                  |                      |   |                             |   |                     |     |                         | √       |   |
| CO-2:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           | develop mass and energy balance sheet for food processing operations |                  |                      |   |                             |   |                     |     |                         |         | √ |
| CO-3:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           | trouble suits food processing equipment operation                    |                  |                      |   |                             |   |                     |     |                         | √       |   |
| CO-4:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           | produce new food product by high temperature preservation technique  |                  |                      |   |                             |   |                     |     |                         | √       |   |
| CO-5:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           | implement freezing and refrigeration system for perishable products  |                  |                      |   |                             |   |                     |     |                         |         | √ |
| Module-1: Engineering Properties of Food                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           |                                                                      |                  |                      |   |                             |   |                     |     |                         | 12 Hour |   |
| Introduction – Food Engineering - Engineering properties – importance and role - Physical properties - types and methods to measure - Graphical method, weight, water displacement method - Thermal properties - Latent heat, sensible heat - Frictional properties - Angle of repose, coefficient of friction - Lab Experiment on physical properties of fruits and vegetables - Aero and hydrodynamic properties - Terminal velocity and Flow rate - Mechanical properties and Rheological properties - Texture profile analyzer and viscometer - Electrical properties- types and methods to determine - Conductivity meter and diffusivity meter - Optical properties- types and methods to determine - Hunter colour meter - Role of engineering properties of food in process design - Role of engineering properties of food in product design          |           |                                                                      |                  |                      |   |                             |   |                     |     |                         |         |   |
| Module-2: Mass and Energy Balance in Food Processing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |                                                                      |                  |                      |   |                             |   |                     |     |                         | 12 Hour |   |
| Introduction to mass and energy - Law of Conservation - Energy conservation - Problems - Mass Balance - Concepts and application - Problems - Tutorial for mass and energy conservation - Energy Balance - Concepts and application - Mass and energy balance calculation - Mass and energy balance problems for evaporation - Mass and energy balance problems for drying - Mass and energy balance problems for chilling - Mass and energy balance problems for freezing - Mass and energy balance problems for cold storage - Mass and energy balance problems for Mixing - Mass and energy balance problems for size reduction                                                                                                                                                                                                                             |           |                                                                      |                  |                      |   |                             |   |                     |     |                         |         |   |
| Module-3: Food Processing Machines and Operations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |                                                                      |                  |                      |   |                             |   |                     |     |                         | 12 Hour |   |
| Introduction – Food processing operations - Basic processing steps for plant foods - Basic processing steps for animal foods - Basic processing steps for dairy - Cleaning of raw materials - methods - Cleaning equipment operation - Sorting and grading – definition and types - Operation of sorters and graders - Lab Experiment preprocessing operations in foods - Size reduction – principles and problems - Size reduction for solids, liquid, and semi-solid foods - Peeling - definition, types, and importance - Description about peelers - Filtration and Centrifugation - Definition and types - Operation and application - Membrane separation – types - Operation and application - Extraction and Expression process - Operation and application - Lab Experiments on Handling of food Material - Lab Experiments on size reduction process |           |                                                                      |                  |                      |   |                             |   |                     |     |                         |         |   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                |
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| <b>Module-4: Food Engineering Concepts - High Temperature Processing</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>12 Hour</b> |
| Evaporation - principle - Methods of operation - Evaporator - types - Design, construction, and operation - Moisture content – Definition and types - Determination of moisture content - Blanching – Definition and importance - Blanchers – Types and Operation - Lab Experiment on moisture content determination - Drying and dehydration – definition and concepts - Drying mechanism-constant rate and falling rate period - Drying Techniques – Solar and tray drying - Spray drying and Freeze drying - Foam mat drying and Osmotic dehydration - Pasteurization- Definition and methods - Design and operation of pasteurizers - Sterilization – Definition, Design, and operation - Canning– Definition, Design, and operation - Retorting- Definition, Design, and operation - Lab Experiments on high-temperature preservation for foods - Lab Experiments on D, Z, and F value |                |
| <b>Module-5: Food Engineering Concepts – Low Temperature Processing</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>12 Hour</b> |
| Introduction – low temperature processing techniques - Refrigeration – Carnot cycle - Chilling or cooling - Application - Types and operation of Chillers - Freezing - Application - Types and operation of Freezers - Freezing - Theory and equipment - Ice crystal development - Lab Experiments on chilling of foods - Melting of ice - Freezing injuries, Frozen burn – Occurrence - Freezing injuries, Frozen burn - prevention - Freezing time calculation - Slow and blast freezing - Individual Quick-frozen foods - Definition and operation - Freeze drying- Definition and operation - Freeze concentration - Definition and operation - Problems on frozen food storage system - Problems on cold chain - Lab Experiments on freezing of foods - Lab Experiments on Thawing of foods                                                                                            |                |

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Learning Resources</b> | <ol style="list-style-type: none"> <li>1. Sahay, K.M. and K.K. Singh, "Module Operations in Agricultural Processing". Vikas Publishing House Pvt. Ltd., New Delhi, 2003.</li> <li>2. McCabe. and Smith, J.C."Module Operations of Chemical Engineering". McGraw - Hill Book Co. New York, 2002.</li> <li>3. Chakravarty A.and D.S.De." Post-harvest technology of cereals and pulses". Oxford &amp; IBH Publishing Co., New Delhi, 1988.</li> <li>4. Mohesenin. N.N, "Physical properties of Plant and Animal Materials". Gordon and Breach Science Publishers, New York, 1985.</li> <li>5. P. Fellows, "Food Processing Technology. Principles and practice", Ellis Horwood International publishers, Chichester, England, 2005.</li> <li>6. Earle R.L. "Module operations in Food Processing", Pergamon Press. 2000.</li> <li>7. Repulsing, "Introduction to Food Engineering". Academic press, California, USA, 2001 .</li> <li>8. Laboratory Manual for Food Engineering</li> </ol> |
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| Learning Assessment |                           |                                      |          |                    |          |                                             |          |
|---------------------|---------------------------|--------------------------------------|----------|--------------------|----------|---------------------------------------------|----------|
|                     | Bloom's Level of Thinking | Continuous Learning Assessment (CLA) |          |                    |          | Summative Final Examination (40% weightage) |          |
|                     |                           | Formative                            |          | Life-Long Learning |          |                                             |          |
|                     |                           | CLA-1 Average of Module test (45%)   |          | CLA-2 (15%)        |          |                                             |          |
|                     |                           | Theory                               | Practice | Theory             | Practice | Theory                                      | Practice |
| Level 1             | Remember                  | 15%                                  | -        | -                  | -        | 15%                                         | -        |
| Level 2             | Understand                | 25%                                  | -        | -                  | -        | 25%                                         | -        |
| Level 3             | Apply                     | 30%                                  | -        | -                  | 15%      | 30%                                         | -        |
| Level 4             | Analyze                   | 30%                                  | -        | -                  | 25%      | 30%                                         | -        |
| Level 5             | Evaluate                  | -                                    | -        | -                  | 30%      | -                                           | -        |
| Level 6             | Create                    | -                                    | -        | -                  | 30%      | -                                           | -        |
|                     | Total                     | 100 %                                |          | 100 %              |          | 100 %                                       |          |

|                        |                                            |                               |
|------------------------|--------------------------------------------|-------------------------------|
| <b>Course Designer</b> |                                            |                               |
| Experts from Industry  | Experts from Higher Technical Institutions | Internal Experts              |
|                        |                                            | Dr. G. Nagamaniammai, SRM IST |

|             |           |             |                                                           |                 |   |                   |   |   |   |   |
|-------------|-----------|-------------|-----------------------------------------------------------|-----------------|---|-------------------|---|---|---|---|
| Course Code | 21FPC505J | Course Name | ANALYTICAL TECHNIQUES AND INSTRUMENTS FOR FOOD PROCESSING | Course Category | C | PROFESSIONAL CORE | L | T | P | C |
|             |           |             |                                                           |                 |   |                   | 3 | 0 | 2 | 4 |

|                            |                          |                               |     |                     |     |
|----------------------------|--------------------------|-------------------------------|-----|---------------------|-----|
| Pre-requisite Courses      | Nil                      | Co-requisite Courses          | Nil | Progressive Courses | Nil |
| Course Offering Department | Food Process Engineering | Data Book / Codes / Standards | Nil |                     |     |

|                                  |                                                                                                       |
|----------------------------------|-------------------------------------------------------------------------------------------------------|
| Course Learning Rationale (CLR): | <b>The purpose of learning this course is to:</b>                                                     |
| CLR-1:                           | analyze extended use of spectroscopic techniques                                                      |
| CLR-2:                           | explain components of advanced instruments in food analysis                                           |
| CLR-3:                           | explain principles and application of instruments in food industry                                    |
| CLR-4:                           | use of analytical techniques in food analysis                                                         |
| CLR-5:                           | analyze the applications of advanced instrumentation techniques and e-sensor systems in food analysis |

| Course Outcomes (CO): | At the end of this course, learners will be able to:                                                | Programme Outcomes (PO) |   |   |
|-----------------------|-----------------------------------------------------------------------------------------------------|-------------------------|---|---|
|                       |                                                                                                     | 1                       | 2 | 3 |
| CO-1:                 | apply the knowledge spectroscopy in food analysis                                                   |                         |   | √ |
| CO-2:                 | gain familiarity with advanced analytical instruments in food processing                            |                         | √ |   |
| CO-3:                 | analyze knowledge about, purification and analysis of food ingredients                              |                         | √ |   |
| CO-4:                 | gain knowledge in instruments application in food industry                                          |                         |   | √ |
| CO-5:                 | apply the knowledge about. advanced instrumentation techniques and e-sensor system in food analysis |                         | √ |   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |
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| <b>Module-1 Understanding and Applying Spectroscopy in Food Analysis</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>20 Hour</b> |
| Spectroscopy different types, Beer's Law and Deviations from Beer's Law, Theory spectroscopy, Visible spectrometry and Colorimetry, Instrumentation Colorimetry, Instrumentation Single beam UV-Visible spectrophotometers, Double beam spectrophotometer components, Working of double beam spectrophotometer -block diagram. Applications of UV-Visible spectrophotometer. Applications of UV-Visible spectrophotometer., Instrumentation FTIR, Application of NIR and FTIR in food analysis. Mass spectroscopy – Theory, Types of ionization. Types of ionization. Mass Spectrometers instrumentation Analyzers and Detector. Mass spectra Interpretation, Experimental examples, Limitations of Mass spectroscopy, Applications of Mass spectroscopy in food technology, X-ray diffraction – Mosely's law, K band. XRD Principle, Instrumentation, various types of X-ray detectors, XRD applications in food products. Spectrophotometric determination of antioxidant property by DPPH method, Estimation of vitamin c in various food items by spectrophotometer, Protein estimation by spectrophotometric method, Refractometric analysis to confirm freshness of fruits and vegetables, Determination of the crystallinity index of various food products by X-Ray diffraction. |                |
| <b>Module-2 Analytical Techniques in Food Processing</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>20 Hour</b> |
| Thermal methods– Thermogravimetry. Differential Scanning Calorimetry-Differential Thermal Analysis, applications of thermal analysis in food. Polarimetry principle, Applications of polarimetry in food analysis, Applications of polarimetry in food analysis. Refractometry Principle, Snell's law, Refractometer instrumentation, Applications of polarimetry and refractometry in Food analysis. Applications of polarimetry and refractometry in Food analysis. Electrophoresis, Principle, Electrophoresis, procedure. Types of electrophoresis and applications in food sample analysis, SDS page and its application. Principles of chromatography, Classification of chromatography. Adsorption, partition, Molecular exclusion, ion exchange and affinity. Molecular exclusion, ion exchange and affinity. Applications of chromatographic technique in food technology. TLC and paper chromatography. Applications TLC and paper chromatography in food analysis, HPTLC instrumentation and its application in Food analysis                                                                                                                                                                                                                                                 |                |

Experiment on stimulation of various amino acids and colors by TLC: Estimation of amino acid by ascending Paper Chromatography, : Determination of the artificial colors of various food sample by radial paper chromatography, A study on TGA and DSC curve interpretation.

**Module-3 Advanced Techniques in Food Analysis and E-sensors**

**20 Hour**

Introduction, HPLC system; sample preparation, principle of separation, solvent system and degasser, Pump, injector, types of columns and Different types of HPLC detectors, recorder, Different types of HPLC detectors, recorder, Procedure for conducting qualitative and quantitative analysis using HPLC. Application of HPLC in food analysis. Gas chromatography- Introduction, sample preparation, principle of separation in GC types of carrier gases used, injection port, oven, Types of GC columns. Different types of detectors and recorder. Applications of GC in food sample analysis. Different types of detectors and recorder. E sensors- e nose and e tongue - instrumentation, application and working principles, Antibiotic residue analysis in meat using HPLC: Demonstration of GC-MS for quantitative estimation of composition of food samples

|                           |                                                                                                                                          |                                                                                                                                                                          |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Learning Resources</b> | 1. Darwin G. Caldwell, "Robotics and automation in the food industry Current and future technologies", Woodhead Publishing Limited, 2013 | 3. Skoog Douglas A., West, Donald M., Holler, F. James., and Crouch Stanley R. "Analytical Chemistry: An Introduction". Seventh Edition: South-Western, Australia, 2000. |
|                           | 2. Sharma, B.K. Instrumental Methods of Chemical Analysis. Goel Publishing House, New Delhi. 2004.                                       | 4. Nielsen, S.S. Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London.2004                                                      |

| Learning Assessment |                           |                                      |          |                    |          |                                             |          |
|---------------------|---------------------------|--------------------------------------|----------|--------------------|----------|---------------------------------------------|----------|
|                     | Bloom's Level of Thinking | Continuous Learning Assessment (CLA) |          |                    |          | Summative Final Examination (40% weightage) |          |
|                     |                           | Formative                            |          | Life-Long Learning |          |                                             |          |
|                     |                           | CLA-1 Average of unit test (45%)     |          | CLA-2 (15%)        |          |                                             |          |
|                     |                           | Theory                               | Practice | Theory             | Practice | Theory                                      | Practice |
| Level 1             | Remember                  | 15%                                  | -        | -                  | -        | 15%                                         | -        |
| Level 2             | Understand                | 25%                                  | -        | -                  | -        | 25%                                         | -        |
| Level 3             | Apply                     | 30%                                  | -        | -                  | 15%      | 30%                                         | -        |
| Level 4             | Analyze                   | 30%                                  | -        | -                  | 25%      | 30%                                         | -        |
| Level 5             | Evaluate                  | -                                    | -        | -                  | 30%      | -                                           | -        |
| Level 6             | Create                    | -                                    | -        | -                  | 30%      | -                                           | -        |
|                     | Total                     | 100 %                                |          | 100 %              |          | 100 %                                       |          |

| <b>Course Designers</b> |                                            |                         |
|-------------------------|--------------------------------------------|-------------------------|
| Experts from Industry   | Experts from Higher Technical Institutions | Internal Experts        |
|                         |                                            | Dr. R. Preetha, SRM IST |

# ACADEMIC CURRICULA

**Food and Nutritional Biotechnology**

**Professional Elective Courses**

**Regulations 2021**

**SRM INSTITUTE OF SCIENCE AND TECHNOLOGY**

**(Deemed to be University u/s 3 of UGC Act, 1956)**

Kattankulathur, Chengalpattu District 603203, Tamil Nadu,  
India

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                           |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   |   |        |  |
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| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 21FPE510T                                                                 | Course Name              | ADVANCED TECHNIQUES IN FOOD PRESERVATION |                             | Course Category | E                   | PROFESSIONAL ELECTIVE |  |  | L | T                       | P | C |        |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                           |                          |                                          |                             |                 |                     |                       |  |  | 3 | 0                       | 0 | 3 |        |  |
| Pre-requisite Courses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Nil                                                                       |                          | Co-requisite Courses                     | Nil                         |                 | Progressive Courses | Nil                   |  |  |   |                         |   |   |        |  |
| Course Offering Department                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                           | Food Process Engineering |                                          | Data Book / Codes/Standards |                 |                     | Nil                   |  |  |   |                         |   |   |        |  |
| Course Learning Rationale (CLR):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | The purpose of learning this course is to:                                |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   |   |        |  |
| CLR-1 :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | know irradiation techniques                                               |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   |   |        |  |
| CLR-2 :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | understand high pressure processing (HPP) techniques in food preservation |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   |   |        |  |
| CLR-3 :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | use Pulsed electric field (PEF) in food processing applications           |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   |   |        |  |
| CLR-4 :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | apply ohmic heat and ultrasound to preserve food                          |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   |   |        |  |
| CLR-5 :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | identify suitable combination preservation technique for specific foods   |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   |   |        |  |
| Course Outcomes (CO):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | At the end of this course, learners will be able to:                      |                          |                                          |                             |                 |                     |                       |  |  |   | Programme Outcomes (PO) |   |   |        |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                           |                          |                                          |                             |                 |                     |                       |  |  |   | 1                       | 2 | 3 |        |  |
| CO-1:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | develop irradiation process technique for food products                   |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   | √ |        |  |
| CO-2:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | apply HPP technique for liquid foods                                      |                          |                                          |                             |                 |                     |                       |  |  |   |                         | √ |   |        |  |
| CO-3:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | implement PEF to extent the stability of foods                            |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   | √ |        |  |
| CO-4:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | interpret the effect of ohmic and ultrasound processing on foods          |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   | √ |        |  |
| CO-5:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | integrate combinational preservation approaches to preserve perishables   |                          |                                          |                             |                 |                     |                       |  |  |   |                         | √ |   |        |  |
| Module-1: Food Irradiation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                           |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   |   | 9 Hour |  |
| Introduction to irradiation - Definitions - Radiation sources - Equipment to produce radiation - Operation - Mode of action - Measurement of radiation - Dosimetry - Lab - Experiments on Irradiated foods - Merits and demerits - Limitations of food irradiation - Nutritional changes in irradiated foods - Microbiological changes in irradiated foods - Recommended dosage for animal foods - Regulations for Processing plants - Regulations for Processing products - National standards for irradiated foods - International standards for irradiated foods                                                        |                                                                           |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   |   |        |  |
| Module-2: High Pressure Processing and Cold Plasma                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                           |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   |   | 9 Hour |  |
| HPP - Introduction – Principle of HPP processing - Types of processing Chambers - Description of HPP chambers - Mechanism for preservation - Applications to food systems - Effect of HPP on Microbes - Effect of HPP on Nutrients - Factors affecting the quality - High Pressure Freezing (HPF) - Principles - HPF processing - Applications - Limitation in implementation. Cold Plasma- Introduction- Principle- Mode of action- Equipment and tools to generate cold plasma- Applications in food industries.                                                                                                         |                                                                           |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   |   |        |  |
| Module-3: Pulsed Electric Field and UV treatments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                           |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   |   | 9 Hour |  |
| PEF - Introduction - Principle - Operation - Mechanism of action - PEF treatment systems - Main processing parameters - Design of PEF processing Module - Technology – equipment - Modeling - PEF processing system - Applications merit and demerits - Microbial disruption - Enzyme inactivation - Safety aspects - Limitation - Effect of processing on food composition - Pulsed electric field - Mode of action - Processing and operation - Oscillating magnetic field - Mode of action - Processing and operation. UV Treatment- Introduction- Principle - mode of action – Equipment and operations- Applications. |                                                                           |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   |   |        |  |
| Module-4: Ultrasound and Ohmic Heating                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                           |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   |   | 9 Hour |  |
| Ultrasound – Introduction - Principle - Fundamentals - Ultrasound treatment system Description - Ultrasound - processing - Mode of action - Application - Modeling – Ultrasound processing system - Effect on microbes - Ultrasound - preservation aid - Effect on properties of foods - Ohmic heating – Introduction, Principle - Role of electrical conductivity of material on processing - Processing and operation - Treatment of products - Effect of processing on food - Cold plasma - Mode of action - Processing and operation                                                                                   |                                                                           |                          |                                          |                             |                 |                     |                       |  |  |   |                         |   |   |        |  |

| <b>Module-5: Minimal Processing and Hurdle Technologies</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>9 Hour</b> |
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| Minimal processing -Introduction - Principle, Definition, Terminologies - Factors affecting minimal processing - Hurdle Technology - Concept - Basics consideration for hurdle technology - Mechanism - Mode of action - Effect on food composition - Practice -Hurdle technology development for fresh fruits, vegetables, and salad - Hurdle technology development for packed fruits, vegetables, and salad - Hurdle technology development for fresh-cut animal foods - Hurdle technology development for packed animal foods - Hurdle technology development for liquid foods - Multi – target preservation - Chemical and biochemical hurdle - Organic acids - Plant-derived antimicrobials – antimicrobial enzymes - Bio preservative - Bacteriocins - Chitin or chitosan |               |

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
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| <b>Learning Resources</b> | <ol style="list-style-type: none"> <li>1. Da-wen Sun, "Emerging Technologies for Food Processing", Elsevier Academic Press Marcel Dekker Inc. NY, 1995.</li> <li>2. Leistner L. and Gould G. "Hurdle Technologies – Combination treatments for food stability safety and quality", Kluwer Academics / Plenum Publishers, New York, 2002.</li> <li>3. Gustavo V. Barbosa-Canovas, Maria S. Tapia, M. Soledad Tapia, M. Pelicano, "Novel Food Processing Technologies "(Food Science and Technology Series), Publisher: CRC Press, November, 2004.</li> <li>4. Barbosa-Canovas, G V, "Pulsed electric fields in food processing: Fundamental aspects and applications"- a volume in the Food Preservation Technology series, edited by Washington State University and Q H Zhang, Ohio State University, USA, Woodhead Publishing Limited, Abington Hall, Abington, Cambridge, CB1 6AH, England, 2001.</li> <li>5. Laboratory Manual for advanced techniques in food preservation</li> </ol> |
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| Learning Assessment |                              |                                                    |          |                                        |          |                                                   |          |
|---------------------|------------------------------|----------------------------------------------------|----------|----------------------------------------|----------|---------------------------------------------------|----------|
|                     | Bloom's<br>Level of Thinking | Continuous Learning Assessment (CLA)               |          |                                        |          | Summative<br>Final Examination<br>(40% weightage) |          |
|                     |                              | Formative<br>CLA-1 Average of Module test<br>(50%) |          | Life Long Learning<br>CLA-2 –<br>(10%) |          |                                                   |          |
|                     |                              | Theory                                             | Practice | Theory                                 | Practice | Theory                                            | Practice |
| Level 1             | Remember                     | 15%                                                | -        | 15%                                    | -        | 15%                                               | -        |
| Level 2             | Understand                   | 25%                                                | -        | 20%                                    | -        | 25%                                               | -        |
| Level 3             | Apply                        | 30%                                                | -        | 25%                                    | -        | 30%                                               | -        |
| Level 4             | Analyze                      | 30%                                                | -        | 25%                                    | -        | 30%                                               | -        |
| Level 5             | Evaluate                     | -                                                  | -        | 10%                                    | -        | -                                                 | -        |
| Level 6             | Create                       | -                                                  | -        | 5%                                     | -        | -                                                 | -        |
|                     | Total                        | 100 %                                              |          | 100 %                                  |          | 100 %                                             |          |

| <b>Course Designers</b> |                                            |                               |
|-------------------------|--------------------------------------------|-------------------------------|
| Experts from Industry   | Experts from Higher Technical Institutions | Internal Experts              |
|                         |                                            | Dr. G. Nagamaniammai, SRM IST |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |                                                                                                                                  |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-----------------------------|-----------------|---------------------|-----------------------|-----|---|-------------------------|---|---|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 21FPE511T | Course Name                                                                                                                      | HANDLING, PACKAGING AND STORAGE OF FOOD PRODUCTS |                             | Course Category | E                   | PROFESSIONAL ELECTIVE | L   | T | P                       | C |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |                                                                                                                                  |                                                  |                             |                 |                     |                       | 3   | 0 | 0                       | 3 |   |
| Pre-requisite Courses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           | Ni                                                                                                                               | Co-requisite Courses                             |                             | Nil             | Progressive Courses |                       | Nil |   |                         |   |   |
| Course Offering Department                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           | Food Process Engineering                                                                                                         |                                                  | Data Book / Codes/Standards |                 | Nil                 |                       |     |   |                         |   |   |
| Course Learning Rationale (CLR):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |                                                                                                                                  |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           | The purpose of learning this course is to:                                                                                       |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
| CLR-1 :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           | gain the knowledge about material handling system and equipment                                                                  |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
| CLR-2 :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           | understand the basic concepts in food packaging                                                                                  |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
| CLR-3 :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           | obtain information about different types of food packages                                                                        |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
| CLR-4 :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           | understand about various food packaging equipment                                                                                |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
| CLR-5 :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           | attain information about different types of storage system for food commodities                                                  |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
| Course Outcomes (CO):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |                                                                                                                                  |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           | At the end of this course, learners will be able to:                                                                             |                                                  |                             |                 |                     |                       |     |   | Programme Outcomes (PO) |   |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |                                                                                                                                  |                                                  |                             |                 |                     |                       |     |   | 1                       | 2 | 3 |
| CO-1:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           | understand the basic concepts of nutraceutical and its classification used as health supplements.                                |                                                  |                             |                 |                     |                       |     |   |                         | √ |   |
| CO-2:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           | learnt function of flavonoids health benefits for cardiovascular disease and bone health.                                        |                                                  |                             |                 |                     |                       |     |   |                         |   | √ |
| CO-3:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           | analyze about the important of plant derived bioactive compounds potential to control the risk of diseases.                      |                                                  |                             |                 |                     |                       |     |   |                         | √ |   |
| CO-4:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           | understood the vital role of phytosterol derived from plants source used to prevent cancer and other diseases.                   |                                                  |                             |                 |                     |                       |     |   |                         |   | √ |
| CO-5:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           | described about role of Bioactive compound used for reducing the risk of CVD, Diabetics, CNS disorders and Respiratory disorder. |                                                  |                             |                 |                     |                       |     |   |                         |   | √ |
| Module-1: Food Handling System                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |                                                                                                                                  |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
| 9 Hour                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                                                                                                                                  |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
| Introduction to material handling - Requirements of materials handling system - Classification of material - Mobility of a bulk material - Load Utilization Process - Various materials in load utilization - Classification of Materials - Handling Equipment - Film wrapping equipment - Conveyors and bulk handling equipment - Construction of Belt Conveyors - Design of chain Conveyors - Construction of Screw Conveyors - Design of pneumatic Conveyors - Construction of bucket elevator - Design of hoppers and ducts - Introduction to Newtonian fluids - Handling of semi-liquid materials - Applications of hydraulic conveyors.                                                                                                                                 |           |                                                                                                                                  |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
| Module-2: Design of Food Packaging Machine                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |                                                                                                                                  |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
| 9 Hour                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                                                                                                                                  |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
| Introduction to food packaging - Explanation of food safety and security - Requirements of food packaging - Problems related to packaging - Functions of packaging - Selection of packaging materials - Brief on primary packaging - Design on secondary packaging - Design on tertiary packaging - Brief on quaternary packaging - Design and development of packaging material - Product Needs in packaging design - Distribution needs and wants of packaging - Role of Physical Environment in packaging - Role of Biological Environment in packaging - Consumer Needs and wants of Packaging - Factors affecting product quality - Methods of Shelf Life Estimation - Methods of Shelf Life Estimation.                                                                 |           |                                                                                                                                  |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
| Module-3: Food Packaging Materials and Methods                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |                                                                                                                                  |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
| 9 Hour                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                                                                                                                                  |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
| Introduction to food packaging materials - Techniques involved in food packaging - Identification of appropriate packaging materials based on products - Properties of packaging material - Paper and paperboard packaging - Films: cellulose film, plastic films, aluminium foils and laminations - Different types of food packages - Concept of canning and equipment used - Designing parameters of steel cans - Introduction to special packaging - Active and intelligent packaging - Aseptic packaging and its packaging design - Concept of modified atmospheric packaging- design parameters - Vacuum, gas packaging - Concept of shrink wrap packaging - Retort pouch packaging - Advantage of biodegradable packaging - Recent updates in biodegradable packaging. |           |                                                                                                                                  |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
| Module-4: Selection of Food Packaging System                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |                                                                                                                                  |                                                  |                             |                 |                     |                       |     |   |                         |   |   |
| 9 Hour                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                                                                                                                                  |                                                  |                             |                 |                     |                       |     |   |                         |   |   |

Introduction to food packaging equipment - Methods in food packaging - Recent equipment in food packaging - Packaging equipment for solid foods - Packaging equipment for liquid foods - Packaging equipment for semi-liquid foods - Concept of fillers and its uses - Types of fillers used in industries - Fillers used in glass bottles - Fillers used in paper bottles - Fillers used for pouch filling - Introduction to thermoforming equipment - Techniques in Plastic cup formation - Design of Form – Fill – Seal equipment - Sealing equipment for liquid foods - Sealing equipment for solid foods - Equipment used in labeling of packages - Operation of Capping equipment - Equipment used in cartooning.

#### Module-5: Storage Systems

9 Hour

Introduction of storage of food commodities - Need for storage of food commodities - Traditional storage structures - Modern storage bins- design and construction - Improved storage bins - Entomology in storage of food commodities - Concept of Bag storage method - Design of bulk storage - Methods in stacking of food grains - Concept of controlled atmosphere storage - Concept of modified atmosphere storage - Designing of MA storage system - Designing of CA storage systems - Limitations in MA and CA storage systems - Effect of nitrogen on perishable commodities - Effect of oxygen on perishable commodities - Effect of carbon dioxide on perishable commodities - Durability of storage structures - Recent advances in storage system.

|                    |                                                                                                                                         |                                                                                                                                  |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Learning Resources | 1. Jacob John. "A handbook on Food packaging". Daya publishing House, Delhi. 2010.                                                      | 4. Justice, O.I. and I.N. Bass. "Principles and practices of seed storage". Castle House Publication Ltd. 1995.                  |
|                    | 2. K.M. Sahay and K. K. Singh "Module Operations of Agricultural processing". Edition II. Vikas Publishing House Pvt. Ltd, Noida. 2010. | 5. Multon, J.L. "Preservation and storage of grains, seeds and their by-products". CBS Publishers and Distributors, Delhi. 2001. |
|                    | 3. Crosby, N. T. "Food packaging Materials" Applied Science Publishers, London. 1981.                                                   |                                                                                                                                  |

| Learning Assessment |                              |                                                  |          |                                        |          |                                                   |          |
|---------------------|------------------------------|--------------------------------------------------|----------|----------------------------------------|----------|---------------------------------------------------|----------|
|                     | Bloom's<br>Level of Thinking | Continuous Learning Assessment (CLA)             |          |                                        |          | Summative<br>Final Examination<br>(40% weightage) |          |
|                     |                              | Formative<br>CLA-1 Average of unit test<br>(50%) |          | Life Long Learning<br>CLA-2 –<br>(10%) |          |                                                   |          |
|                     |                              | Theory                                           | Practice | Theory                                 | Practice | Theory                                            | Practice |
| Level 1             | Remember                     | 15%                                              | -        | 15%                                    | -        | 15%                                               | -        |
| Level 2             | Understand                   | 25%                                              | -        | 20%                                    | -        | 25%                                               | -        |
| Level 3             | Apply                        | 30%                                              | -        | 25%                                    | -        | 30%                                               | -        |
| Level 4             | Analyze                      | 30%                                              | -        | 25%                                    | -        | 30%                                               | -        |
| Level 5             | Evaluate                     | -                                                | -        | 10%                                    | -        | -                                                 | -        |
| Level 6             | Create                       | -                                                | -        | 5%                                     | -        | -                                                 | -        |
|                     | Total                        | 100 %                                            |          | 100 %                                  |          | 100 %                                             |          |

#### Course Designers

|                       |                                            |                             |
|-----------------------|--------------------------------------------|-----------------------------|
| Experts from Industry | Experts from Higher Technical Institutions | Internal Experts            |
|                       |                                            | D.G. Nagamaniammai, SRM IST |

|                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                       |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-----------------------------------------------|-----------------------|-------------------------------|-----------------|-----|-----------------------|--|---------------------|---|-------------------------|---|---|
| Course Code                                                                                                                                                                                                                                                               | 21FPE512T                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Course Name                                                                                           | FOOD MICROBIOLOGY AND FERMENTATION TECHNOLOGY |                       |                               | Course Category | E   | PROFESSIONAL ELECTIVE |  |                     | L | T                       | P | C |
|                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                       |                                               |                       |                               |                 |     |                       |  |                     | 3 | 0                       | 0 | 3 |
| Pre-requisite Courses                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Nil                                                                                                   |                                               | Co- requisite Courses |                               |                 | Nil |                       |  | Progressive Courses |   | Nil                     |   |   |
| Course Offering Department                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Food Process Engineering                                                                              |                                               |                       | Data Book / Codes / Standards |                 |     |                       |  |                     |   |                         |   |   |
| Course Learning Rationale (CLR):                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | The purpose of learning this course is to:                                                            |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |
| CLR-1:                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | attain information about history of food microbiology and identification and preservation of microbes |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |
| CLR-2:                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | know the factors affecting the microbial growth and metabolism                                        |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |
| CLR-3:                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | obtain knowledge about beneficial and harmful effect of microbes                                      |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |
| CLR-4:                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | know the techniques employed to control the microbial growth in foods                                 |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |
| CLR-5:                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | attain information relevant to multi target preservation and food safety tool to avoid the hazards    |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |
| Course Outcomes (CO):                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | At the end of this course, learners will be able to:                                                  |                                               |                       |                               |                 |     |                       |  |                     |   | Programme Outcomes (PO) |   |   |
|                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                       |                                               |                       |                               |                 |     |                       |  |                     |   | 1                       | 2 | 3 |
| CO-1:                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | enrich the technical acquaintance for the isolation and identification of microbes                    |                                               |                       |                               |                 |     |                       |  |                     |   | √                       |   |   |
| CO-2:                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | control the microbes based on factors in foods                                                        |                                               |                       |                               |                 |     |                       |  |                     |   |                         | √ |   |
| CO-3:                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | employ the fermentation techniques with specific skill                                                |                                               |                       |                               |                 |     |                       |  |                     |   |                         | √ |   |
| CO-4:                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | prevent food spoilage by using different control methods                                              |                                               |                       |                               |                 |     |                       |  |                     |   |                         | √ |   |
| CO-5:                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | acquire technical knowledge for identifying food safety complications                                 |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   | √ |
| Module-1 Classification and Identification of Microbes 10 Hour                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                       |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |
| History of food microbiology, classification of bacteria based on morphological, cultural, colony, biochemical, physiological characteristics. Classification of molds and yeasts. Types of nutritional media, staining techniques, simple and differential techniques.   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                       |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |
| Module-2 Factors Affecting the Growth of Microbes and Beneficial and Pathogenic Microbes in Food 8 Hour                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                       |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |
| Extrinsic factors, Intrinsic factors, Beneficial and Pathogenic effect of bacteria, yeast and mold in food, microbial growth kinetics and log reduction, microbial metabolism of food components.                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                       |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |
| Module-3 Fermentation 9 Hour                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                       |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |
| Single cell protein - Advantages and disadvantages of single cell protein, Probiotic microbes, Fermented products - Sauerkraut fermentation, Vinegar fermentation, Lactic acid fermentation.                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                       |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |
| Module-4 Food Borne Diseases and Control Methods 9 Hour                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                       |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |
| Food borne diseases - Food infection, Food intoxication. Measures to control the microbial growth – physical, chemical and radiation methods. Homeostasis of microorganism, Hurdle concept                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                       |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |
| Module-5 Natural Antimicrobials from Microorganisms and Safety Practices 9 Hour                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                       |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |
| Natural antimicrobials from microorganisms - Bacteriocin structure, Bacteriocin function, Application of bacteriocins in food systems. Basic principles of food plant sanitation, Hazard Analysis and Critical Control Point (HACCP), Good manufacturing practices (GMP). |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                       |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |
| Learning Resources                                                                                                                                                                                                                                                        | 1. Frazier W.C., Westhoff D.C. and Vanitha N.M., (2014). Food Microbiology, 5th Edition, Tata McGraw Hill Publishing Company.<br>2. Adams, M.R., Moss, M.O., McClure, P.J. and Society, R. (2016). Food Microbiology. 4 <sup>th</sup> Edition. Cambridge, UK: Royal Society of Chemistry.<br>3. Erkmen, O., 2021. Microbiological analysis of Foods and Food Processing Environments. Academic Press<br>4. Hutkins, R.W. (2019). Microbiology and Technology of Fermented Foods. Hoboken, Nj, USA: John Wiley and Sons, Inc.<br>5. Shikha Ojha, K and Tiwari, B.K. (2016). Novel food fermentation technologies. Cham: Springer. |                                                                                                       |                                               |                       |                               |                 |     |                       |  |                     |   |                         |   |   |

| Learning Assessment |                              |                                                  |          |                                      |          |                                                   |          |
|---------------------|------------------------------|--------------------------------------------------|----------|--------------------------------------|----------|---------------------------------------------------|----------|
|                     | Bloom's<br>Level of Thinking | Continuous Learning Assessment (CLA)             |          |                                      |          | Summative<br>Final Examination<br>(40% weightage) |          |
|                     |                              | Formative<br>CLA-1 Average of Unit test<br>(50%) |          | Life-Long Learning<br>CLA-2<br>(10%) |          |                                                   |          |
|                     |                              | Theory                                           | Practice | Theory                               | Practice | Theory                                            | Practice |
| Level 1             | Remember                     | 20%                                              | -        | 20%                                  | -        | 20%                                               | -        |
| Level 2             | Understand                   | 20%                                              | -        | 20%                                  | -        | 20%                                               | -        |
| Level 3             | Apply                        | 30%                                              | -        | 30%                                  | -        | 30%                                               | -        |
| Level 4             | Analyze                      | 30%                                              | -        | 30%                                  | -        | 30%                                               | -        |
| Level 5             | Evaluate                     | -                                                | -        | -                                    | -        | -                                                 | -        |
| Level 6             | Create                       | -                                                | -        | -                                    | -        | -                                                 | -        |
|                     | Total                        | 100 %                                            |          | 100 %                                |          | 100 %                                             |          |

| Course Designers      |                                            |                               |
|-----------------------|--------------------------------------------|-------------------------------|
| Experts from Industry | Experts from Higher Technical Institutions | Internal Experts              |
|                       |                                            | Dr. S. Periyar Selvam, SRMIST |
|                       |                                            |                               |

|                                                                                                                                                                                                                                                                                                                                                   |                                                                                                |                              |                                             |                            |     |                       |               |                                |          |   |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------|---------------------------------------------|----------------------------|-----|-----------------------|---------------|--------------------------------|----------|---|--|
| <b>Course Code</b>                                                                                                                                                                                                                                                                                                                                | 21FPE513T                                                                                      | <b>Course Name</b>           | BIOCHEMISTRY OF PROCESSING AND PRESERVATION | <b>Course Category</b>     | E   | PROFESSIONAL ELECTIVE | L             | T                              | P        | C |  |
|                                                                                                                                                                                                                                                                                                                                                   |                                                                                                |                              |                                             |                            |     |                       | 3             | 0                              | 0        | 3 |  |
| <b>Pre-requisite Courses</b>                                                                                                                                                                                                                                                                                                                      | Nil                                                                                            | <b>Co- requisite Courses</b> | Nil                                         | <b>Progressive Courses</b> | Nil |                       |               |                                |          |   |  |
| <b>Course Offering Department</b>                                                                                                                                                                                                                                                                                                                 | Food Process Engineering                                                                       |                              | <b>Data Book / Codes / Standards</b>        |                            |     |                       |               |                                |          |   |  |
| <b>Course Learning Rationale (CLR):</b>                                                                                                                                                                                                                                                                                                           | <b>The purpose of learning this course is to:</b>                                              |                              |                                             |                            |     |                       |               |                                |          |   |  |
| <b>CLR-1:</b>                                                                                                                                                                                                                                                                                                                                     | explain about overview of food biochemistry and enzyme activity.                               |                              |                                             |                            |     |                       |               |                                |          |   |  |
| <b>CLR-2:</b>                                                                                                                                                                                                                                                                                                                                     | describe about biomacromolecules in food sources.                                              |                              |                                             |                            |     |                       |               |                                |          |   |  |
| <b>CLR-3:</b>                                                                                                                                                                                                                                                                                                                                     | analyze about the biochemistry of nucleic acids and genomics application in food science.      |                              |                                             |                            |     |                       |               |                                |          |   |  |
| <b>CLR-4:</b>                                                                                                                                                                                                                                                                                                                                     | describe about biochemistry of muscle foods and sea foods.                                     |                              |                                             |                            |     |                       |               |                                |          |   |  |
| <b>CLR-5:</b>                                                                                                                                                                                                                                                                                                                                     | discuss about proteomics application in foods, dairy products and cereal and grains.           |                              |                                             |                            |     |                       |               |                                |          |   |  |
| <b>Course Outcomes (CO):</b>                                                                                                                                                                                                                                                                                                                      | <b>At the end of this course, learners will be able to:</b>                                    |                              |                                             |                            |     |                       |               | <b>Programme Outcomes (PO)</b> |          |   |  |
|                                                                                                                                                                                                                                                                                                                                                   |                                                                                                |                              |                                             |                            |     |                       | <b>1</b>      | <b>2</b>                       | <b>3</b> |   |  |
| <b>CO-1:</b>                                                                                                                                                                                                                                                                                                                                      | understand the basic concepts and functions of enzymatic activity in food sources.             |                              |                                             |                            |     |                       |               | √                              |          |   |  |
| <b>CO-2:</b>                                                                                                                                                                                                                                                                                                                                      | learnt function of carbohydrate, proteins, and lipid and fat content in food.                  |                              |                                             |                            |     |                       |               |                                |          | √ |  |
| <b>CO-3:</b>                                                                                                                                                                                                                                                                                                                                      | analyze about the various methods of genetic engineering application techniques in food.       |                              |                                             |                            |     |                       |               |                                | √        |   |  |
| <b>CO-4:</b>                                                                                                                                                                                                                                                                                                                                      | understood the organoleptic properties of food substance.                                      |                              |                                             |                            |     |                       |               | √                              |          |   |  |
| <b>CO-5:</b>                                                                                                                                                                                                                                                                                                                                      | described about biochemistry in meat and poultry, fish processing, and organic acids in foods. |                              |                                             |                            |     |                       |               |                                |          | √ |  |
| <b>Module-1 Introductory of Biomolecules</b>                                                                                                                                                                                                                                                                                                      |                                                                                                |                              |                                             |                            |     |                       | <b>9 Hour</b> |                                |          |   |  |
| Glycobiology of Foods: Food Carbohydrates—Occurrence, Production, Food Uses, and Healthful Properties; Amino Acids, Oligopeptides, Polypeptides, and Proteins.                                                                                                                                                                                    |                                                                                                |                              |                                             |                            |     |                       |               |                                |          |   |  |
| <b>Module-2 Mechanisms of Biochemical Changes</b>                                                                                                                                                                                                                                                                                                 |                                                                                                |                              |                                             |                            |     |                       | <b>9 Hour</b> |                                |          |   |  |
| Biological Oxidations: Enzymatic and Nonenzymatic Browning Reactions and Control Mechanisms; Lipid Oxidation and oxidation induced changes in foods. Control of Oxidation; caramelization.                                                                                                                                                        |                                                                                                |                              |                                             |                            |     |                       |               |                                |          |   |  |
| <b>Module-3 Biochemistry of Processing of Nutritional Compounds</b>                                                                                                                                                                                                                                                                               |                                                                                                |                              |                                             |                            |     |                       | <b>9 Hour</b> |                                |          |   |  |
| Chemical changes in food during processing: overview; food processing perspective; means of controlling chemical reactions in foods during processing and handling; principal changes in starch during food processing; changes in pectin and cellulose during processing; chemical reactions of proteins; changes in vitamins during processing. |                                                                                                |                              |                                             |                            |     |                       |               |                                |          |   |  |
| <b>Module-4 Biochemical Changes in Foods Products of Animal and Plant Origin</b>                                                                                                                                                                                                                                                                  |                                                                                                |                              |                                             |                            |     |                       | <b>9 Hour</b> |                                |          |   |  |
| Biochemistry of Raw Meat and Poultry; Biochemistry of sea food processing; Biochemistry of Milk Processing; Biochemistry of Vegetable processing and Biochemical changes in vegetables; Flavor Compounds in Foods; Food Acids: Organic Acids, Volatile Organic Acids, and Phenolic Acid; chemical changes in natural food pigments.               |                                                                                                |                              |                                             |                            |     |                       |               |                                |          |   |  |
| <b>Module-5 Application of Enzymes in Food Industries</b>                                                                                                                                                                                                                                                                                         |                                                                                                |                              |                                             |                            |     |                       | <b>9 Hour</b> |                                |          |   |  |
| Enzymes Applied in Food Technology; Plant derived enzymes – Papain, Bromelain, Ficin and Lipoxygenase; Specific Application in the Food Industry; Food Application and Benefits; Enzyme actions in beer production; Sugar Syrups; Corn Syrups; Dairy and bakery products.                                                                         |                                                                                                |                              |                                             |                            |     |                       |               |                                |          |   |  |

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Learning Resources</b> | <ol style="list-style-type: none"> <li>1. Y. H. Hui "Food Biochemistry and Food Processing, First edition, Blackwell publications, ISBN-13: 978-0-8138-0378-4, 2006.</li> <li>2. Fatihydiz, "Advances in Food Biochemistry", CRC Press (Taylor &amp; Francis group), ISBN: 978-0-8493-7499-9, 2010.</li> <li>3. Benjamin. K. Simpson, "Food Biochemistry and Food Processing", Second edition, Wiley- Blackwell publication, ISBN: 978-0-8138-0874-1, 2012.</li> <li>4. J.Scott Smith and Y.H.Hui, "Food Processing: Principles and Applications" Blackwell publishing, 2004.</li> <li>5. Thomas Richardson, John W. Finley. Chemical Changes in Food During Processing, Edited by Institute of food technolog1sts 221 N. Lasalle St. Chicago, Illinois</li> </ol> |
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| Learning Assessment |                              |                                                  |          |                                      |          |                                                   |          |
|---------------------|------------------------------|--------------------------------------------------|----------|--------------------------------------|----------|---------------------------------------------------|----------|
|                     | Bloom's<br>Level of Thinking | Continuous Learning Assessment (CLA)             |          |                                      |          | Summative<br>Final Examination<br>(40% weightage) |          |
|                     |                              | Formative<br>CLA-1 Average of Unit test<br>(50%) |          | Life-Long Learning<br>CLA-2<br>(10%) |          |                                                   |          |
|                     |                              | Theory                                           | Practice | Theory                               | Practice | Theory                                            | Practice |
| Level 1             | Remember                     | 15%                                              | -        | 15%                                  | -        | 15%                                               | -        |
| Level 2             | Understand                   | 25%                                              | -        | 20%                                  | -        | 25%                                               | -        |
| Level 3             | Apply                        | 30%                                              | -        | 25%                                  | -        | 30%                                               | -        |
| Level 4             | Analyze                      | 30%                                              | -        | 25%                                  | -        | 30%                                               | -        |
| Level 5             | Evaluate                     | -                                                | -        | 10%                                  | -        | -                                                 | -        |
| Level 6             | Create                       | -                                                | -        | 5%                                   | -        | -                                                 | -        |
|                     | Total                        | 100 %                                            |          | 100 %                                |          | 100 %                                             |          |

| <b>Course Designers</b> |                                            |                             |
|-------------------------|--------------------------------------------|-----------------------------|
| Experts from Industry   | Experts from Higher Technical Institutions | Internal Experts            |
|                         |                                            | Dr. P. Gurumoorthi, SRM IST |
|                         |                                            |                             |

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|----------------------------|-----------|--------------------------|----------------------------|-----------------------------|-----------------|-----|-----------------------|-----|--|---|---|---|---|
| Course Code                | 21FPE514T | Course Name              | CROP PROCESSING TECHNOLOGY |                             | Course Category | E   | PROFESSIONAL ELECTIVE |     |  | L | T | P | C |
|                            |           |                          |                            |                             |                 |     |                       |     |  | 3 | 0 | 0 | 3 |
| Pre-requisite Courses      |           | Nil                      |                            | Co-requisite Courses        | Nil             |     | Progressive Courses   | Nil |  |   |   |   |   |
| Course Offering Department |           | Food Process Engineering |                            | Data Book / Codes/Standards |                 | Nil |                       |     |  |   |   |   |   |

|                                         |                                                                     |
|-----------------------------------------|---------------------------------------------------------------------|
| <b>Course Learning Rationale (CLR):</b> | <b>The purpose of learning this course is to:</b>                   |
| <b>CLR-1 :</b>                          | demonstrate rice and pulse processing                               |
| <b>CLR-2 :</b>                          | understand wheat, corn and millet milling operations                |
| <b>CLR-3 :</b>                          | illustrate edible oil processing plant operations                   |
| <b>CLR-4 :</b>                          | select appropriate processing methods for coffee and tea production |
| <b>CLR-5 :</b>                          | execute spices and plantation products production                   |

| <b>Course Outcomes (CO):</b> | <b>At the end of this course, learners will be able to:</b>           | <b>Programme Outcomes (PO)</b> |          |          |
|------------------------------|-----------------------------------------------------------------------|--------------------------------|----------|----------|
|                              |                                                                       | <b>1</b>                       | <b>2</b> | <b>3</b> |
| <b>CO-1:</b>                 | plan rice and pulse processing plant operations                       |                                |          | √        |
| <b>CO-2:</b>                 | construct a new processing module for wheat, corn and millet products |                                | √        |          |
| <b>CO-3:</b>                 | develop edible processing oil plant                                   |                                | √        |          |
| <b>CO-4:</b>                 | evaluate coffee and tea processing plant operations                   |                                |          | √        |
| <b>CO-5:</b>                 | construct spice mix and plantation products processing line           |                                | √        |          |

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| <b>Module-1: Cereals Processing</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>9 Hours</b> |
| Introduction - Paddy - varieties - Structure - Composition – Milling process: Pre-milling equipment - Milling equipment - Cleaner and rice graders - Parboiling - definition - methods - Batch and continuous parboiling methods and processing equipment - Merits and demerits for parboiling and Changes in rice during parboiling - Layout for Modern rice mill; Structure and composition - Wheat milling - stages of milling processing - Milling equipment operation - Block diagram for wheat mills ; Corn - Structure and composition - Corn wet milling - Corn dry milling - High Fructose corn syrup production; Oats - Structure, composition - Oat processing |                |
| <b>Module-2: Millets and Pulses Processing</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>9 Hours</b> |
| Millets – Structure and composition - Processing of sorghum - Processing of ragi - Breakfast cereals - Expanded snacks - Video presentation for processing plant operation for millets and cereal-based products; Pulse - Structure and composition - Milling process – methods of pretreatment - Traditional pulse milling - Modern pulse milling - Merits and demerits; Soybean processing                                                                                                                                                                                                                                                                              |                |
| <b>Module-3: Oilseed Processing</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>9 Hours</b> |
| Oil seed- Structure and composition - Pretreatment for oil seeds - Oil milling processes - Traditional and modern oil milling process - Mechanical Extraction - Solvent extraction - Oil pressing – Cold and hot – Expression; Oil refining process flow - Neutralization, degumming - Deodorization, hydrogenation, winterization - Oil processing waste utilization. Palm oil – structure, composition and uses - Palm oil extraction processes. Coconut Oil - structure, composition and uses - Coconut oil extraction processes. Health benefits of oils and blended oils with legal requirements.                                                                    |                |
| <b>Module-4: Plantation Crops</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>9 Hours</b> |
| Tea – Types and importance - Process flow chart for tea production - Differences in processing operation for varieties of tea - Tea processing equipment. Coffee – structure and importance - Process flow chart for coffee production - Differences in processing operation for varieties of tea - Tea processing equipment. Cocoa – structure and importance - Process flow chart for cocoa production - Traditional and modern methods - Chocolate processing. Cashew nut – Types and importance - Process flow chart for Cashew nut production - Traditional and modern methods - Cashew nut oil processing and applications.                                         |                |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                |
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| <b>Module-5: Spices and Crop Products processing</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>9 Hours</b> |
| Spices - Introduction, scope - Pepper – structure and composition - Milling - Oleoresin extraction- Application - Pepper – structure and composition - Milling - Spice blend milling - Oleoresin Extraction- Application - Demo – Pepper and chilling pre- and post-harvest treatments. Turmeric – structure, composition, and importance - Milling – Curcumin extraction. Cardamom - structure, composition, and importance - Flavour extraction and application. Tapioca - structure, composition, and importance - Sago processing. Potato - structure, composition, and importance - Potato Product processing |                |

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| <b>Learning Resources</b> | 1. Unit operations in Agricultural Processing by K.M. Sahay and K.K. Singh. 2 <sup>nd</sup> revised and Enlarged Edition. Vikas Publishing House Pvt. Ltd. 2004.<br>2. Cereal Processing Technology Ed. By, Gavin Woens CRC Press, 2001.<br>3. Coffee Processing Technology, Michael Sivetz and Foote, “,” Vol II, AVI Publishing Co.,2007. | 4. Spice Production – A Text Book, S.P. Kanunjia, Raj Narayan, Akali Seema & Moakala, 2021.<br>5. Handbook of herbs and Spices, Ed K.V. Peter, CRC Publishers., 2001. |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| Learning Assessment |                              |                                                  |          |                                        |          |                                                   |          |
|---------------------|------------------------------|--------------------------------------------------|----------|----------------------------------------|----------|---------------------------------------------------|----------|
|                     | Bloom's<br>Level of Thinking | Continuous Learning Assessment (CLA)             |          |                                        |          | Summative<br>Final Examination<br>(40% weightage) |          |
|                     |                              | Formative<br>CLA-1 Average of Unit test<br>(50%) |          | Life Long Learning<br>CLA-2 –<br>(10%) |          |                                                   |          |
|                     |                              | Theory                                           | Practice | Theory                                 | Practice | Theory                                            | Practice |
| Level 1             | Remember                     | 15%                                              | -        | 15%                                    | -        | 15%                                               | -        |
| Level 2             | Understand                   | 25%                                              | -        | 20%                                    | -        | 25%                                               | -        |
| Level 3             | Apply                        | 30%                                              | -        | 25%                                    | -        | 30%                                               | -        |
| Level 4             | Analyze                      | 30%                                              | -        | 25%                                    | -        | 30%                                               | -        |
| Level 5             | Evaluate                     | -                                                | -        | 10%                                    | -        | -                                                 | -        |
| Level 6             | Create                       | -                                                | -        | 5%                                     | -        | -                                                 | -        |
|                     | Total                        | 100 %                                            |          | 100 %                                  |          | 100 %                                             |          |

| <b>Course Designers</b> |                                            |                              |
|-------------------------|--------------------------------------------|------------------------------|
| Experts from Industry   | Experts from Higher Technical Institutions | Internal Experts             |
|                         |                                            | Dr G. Nagamaniammai, SRM IST |
|                         |                                            |                              |

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|-----------------------|-------------------------------|-----|-----------------------|---------------------|---|-----|---|-------------------------|--------|---|
| Course Code                                                                                                                                                                                                                                                                                                                 | 21FPE515T                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Course Name                                                                                                           | POST - HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES |                       | Course Category               | E   | PROFESSIONAL ELECTIVE |                     |   | L   | T | P                       | C      |   |
|                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                       |                                                    |                       |                               |     | 3                     | 0                   | 0 | 3   |   |                         |        |   |
| Pre-requisite Courses                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Nil                                                                                                                   |                                                    | Co- requisite Courses |                               | Nil |                       | Progressive Courses |   | Nil |   |                         |        |   |
| Course Offering Department                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Food Process Engineering                                                                                              |                                                    |                       | Data Book / Codes / Standards |     |                       | Nil                 |   |     |   |                         |        |   |
| Course Learning Rationale (CLR):                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | The purpose of learning this course is to:                                                                            |                                                    |                       |                               |     |                       |                     |   |     |   |                         |        |   |
| CLR-1:                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | understand the concepts of physiological characteristics of fruits and vegetables                                     |                                                    |                       |                               |     |                       |                     |   |     |   |                         |        |   |
| CLR-2:                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | gain knowledge about fruits and vegetable harvesting criteria                                                         |                                                    |                       |                               |     |                       |                     |   |     |   |                         |        |   |
| CLR-3:                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | obtain information about postharvest losses and preservation                                                          |                                                    |                       |                               |     |                       |                     |   |     |   |                         |        |   |
| CLR-4:                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | know the postharvest handling, transport and storage methods                                                          |                                                    |                       |                               |     |                       |                     |   |     |   |                         |        |   |
| CLR-5:                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | attain information relevant to fruits and vegetables processing and preservation                                      |                                                    |                       |                               |     |                       |                     |   |     |   |                         |        |   |
| Course Outcomes (CO):                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | At the end of this course, learners will be able to:                                                                  |                                                    |                       |                               |     |                       |                     |   |     |   | Programme Outcomes (PO) |        |   |
|                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                       |                                                    |                       |                               |     |                       |                     |   |     |   | 1                       | 2      | 3 |
| CO-1:                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | gain the knowledge of fruits and vegetables classification                                                            |                                                    |                       |                               |     |                       |                     |   |     |   | √                       |        |   |
| CO-2:                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | apply maturity indices for harvesting fruits and vegetables                                                           |                                                    |                       |                               |     |                       |                     |   |     |   |                         |        | √ |
| CO-3:                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | employ specific preservation techniques based on the types of fruits and vegetables and reduce the postharvest losses |                                                    |                       |                               |     |                       |                     |   |     |   |                         | √      |   |
| CO-4:                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | use unique handling, transport and storage methods with subject to fruits and vegetables                              |                                                    |                       |                               |     |                       |                     |   |     |   |                         | √      |   |
| CO-5:                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | acquire technical knowledge for processing the fruits and vegetables                                                  |                                                    |                       |                               |     |                       |                     |   |     |   |                         | √      |   |
| Module-1 Classification and Post - Harvest Physiology                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                       |                                                    |                       |                               |     |                       |                     |   |     |   |                         | 9 Hour |   |
| Fruit and vegetable production in India, Postharvest losses of fruit and vegetable in India, Classification of fruit and vegetables, Importance of post-harvest physiology.                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                       |                                                    |                       |                               |     |                       |                     |   |     |   |                         |        |   |
| Module-2 Maturity Criteria                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                       |                                                    |                       |                               |     |                       |                     |   |     |   |                         | 9 Hour |   |
| Stages of growth, Maturity criteria, Determination of harvest maturity indices, Computational, Physical, Chemical and Physiological methods. Changes during fruit ripening.                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                       |                                                    |                       |                               |     |                       |                     |   |     |   |                         |        |   |
| Module-3. Types of PHT Losses, Spoilage and Preservation Methods                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                       |                                                    |                       |                               |     |                       |                     |   |     |   |                         | 9 Hour |   |
| Types of post-harvest losses, Mechanical injury types, Respiration and Transpiration losses, Methods to measure respiration and transpiration losses, Technologies to control post-harvest losses, Spoilage of fruits and vegetables, Methods for the preservation of fruits and vegetables. Enzymatic browning and control |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                       |                                                    |                       |                               |     |                       |                     |   |     |   |                         |        |   |
| Module-4 Post-Harvest Handling                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                       |                                                    |                       |                               |     |                       |                     |   |     |   |                         | 9 Hour |   |
| Post-harvest handling, transportation, precooling after Harvest, Cleaning, Trimming, Peeling, Grading, Sorting, Washing, Curing, Blanching methods. Storage methods for fruits and vegetables.                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                       |                                                    |                       |                               |     |                       |                     |   |     |   |                         |        |   |
| Module-5 Processing Concepts for Fruits and Vegetables                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                       |                                                    |                       |                               |     |                       |                     |   |     |   |                         | 9 Hour |   |
| Processing concepts for fruits and vegetables, Minimal processing concept - Processing methods, Equipment for fruits and vegetables products, Recent trends in fruits and vegetables processing.                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                       |                                                    |                       |                               |     |                       |                     |   |     |   |                         |        |   |
| Learning Resources                                                                                                                                                                                                                                                                                                          | 1. L.R. Verma and V.K. Joshi, "Post-Harvest Technology of Fruits and vegetables". Volume 1 and 2. Indus Publishing Company, New Delhi. 2006.<br>2. Joshi, V.K. (2021). Postharvest Management of Fruits and Vegetables. New India Publishing Agency.<br>3. Sudheer, K.P. and V Indira (2020). Postharvest Technology of Horticultural Crops. New India Publishing Agency.<br>4. Florkowski, W.J., Shewfelt, R.L., Prussia, S.E. and Banks, N. (2014). Postharvest Handling A Systems Approach. San Diego Elsevier Science and Technology Ann Arbor, Michigan Proquest.<br>5. Ramaswamy, H.S. (2015). Post-harvest Technologies of Fruits and Vegetables. Lancaster, Pennsylvania: Destech Publications, Inc.. |                                                                                                                       |                                                    |                       |                               |     |                       |                     |   |     |   |                         |        |   |

| Learning Assessment   |                              |                                                  |          |                                      |                               |                                                   |          |
|-----------------------|------------------------------|--------------------------------------------------|----------|--------------------------------------|-------------------------------|---------------------------------------------------|----------|
|                       | Bloom's<br>Level of Thinking | Continuous Learning Assessment (CLA)             |          |                                      |                               | Summative<br>Final Examination<br>(40% weightage) |          |
|                       |                              | Formative<br>CLA-1 Average of Unit test<br>(50%) |          | Life-Long Learning<br>CLA-2<br>(10%) |                               |                                                   |          |
|                       |                              | Theory                                           | Practice | Theory                               | Practice                      | Theory                                            | Practice |
| Level 1               | Remember                     | 20%                                              | -        | 20%                                  | -                             | 20%                                               | -        |
| Level 2               | Understand                   | 20%                                              | -        | 20%                                  | -                             | 20%                                               | -        |
| Level 3               | Apply                        | 30%                                              | -        | 30%                                  | -                             | 30%                                               | -        |
| Level 4               | Analyze                      | 30%                                              | -        | 30%                                  | -                             | 30%                                               | -        |
| Level 5               | Evaluate                     | -                                                | -        | -                                    | -                             | -                                                 | -        |
| Level 6               | Create                       | -                                                | -        | -                                    | -                             | -                                                 | -        |
|                       | Total                        | 100 %                                            |          | 100 %                                |                               | 100 %                                             |          |
| Course Designers      |                              |                                                  |          |                                      |                               |                                                   |          |
| Experts from Industry |                              | Experts from Higher Technical Institutions       |          |                                      | Internal Experts              |                                                   |          |
|                       |                              |                                                  |          |                                      | Dr. S. Perivar Selvam, SRMIST |                                                   |          |

|                                                                                                                                                                                                                                                                                                                                                           |                                                                                                      |             |                           |                               |   |                       |                         |   |   |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------|---------------------------|-------------------------------|---|-----------------------|-------------------------|---|---|---|
| Course Code                                                                                                                                                                                                                                                                                                                                               | 21FPE516T                                                                                            | Course Name | ADVANCED DAIRY TECHNOLOGY | Course Category               | E | PROFESSIONAL ELECTIVE | L                       | T | P | C |
|                                                                                                                                                                                                                                                                                                                                                           |                                                                                                      |             |                           |                               |   |                       | 3                       | 0 | 0 | 3 |
| Pre-requisite Courses                                                                                                                                                                                                                                                                                                                                     | Nil                                                                                                  |             | Co- requisite Courses     | Nil                           |   | Progressive Courses   | Nil                     |   |   |   |
| Course Offering Department                                                                                                                                                                                                                                                                                                                                | Food Process Engineering                                                                             |             |                           | Data Book / Codes / Standards |   | Nil                   |                         |   |   |   |
| Course Learning Rationale (CLR):                                                                                                                                                                                                                                                                                                                          | The purpose of learning this course is to:                                                           |             |                           |                               |   |                       |                         |   |   |   |
| CLR-1:                                                                                                                                                                                                                                                                                                                                                    | explain about overview of dairy biotechnology.                                                       |             |                           |                               |   |                       |                         |   |   |   |
| CLR-2:                                                                                                                                                                                                                                                                                                                                                    | describe about preservation techniques in dairy industries.                                          |             |                           |                               |   |                       |                         |   |   |   |
| CLR-3:                                                                                                                                                                                                                                                                                                                                                    | analyze about the enzyme activity in milk products, and application of drying techniques in dairy.   |             |                           |                               |   |                       |                         |   |   |   |
| CLR-4:                                                                                                                                                                                                                                                                                                                                                    | describe about hurdle technology and other various techniques in dairy processing.                   |             |                           |                               |   |                       |                         |   |   |   |
| CLR-5:                                                                                                                                                                                                                                                                                                                                                    | discuss about application of biotechnology in dairy production.                                      |             |                           |                               |   |                       |                         |   |   |   |
| Course Outcomes (CO):                                                                                                                                                                                                                                                                                                                                     | At the end of this course, learners will be able to:                                                 |             |                           |                               |   |                       | Programme Outcomes (PO) |   |   |   |
|                                                                                                                                                                                                                                                                                                                                                           |                                                                                                      |             |                           |                               |   |                       | 1                       | 2 | 3 |   |
| CO-1:                                                                                                                                                                                                                                                                                                                                                     | understand the basic concepts and functions of different methods of heat treatment in dairy products |             |                           |                               |   |                       |                         | √ |   |   |
| CO-2:                                                                                                                                                                                                                                                                                                                                                     | learnt function of UHT processing of milk                                                            |             |                           |                               |   |                       |                         | √ |   |   |
| CO-3:                                                                                                                                                                                                                                                                                                                                                     | understood the Hurdle technology, merits and demerits                                                |             |                           |                               |   |                       |                         | √ |   |   |
| CO-4:                                                                                                                                                                                                                                                                                                                                                     | described about application of Bio-peptides and Bio-preservation in dairy industry                   |             |                           |                               |   |                       |                         | √ |   |   |
| CO-5:                                                                                                                                                                                                                                                                                                                                                     | enhance the knowledge about CIP and sanitation maintained in dairy plant.                            |             |                           |                               |   |                       |                         |   | √ |   |
| Module-1 Thermal and Freeze Processing of Milk                                                                                                                                                                                                                                                                                                            |                                                                                                      |             |                           |                               |   |                       | 9 Hour                  |   |   |   |
| Pasteurization, Batch/Holding process, Continuous process, Vaccination, Sacralization, Uperization, Heat processing of milk - Effect of heat on milk, salt system and acidity, milk proteins, Destabilization of caseinate system, freeze processing of milk - Effect of freezing on lactose and caseinate system.                                        |                                                                                                      |             |                           |                               |   |                       |                         |   |   |   |
| Module-2 Ultra-High-Temperature Processing and Hurdle Technology                                                                                                                                                                                                                                                                                          |                                                                                                      |             |                           |                               |   |                       | 9 Hour                  |   |   |   |
| Types of sterilization plants - Direct heating plant, Indirect type heating system. Application of drying mechanism in dairy industry, Application of freeze drying, Spray drying, Humectants, Application of Hurdle technology in dairy, List of Hurdle advantages, Microbial growth inhibition, Application and future directions of hurdle technology. |                                                                                                      |             |                           |                               |   |                       |                         |   |   |   |
| Module-3 Dairy Product Processing                                                                                                                                                                                                                                                                                                                         |                                                                                                      |             |                           |                               |   |                       | 9 Hour                  |   |   |   |
| Demand and supply of dairy product in India. Cheese production, Enzyme modified cheese, Advantage of enzyme modified cheese ripening. Flavor generation in dairy product, Skimmed and Semi-skimmed milk, Controlling the texture of fermented dairy products.                                                                                             |                                                                                                      |             |                           |                               |   |                       |                         |   |   |   |
| Module-4 Application of Biotechnology in Dairy Industry                                                                                                                                                                                                                                                                                                   |                                                                                                      |             |                           |                               |   |                       | 9 Hour                  |   |   |   |
| Bio-Preservation, Bio-peptides, Bio-detergents, Application of genetic engineering in dairy starter culture, Types of packaging in dairy products - Aseptic packaging, Use of tetra pack in dairy industry.                                                                                                                                               |                                                                                                      |             |                           |                               |   |                       |                         |   |   |   |
| Module-5 Clean in Place (CIP) in Dairy Industry                                                                                                                                                                                                                                                                                                           |                                                                                                      |             |                           |                               |   |                       | 9 Hour                  |   |   |   |
| Centralized CIP system, Sanitization in CIP system, Methodology for cleaning equipment used in dairy industry, Sanitization methods. Assessment of effective cleaning and sanitization.                                                                                                                                                                   |                                                                                                      |             |                           |                               |   |                       |                         |   |   |   |

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Learning Resources</b> | <ol style="list-style-type: none"> <li>1. Jagrani Minj, Aparna Sudhakaran V, Anuradha Kumari and Springerlink (Online Service) (2020). Dairy Processing: Advanced Research to Applications. Singapore: Springer Singapore, Imprint Springer.</li> <li>2. Murlidhar Meghwal, Goyal, M.R. and Chavan, R.S. (2017). Dairy Engineering. CRC Press.</li> <li>3. Megh Raj Goyal, Kumar, A. and Gupta, A.K. (2021). Novel dairy processing technologies: techniques, management, and energy conservation. Toronto: Apple Academic Press.</li> </ol> | <ol style="list-style-type: none"> <li>4. Shivashraya Singh (2014). Dairy technology. New Delhi: New India Pub. Agency.</li> <li>5. Chavan, R.S. and Megh Raj Goyal (2018). Technological interventions in dairy science: innovative approaches in processing, preservation, and analysis of milk products. Waretown, N.J.: Apple Academic Press.</li> </ol> |
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| Learning Assessment |                              |                                                  |          |                                      |          |                                                   |          |
|---------------------|------------------------------|--------------------------------------------------|----------|--------------------------------------|----------|---------------------------------------------------|----------|
|                     | Bloom's<br>Level of Thinking | Continuous Learning Assessment (CLA)             |          |                                      |          | Summative<br>Final Examination<br>(40% weightage) |          |
|                     |                              | Formative<br>CLA-1 Average of Unit test<br>(50%) |          | Life-Long Learning<br>CLA-2<br>(10%) |          |                                                   |          |
|                     |                              | Theory                                           | Practice | Theory                               | Practice | Theory                                            | Practice |
| Level 1             | Remember                     | 20%                                              | -        | 20%                                  | -        | 20%                                               | -        |
| Level 2             | Understand                   | 20%                                              | -        | 20%                                  | -        | 20%                                               | -        |
| Level 3             | Apply                        | 30%                                              | -        | 30%                                  | -        | 30%                                               | -        |
| Level 4             | Analyze                      | 30%                                              | -        | 30%                                  | -        | 30%                                               | -        |
| Level 5             | Evaluate                     | -                                                | -        | -                                    | -        | -                                                 | -        |
| Level 6             | Create                       | -                                                | -        | -                                    | -        | -                                                 | -        |
|                     | Total                        | 100 %                                            |          | 100 %                                |          | 100 %                                             |          |

| <b>Course Designers</b> |                                            |                               |
|-------------------------|--------------------------------------------|-------------------------------|
| Experts from Industry   | Experts from Higher Technical Institutions | Internal Experts              |
|                         |                                            | Dr. S. Periyar Selvam, SRMIST |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |                                                                                                      |                                              |                       |                               |     |                       |                     |                         |     |   |        |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------------------------------------------------------------------------------------------|----------------------------------------------|-----------------------|-------------------------------|-----|-----------------------|---------------------|-------------------------|-----|---|--------|--|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 21FPE517T | Course Name                                                                                          | MEAT, POULTRY AND FISH PROCESSING TECHNOLOGY |                       | Course Category               | E   | PROFESSIONAL ELECTIVE |                     | L                       | T   | P | C      |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |                                                                                                      |                                              |                       |                               |     |                       |                     | 3                       | 0   | 0 | 3      |  |
| Pre-requisite Courses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           | Nil                                                                                                  |                                              | Co- requisite Courses |                               | Nil |                       | Progressive Courses |                         | Nil |   |        |  |
| Course Offering Department                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | Food Process Engineering                                                                             |                                              |                       | Data Book / Codes / Standards |     |                       | Nil                 |                         |     |   |        |  |
| Course Learning Rationale (CLR):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           | The purpose of learning this course is to:                                                           |                                              |                       |                               |     |                       |                     |                         |     |   |        |  |
| CLR-1:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           | understand Structure and composition of meat.                                                        |                                              |                       |                               |     |                       |                     |                         |     |   |        |  |
| CLR-2:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           | attain information Processing and preservation of poultry meat.                                      |                                              |                       |                               |     |                       |                     |                         |     |   |        |  |
| CLR-3:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           | know the factors affecting Processing, preservation and transportation of fish.                      |                                              |                       |                               |     |                       |                     |                         |     |   |        |  |
| CLR-4:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           | know the techniques Processing, preservation and transportation of egg.                              |                                              |                       |                               |     |                       |                     |                         |     |   |        |  |
| CLR-5:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           | attain information relevant to multitarget preservation and food safety tool to avoid the hazards    |                                              |                       |                               |     |                       |                     |                         |     |   |        |  |
| Course Outcomes (CO):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           | At the end of this course, learners will be able to:                                                 |                                              |                       |                               |     |                       |                     | Programme Outcomes (PO) |     |   |        |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |                                                                                                      |                                              |                       |                               |     |                       |                     | 1                       | 2   | 3 |        |  |
| CO-1:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           | enrich the technical acquaintance Chilling, freezing, canning, cooking, drying and pickling of meat. |                                              |                       |                               |     |                       |                     |                         | √   |   |        |  |
| CO-2:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           | ascertain Slaughtering, dressing, handling, storage and preservation of poultry meat.                |                                              |                       |                               |     |                       |                     |                         |     | √ |        |  |
| CO-3:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           | know Postmortem changes in fish muscle, freezing of fish and shell fish                              |                                              |                       |                               |     |                       |                     | √                       |     |   |        |  |
| CO-4:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           | acquire the technical knowledge On intricacies' Storage and handling                                 |                                              |                       |                               |     |                       |                     |                         | √   |   |        |  |
| CO-5:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           | identify Hazard assessment                                                                           |                                              |                       |                               |     |                       |                     |                         |     | √ |        |  |
| Module-1 Meat Composition from Different Sources                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |                                                                                                      |                                              |                       |                               |     |                       |                     |                         |     |   | 9 Hour |  |
| Meat composition from different sources; muscle structure and compositions; post-mortem muscle chemistry; Factors influencing the quality of meat. Meat Microbiology and safety. Ante mortem inspection and handling, Stunning types, Slaughtering types. Steps in slaughtering (Pig, Cattle, Sheep/ Goat) and dressing, Slaughter house operations; Modern abattoirs, typical layout and features, Offal handling and inspection. Grading of meat – retail and wholesale cuts. Operational factors affecting meat quality. Byproduct utilization |           |                                                                                                      |                                              |                       |                               |     |                       |                     |                         |     |   |        |  |
| Module-2 Processing and Preservation Of Meat                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |                                                                                                      |                                              |                       |                               |     |                       |                     |                         |     |   | 9 Hour |  |
| Processing and preservation of meat: Chilling and freezing of meat, Canning, cooking, drying, pickling, curing and smoking; prepared meat products like sausages, kebabs, etc. Intermediate moisture and dried meat products, Packaging of meat products. Meat plant hygiene – GMP, ageing of meat                                                                                                                                                                                                                                                |           |                                                                                                      |                                              |                       |                               |     |                       |                     |                         |     |   |        |  |
| Module-3 Poultry Processing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           |                                                                                                      |                                              |                       |                               |     |                       |                     |                         |     |   | 9 Hour |  |
| Poultry: methods of slaughtering, Slaughtering equipment and operations, dressing, handling, storage, and preservation of poultry meat. Spoilage and its control. Freezing and chilling of poultry. byproduct utilization                                                                                                                                                                                                                                                                                                                         |           |                                                                                                      |                                              |                       |                               |     |                       |                     |                         |     |   |        |  |
| Module-4 Eggs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |                                                                                                      |                                              |                       |                               |     |                       |                     |                         |     |   | 9 Hour |  |
| Eggs: Composition, handling, candling, washing, coating, packaging and storage. Egg processing. Egg powder manufacturing and pasteurization. Egg spoilage and its control, Egg Products and their nutritive Value                                                                                                                                                                                                                                                                                                                                 |           |                                                                                                      |                                              |                       |                               |     |                       |                     |                         |     |   |        |  |
| Module-5 Fish and Marine Products Technology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |                                                                                                      |                                              |                       |                               |     |                       |                     |                         |     |   | 9 Hour |  |
| Fish and Marine Products Technology, Fish and Marine Products and their nutritive value, commercially important marine products from India, Proximate composition, Postmortem changes in fish muscle. Handling, preservation and transportation of fish, Microbial spoilage of fish, Freezing of fish and shell fish., Entrepreneurship Development in Meat and Seafood Industry                                                                                                                                                                  |           |                                                                                                      |                                              |                       |                               |     |                       |                     |                         |     |   |        |  |

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

| Learning Assessment |                              |                                                    |          |                                      |          |                                                   |          |
|---------------------|------------------------------|----------------------------------------------------|----------|--------------------------------------|----------|---------------------------------------------------|----------|
|                     | Bloom's<br>Level of Thinking | Continuous Learning Assessment (CLA)               |          |                                      |          | Summative<br>Final Examination<br>(40% weightage) |          |
|                     |                              | Formative<br>CLA-1 Average of Module test<br>(50%) |          | Life-Long Learning<br>CLA-2<br>(10%) |          |                                                   |          |
|                     |                              | Theory                                             | Practice | Theory                               | Practice | Theory                                            | Practice |
| Level 1             | Remember                     | 20%                                                | -        | 20%                                  | -        | 20%                                               | -        |
| Level 2             | Understand                   | 20%                                                | -        | 20%                                  | -        | 20%                                               | -        |
| Level 3             | Apply                        | 30%                                                | -        | 30%                                  | -        | 30%                                               | -        |
| Level 4             | Analyze                      | 30%                                                | -        | 30%                                  | -        | 30%                                               | -        |
| Level 5             | Evaluate                     | -                                                  | -        | -                                    | -        | -                                                 | -        |
| Level 6             | Create                       | -                                                  | -        | -                                    | -        | -                                                 | -        |
|                     | Total                        | 100 %                                              |          | 100 %                                |          | 100 %                                             |          |

| <b>Course Designers</b> |                                            |                              |
|-------------------------|--------------------------------------------|------------------------------|
| Experts from Industry   | Experts from Higher Technical Institutions | Internal Experts             |
|                         |                                            | Dr. G.Sarathchandra, SRM IST |
|                         |                                            | Dr. P. Gurumoorthi, SRM IST  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                |             |                                    |                               |                 |                     |                       |   |   |   |                         |   |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-------------|------------------------------------|-------------------------------|-----------------|---------------------|-----------------------|---|---|---|-------------------------|---|---|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 21FPE518T                                                                                                                      | Course Name | NUTRACEUTICAL AND FUNCTIONAL FOODS |                               | Course Category | E                   | PROFESSIONAL ELECTIVE |   |   | L | T                       | P | C |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                |             |                                    |                               |                 |                     | 3                     | 0 | 0 | 3 |                         |   |   |
| Pre-requisite Courses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Nil                                                                                                                            |             | Co- requisite Courses              | Nil                           |                 | Progressive Courses | Nil                   |   |   |   |                         |   |   |
| Course Offering Department                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Food Process Engineering                                                                                                       |             |                                    | Data Book / Codes / Standards |                 |                     | Nil                   |   |   |   |                         |   |   |
| Course Learning Rationale (CLR):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | The purpose of learning this course is to:                                                                                     |             |                                    |                               |                 |                     |                       |   |   |   |                         |   |   |
| CLR-1:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | explain about linking between nutrition and Medicine.                                                                          |             |                                    |                               |                 |                     |                       |   |   |   |                         |   |   |
| CLR-2:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | describe about flavonoids and its health benefits.                                                                             |             |                                    |                               |                 |                     |                       |   |   |   |                         |   |   |
| CLR-3:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | analyze about the bioactive compounds from plant sources used as health supplements.                                           |             |                                    |                               |                 |                     |                       |   |   |   |                         |   |   |
| CLR-4:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | describe phytoestrogen and its role in health benefits as supplementary products.                                              |             |                                    |                               |                 |                     |                       |   |   |   |                         |   |   |
| CLR-5:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | discuss about nutraceuticals, efficacy, safety and toxicity                                                                    |             |                                    |                               |                 |                     |                       |   |   |   |                         |   |   |
| Course Outcomes (CO):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | At the end of this course, learners will be able to:                                                                           |             |                                    |                               |                 |                     |                       |   |   |   | Programme Outcomes (PO) |   |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                |             |                                    |                               |                 |                     |                       |   |   |   | 1                       | 2 | 3 |
| CO-1:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | understand the basic concepts of nutraceutical and its classification used as health supplements.                              |             |                                    |                               |                 |                     |                       |   |   |   |                         | √ |   |
| CO-2:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | learned function of flavonoids health benefits for cardiovascular disease and bone health.                                     |             |                                    |                               |                 |                     |                       |   |   |   |                         | √ |   |
| CO-3:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | analyze about the important of plant derived bioactive compounds potential to control the risk of diseases.                    |             |                                    |                               |                 |                     |                       |   |   |   | √                       |   |   |
| CO-4:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | understood the vital role of phytosterol derived from plants source used to prevent cancer and other diseases.                 |             |                                    |                               |                 |                     |                       |   |   |   |                         |   | √ |
| CO-5:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | described about role of Bioactive compound used for reduce the risk of CVD, Diabetics, CNS disorders and Respiratory disorder. |             |                                    |                               |                 |                     |                       |   |   |   |                         |   | √ |
| Module-1. Concepts of Nutraceutical: Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                |             |                                    |                               |                 |                     |                       |   |   |   | 9 Hour                  |   |   |
| Classification of Nutraceutical; Definition, History, Classification of Functional Foods: Probiotics, Prebiotics and Symbiotics; Nutrient vs. Non-nutrient; Prebiotics - Chemistry, Sources and Bioavailability, Effect of Processing, Effects on Human Health and Potential Applications in Risk Reduction of Diseases, Perspective for Food Applications for the Following: Non-Digestible Carbohydrates/Oligosaccharides: Dietary Fibre; Resistant Starch, Gums                                                                                       |                                                                                                                                |             |                                    |                               |                 |                     |                       |   |   |   |                         |   |   |
| Module-2 Plant Metabolites and Non- Nutrients                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                |             |                                    |                               |                 |                     |                       |   |   |   | 9 Hour                  |   |   |
| Plant Metabolites and Non- Nutrient Effect of Specific Nutrients: Alkaloids, Glucosinolates, Terpenoids and Phenolics- Chemistry, Classes, Sources, Bioavailability and Effects on Human Health; Antinutrients Present in Food: Phytate, Saponin, Haemagglutinins, Protease, Amylase and Lipase Inhibitors. Spices and Condiments Nutritive Value and Uses in Cooking. Non- Nutrient Effect of Specific Nutrients: Proteins, Peptides and Nucleotides, Conjugated Linoleic Acid and n-3 Fatty Acids, Vitamins and Minerals                               |                                                                                                                                |             |                                    |                               |                 |                     |                       |   |   |   |                         |   |   |
| Module-3 Properties, Structures and Functions of Nutraceuticals                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                |             |                                    |                               |                 |                     |                       |   |   |   | 9 Hour                  |   |   |
| Introduction to Nutraceuticals as Science - Historical Perspective, Classification, Scope and Prospects; Applied Aspects of Nutraceutical Science: Sources of Nutraceuticals. Relation of Nutraceutical Science with Other Sciences: Medicine, Human Physiology, Genetics, Food Technology, Chemistry and Nutrition; Properties, Structure and Functions of Various Nutraceuticals Glucosamine, Octacosanol, Lycopene, Carnitine, Melatonin and Ornithine Alpha Ketoglutarate. Use of Proanthocyanidins, Grape Products, Flaxseed Oil as Nutraceuticals. |                                                                                                                                |             |                                    |                               |                 |                     |                       |   |   |   |                         |   |   |
| Module-4 Nutraceutical: Applied Aspects and Relation with Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                |             |                                    |                               |                 |                     |                       |   |   |   | 9 Hour                  |   |   |
| Nutraceutical: Applied Aspects and Relation with Science: Relation of Nutraceutical Science with Other Sciences: Nutraceuticals in Medicine; Nutraceuticals for Cardiovascular Diseases; Nutraceuticals against Alzheimer's Diseases: Nutraceuticals for Diabetes: Nutraceuticals in Parkinson's diseases: Nutraceuticals in Cancer: Nutraceuticals and Gene Interactions.                                                                                                                                                                               |                                                                                                                                |             |                                    |                               |                 |                     |                       |   |   |   |                         |   |   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |
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| <b>Module-5 Nutraceuticals in Food Processing Technology, Chemistry and Nutrition</b>                                                                                                                                                                                                                                                                                                                                                                                                              | <b>9 Hour</b> |
| Nutraceuticals in Food Processing Technology, Chemistry and Nutrition: Biotechnology in the Product Development of Nutraceuticals; Nanotechnology for Enhancing the Bioavailability and Delivery of Nutraceuticals; Nutraceutical Supplements and Remedies; Nutraceutical Supplements from Plant Sources; Nutraceutical Components from Animal Sources; Marine Sources as Nutraceutical Rich Supplements; Nutraceutical Remedies for Arthritis, Bronchitis, Circulatory Problems And Hypoglycemia. |               |

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Learning Resources</b> | <ol style="list-style-type: none"> <li>Vattem, Dhiraj A. and Vatsala Maitin. 2016. <i>Functional Foods, Nutraceuticals and Natural Products, Concepts and Applications</i>. USA: DEStech Publications, Inc.</li> <li>Boye, Joyce I. 2015. <i>Nutraceutical and Functional Food Processing Technology</i>. New Jersey: Wiley-Blackwell.</li> <li>Iwu, Maurice M. 2017. <i>Food as Medicine: Functional Food Plants of Africa</i>. US: CRC Press.</li> <li>Cho, S. S. and M. L. Dreher. 2001. <i>Handbook of Dietary Fiber</i>. New York: Marcel Dekker Inc.</li> <li>Wildman, R. E. C. 2000. <i>Handbook of Nutraceuticals and Functional Foods</i>. Boca Raton: CRC Press.</li> <li>Aluko, Rotimi E. 2012. <i>Functional Foods and Nutraceuticals</i>. Germany: Springer</li> </ol> |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| Learning Assessment |                              |                                                  |          |                                      |          |                                                   |          |
|---------------------|------------------------------|--------------------------------------------------|----------|--------------------------------------|----------|---------------------------------------------------|----------|
|                     | Bloom's<br>Level of Thinking | Continuous Learning Assessment (CLA)             |          |                                      |          | Summative<br>Final Examination<br>(40% weightage) |          |
|                     |                              | Formative<br>CLA-1 Average of Unit test<br>(50%) |          | Life-Long Learning<br>CLA-2<br>(10%) |          |                                                   |          |
|                     |                              | Theory                                           | Practice | Theory                               | Practice | Theory                                            | Practice |
| Level 1             | Remember                     | 15%                                              | -        | 15%                                  | -        | 15%                                               | -        |
| Level 2             | Understand                   | 25%                                              | -        | 20%                                  | -        | 25%                                               | -        |
| Level 3             | Apply                        | 30%                                              | -        | 25%                                  | -        | 30%                                               | -        |
| Level 4             | Analyze                      | 30%                                              | -        | 25%                                  | -        | 30%                                               | -        |
| Level 5             | Evaluate                     | -                                                | -        | 10%                                  | -        | -                                                 | -        |
| Level 6             | Create                       | -                                                | -        | 5%                                   | -        | -                                                 | -        |
|                     | Total                        | 100 %                                            |          | 100 %                                |          | 100 %                                             |          |

| Course Designers      |                                            |                             |
|-----------------------|--------------------------------------------|-----------------------------|
| Experts from Industry | Experts from Higher Technical Institutions | Internal Experts            |
|                       |                                            | Dr. P. Gurumoorthi, SRM IST |

|             |           |             |                                                            |                 |   |                       |   |   |   |   |
|-------------|-----------|-------------|------------------------------------------------------------|-----------------|---|-----------------------|---|---|---|---|
| Course Code | 21FPE519T | Course Name | FOOD INGREDIENTS, SUPPLEMENTS AND FORTIFICATION TECHNOLOGY | Course Category | E | PROFESSIONAL ELECTIVE | L | T | P | C |
|             |           |             |                                                            |                 |   |                       | 3 | 0 | 0 | 3 |

|                            |                          |                             |     |                     |     |
|----------------------------|--------------------------|-----------------------------|-----|---------------------|-----|
| Pre-requisite Courses      | Nil                      | Co-requisite Courses        | Nil | Progressive Courses | Nil |
| Course Offering Department | Food Process Engineering | Data Book / Codes/Standards | Nil |                     |     |

|                                  |                                                                                                                   |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Course Learning Rationale (CLR): | <b>The purpose of learning this course is to:</b>                                                                 |
| CLR-1 :                          | comprehend sensory modification, additive functions, and waste valorization for sustainable food production.      |
| CLR-2 :                          | analyze fortification and supplementation principles, addressing nutrient deficiencies and regulatory compliance. |
| CLR-3 :                          | apply knowledge in developing health foods with optimized nutrition, packaging, and shelf life.                   |
| CLR-4 :                          | evaluate bioavailability, technological constraints, and safety considerations in fortification strategies.       |
| CLR-5 :                          | explore the role of ingredients in sensory enhancement and preservation for quality food processing.              |

|                       |                                                                                                                            |                                |          |          |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------|----------|
| Course Outcomes (CO): | <b>At the end of this course, learners will be able to:</b>                                                                | <b>Programme Outcomes (PO)</b> |          |          |
|                       |                                                                                                                            | <b>1</b>                       | <b>2</b> | <b>3</b> |
| CO-1:                 | understand principles of sensory modification, additive functions, and waste valorization for sustainable food production. |                                |          | √        |
| CO-2:                 | analyze fortification and supplementation principles to address nutrient deficiencies and ensure regulatory compliance.    |                                | √        |          |
| CO-3:                 | apply knowledge to develop health foods with optimized nutrition, packaging, and shelf life.                               |                                | √        |          |
| CO-4:                 | evaluate bioavailability, technological constraints, and safety considerations in fortification strategies.                |                                |          | √        |
| CO-5:                 | explore ingredient roles in sensory enhancement and preservation for quality food processing.                              |                                |          | √        |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <b>Module 1 . Introduction to Food Ingredients</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>9 Hours</b> |
| Ingredients and processes that modify the color, Ingredients and processes that modify flavor and aroma, Ingredients and processes that modify the texture, Ingredients and processes that modify the sound, Preservatives, Antioxidants, Phosphates, Food and texture, Rheology, hydrocolloids, Emulsions, Oils and fats, Emulsions and emulsifiers; Industrial ingredients- Flour, starches and starch derivatives, fibers, Vegetable proteins, Milk proteins, Animal proteins                                                                                                                      |                |
| <b>Module 2 . Novel Food Ingredients</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>9 Hours</b> |
| Novel bioactive ingredients and waste valorization of high value products extracted from food waste streams, Bioactive components for control of chronic disease conditions, Legislation and regulation, including health claims and EFSA definitions, Technologies for organoleptic property control and enhancement of ingredient bioavailability.                                                                                                                                                                                                                                                  |                |
| <b>Module 3. Food Fortification</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>9 Hours</b> |
| Food Fortification Needs, objectives, principles and rationale, selection, and basis of fortificant. Technology of fortifying food products Characteristics of nutrients used in cereal fortification; Types and levels of micronutrients to be added; Fortification methods; Fortification premixes, Design and composition of premixes and quality control; Rationale for micronutrient fortification of snack products, Merits and demerits of fortification, Choice of products and selection of micronutrients, Fortification of cereal foods, beverages, oil, salt, sugar, Oil, Dairy products. |                |
| <b>Module 4. Food Supplementation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>9 Hours</b> |
| Food supplements, Need for supplementary foods, Technology for food supplementations, National and International regulatory requirements for supplementary foods and packs. Supplements and toxicity related to dose: common dietary supplements; relevance of the dose; possible toxic effects.                                                                                                                                                                                                                                                                                                      |                |
| <b>Module 5. Regulatory Requirements for Health claims</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>9 Hours</b> |
| Health Foods Selection of nutrients, Technology of incorporation, Bioavailability, Packaging, Shelf life. Setting level of fortification, Safety limits, Technological and cost limits, Challenges in fortifying snack products, Nutrient interaction and bioavailability of fortified nutrients and supplements.                                                                                                                                                                                                                                                                                     |                |

|                           |                                                                                                                                                                                |                                                                                                                                                                          |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Learning Resources</b> | 1. Klaassen, Curtis; Watkins III, John B. (2015), Casarett & Doull's Essentials of Toxicology, Third Edition, McGraw-Hill Medical, ISBN 10: 0071847081 ISBN 13: 9780071847087. | 5. Shibamoto, T., and Bjeldanes, L. (2009) Introduction to Food Toxicology, 2nd Ed. Elsevier Inc., Burlington, MA                                                        |
|                           | 2. Tõnu Püssa (2013), Principles of Food Toxicology, Second Edition, CRC Press, ISBN 9781466504103.                                                                            | 6. Watson, D.H. (1998) Natural Toxicants in Food, CRC Press, LLC. Boca Raton, FL                                                                                         |
|                           | 3. S.S. Deshpande Ed (2013), Handbook of Food Toxicology, CRC Press, ISBN 9780824707606.                                                                                       | 7. Duffus, J.H., and Worth, H.G. J. (2006) Fundamental Toxicology, The Royal Society of Chemistry                                                                        |
|                           | 4. Helferich, W., and Winter, C.K. (2001) Food Toxicology, CRC Press, LLC. Boca Raton, FL                                                                                      | 8. Stine, K.E., and Brown, T.M. (2006) Principles of Toxicology, 2nd Ed. CRC Press.<br>9. Tõnu, P. (2007) Principles of Food Toxicology. CRC Press, LLC. Boca Raton, FL. |

| Learning Assessment |                              |                                                  |          |                                        |          |                                                   |          |
|---------------------|------------------------------|--------------------------------------------------|----------|----------------------------------------|----------|---------------------------------------------------|----------|
|                     | Bloom's<br>Level of Thinking | Continuous Learning Assessment (CLA)             |          |                                        |          | Summative<br>Final Examination<br>(40% weightage) |          |
|                     |                              | Formative<br>CLA-1 Average of Unit test<br>(50%) |          | Life Long Learning<br>CLA-2 –<br>(10%) |          |                                                   |          |
|                     |                              | Theory                                           | Practice | Theory                                 | Practice | Theory                                            | Practice |
| Level 1             | Remember                     | 15%                                              | -        | 15%                                    | -        | 15%                                               | -        |
| Level 2             | Understand                   | 25%                                              | -        | 20%                                    | -        | 25%                                               | -        |
| Level 3             | Apply                        | 30%                                              | -        | 25%                                    | -        | 30%                                               | -        |
| Level 4             | Analyze                      | 30%                                              | -        | 25%                                    | -        | 30%                                               | -        |
| Level 5             | Evaluate                     | -                                                | -        | 10%                                    | -        | -                                                 | -        |
| Level 6             | Create                       | -                                                | -        | 5%                                     | -        | -                                                 | -        |
|                     | Total                        | 100 %                                            |          | 100 %                                  |          | 100 %                                             |          |

| <b>Course Designers</b> |                                            |                                |
|-------------------------|--------------------------------------------|--------------------------------|
| Experts from Industry   | Experts from Higher Technical Institutions | Internal Experts               |
|                         |                                            | Dr. G. Nagamianiammai, SRM IST |

|             |           |             |                                                   |                 |   |                       |   |   |   |   |
|-------------|-----------|-------------|---------------------------------------------------|-----------------|---|-----------------------|---|---|---|---|
| Course Code | 21FPE520T | Course Name | FOOD INDUSTRY WASTE MANAGEMENT FOR SUSTAINABILITY | Course Category | E | PROFESSIONAL ELECTIVE | L | T | P | C |
|             |           |             |                                                   |                 |   |                       | 3 | 0 | 0 | 3 |

|                            |                          |                               |     |                     |     |
|----------------------------|--------------------------|-------------------------------|-----|---------------------|-----|
| Pre-requisite Courses      | NIL                      | Co-requisite Courses          | NIL | Progressive Courses | NIL |
| Course Offering Department | Food Process Engineering | Data Book / Codes / Standards | NIL |                     |     |

|                                  |                                                                                                                          |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Course Learning Rationale (CLR): | <i>The purpose of learning this course is to:</i>                                                                        |
| CLR-1:                           | <i>apply the concepts in sustainable waste management for food industry waste management</i>                             |
| CLR-2:                           | <i>use waste management tools in fruit and vegetable industry waste management</i>                                       |
| CLR-3:                           | <i>design of large-scale waste management methods and waste utilization in tuber crop and sugar industry</i>             |
| CLR-4:                           | <i>apply large-scale waste management methods and waste utilization in fish processing, poultry and dairy industry</i>   |
| CLR-5:                           | <i>explain about design of brewery industry waste management, solid waste management and coconut industry byproducts</i> |

| Course Outcomes (CO): | At the end of this course, learners will be able to:                                                                   | Programme Outcomes (PO) |   |   |
|-----------------------|------------------------------------------------------------------------------------------------------------------------|-------------------------|---|---|
|                       |                                                                                                                        | 1                       | 2 | 3 |
| CO-1:                 | <i>apply the Knowledge of sustainable food industry waste management</i>                                               |                         | √ |   |
| CO-2:                 | <i>gain familiarity in fruit and vegetable industry waste management</i>                                               |                         |   | √ |
| CO-3:                 | <i>gain familiarity in large-scale waste management methods and waste utilization in tuber crop and sugar industry</i> |                         | √ |   |
| CO-4:                 | <i>gain the knowledge about fish processing, poultry and dairy industry</i>                                            |                         |   | √ |
| CO-5:                 | <i>gain the knowledge of brewery industry waste management, solid waste management and coconut industry byproducts</i> |                         |   | √ |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <b>Module-1 Sustainable Development, Circular Economy and Waste Management in Food Industry</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>15 Hour</b> |
| <i>sustainable development in food sector, challenges and possibilities, circular economy in food waste management, the impact of food waste. main types of food losses and wastage. nature of food industry waste. biochemical composition of agriculture residues/food waste. uses of food-industrial residues. energy from `combustion, gasification and pyrolysis of solid agro or food waste. combustion and burning of waste for heat/energy generation thermo-chemical process. Technologies to convert rice biomass into energy, Bio-chemical process, Biodiesel and ethanol production, Waste Management in food Industries. food waste composting, benefits of compost to the environment and agriculture, environment composting methods. technologies to convert rice biomass into energy; utilization of lignocellulose waste from food industry, paper making from cellulosic waste.</i>       |                |
| <b>Module-2 Perishable Food Waste Management</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>15 Hour</b> |
| <i>global scenario of fruit and vegetable waste. different sources of fruit and vegetable wastes, fruit and vegetable processing industries and waste generation in India. utilization of fruit and vegetable waste for generation of biofuel. different steps in converting vegetable waste to biofuel production. biodiesel and bio-ethanol production from fruit and vegetable waste. bio-ethanol production from waste potatoes. types of byproducts of fruit and vegetable processing industry. isolation of cellulose from vegetable and fruit wastes and its utilization's production from fruit and vegetable waste organic acid production from vegetable waste. bioactive compounds from food industry waste. fish industry waste, applications of chitosan, methods and production of fish meal, fish oils, fish protein concentrate, types of waste from poultry, poultry waste utilization,</i> |                |
| <b>Module-3 Food industry Waste Utilization and Waste Treatment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>15 Hour</b> |
| <i>waste from rice mill industry. utilization of rice husk- cement preparation, ceramic materials. ceramic materials from rice husk. utilization of rice bran, problems in processing of rice bran, stabilization-methods of utilization, rice bran stabilizers, uses of bran, bran oil and defatted bran. waste from tuber crops, waste recycling plant. by products from tuber crop waste, potato and tapioca waste utilization, bio-ethanol production from potato waste, bio-ethanol production from waste potato's, biotechnological potential of cassava bagasse, dairy waste sources, characteristics of dairy waste, mechanical, and chemical treatment of dairy waste water, biological treatment of dairy waste water. advanced technologies for dairy effluent treatment, dairy industry by-products utilization of lignocellulose waste from</i>                                                 |                |

food industry, sources of wastewater in a sugar industry, wastewater treatment of sugar industry, waste water treatment of sugar industry. waste water recycling, alcohol production from cane sugar industry waste from coconut processing units, uses of coir pith, biogas production- particle board, utilization of coconut husk-coir fiber, coconut shell utilization methods for production of shell charcoal, fuel briquette preparation, fuel briquette-machineries used.

|                           |                                                                                                                                     |                                                                                                                                                                                     |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Learning Resources</b> | 1. .Lerwen Liu, and Ramakrishna. <i>An Introduction to Circular Economy</i> . Springer, New York, USA. 2021 ISBN: 978-981-15-8509-8 | 3. Ashok Panday <i>Biotechnology of agro-industry waste utilization</i> Springer, New York, USA, 2009.                                                                              |
|                           | 2. Ioannis Arvanitoyannis. <i>Waste management for Food Industries</i> , Academic Press , USA 2013                                  | 4. Elina Närvänen , Nina Mesiranta, Malla Mattila, Anna Heikkinen . <i>Food Waste Management: Solving the Wicked Problem</i> Paperback pringer Nature Switzerland AG; 1st ed. 2020. |

| Learning Assessment |                              |                                                    |          |                                      |          |                                                   |          |
|---------------------|------------------------------|----------------------------------------------------|----------|--------------------------------------|----------|---------------------------------------------------|----------|
|                     | Bloom's<br>Level of Thinking | Continuous Learning Assessment (CLA)               |          |                                      |          | Summative<br>Final Examination<br>(40% weightage) |          |
|                     |                              | Formative<br>CLA-1 Average of Module test<br>(50%) |          | Life-Long Learning<br>CLA-2<br>(10%) |          |                                                   |          |
|                     |                              | Theory                                             | Practice | Theory                               | Practice | Theory                                            | Practice |
| Level 1             | Remember                     | 15%                                                | -        | 15%                                  | -        | 15%                                               | -        |
| Level 2             | Understand                   | 25%                                                | -        | 20%                                  | -        | 25%                                               | -        |
| Level 3             | Apply                        | 30%                                                | -        | 25%                                  | -        | 30%                                               | -        |
| Level 4             | Analyze                      | 30%                                                | -        | 25%                                  | -        | 30%                                               | -        |
| Level 5             | Evaluate                     | -                                                  | -        | 10%                                  | -        | -                                                 | -        |
| Level 6             | Create                       | -                                                  | -        | 5%                                   | -        | -                                                 | -        |
|                     | Total                        | 100 %                                              |          | 100 %                                |          | 100 %                                             |          |

| <b>Course Designers</b> |                                            |                       |
|-------------------------|--------------------------------------------|-----------------------|
| Experts from Industry   | Experts from Higher Technical Institutions | Internal Experts      |
|                         |                                            | Dr R Preetha, SRM IST |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                                                                     |                                     |                       |                               |     |                       |                     |  |     |   |                         |        |   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------------------------------------------------------------------|-------------------------------------|-----------------------|-------------------------------|-----|-----------------------|---------------------|--|-----|---|-------------------------|--------|---|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 21FPE521T | Course Name                                                         | BAKERY AND CONFECTIONERY TECHNOLOGY |                       | Course Category               | E   | PROFESSIONAL ELECTIVE |                     |  | L   | T | P                       | C      |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                                                                     |                                     |                       |                               |     |                       |                     |  | 3   | 0 | 0                       | 3      |   |
| Pre-requisite Courses                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           | Nil                                                                 |                                     | Co- requisite Courses |                               | Nil |                       | Progressive Courses |  | Nil |   |                         |        |   |
| Course Offering Department                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           | Food Process Engineering                                            |                                     |                       | Data Book / Codes / Standards |     |                       | Nil                 |  |     |   |                         |        |   |
| Course Learning Rationale (CLR):                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           | The purpose of learning this course is to:                          |                                     |                       |                               |     |                       |                     |  |     |   |                         |        |   |
| CLR-1:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           | understand the concepts of baking technology                        |                                     |                       |                               |     |                       |                     |  |     |   |                         |        |   |
| CLR-2:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           | know ingredients involved baking process                            |                                     |                       |                               |     |                       |                     |  |     |   |                         |        |   |
| CLR-3:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           | understanding baking industrial requirements                        |                                     |                       |                               |     |                       |                     |  |     |   |                         |        |   |
| CLR-4:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           | quality assurance of baking industries                              |                                     |                       |                               |     |                       |                     |  |     |   |                         |        |   |
| CLR-5:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           | industrial lay out and structural requirement of baking industries. |                                     |                       |                               |     |                       |                     |  |     |   |                         |        |   |
| Course Outcomes (CO):                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           | At the end of this course, learners will be able to:                |                                     |                       |                               |     |                       |                     |  |     |   | Programme Outcomes (PO) |        |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                                                                     |                                     |                       |                               |     |                       |                     |  |     |   | 1                       | 2      | 3 |
| CO-1:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           | demonstrate the baking process                                      |                                     |                       |                               |     |                       |                     |  |     |   |                         | √      |   |
| CO-2:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           | selection of ingredients, utensils and equipment                    |                                     |                       |                               |     |                       |                     |  |     |   |                         | √      |   |
| CO-3:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           | food safety and quality aspects of baking industries                |                                     |                       |                               |     |                       |                     |  |     |   | √                       |        |   |
| CO-4:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           | plan for lay out design for bakery industry                         |                                     |                       |                               |     |                       |                     |  |     |   |                         |        | √ |
| CO-5:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           | extrusion technological aspects.                                    |                                     |                       |                               |     |                       |                     |  |     |   |                         |        | √ |
| Module-1 Introductory Aspects of Bakery and Confectionery Industries                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                                                                     |                                     |                       |                               |     |                       |                     |  |     |   |                         | 9 Hour |   |
| Principles of Baking; Raw Material and their Role – flour, leavening agents, sugars, fats, additives, spice; Types of Bakery Products and Technology for their Manufacture – dough and batters; cakes, pies, pastries, bread, biscuits; Icings and Filling.                                                                                                                                                                                                                                 |           |                                                                     |                                     |                       |                               |     |                       |                     |  |     |   |                         |        |   |
| Module-2 Manufacturing Process of Bakery and Confectionery Products                                                                                                                                                                                                                                                                                                                                                                                                                         |           |                                                                     |                                     |                       |                               |     |                       |                     |  |     |   |                         | 9 Hour |   |
| Principles of Confectionery Manufacture; Raw Material and their Role – interfering agents, inversion of sugars, etc.; Types of Confectionery Products and Technology for their Manufacture; Chocolate – raw material, types, and manufacture                                                                                                                                                                                                                                                |           |                                                                     |                                     |                       |                               |     |                       |                     |  |     |   |                         |        |   |
| Module-3 Food Safety and Quality Aspects of Bakery and Confectionery Industries                                                                                                                                                                                                                                                                                                                                                                                                             |           |                                                                     |                                     |                       |                               |     |                       |                     |  |     |   |                         | 9 Hour |   |
| Quality Parameters of Bakery Products - chemistry of dough and batters; rheological testing and interpretation of data; sensory evaluation; Staling and Nutrient Losses in Bakery Products; Sanitation and Hygiene in a Bakery Module.                                                                                                                                                                                                                                                      |           |                                                                     |                                     |                       |                               |     |                       |                     |  |     |   |                         |        |   |
| Module-4. Machinery and Equipment for Baking Technologies                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |                                                                     |                                     |                       |                               |     |                       |                     |  |     |   |                         | 9 Hour |   |
| Baking Tools and Equipment and their functions; Oven & Baking: Knowledge and working of various types of ovens. Baking temperatures for bread and confectionery goods. Methods of bread making: Straight dough method. delayed salt methods No time dough method. Sponge and dough methods. Characteristics of good bread: External characteristics; Volume, symmetry of shapes Internal characteristics - color, • texture, aroma, clarity and elasticity. Bread faults and their remedies |           |                                                                     |                                     |                       |                               |     |                       |                     |  |     |   |                         |        |   |
| Module-5 Status of Bakery and Confectionery Industries in India                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                                                                     |                                     |                       |                               |     |                       |                     |  |     |   |                         | 9 Hour |   |
| Bakery layout: The required approvals for setting up of a Bakery, Government procedure and Bye laws. Selection of site, Selection of equipment, Layout design, Electricity, Quality control of raw material of finished products.                                                                                                                                                                                                                                                           |           |                                                                     |                                     |                       |                               |     |                       |                     |  |     |   |                         |        |   |

|                           |                                                                                                                                                      |                                                                                          |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| <b>Learning Resources</b> | 1. <i>Extrusion of Food</i> , Vol 2; Harper JM; 1981, CRC Press.                                                                                     | 5. <i>Up to-date Bread Making</i> ; Fance WJ & Wrogg BH; 1968, Macclasen & Sons Ltd.     |
|                           | 2. <i>Bakery Technology &amp; Engineering</i> ; Matz SA; 1960; AVI Pub.                                                                              | 6. <i>Modern Cereal Chemistry</i> ; Kent-Jones DW & Amos AJ; 1967, Food Trade Press Ltd. |
|                           | 3. Hui, Y. H., Corke, H., De Leyn, I., Nip, W. K., & Cross, N. A. (Eds.). (2008). <i>Bakery products: science and technology</i> . John Wiley & Sons |                                                                                          |
|                           | 4. Khetarpaul, N. (2005). <i>Bakery science and cereal technology</i> . Daya Books.                                                                  |                                                                                          |

| Learning Assessment |                              |                                                    |          |                                      |          |                                                   |          |
|---------------------|------------------------------|----------------------------------------------------|----------|--------------------------------------|----------|---------------------------------------------------|----------|
|                     | Bloom's<br>Level of Thinking | Continuous Learning Assessment (CLA)               |          |                                      |          | Summative<br>Final Examination<br>(40% weightage) |          |
|                     |                              | Formative<br>CLA-1 Average of Module test<br>(50%) |          | Life-Long Learning<br>CLA-2<br>(10%) |          |                                                   |          |
|                     |                              | Theory                                             | Practice | Theory                               | Practice | Theory                                            | Practice |
| Level 1             | Remember                     | 15%                                                | -        | 15%                                  | -        | 15%                                               | -        |
| Level 2             | Understand                   | 25%                                                | -        | 20%                                  | -        | 25%                                               | -        |
| Level 3             | Apply                        | 30%                                                | -        | 25%                                  | -        | 30%                                               | -        |
| Level 4             | Analyze                      | 30%                                                | -        | 25%                                  | -        | 30%                                               | -        |
| Level 5             | Evaluate                     | -                                                  | -        | 10%                                  | -        | -                                                 | -        |
| Level 6             | Create                       | -                                                  | -        | 5%                                   | -        | -                                                 | -        |
|                     | Total                        | 100 %                                              |          | 100 %                                |          | 100 %                                             |          |

| <b>Course Designers</b> |                                            |                             |
|-------------------------|--------------------------------------------|-----------------------------|
| Experts from Industry   | Experts from Higher Technical Institutions | Internal Experts            |
|                         |                                            | Dr. P. Gurumoorthi, SRM IST |

|                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                              |                               |                     |                     |     |                                                                                                                                                                                                                                                                               |                         |   |   |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------|---------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---|---|---|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                    | 21FPE522T                                                                                                                                                                                                    | Course Name                   | BEVERAGE TECHNOLOGY | Course Category     | E   | PROFESSIONAL ELECTIVE                                                                                                                                                                                                                                                         | L                       | T | P | C |
|                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                              |                               |                     |                     |     |                                                                                                                                                                                                                                                                               | 3                       | 0 | 0 | 3 |
| Pre-requisite Courses                                                                                                                                                                                                                                                                                                                                                                                          | Nil                                                                                                                                                                                                          | Co- requisite Courses         | Nil                 | Progressive Courses | Nil |                                                                                                                                                                                                                                                                               |                         |   |   |   |
| Course Offering Department                                                                                                                                                                                                                                                                                                                                                                                     | Food Process Engineering                                                                                                                                                                                     | Data Book / Codes / Standards |                     |                     |     |                                                                                                                                                                                                                                                                               |                         |   |   |   |
| Course Learning Rationale (CLR):                                                                                                                                                                                                                                                                                                                                                                               | The purpose of learning this course is to:                                                                                                                                                                   |                               |                     |                     |     |                                                                                                                                                                                                                                                                               |                         |   |   |   |
| CLR-1:                                                                                                                                                                                                                                                                                                                                                                                                         | realize the concept of quality control in soft drink industries                                                                                                                                              |                               |                     |                     |     |                                                                                                                                                                                                                                                                               |                         |   |   |   |
| CLR-2:                                                                                                                                                                                                                                                                                                                                                                                                         | know the advantage and disadvantages of alcoholic beverages                                                                                                                                                  |                               |                     |                     |     |                                                                                                                                                                                                                                                                               |                         |   |   |   |
| CLR-3:                                                                                                                                                                                                                                                                                                                                                                                                         | create awareness on functional beverages                                                                                                                                                                     |                               |                     |                     |     |                                                                                                                                                                                                                                                                               |                         |   |   |   |
| CLR-4:                                                                                                                                                                                                                                                                                                                                                                                                         | understand the beverages standards and regulation in India                                                                                                                                                   |                               |                     |                     |     |                                                                                                                                                                                                                                                                               |                         |   |   |   |
| CLR-5:                                                                                                                                                                                                                                                                                                                                                                                                         | learn the risk and quality assessment methods                                                                                                                                                                |                               |                     |                     |     |                                                                                                                                                                                                                                                                               |                         |   |   |   |
| Course Outcomes (CO):                                                                                                                                                                                                                                                                                                                                                                                          | At the end of this course, learners will be able to:                                                                                                                                                         |                               |                     |                     |     |                                                                                                                                                                                                                                                                               | Programme Outcomes (PO) |   |   |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                              |                               |                     |                     |     |                                                                                                                                                                                                                                                                               | 1                       | 2 | 3 |   |
| CO-1:                                                                                                                                                                                                                                                                                                                                                                                                          | enhance the knowledge on types of beverages                                                                                                                                                                  |                               |                     |                     |     |                                                                                                                                                                                                                                                                               | √                       |   |   |   |
| CO-2:                                                                                                                                                                                                                                                                                                                                                                                                          | apply the knowledge on quality control in soft drink industries                                                                                                                                              |                               |                     |                     |     |                                                                                                                                                                                                                                                                               |                         | √ |   |   |
| CO-3:                                                                                                                                                                                                                                                                                                                                                                                                          | gain the knowledge on quality control in alcoholic beverages                                                                                                                                                 |                               |                     |                     |     |                                                                                                                                                                                                                                                                               |                         | √ |   |   |
| CO-4:                                                                                                                                                                                                                                                                                                                                                                                                          | learn the different functional beverages                                                                                                                                                                     |                               |                     |                     |     |                                                                                                                                                                                                                                                                               |                         | √ |   |   |
| CO-5:                                                                                                                                                                                                                                                                                                                                                                                                          | know the implementation of GMP and HACCP in beverage industry                                                                                                                                                |                               |                     |                     |     |                                                                                                                                                                                                                                                                               |                         |   |   | √ |
| Module-1 Types of Beverages and Raw Materials                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                              |                               |                     |                     |     |                                                                                                                                                                                                                                                                               | 9 Hour                  |   |   |   |
| Current status of the beverage industry in India and world, Types of beverages- Alcoholic and non-alcoholic, Nutritional and therapeutic benefits. Raw materials, Water, Acidulants, Emulsifiers, Stabilizers, Sweeteners, Bulking agents, Flavoring, Coloring agents, Threshold limits of ingredients, Threshold limits of water quality, Requirements of soluble solids and titratable acidity in beverages. |                                                                                                                                                                                                              |                               |                     |                     |     |                                                                                                                                                                                                                                                                               |                         |   |   |   |
| Module-2 Non-Alcoholic Beverages                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                              |                               |                     |                     |     |                                                                                                                                                                                                                                                                               | 9 Hour                  |   |   |   |
| Non-Alcoholic Beverages, Natural Fruit based beverages, Synthetic/Artificial beverages, Carbonated beverages, Dairy-based beverages, Whey based beverages, Flavored milk, Advantages and Disadvantages of soft drinks.                                                                                                                                                                                         |                                                                                                                                                                                                              |                               |                     |                     |     |                                                                                                                                                                                                                                                                               |                         |   |   |   |
| Module-3 Alcoholic Beverages                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                              |                               |                     |                     |     |                                                                                                                                                                                                                                                                               | 9 Hour                  |   |   |   |
| Alcoholic Beverages, Types of wine, Types of beer, Distilled beverages, Brandy, Whiskey, Rum, Gin, Production and defects, Advantages and Disadvantages alcoholic beverages.                                                                                                                                                                                                                                   |                                                                                                                                                                                                              |                               |                     |                     |     |                                                                                                                                                                                                                                                                               |                         |   |   |   |
| Module-4 Speciality Beverages                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                              |                               |                     |                     |     |                                                                                                                                                                                                                                                                               | 9 Hour                  |   |   |   |
| Speciality Beverages, Coffee, Tea, Probiotics as ingredient in functional beverage – production, Probiotics health benefits, Fortification of beverages, Specific nutrients in fortification.                                                                                                                                                                                                                  |                                                                                                                                                                                                              |                               |                     |                     |     |                                                                                                                                                                                                                                                                               |                         |   |   |   |
| Module-5 Safety and Quality Control in Beverages                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                              |                               |                     |                     |     |                                                                                                                                                                                                                                                                               | 9 Hour                  |   |   |   |
| Sport beverages, Physiological needs, Formulation, Foodborne Pathogens in Beverages, Quality control in soft drink industries, Sanitation and hygienic in Beverage industries, GMP in the Beverage Industry, Hazard Analysis and Critical Control Points (HACCP).                                                                                                                                              |                                                                                                                                                                                                              |                               |                     |                     |     |                                                                                                                                                                                                                                                                               |                         |   |   |   |
| Learning Resources                                                                                                                                                                                                                                                                                                                                                                                             | 1. Charles Bamforth –Brewing: New Technologies, Woodhead Publishing Limited, England, 2006.<br>2. Varnam AH and Sutherland JM - Beverages: Technology, Chemistry and Microbiology, Springe Publishers, 1999. |                               |                     |                     |     | 3. Debby Newslow. Food Safety Management Programs - Applications, Best Practices, and Compliance, CRC Press, 2013.<br>4. Veslemøy Andersen, Huub Lelieveld, Yasmine Motarjemi. Food Safety Management - A Practical Guide for the Food Industry. 2nd Edition. Elsevier, 2023. |                         |   |   |   |

| Learning Assessment |                              |                                                  |          |                                      |          |                                                   |          |
|---------------------|------------------------------|--------------------------------------------------|----------|--------------------------------------|----------|---------------------------------------------------|----------|
|                     | Bloom's<br>Level of Thinking | Continuous Learning Assessment (CLA)             |          |                                      |          | Summative<br>Final Examination<br>(40% weightage) |          |
|                     |                              | Formative<br>CLA-1 Average of Unit test<br>(50%) |          | Life-Long Learning<br>CLA-2<br>(10%) |          |                                                   |          |
|                     |                              | Theory                                           | Practice | Theory                               | Practice | Theory                                            | Practice |
| Level 1             | Remember                     | 20%                                              | -        | 20%                                  | -        | 20%                                               | -        |
| Level 2             | Understand                   | 20%                                              | -        | 20%                                  | -        | 20%                                               | -        |
| Level 3             | Apply                        | 30%                                              | -        | 30%                                  | -        | 30%                                               | -        |
| Level 4             | Analyze                      | 30%                                              | -        | 30%                                  | -        | 30%                                               | -        |
| Level 5             | Evaluate                     | -                                                | -        | -                                    | -        | -                                                 | -        |
| Level 6             | Create                       | -                                                | -        | -                                    | -        | -                                                 | -        |
|                     | Total                        | 100 %                                            |          | 100 %                                |          | 100 %                                             |          |

| Course Designers      |                                            |                               |
|-----------------------|--------------------------------------------|-------------------------------|
| Experts from Industry | Experts from Higher Technical Institutions | Internal Experts              |
|                       |                                            | Dr. S. Periyar Selvam, SRMIST |

|                                                                                                                                                                                                                                                                                                             |           |                                                                                                                               |                                                 |                      |                             |     |                       |                     |   |                         |        |   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|----------------------|-----------------------------|-----|-----------------------|---------------------|---|-------------------------|--------|---|
| Course Code                                                                                                                                                                                                                                                                                                 | 21FPE523T | Course Name                                                                                                                   | INNOVATIVE DESIGNER FOOD DEVELOPMENT TECHNOLOGY |                      | Course Category             | E   | PROFESSIONAL ELECTIVE |                     | L | T                       | P      | C |
|                                                                                                                                                                                                                                                                                                             |           |                                                                                                                               |                                                 |                      |                             |     |                       |                     | 3 | 0                       | 0      | 3 |
| Pre-requisite Courses                                                                                                                                                                                                                                                                                       |           | NIL                                                                                                                           |                                                 | Co-requisite Courses |                             | NIL |                       | Progressive Courses |   | Nil                     |        |   |
| Course Offering Department                                                                                                                                                                                                                                                                                  |           | Food Process Engineering                                                                                                      |                                                 |                      | Data Book / Codes/Standards |     |                       | Nil                 |   |                         |        |   |
| Course Learning Rationale (CLR):                                                                                                                                                                                                                                                                            |           | The purpose of learning this course is to:                                                                                    |                                                 |                      |                             |     |                       |                     |   |                         |        |   |
| CLR-1 :                                                                                                                                                                                                                                                                                                     |           | understand the concept and significance of designer food products in meeting consumer needs and market demands.               |                                                 |                      |                             |     |                       |                     |   |                         |        |   |
| CLR-2 :                                                                                                                                                                                                                                                                                                     |           | explore the process of ideation, feasibility studies, and consumer research in the development of designer food products.     |                                                 |                      |                             |     |                       |                     |   |                         |        |   |
| CLR-3 :                                                                                                                                                                                                                                                                                                     |           | analyze quality assessment techniques, including sensory evaluation and shelf life testing, for new food product development. |                                                 |                      |                             |     |                       |                     |   |                         |        |   |
| CLR-4 :                                                                                                                                                                                                                                                                                                     |           | investigate the role of technology, such as 3D food printing and encapsulation, in the production of designer food products.  |                                                 |                      |                             |     |                       |                     |   |                         |        |   |
| CLR-5 :                                                                                                                                                                                                                                                                                                     |           | examine the characteristics, consumers, and ethical considerations in food ingredient and service industries.                 |                                                 |                      |                             |     |                       |                     |   |                         |        |   |
| Course Outcomes (CO):                                                                                                                                                                                                                                                                                       |           | At the end of this course, learners will be able to:                                                                          |                                                 |                      |                             |     |                       |                     |   | Programme Outcomes (PO) |        |   |
|                                                                                                                                                                                                                                                                                                             |           |                                                                                                                               |                                                 |                      |                             |     |                       |                     |   | 1                       | 2      | 3 |
| CO-1:                                                                                                                                                                                                                                                                                                       |           | explains about significance and need of new food product development.                                                         |                                                 |                      |                             |     |                       |                     |   |                         | √      |   |
| CO-2:                                                                                                                                                                                                                                                                                                       |           | develop a design of food product development.                                                                                 |                                                 |                      |                             |     |                       |                     |   |                         | √      |   |
| CO-3:                                                                                                                                                                                                                                                                                                       |           | make qualitative evaluation of new food product development.                                                                  |                                                 |                      |                             |     |                       |                     |   |                         |        | √ |
| CO-4:                                                                                                                                                                                                                                                                                                       |           | awareness about food service industries                                                                                       |                                                 |                      |                             |     |                       |                     |   |                         |        | √ |
| CO-5:                                                                                                                                                                                                                                                                                                       |           | know about various special foods                                                                                              |                                                 |                      |                             |     |                       |                     |   |                         | √      |   |
| Module 1. Designer Food Product                                                                                                                                                                                                                                                                             |           |                                                                                                                               |                                                 |                      |                             |     |                       |                     |   |                         | 9 Hour |   |
| Definition, Characteristics, Need for designer food product development. Classification: Line extensions - Repositioning of existing products - new form of existing product - Reformulation - New packaging – Smart packing- Innovative products - Creative products and Value added products              |           |                                                                                                                               |                                                 |                      |                             |     |                       |                     |   |                         |        |   |
| Module 2. Ideation and Technologies                                                                                                                                                                                                                                                                         |           |                                                                                                                               |                                                 |                      |                             |     |                       |                     |   |                         | 9 Hour |   |
| Idea generation, Sources, Screening, Feasibility studies, Consumer research, Product design and Formulation, Process development: Prototype development and scale up. Technologies: 3D food printing – Extrusion – Super critical fluid extraction- Encapsulation- Drying                                   |           |                                                                                                                               |                                                 |                      |                             |     |                       |                     |   |                         |        |   |
| Module 3. Food Product Commercialization                                                                                                                                                                                                                                                                    |           |                                                                                                                               |                                                 |                      |                             |     |                       |                     |   |                         | 9 Hour |   |
| Quality assessment of new developed products -Sensory Evaluation- Shelf-life Testing- Packaging and labeling Trends- Product life cycle, Product Commercialization and Marketing: Costing and Pricing, Test Market, Product launching and Entrepreneurship.                                                 |           |                                                                                                                               |                                                 |                      |                             |     |                       |                     |   |                         |        |   |
| Module 4. Development of Designer Foods                                                                                                                                                                                                                                                                     |           |                                                                                                                               |                                                 |                      |                             |     |                       |                     |   |                         | 9 Hour |   |
| Health foods, medical foods, Therapeutic foods, Herbal foods, Fortified foods. Infant foods, Geriatric foods, Sports drink, Infertility. Functional foods, Designer foods and Nutraceuticals. Prebiotics, Probiotics and Symbiotics.                                                                        |           |                                                                                                                               |                                                 |                      |                             |     |                       |                     |   |                         |        |   |
| Module 5. Food Safety and Regulation                                                                                                                                                                                                                                                                        |           |                                                                                                                               |                                                 |                      |                             |     |                       |                     |   |                         | 9 Hour |   |
| In Food Ingredient Industry: Characteristics, Consumers, Product development and Quality in food ingredient industry. In Food Service Industry: Characteristics, Consumers, Product development and quality in food service industry. Ethics and Intellectual property/ Patents in food product development |           |                                                                                                                               |                                                 |                      |                             |     |                       |                     |   |                         |        |   |

|                           |                                                                                                                       |                                                                                                                                                     |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Learning Resources</b> | 1. Andrew, J.Taylor.(2002). Food Flavor Technology, Sheffield Academic Press.                                         | 4. Mike Stringer and Colin Dennis. (2002). Chilled foods A comprehensive guide, 2nd edition, Woodhead publishing limited, Cambridge, England, 2000. |
|                           | 2. Debashri, Ray. (2002). Nutritional Challenge and Total Quality Management, 1st edition; Sarup and Sons, New Delhi. | 5. Rita Singh. (2004). Food Biotechnology. Volume 1, 1st edition, Global Vision publishing house, Delhi.                                            |
|                           | 3. Man, C.M.D. and Jones, A.A. (1994). Shelf-life Evaluation of Foods, Blackie Academic and Professional, London.     |                                                                                                                                                     |

| Learning Assessment |                              |                                                    |          |                                      |          |                                                   |          |
|---------------------|------------------------------|----------------------------------------------------|----------|--------------------------------------|----------|---------------------------------------------------|----------|
|                     | Bloom's<br>Level of Thinking | Continuous Learning Assessment (CLA)               |          |                                      |          | Summative<br>Final Examination<br>(40% weightage) |          |
|                     |                              | Formative<br>CLA-1 Average of Module test<br>(50%) |          | Life-Long Learning<br>CLA-2<br>(10%) |          |                                                   |          |
|                     |                              | Theory                                             | Practice | Theory                               | Practice | Theory                                            | Practice |
| Level 1             | Remember                     | 15%                                                | -        | 15%                                  | -        | 15%                                               | -        |
| Level 2             | Understand                   | 25%                                                | -        | 20%                                  | -        | 25%                                               | -        |
| Level 3             | Apply                        | 30%                                                | -        | 25%                                  | -        | 30%                                               | -        |
| Level 4             | Analyze                      | 30%                                                | -        | 25%                                  | -        | 30%                                               | -        |
| Level 5             | Evaluate                     | -                                                  | -        | 10%                                  | -        | -                                                 | -        |
| Level 6             | Create                       | -                                                  | -        | 5%                                   | -        | -                                                 | -        |
|                     | Total                        | 100 %                                              |          | 100 %                                |          | 100 %                                             |          |

| <b>Course Designers</b> |                                            |                               |
|-------------------------|--------------------------------------------|-------------------------------|
| Experts from Industry   | Experts from Higher Technical Institutions | Internal Experts              |
|                         |                                            | Dr. G. Nagamaniammai, SRM IST |



**SRM INSTITUTE OF SCIENCE AND TECHNOLOGY**

**(Deemed to be University u/s 3 of UGC Act, 1956)**

Kattankulathur, Chengalpattu District 603203, Tamil Nadu,  
India