RAMAIAH UNIVERSITY OF APPLIED SCIENCES

# M S Ramaiah University of Applied Sciences

# Programme Structure and Course Details of M.Sc. in Food Science and Technology

## Programme Code: 093

## BATCH 2024-2026

**M S Ramaiah University of Applied Sciences**

**Faculty of Life and Allied Health Sciences**

**Department of Food Technology**

Dean - Academics
M.S. Ramaiah University of Applied Sciences
Bangalore - 560 054

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Faculty of Life & Allied Health Sciences
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BANGALORE-560 054

# University's Vision, Mission and Objectives

The M. S. Ramaiah University of Applied Sciences (MSRUAS) will focus on student-centric professional education and motivates its staff and students to contribute significantly to the growth of technology, science, economy and society through their imaginative, creative and innovative pursuits. Hence, the University has articulated the following vision and objectives.

## Vision

MSRUAS aspires to be the premier university of choice in Asia for student centric professional education and services with a strong focus on applied research whilst maintaining the highest academic and ethical standards in a creative and innovative environment

## Mission

Our purpose is the creation and dissemination of knowledge. We are committed to creativity, innovation and excellence in our teaching and research. We value integrity, quality and teamwork in all our endeavors. We inspire critical thinking, personal development and a passion for lifelong learning. We serve the technical, scientific and economic needs of our Society.

## Objectives

1. To disseminate knowledge and skills through instructions, teaching, training, seminars, workshops and symposia in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences to equip students and scholars to meet the needs of industries, business and society
2. To generate knowledge through research in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences to meet the challenges that arise in industry, business and society
3. To promote health, human well-being and provide holistic healthcare
4. To provide technical and scientific solutions to real life problems posed by industry, business and society in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences
5. To instill the spirit of entrepreneurship in our youth to help create more career opportunities in the society by incubating and nurturing technology product ideas and supporting technologybacked business
6. To identify and nurture leadership skills in students and help in the development of our future leaders to enrich the society we live in
7. To develop partnership with universities, industries, businesses, research establishments, NGOs, international organizations, governmental organizations in India and abroad to enrich the experiences of faculties and students through research and developmental programmes.

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**Programme Specifications: M.Sc. in Food Science and Technology**

| | |
|---|---|
| **Faculty** | Life and Allied Health Sciences |
| **Department** | Food Technology |
| **Programme Code** | 093 |
| **Programme Name** | M.Sc. in Food Science and Technology |
| **Dean of the Faculty** | Dr. Soma Chaki |
| **Head of the Department** | Dr. Rajadurai M |

1. **Title of the Award:** M.Sc. in Food Science and Technology
2. **Mode of Study:** Full Time
3. **Awarding Institution /Body:** M S Ramaiah University of Applied Sciences
4. **Joint Award:** Not Applicable
5. **Teaching Institution:** Faculty of Life and Allied Health Sciences, M S Ramaiah University of Applied Sciences, Bengaluru
6. **Date of Programme Specifications:** July 2022
7. **Date of Programme Approval by the Academic Council of MSRUAS:** November 2018
8. **Next Review Date:** August 2026
9. **Programme Approving Regulating Body and Date of Approval:** -
10. **Programme Accredited Body and Date of Accreditation:** Not Applicable
11. **Grade Awarded by the Accreditation Body:** Not Applicable
12. **Programme Accreditation Validity:** Not Applicable
13. **Programme Benchmark:** Not Applicable
14. **Rationale of the programme:**

Government of India has set up three Mega food parks in Karnataka State and few more in pipe line. These food parks have been established with view of creating more than ten thousand jobs eachacross the value chain. In view of this, RUAS started UG course titled B.Sc. (Hons.) Food Processing and Technology in 2018 to develop well trained professional for food Industry. However, UG courses to a large extent help in developing man power suitable for operations /process management. This creates a void in skilled personal suitable for research, new product development or process development. Hence this proposal to start a postgraduate course to meet the requirement of food sector in Karnataka state and across India.

This PG course in food science and technology, would concentrate on the study of food, with an emphasis on creating and researching on reliable, viable, and good quality food products /production processes. Pursuing a research based PG course in food sciences will lead to development of new products and technology. Candidates with a Master of Science in this



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discipline are uniquely equipped to take on jobs focusing on Quality food production and pursue entrepreneurship as well.

**15. Programme Mission**

RUAS, a young and progressive University with excellent teaching, learning resources and faculty base would like to offer M.Sc. in Food Science and Technology as a postgraduate programme with a strong aim to acquaint aspiring students with a foundation and first degree training to make them ready for research assistants/associates, manage food production shop floor, food quality analysts, new product development, marketing executives, administrators in food industries and even pursue their career as entrepreneur.

**16. Graduate Attributes**

GA-1. Ability to apply fundamental knowledge of Biology, Biochemistry, Food Chemistry, FoodMicrobiology for developing food products and preservation.

GA-2. Ability to develop technologies for food processing and preservation

GA-3. Ability to develop processes for food product development

GA-4. Ability to test food for quality, safety and nutrition

GA-5. Ability to develop packaging for preservation and distribution

GA-6. Ability to perform administrative duties in government, semi-government, private and publicsector organizations

GA-7. Ability to teach in schools, colleges and universities with additional qualification and training

GA-8. Ability to understand and solve scientific problems by conducting experimental investigations

GA-9. Ability to apply appropriate tools, techniques and understand utilization of resources appropriately in various laboratories

GA-10. Ability to understand the effect of scientific solutions on legal, cultural, social and public health and safety aspects

GA-11. Ability to develop sustainable solutions and understand their effect on society and environment

GA-12. Ability to apply ethical principles to scientific practices and professional responsibilities

GA-13. Ability to work as a member of a team, to plan and to integrate knowledge of various disciplines and to lead teams in multidisciplinary settings

GA-14. Ability to make effective oral presentations and communicate technical ideas to a broad



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GA-15. Ability to adapt to the changes and advancements in science and engage in independent andlife-long learning.

**17. Programme Outcome (POs)**

**PO 1. Technical Knowledge**: Demonstrate in-depth knowledge of the scientific fundamentals and the modern technical knowledge needed to support Food technology research activities.

**PO 2. Design/Development solution**: Identify, analyze and understand the problems related to lifesciences and find valid conclusions with basic knowledge acquired in the fields.

**PO 3. Multidisciplinary approach:** Correlate how different sub-systems co-operate with each other intocurrent research and development in the respective fields.

**PO 4. Entrepreneurship skills:** Analyze manufacturing constituents and complete systems for relevantproducts and to enable enterprising skills for competing globally.

**PO 5. Societal Responsibility:** Innovate and develop sustainable solutions and understand their effect on society and environment.

**PO 6. Leadership and Ethics:** Apply professional Ethics, Leadership and consensus building skillsrelevant to the aspects of business enterprise in the respective fields.

**PO 7. Lifelong learning:** Adopt changes and advancements in science and engage in independentlearning.

**PO 8. Communication:** Communicate the information effectively in scientific writing and oralpresentation.

**18. Programme Goal**

Food Technology is a multidisciplinary subject Food involving engineering, Food Chemistry, Microbiology, safety, quality, packaging and product distribution, which is employed to develop new technologies. This Programme enables students to develop new product, pursue research, serve in food sector and nurture entrepreneurship.



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**19. Programme Educational Objectives (PEO):**

The objectives of the programme are to enable the students to:

**PEO 1.** Provide a common platform for students from varied disciplines, to nurture their zeal to enhance knowledge on food science through structured courses and research opportunities.

**PEO 2.** Enable the students to be proficient in new product development through application of cutting edge technologies in food fermentation, enzymology, and nutraceuticals.

**PEO 3.** Facilitate students with contemporary knowledge of food quality and safety for developmentof healthy and safe foods.

**PEO 4.** Stimulate interdisciplinary research or pursue doctoral programs and enable them for Industry and or academia, thus enhancing skilled professionals in food industry.

**20. Programme Specific Outcomes (PSO):**

**PSO 1.** Analyze and assess various food processing, preservation and packaging technologies

**PSO 2.** Develop technologies for food processing, preservation, packaging and quality assessment

**PSO 3.** Design and develop new food products and sustainable packaging

**PSO 4.** Demonstrate entrepreneurship traits to start a new enterprise and work under constraints to meet organizational objectives.

## 21. Programme Structure

| Semester I | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No.** | **Code** | **Course Title** | **Theory (h/W/S)** | **Tutorials (h/W/S)** | **Practical (h/W/S)** | **Total Credits** | **Max. Marks** |
| 1 | FTC501A | Food Processing and Packaging | 3 | | 2 | 4 | 100 |
| 2 | FTC502A | Food Additives and Preservatives | 3 | | 2 | 4 | 100 |
| 3 | FTC503A | Biochemistry | 3 | | 2 | 4 | 100 |
| 4 | FTC504A | Food Microbiology | 3 | | 2 | 4 | 100 |
| 5 | FTC505A | Food Chemistry | 3 | | 2 | 4 | 100 |
| 6 | FTC506A | Enzymes in Food Processing | 3 | | | 3 | 100 |
| **Total** | | | **18** | | **10** | **23** | **600** |
| **Total number of contact hours per week** | | | **28 hours** | | | | |

| Semester II | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No.** | **Code** | **Course Title** | **Theory (h/W/S)** | **Tutorials (h/W/S)** | **Practical (h/W/S)** | **Total Credits** | **Max. Marks** |
| 1 | FTC507A | Nutraceuticals and Functional Foods | 3 | | 2 | 4 | 100 |
| 2 | FTC508A | Food Quality and Sensory Analysis | 3 | | 2 | 4 | 100 |
| 3 | FTC509A | Food Production and Operations Management | 3 | | | 3 | 100 |
| 4 | FTC510A | Advances In Fermentation Technology | 3 | | 2 | 4 | 100 |
| 5 | FTC511A | Research Methodology | 3 | | | 3 | 100 |
| 6 | FTE501A<br>FTE502A<br>FTE503A<br>FTE504A | Elective-I (Refer Elective Table) | 3 | | 2 | 4 | 100 |
| **Total** | | | **18** | | **8** | **22** | **600** |
| **Total number of contact hours per week** | | | **26 hours** | | | | |

| Semester III | | | | | | | |
|---|---|---|---|---|---|---|---|
| S. No. | Code | Course Title | Theory (h/W/S) | Tutorials (h/W/S) | Practical (h/W/S) | Total Credits | Max. Marks |
| 1 | FTC601A | Innovation and Entrepreneurship | 3 | | - | 3 | 100 |
| 2 | FTE601A<br>FTE602A<br>FTE603A<br>FTE604A | Elective-II (Refer Elective Table) | 3 | | 2 | 4 | 100 |
| 3 | FTP601A | Group Project | | | 20 | 10 | 100 |
| **Total** | | | **6** | | **22** | **17** | **300** |
| **Total number of contact hours per week** | | | **28 hours** | | | | |

| Semester IV | | | | | | | |
|---|---|---|---|---|---|---|---|
| S. No. | Code | Course Title | Theory (h/W/S) | Tutorials (h/W/S) | Practical (h/W/S) | Total Credits | Max. Marks |
| 1 | FTI601A | Research Project | | | 30 | 24 | 300 |
| **Total** | | | | | | **24** | **300** |
| **Total number of contact hours per week** | | | **30 h** | | | | |
| **Total Number of Credits in M.Sc. Programme** | | | **86** | | **Total Marks** | | **1800** |

**Elective course**

Two Elective courses (**E**- I and **E-II**) can be chosen from any one of the following streams--

| Professional Core Electives (PCEs) | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Elective Courses -1** | **Credits** |
| 1 | FTE501A | Post-Harvest Technology of Cereals and Pulses | 3+1 |
| 2 | FTE502A | Millet Processing Technology | 3+1 |
| 3 | FTE503A | Fruits and Vegetable Processing Technology | 3+1 |
| 4 | FTE504A | Spices and Flavor Technology | 3+1 |
| **Sl. No.** | **Course Code** | **Elective Courses -2** | **Credits** |
| 1 | FTE601A | Advances in Dairy Processing | 3+1 |
| 2 | FTE602A | Dairy Microbiology | 3+1 |
| 3 | FTE603A | Dairy Engineering | 3+1 |
| 4 | FTE604A | Baking and Confectionery Technology | 3+1 |

**Group Project - FTI601A:**

A group shall have up to 5 students. The purpose of group project is that the group should be able to design and develop a product in their area of specialization. The students are required to exhibit/ demonstrate the working of the product and generate a project report as well. The IPR

rights of all such work lies with the University. The students are required to sign an agreement before the commencement of the project. Students can choose a project from the database of projects available with the concerned department and the same should be approved by a committee of examiners.

**Research Project - FTI601A:**

A student chooses a topic for the Dissertation based on relevance and need. The detail procedure of executing and assessing Dissertation is available as a standard template.

**22. Course Delivery: As per the Timetable**

**23. Teaching and Learning Methods**

1. Face to Face Lectures using Audio-Visuals
2. Workshops, Group Discussions, Debates, Presentations
3. Demonstrations
4. Guest Lectures
5. Laboratory work/Field work/Workshop
6. Industry Visit
7. Seminars
8. Group Exercises
9. Project Work
10. Project
11. Exhibitions
12. Technical festivals

**24. Assessment and Grading**

**24.1. Components of Grading**

There shall be two components of grading:

**Component 1, Continuous Evaluation (CE):** This component involves multiple subcomponents (SC1, SC2, etc.) of learning assessment. The assessment of the subcomponents of CE is conducted during the semester at regular intervals. This subcomponent represents the formative assessment of students' learning.

**Component 2, Semester-end Examination (SEE):** This component represents the summative assessment carried out in the form an examination conducted at the end of the semester.

Marks obtained CE and SEE components have equal weightage (CE: 50% and SEE: 50%) in determing the final marks obtained by a student in a course.

The complete details of Grading are given in the Academic Regulations.

**The template for weightage of CE and SEE in percentages for each type of course is indicated in Table a to c**

**24.2. Theory Courses**

The following TWO options are available for each Faculty to perform the CE exercise.

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**Option 1 for a Theory Course: (Table a)**

| Option 1 for a Theory Course | | | | |
|---|---|---|---|---|
| | Continuous evaluation | | | SEE |
| Component | SC1 (Midterm) | SC2 (Innovative assignment) | SC3 (Written assignment) | Semester End Examination |
| Weightage | 25 | 12.5 | 12.5 | 50 |

In Option 1 (Table a), there shall be three subcomponents of CE (SC1, SC2, and SC3). SC1 subcomponent mandatorily has to be mid-term and is evaluated for 25% weightage, whereas SC2 and SC3 can be of any of the following types and will be individually evaluated for 12.5 % weightage each.

a) Online test
b) Assignment/Problem solving
c) Field Assignment
d) Open book test
e) Portfolio
f) Reports
g) Case study
h) Group task
i) Creative submission
j) Any other

After the three subcomponents are evaluated, the CE component marks are determined as:

CE Component Marks = Total of all the three subcomponents

An additional subcomponent (SC4) may be used at the discretion of the Faculty/Department. The department can conduct the 4th subcomponent SC4 if this subcomponent gives benefit to students. If the Department/Faculty conducts the SC4 subcomponent of evaluation, and the score obtained by the student in SC4 is greater than the lowest score of the previous three subcomponents SC1 to SC3, then it replaces the lowest of the three scores.

**Option 2 for a Theory Course: (Table b)**

| Option 2 for a Theory Course | | | | |
|---|---|---|---|---|
| | Continuous evaluation | | | SEE |
| Component | SC1 | SC2 | SC3 | Semester End Examination |
| Marks | 25 | 25 | | 50 |

In Option 2 (Table b), there shall be three subcomponents. Out of these three, there shall be two assignments and one mid-term test. The assignments can be of any of the following types:

a) Online Test
b) Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports

g) Case Study
h) Group Task
i) Any other

After the three subcomponents of CE are evaluated, the CE component Marks are determined as:

CE Component Marks = (Best of SC2 and SC3) + (Midterm)

Each Faculty Dean, in consultation with the heads of all departments in the Faculty and the Faculty Academic Registrar, decides whether Option 1 or Option 2 is adopted for each programme offered by the Faculty. He/she notifies the students about the option at the beginning of the semester.

**24.3 Theory + Laboratory course**

There shall be three subcomponents of CE (SC1, SC2, and SC3) as represented in table c. SC1 and SC2 subcomponent mandatorily has to be mid-term and lab records respectively, Midterm will have 25% weightage whereas Lab record and SC3 will have 10% weightage. SC3 carries 15% weightage and can be of any of the following types:

a) Online Test
b) Assignments/Problem Solving
c) Field Assignment
d) Open Book Test
e) Portfolio
f) Reports
g) Case Study
h) Group Task
i) Any other

After the three subcomponents are evaluated, the CE component marks are determined as:
CE Component Marks = Total of all the three subcomponents
SEE will have 2 components SEE written exam with 40% weightage and Laboratory Exam with 10% weightage.

**Table c: Typical evaluation template for Theory + Laboratory course**

| | CE (Weightage: 50 %) | | | SEE (Weightage: 50 %) | |
|---|---|---|---|---|---|
| **Assessment Type** | **SC1 (Mid-term exam)** | **SC2 (Lab records)** | **SC3 (Assignment)** | **SEE Written exam** | **Lab Exam** |
| **Component Weightage** | **25** | **10** | **15** | **40** | **10** |

## 25. Student Support for Learning

1. Course Notes
2. Reference Books in the Library
3. Magazines and Journals
4. Internet Facility
5. Computing Facility
6. Laboratory Facility
7. Workshop Facility
8. Staff Support



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9. Lounges for Discussions
10. Any other support that enhances their learning

**26. Quality Control Measures**

1. Review of Course Notes
2. Review of Question Papers and Assignment Questions
3. Student Feedback
4. Moderation of Assessed Work
5. Opportunities for students to see their assessed work
6. Review by external examiners and external examiners reports
7. Staff Student Consultative Committee meetings
8. Student exit feedback
9. Subject Assessment Board (SAB)
11. Programme Assessment Board (PAB)

**27. Curricular Map**

| Semester | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | Food Processing and Packaging | 3 | 2 | | | | | | | 3 | 2 | | |
| I | Food Additives and Preservatives | | | 3 | | | | | | | 3 | | |
| I | Biochemistry | | 2 | 3 | | | | | | | | 3 | |
| I | Food Microbiology | | 3 | | | | | | | | 3 | | |
| I | Food Chemistry | | 3 | | | | | | | | 2 | 1 | |
| I | Enzymes in Food Processing | 3 | | | | | | | | | 3 | 1 | |
| II | Nutraceuticals and Functional Foods | 2 | 2 | | | | | | | 3 | 2 | | |
| II | Food Quality and Sensory Analysis | 3 | 2 | | | | | | | 2 | 3 | | |
| II | Food Production and Operations Management | | | | 3 | | 1 | | | 1 | | | 3 |
| II | Advances In Fermentation Technology | 3 | 2 | | | | | | | | 2 | | 1 |
| II | Research Methodology | | 1 | | | | | | 3 | | 2 | | |
| III | Innovation and Entrepreneurship | | | | 3 | | | | 2 | | | 2 | 3 |
| III | Group Project | | 2 | 2 | | | | 1 | 1 | | | 2 | 3 |
| IV | Research Project | | 1 | 2 | | | | | 3 | | | 2 | 1 |
| | **ELECTIVE -I** | | | | | | | | | | | | |
| II | Post-Harvest Technology of Cereals and Pulses | | 3 | 2 | | | | | | | 2 | 2 | |
| II | Millet Processing Technology | 2 | 2 | | | | | | | | 2 | 1 | |
| II | Fruits and Vegetable Processing Technology | 3 | 1 | 1 | | | | | | | 1 | 2 | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| II | Spices and Flavor Technology | | 2 | 3 | | | | | | | | 3 | 1 |
| ELECTIVE- II | | | | | | | | | | | | | |
| III | Advances in Dairy Processing | 2 | 2 | | | | | | | | 2 | 2 | |
| III | Dairy Microbiology | 1 | | 3 | | | | | | 1 | | 3 | |
| III | Dairy Engineering | | 2 | 3 | | | | | | | 2 | 3 | |
| III | Baking and Confectionery Technology | 2 | 2 | | | | | | 2 | | 2 | 2 | 2 |

**28. Co-curricular Activities**

Students are encouraged to take part in co-curricular activities like seminars, conferences, symposia, paper writing, attending industry exhibitions, project competitions and related activities for enhancing their knowledge and networking.

**29. Cultural and Literary Activities**

Annual cultural festivals are held to showcase the creative talents in students. They are involved in planning and organizing the activities.

**30. Sports and Athletics**

Students are encouraged to take part in sports and athletic events regularly. Annual sports meet will be held to demonstrate sportsmanship and competitive spirit.

RAMAIAH UNIVERSITY OF APPLIED SCIENCES

# M S Ramaiah University of Applied Sciences

## Course Specification

## Of

## M.Sc. in Food Science and Technology

## Programme Code: 093

## BATCH 2024-2026

**M S Ramaiah University of Applied Sciences**
**Faculty of Life and Allied Health Sciences**
**Department of Food Technology**



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# SEMESTER-I

| Course Specifications: Food Processing and Packaging | |
|---|---|
| **Course Title** | Food Processing and Packaging |
| **Course Code** | FTC501A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

**1. Course Summary**

The aim of this course is to learn cutting-edge food processing and food packaging technologies. Students will understand the emerging food processing technologies. They will be familiarized with supercritical fluid extraction, microwave and radio frequency technologies, and hurdle technology. Students will also learn about advanced food packaging technologies like active and intelligent packaging, the permeability properties of polymers, and MAP technology and its importance.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 03+01 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 30 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**Teaching, Learning and Assessment**

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

- **CO 1.** Explain the emerging technology in food processing like membrane technology, HPP, Ultrasound, SCFE
- **CO 2.** Describe Microwave process, radio frequency, IR drying and Hurdle technology
- **CO 3.** Discuss the advance food packing technologies
- **CO 4.** Assess various advance food processing and packaging technologies

**4. Course Contents**

**Unit I:**

**Emerging technology in food processing**-membrane technology, HPP, PEF, Ultra sound. Supercritical fluid extraction: Concept, property of near critical fluids NCF and extraction methods. Application of SCFE in food processing.

**Unit II:**

**Microwave and radio frequency, IR drying**: Definition, Advantages, mechanism of heat generation, inductive heating in food processing and preservation.

**Unit III:**

**Hurdle technology**: Types of preservation techniques and their principles, concept of hurdle technology and its application.

**Unit IV:**

Active and intelligent packaging systems, Advances in Active packaging techniques and intelligent packaging techniques.

**Unit V:**

Permeability properties of polymer packaging, measurement of permeability –water and gases. Selection criteria of packaging films.

**Unit VI:**

Novel MAP gases, testing novel MAP applications, Novel MAP applications for fresh and prepared food products. Oxygen and ethylene scavenging technology: concept and its food applications.

**Unit VII:**

Non-migratory bioactive polymers (NMBP) in food packaging, Advantages and limitations

**Practical**

1. To carry out the dehydration experiment for fruits and vegetables
2. To study microwave blanching of fruits and vegetable and determination of blanching efficacy
3. To study Ultra sonication and its effects
4. Determination of WVTR in different packaging materials
5. Application of MAP packaging in selected foods
6. Development of ethylene scavengers for fresh fruits and vegetables
7. Determination of oxidative changes in packaged foods
8. Comparative evaluation of flexible and rigid packages for fragile foods
9. To study textural characteristics of selected fruit/ vegetable under MAP storage
10. Visit to food packaging material manufacturing industry

**5. CO-PO PSO Mapping:**

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | | 2 | | | | | | 3 | 2 | | |
| CO-2 | 2 | | 1 | | | | 2 | | 1 | 2 | 2 | |
| CO-3 | | 3 | | | | | 2 | | 2 | | | |
| CO-4 | | 2 | 2 | | | | | | | 2 | 2 | |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods:**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 02 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 05 |
| 1. Case Study Presentation | | |
| 2. Guest Lecture | 02 | |
| 3. Industry / Field Visit | 01 | |
| 4. Brain Storming Sessions | | |
| 5. Group Discussions | | |
| 6. Discussing Possible Innovations | 02 | |
| Term Tests, Laboratory Examination/Written Examination, Presentations | | 08 |
| Total Duration in Hours | | **75** |

**7. Course Assessment**

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.

The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| | Focus of Course Learning Outcomes in each component assessed | | | | |
|---|---|---|---|---|---|
| | CE (50% Weightage) | | | SEE (50% Weightage) | |
| | SC1 | SC2 | SC3 | SEE Theory | SEE Lab |
| | 50 Marks | 25 Marks | 25 Marks | 100 Marks | 50 Marks |
| **CO-1** | ✓ | x | x | ✓ | ✓ |
| **CO-2** | ✓ | ✓ | x | ✓ | ✓ |
| **CO-3** | x | ✓ | ✓ | ✓ | ✓ |
| **CO-4** | x | x | ✓ | ✓ | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

**8. Achieving Course Learning Outcomes**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | ------ |
| 6. | Practical Skills | Laboratory exercises |
| 7. | Group Work | Assignment/ Class Presentations |
| 8. | Self-Learning | Assignment, Examination |
| 9. | Written Communication Skills | Assignment |
| 10. | Verbal Communication Skills | Class Presentations |
| 11. | Presentation Skills | Class Presentations |
| 12. | Behavioral Skills | ——— |
| 13. | Information Management | Assignment |
| 14. | Personal Management | Assignment, Examination |
| 15. | Leadership Skills | Effective management of learning, time management, achieving the learning outcomes |

**9. Course Resources**

1. **References**
   a. Ahvenainen R. 2001. Novel Food Packaging Techniques. CRC.
   b. Barbosa-Canovas 2002. Novel Food Processing Technologies. CRC.
   c. Gould GW. 2000. New Methods of Food Preservation. CRC
   d. Fellow P, 1988, Food processing technology, New York, VCH Ellis Horwood
   e. K.M. Sahay and K.K. singh. 2001. Unit Operations of Agricultural Processing. Vikas Publishing House Pvt. Ltd., Noida, UP.
   f. George D. Saravacos and Athanasios E. Kostaropoulos. 2002. Handbook of Food Processing Equipment. Springer Science+Business Media, New York, USA
2. **Websites:** https://www.foodprocessing.com/

3. **Magazines and Journals**
   a. FOOD SCIENCE and TECHNOLOGY-Magazine
   b. Journal of Food Science and Technology (AFSTI)

## 10. Course Organization

| | | | |
|---|---|---|---|
| **Course Code** | FTC501A | | |
| **Course Title** | Food Processing and Packaging | | |
| **Course Leader/s Name** | | Allotted as per time table | |
| **Course Leader Contact Details** | | **Phone:** | 080-49066666 |
| | | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | | June 2024 | |
| **Next Course Specifications Review Date** | | July 2026 | |

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DEAN
Faculty of Life & Allied Health Sciences
M.S. RAMAIAH UNIVERSITY OF APPLIED SCIENCES
BANGALORE-560 054

| Course Specifications: Food Additives and Preservatives | |
|---|---|
| **Course Title** | Food Additives and Preservatives |
| **Course Code** | FTC502A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

1. **Course Summary**

The aim of this course is to introduce students to different additives and preservatives used in the food industry. The students will be able to understand the mode of action of additives and preservatives in food products. They will also be familiar with the regulatory requirements for food additives. The course will also educate students regarding the chronic toxicity and health implications of food additives.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 03+01 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 30 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**Teaching, Learning and Assessment**

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO 1.** Describe the role of food additives and preservatives.

**CO 2.** Summarize the properties of food preservatives.

**CO 3.** Explain toxicology and safety evaluation of food additives.

**CO 4.** Differentiate intentional and unintentional food additives.

**CO 5.** Discuss about nutritive and non-nutritive sweeteners.

**4. Course Contents**

**Unit-I:**

**Food Additives:** Structure, Chemistry, Function and application of Preservatives, Emulsifying and Stabilizing agents, Sweeteners, buffering agents, bleaching, maturing agents and starch modifiers, Food colors, flavors, anti-caking agent, Antioxidants etc.

**Unit-II:**

**Food Preservatives:** Natural preservation, chemical preservatives, their chemical action on foods

and human system, Antioxidants and chelating agents, their role in foods, types of antioxidants natural and synthetic, chelating agents, their mode of action in foods with examples, salts, humectants/polyhydric alcohol, firming agent, nutritional and non-nutritional sweeteners; Production of enzymes, leavening agents, fat substitutes, flavor and taste enhancers in food processing; Acidity regulators; Emulsifiers.

**Unit-III:**

**Naturally occurring food additives:** Food colors and dyes: Regulatory aspects of dyes, food color (natural and artificial), pigments and their importance and utilization as food color; processing of natural and artificial food colorants: nature, properties and functions and mode of action.

**Unit-IV:**

**Safety of food additives:** Safety assessment of Food additives: No-observed Effect Level (NOEL Acceptable daily intake (ADI), Dietary exposure in chronic toxicity and health implications.

**Unit-V:**

Intentional and unintentional food additives, their toxicology and safety evaluation.

**Practical**

1. Market survey of preserved foods
2. Evaluation of GRAS aspect of food additives
3. Preservation of coconut shreds using humectants
4. Preparation of preserved products from fruits using class I preservatives
5. Preparation of preserved products using class II preservatives
6. Shelf life and sensory evaluation of developed products
7. Market survey of products without added preservatives
8. Detection of alginates in foods (chocolate, ice cream)
9. Isolation, identification and estimation of synthetic food colours
10. Visits to food processing and preservation unit (Optional)

**5. CO-PO PSO Mapping:**

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | | | 3 | | | | | | | 3 | 1 | |
| CO-2 | 3 | | | | | | | | 2 | 3 | 1 | |
| CO-3 | | | 3 | | | | 1 | | 2 | 2 | | |
| CO-4 | 3 | | 2 | | | | | | | 3 | | |
| CO-5 | 3 | | | | | | 1 | | 3 | | | |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods:

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 02 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 05 |
| 1. Case Study Presentation | | |
| 2. Guest Lecture | 02 | |
| 3. Industry / Field Visit | 01 | |
| 4. Brain Storming Sessions | | |
| 5. Group Discussions | | |
| 6. Discussing Possible Innovations | 02 | |
| Term Tests, Laboratory Examination/Written Examination, Presentations | | 08 |
| Total Duration in Hours | | **75** |

## 7. Course Assessment

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.

The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| Focus of Course Learning Outcomes in each component assessed | | | | | |
|---|---|---|---|---|---|
| | CE (50% Weightage) | | | SEE (50% Weightage) | |
| | SC1 | SC2 | SC3 | SEE Theory | SEE Lab |
| | 50 Marks | 25 Marks | 25 Marks | 100 Marks | 50 Marks |
| **CO-1** | ✓ | ✓ | x | ✓ | ✓ |
| **CO-2** | ✓ | ✓ | x | ✓ | ✓ |
| **CO-3** | x | ✓ | ✓ | ✓ | ✓ |
| **CO-4** | x | x | ✓ | ✓ | ✓ |
| **CO-5** | x | x | ✓ | ✓ | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

**8. Achieving Course Learning Outcomes**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | ------- |
| 6. | Practical Skills | Laboratory exercises |
| 7. | Group Work | Assignment/ Class Presentations |
| 8. | Self-Learning | Assignment, Examination |
| 9. | Written Communication Skills | Assignment |
| 10. | Verbal Communication Skills | Class Presentations |
| 11. | Presentation Skills | Class Presentations |
| 12. | Behavioral Skills | ------- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | Assignment, Examination |
| 15. | Leadership Skills | Effective management of learning, time management, achieving the learning outcomes |

**9. Course Resources**

1. **References**


a. H. D. Belitz, W. Grosch and P. Schieberle. 2009. Food Chemistry. 4th Edition. Springer-Verlag, Berlin, Heidelberg.
b. S.N. Mahindru. 2008. Food Additives: Characteristics, Detection and Estimation. Aph Publishing Corporation, New Delhi.
c. S.S. Deshpande. 2002. Handbook of Food Toxicology. Marcel and Dekker AG, Basel, Switzerland.
d. Baren, A. F. et al (2001). Food additives, 2nd edition, Marcel Dekker.
e. George, A. B. (1991). Encyclopaedia of food and colour additives, Vol III, CRC Press.
f. Nakai, S. and Modler, H. W. (2000). Food proteins: processing applications, Wiley Robertson.




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2. **Websites**
   https://www.egyankosh.ac.in/bitstream/123456789/12391/1/Unit-10.pdf
3. **Magazines and Journals**
   a. FOOD SCIENCE and TECHNOLOGY-Magazine

**10. Course Organization**

| | | |
|---|---|---|
| **Course Code** | FTC502A | |
| **Course Title** | Food Additives and Preservatives | |
| **Course Leader/s Name** | Allotted as per time table | |
| **Course Leader Contact Details** | **Phone:** | 080-49066666 |
| | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | June 2024 | |
| **Next Course Specifications Review Date** | July 2026 | |

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DEAN
Faculty of Life & Allied Health Sciences
M.S. RAMAIAH UNIVERSITY OF APPLIED SCIENCES
BANGALORE-560 054

| Course Specifications: Biochemistry | |
|---|---|
| **Course Title** | Biochemistry |
| **Course Code** | FTC503A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

## 2. Course Summary

The aim of this course is to introduce students to the basic concepts of biochemistry and its significance in food science and technology. Students will be taught the basics of biochemistry, such as macro- and micromolecules and their classification, general reactions, digestion, absorption, and metabolism. Students will also be taught the importance of biochemistry in understanding food chemistry, food processing, and product development. Students will also be carrying out experiments on the quantitative analysis of carbohydrates, proteins, lipids, enzymes, and vitamins.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 03+01 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 30 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## Teaching, Learning and Assessment

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO 1.** Explain the physico-chemical properties of water, cell structure and functions of cellular organelles.
- **CO 2.** Outline the classification, chemical properties, general reactions, digestion, absorption and metabolism of carbohydrates, lipids and proteins.
- **CO 3.** Summarize biological functions of vitamins, minerals, nucleic acids and their application in food processing.
- **CO 4.** Illustrate various pathways involved in metabolism of carbohydrates, proteins and lipids.
- **CO 5.** Analyze and apply suitable method for quantitative analysis of carbohydrates, proteins, and lipid.

**4. Course Contents**

**Unit-I:**

Importance of biochemistry in food science and technology. Water: Physical and chemical properties of water, Weak interactions in aqueous systems, Ionization of water and Buffers.

**Unit-II:**

**The Cell Structure and Function**: Prokaryotic and Eukaryotic cell, Plant and Animal cell and its sub cellular organelles- nucleus, endoplasmic reticulum, Golgi apparatus, vacuoles, mitochondria, chloroplasts, micro bodies, cytoskeleton, cell wall and their functions.

**Unit-III:**

**Carbohydrates:** Introduction, classification: Monosaccharides- stereochemistry, nomenclature, cyclic forms, general reactions of monosaccharides, Oligosaccharides and polysaccharides, digestion and absorption. Carbohydrate metabolism: Glycolysis, TCA cycle, Electron transport and oxidative phosphorylation, Pentose phosphate pathway.

**Unit-IV:**

**Amino acids**: Introduction, structure- stereochemistry, classification, chemical properties.

**Proteins:** Importance of proteins in living system, diverse roles of proteins, classification, properties of proteins, Denaturation of proteins, structural organization of proteins-Primary, secondary, tertiary and quaternary structures, digestion and absorption. Amino acid metabolism: Deamination, transamination and decarboxylation of amino acids.

**Unit-V:**

**Lipids:** Introduction, classification, Triglycerols, Saturated and unsaturated fats, chemical properties, oxidation reactions, rancidity, digestion and absorption. Lipid metabolism: β-Oxidation of fatty acids and energetic.

**Unit-VI:**

**Nucleic acids:** RNA and DNA; their biological functions, nucleosides and nucleotides, structure and functions, Types of RNA, their characteristics and role. Clover leaf structure of t-RNA.

**Unit-VII:**

**Minerals and vitamins**: Functions, dietary sources and deficiency disorders.

**Practical**

1. Preparation of standard solutions
2. Estimation of total carbohydrates by Phenol sulphuric acid method
3. Estimation of starch by Anthrone method
4. Estimation of total Proteins by Lowry's method
5. Estimation of total lipids by Bligh and Dyer method
6. Determination of saponification number and acid value of an oil/fat
7. Determination of iodine number of an oil/fat
8. Estimation of Ascorbic acid by titrimetry

9. Determination of organic acid content by titrimetry
10. Separation of amino acids by Paper and Thin layer chromatography
11. Estimation of amylase enzymes in food

**5. CO-PO PSO Mapping:**

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | | | | 1 | | | | | 1 | 2 | |
| CO-2 | 1 | 2 | 2 | 1 | | | | | | | | 2 |
| CO-3 | 1 | 2 | 1 | | | 1 | | | | | 3 | 2 |
| CO-4 | | 2 | 3 | | | | 1 | | | | | 2 |
| CO-5 | 1 | 3 | 2 | | | | | 2 | | | | |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods:**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | |
| 1. Demonstration using Videos | | |
| 2. Demonstration using Physical Models | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 07 |
| 1. Case Study Presentation | | |
| 2. Guest Lecture | 02 | |
| 3. Industry / Field Visit | 03 | |
| 4. Brain Storming Sessions | | |
| 5. Group Discussions | 02 | |
| 6. Discussing Possible Innovations | | |
| Term Tests, Laboratory Examination/Written Examination, Presentations | | 08 |
| Total Duration in Hours | | **75** |



DEAN
Faculty of Life & Allied Health Sciences
M.S. RAMAIAH UNIVERSITY OF APPLIED SCIENCES

## 7. Course Assessment

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.

The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| Focus of Course Learning Outcomes in each component assessed | | | | | |
|---|---|---|---|---|---|
| | CE (50% Weightage) | | | SEE (50% Weightage) | |
| | SC1 | SC2 | SC3 | SEE Theory | SEE Lab |
| | 50 Marks | 25 Marks | 25 Marks | 100 Marks | 50 Marks |
| CO-1 | ✓ | x | x | ✓ | ✓ |
| CO-2 | ✓ | x | ✓ | ✓ | ✓ |
| CO-3 | ✓ | x | ✓ | ✓ | ✓ |
| CO-4 | x | ✓ | x | ✓ | ✓ |
| CO-5 | x | ✓ | x | x | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

## 8. Achieving Course Learning Outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | ------ |
| 6. | Practical Skills | Laboratory exercises |
| 7. | Group Work | Assignment/ Class Presentations |
| 8. | Self-Learning | Assignment, Examination |
| 9. | Written Communication Skills | Assignment |
| 10. | Verbal Communication Skills | Class Presentations |
| 11. | Presentation Skills | Class Presentations |
| 12. | Behavioral Skills | ------ |

| | | |
|---|---|---|
| 13. | Information Management | Assignment |
| 14. | Personal Management | Assignment, Examination |
| 15. | Leadership Skills | Effective management of learning, time management, achieving the learning outcomes |

## 9. Course Resources

### 1. References

a. David L. Nelson and Michael M. Cox. 2012. Lehninger Principles of Biochemistry, 6th Ed. Macmillan Learning, NY, USA.

b. Donald Voet and Judith G. Voet. 2011. Biochemistry, 4th Ed. John Wiley and Sons, Inc., NY, USA.

c. Reginald H. Garrett and Charles M. Girsham, 2010, 4th Ed, Brooks/Cole Cengage Learning

### 2. Magazines and Journals

Biochemistry - Discover Magazine

### 3. Websites

discovermagazine.com/tags/?tag=biochemistry

## 10. Course Organization

| | | | |
|---|---|---|---|
| **Course Code** | FTC503A | | |
| **Course Title** | Biochemistry | | |
| **Course Leader/s Name** | | Allotted as per time table | |
| **Course Leader Contact Details** | | **Phone:** | 080-49066666 |
| | | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | | June 2024 | |
| **Next Course Specifications Review Date** | | July 2026 | |

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DEAN
Faculty of Life & Allied Health Sciences
M.S. RAMAIAH UNIVERSITY OF APPLIED SCIENCES

| Course Specifications: Food Microbiology | |
|---|---|
| **Course Title** | Food Microbiology |
| **Course Code** | FTC504A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

## 1. Course Summary

The aim of this course is to comprehend various microbiological examinations and studies of different food-borne infections and diseases. The students will be able to understand the factors affecting microbial growth in foods and microbiological examinations. They will also learn about food preservation and application. The course will also educate students regarding quality control and quality assurance legislation for food safety, and student will gain knowledge of media preparation, staining, and isolation techniques.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 03+01 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 30 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**Teaching, Learning and Assessment**

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO 1.** Explain the microbiological examination
- **CO 2.** Describe the microflora of fresh food and food preservation technologies
- **CO 3.** Discuss quality control/quality assurance legislation for food safety
- **CO 4.** Prepare various media for cultivation of microorganisms
- **CO 5.** Demonstrate staining, isolation and bacteriological analysis

## 4. Course Contents

**Unit- I:**

History, scope and importance of food microbiology. Microorganisms and food: Their primary sources of microorganisms in foods: Airborne bacteria and fungi, Microorganisms in water, normal flora of skin, nose, throat, and gastrointestinal tract.

**Unit- II**

Factors affecting the survival and growth of microorganisms in food: Intrinsic factors for growth, Moisture, pH and acidity, Nutrient content, Redox Potential

**Unit- III**

**Microbiological examination**- Methods used for detection of pathogens in food such as Rapid methods, Immunological methods, Fluorescent, antibody, Radioimmunoassay, ELISA, PCR, RT-PCR, Microchip based techniques.

**Unit- IV**

**Microflora of Fresh Food**: Meat, Poultry, Eggs, Fruits and vegetable, Shellfish and Finish, Milk, Microbial Spoilage of Food, Fresh Foods, Fresh Milk.

**Unit- V**

**Food Preservation and application to different types of preservation**: Physical methods– Drying, freeze, drying cold storage, heat treatments (pasteurization), Irradiation (UV, microwave, ionization), high pressure processing. Chemical preservatives and Natural antimicrobial compounds. Biologically based preservation systems

**Unit- VI**

**Food borne infections and diseases**: Significance to public health Food hazards and risk factors, Bacterial, and viral food-borne disorders, Food borne important animal parasites, Mycotoxins, *Bacillus, Campylobacter, Brucella, Staphylococcus, Clostridium, E.coli, Aeromonas, Vibrio cholerae, Listeria, Mycobacterium, Salmonella, Shigella*

**Practical**

1. Preparation of common laboratory media and special media for cultivation of microbes.
2. Staining of Bacteria: Gram's staining, acid -fast, spore, capsule, Motility of bacteria, staining of yeast and molds.
3. Microbiological analyses of different foods using conventional methods
4. Coli forms analysis of milk and water samples
5. Determination of thermal death characteristics of bacteria
6. Demonstration of available rapid methods and diagnostic kits used in identification of microorganisms or their products
7. Visits to food processing unit or any other organization dealing with methods in food microbiology.

**5. CO-PO PSO Mapping:**

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | | | | | | | | | 1 | 2 | |
| CO-2 | | 2 | 2 | | | | | | | 2 | 2 | |
| CO-3 | 1 | 2 | | | 2 | | 1 | | | | 1 | |
| CO-4 | | 2 | 2 | | | | | | | | 3 | |
| CO-5 | | 3 | | | | | | | | 2 | 2 | |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods:**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 02 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 05 |
| 1. Case Study Presentation | | |
| 2. Guest Lecture | 02 | |
| 3. Industry / Field Visit | 01 | |
| 4. Brain Storming Sessions | | |
| 5. Group Discussions | | |
| 6. Discussing Possible Innovations | 02 | |
| Term Tests, Laboratory Examination/Written Examination, Presentations | | 08 |
| Total Duration in Hours | | **75** |

**7. Course Assessment**

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final

course marks is also provided in the Academic Regulations document as well.

The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| Focus of Course Learning Outcomes in each component assessed | | | | | |
|---|---|---|---|---|---|
| | CE (50% Weightage) | | | SEE (50% Weightage) | |
| | SC1 | SC2 | SC3 | SEE Theory | SEE Lab |
| | 50 Marks | 25 Marks | 25 Marks | 100 Marks | 50 Marks |
| CO-1 | ✓ | x | x | ✓ | ✓ |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ |
| CO-3 | x | x | ✓ | ✓ | ✓ |
| CO-4 | x | ✓ | ✓ | ✓ | ✓ |
| CO-5 | x | ✓ | x | ✓ | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

**8. Achieving Course Learning Outcomes**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | ------ |
| 6. | Practical Skills | Laboratory exercises |
| 7. | Group Work | Assignment/ Class Presentations |
| 8. | Self-Learning | Assignment, Examination |
| 9. | Written Communication Skills | Assignment |
| 10. | Verbal Communication Skills | Class Presentations |
| 11. | Presentation Skills | Class Presentations |
| 12. | Behavioral Skills | ------ |
| 13. | Information Management | Assignment |
| 14. | Personal Management | Assignment, Examination |
| 15. | Leadership Skills | Effective management of learning, |



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| | | |
|---|---|---|
| | | time management, achieving the learning outcomes |

## 9. Course Resources

1. **References**
   a. Pelczar, M.I. and Reid, R.D. (1993) Microbiology McGraw Hill Book Company, New York, 5th Edition.
   b. Atlas, M. Ronald (1995) Principles of Microbiology, 1st Edition, Mosby-Year Book, Inc, Missouri, U.S.A.
   c. Topley and Wilson's (1983) Principles Immunity, Edited by Ba S.G.
   d. Wilson, A. Miles and M.T. Parkar, Vol. I: General Microbiology and Immunity, II: Systematic Bacteriology. 7th Edition. Edward Arnold Publisher.
   e. Frazier, W.C. (1988) Food Microbiology, McGraw Hill Inc. 4th Edition,
2. **Magazines and Journals:** Journal of Food Sciences and Technology
3. **Websites:** https://www.foodprocessing.com/

## 10. Course Organization

| | | |
|---|---|---|
| **Course Code** | FTC504A | |
| **Course Title** | Food Microbiology | |
| **Course Leader/s Name** | Allotted as per time table | |
| **Course Leader Contact Details** | **Phone:** | 080-49066666 |
| | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | June 2024 | |
| **Next Course Specifications Review Date** | July 2026 | |

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DEAN
Faculty of Life & Allied Health Sciences
M.S. RAMAIAH UNIVERSITY OF APPLIED SCIENCES

## Course Specifications: Food Chemistry

| | |
|---|---|
| **Course Title** | Food Chemistry |
| **Course Code** | FTC505A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

### 1. Course Summary

The aim of this course is to introduce students to the applications of the functional properties of carbohydrates, proteins, lipids, and vitamins in food product development. Students will also be taught the chemistry of flavour compounds, food additives, pigments, food colorants, and anti-nutritional factors. They will also be carrying out experiments on the proximate analysis of food samples, the smoke point, and vitamin and mineral estimation.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 03+01 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 30 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### Teaching, Learning and Assessment

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO 1.** Describe the nature of food chemistry, its application, and the significance of moisture content and water activity in food preparation.
- **CO 2.** Evaluate the physicochemical and functional characteristics of lipids, proteins, carbohydrates, vitamins and minerals; their application in food processing
- **CO 3.** Explain the methods for optimization and retention of vitamins, minerals and natural colors in processed foods
- **CO 4.** Analyze proximate components, mineral estimation and anti-nutritional factors in food samples

### 4. Course Contents

**Unit-I:**

**Introduction to Food Chemistry:** Nature and Scope of Food Chemistry, Role of Food Chemists

Moisture in foods: role and type of water in foods, Functional properties of water, role of water in food spoilage, Water activity and sorption isotherm, Molecular mobility and food stability. Water activity: principles, measurement, control, effects, and related concepts.

**Unit-II:**

**Functional properties of carbohydrates, proteins, and lipids and their applications in food processing:** Carbohydrates: Maillard reaction, caramelization, methods to control non-enzymatic reactions. Modification of carbohydrates: unmodified and modified starches, modified celluloses.

Proteins in foods: Functional properties of proteins in foods – water and oil binding, foaming, gelation, emulsification.

Lipids in foods: role and use of lipids /fat, occurrence, fat group classification, physicochemical aspects of fatty acids in natural foods, hydrolysis, reversion, polymorphism and its application.

**Unit-III:**

**Vitamins and minerals:** structure and properties, distribution and morphology in foods, changes during food processing and storage, regulation and control of their loss in foods.

**Unit-IV:**

**Chemistry of food flavor:** Definitions of flavor, Flavourmatics / flavoring compounds, Sensory assessment of flavor, Technology for flavor retention

**Unit-V:**

**Pigments in animals and plants**: Heme pigments, Chlorophyll, Carotenoids, flavonoids, and Betalains- Effect of processing on pigment behavior, color losses during thermal processing, and technology for retention of natural colors of food stuffs. Food colorants: Regulatory aspects – natural and synthetic permitted food colors. Properties of certified dyes, Use of regulatory dyes.

**Unit VI:**

**Anti-nutritional factors:** Occurrence, effects, and methods of elimination or inactivation- protease inhibitors; lectins; lathyrogens; phytates; and flatulence factors.

**Practical**

1. Estimation of moisture content of foods
2. Determination of ash content in food sample
3. Estimation of calcium in food samples
4. Estimation of iron in food samples
5. Estimation of ascorbic acid in food samples
6. Estimation of crude protein by micro Kjeldahl method
7. Estimation of crude fat by Soxhlet method
8. Determination of refractive index and specific gravity of fats and oils
9. Determination of smoke point and percent fat absorption for different fat and oils
10. Estimation of total tannins in food samples

**5. CO-PO PSO Mapping:**

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | | | | | | | | 3 | | | |
| CO-2 | 3 | | 2 | | | | 1 | | | 3 | | 2 |
| CO-3 | 3 | | | 2 | | | 1 | | | | 3 | 2 |
| CO-4 | | 2 | | 3 | | | 1 | 3 | | 3 | | 2 |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods:**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 02 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 05 |
| 1. Case Study Presentation | | |
| 2. Guest Lecture | 02 | |
| 3. Industry / Field Visit | 01 | |
| 4. Brain Storming Sessions | | |
| 5. Group Discussions | | |
| 6. Discussing Possible Innovations | 02 | |
| Term Tests, Laboratory Examination/Written Examination, Presentations | | 08 |
| Total Duration in Hours | | **75** |

**7. Course Assessment**

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.

The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| Focus of Course Learning Outcomes in each component assessed | | | | | |
|---|---|---|---|---|---|
| | CE (50% Weightage) | | | SEE (50% Weightage) | |
| | SC1 | SC2 | SC3 | SEE Theory | SEE Lab |
| | 50 Marks | 25 Marks | 25 Marks | 100 Marks | 50 Marks |
| CO-1 | ✓ | x | x | ✓ | ✓ |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ |
| CO-3 | x | x | ✓ | ✓ | ✓ |
| CO-4 | x | ✓ | ✓ | ✓ | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

**8. Achieving Course Learning Outcomes**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | ------ |
| 6. | Practical Skills | Laboratory exercises |
| 7. | Group Work | Assignment/ Class Presentations |
| 8. | Self-Learning | Assignment, Examination |
| 9. | Written Communication Skills | Assignment |
| 10. | Verbal Communication Skills | Class Presentations |
| 11. | Presentation Skills | Class Presentations |
| 12. | Behavioral Skills | ------ |
| 13. | Information Management | Assignment |
| 14. | Personal Management | Assignment, Examination |
| 15. | Leadership Skills | Effective management of learning, time management, achieving the learning outcomes |

## 9. Course Resources

1. **References**
   a. DeMan, J.M, 1980, Principles of Food Chemistry, NewYork, AVI
   b. Fennema, Owen R, 1996, Food Chemistry, New York, Marcell Dekke
   c. H.-D. Belitz, W. Grosch and P. Schieberle. 2009. Food Chemisry, 4th Ed. Springer-Verlag Berlin Heidelberg
   d. David L. Nelson and Michael M. Cox. 2012. Lehninger Principles of Biochemistry, 6th Ed. Macmillan Learning, NY, USA.
   e. Lubert Strayer, 2000, Biochemistry, New York, WH. Freeman and co
   f. Donald Voet and Judith G. Voet. 2011. Biochemistry, 4th Ed. John Wiley and Sons, Inc., NY, USA.
   g. Reginald H. Garrett and Charles M. Girsham, 2010, 4th Ed, Brooks/Cole Cengage Learning
2. **Websites**
   a. http:// discovermagazine.com/tags/?tag=biochemistry
   b. https://swayam.gov.in/NPTEL
   c. https://www.foodprocessing.com/
3. **Magazines and Journals**
   a. FOOD SCIENCE and TECHNOLOGY-Magazine
   b. Journal of Food Science and Technology (AFSTI)

## 10. Course Organization

| | | |
|---|---|---|
| **Course Code** | FTC505A | |
| **Course Title** | Food Chemistry | |
| **Course Leader/s Name** | Allotted as per time table | |
| **Course Leader Contact Details** | **Phone:** | 080-49066666 |
| | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | June 2024 | |
| **Next Course Specifications Review Date** | July 2026 | |

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DEAN
Faculty of Life & Allied Health Sciences
M.S. RAMAIAH UNIVERSITY OF APPLIED SCIENCES

## Course Specifications: Enzymes in Food Processing

| | |
|---|---|
| **Course Title** | Enzymes in Food Processing |
| **Course Code** | FTC506A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

### 1. Course Summary

The aim of this course is to introduce students to various enzymes and their applications in the food industry. Students will be taught the applications of enzymes in milk production, the beverage industry, the baking industry, and fat and oil processing. They will also be taught the commercialization of enzyme processes, types of reactions, sources of enzymes, and legal and safety implications.

### 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 03 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 0 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

### Teaching, Learning and Assessment

### 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO 1.** Explain enzyme classification, properties, kinetics and characterization of enzymes
- **CO 2.** Describe various sources of enzymes and commercialization of enzyme processes used in food industry
- **CO 3.** Discuss and decide appropriate application of enzymes in milk production, beverage, baking, jam preparations, oil and fat processing.

### 4. Course Contents

**Unit-I:**

**Enzymes:** Introduction, classification, properties, characterization. Enzyme kinetics - factors affecting the enzymatic activity, enzyme concentration, substrate concentration, environment conditions and enzyme immobilization. Enzymes in food industry: commercialization of enzyme processes, alternative method to use the enzymes, types of reaction Sources of enzymes, legal

and safety implications.

**Unit-II:**

**Enzymes in milk production**: Enzymes in milk preservation, lactose hydrolysis, Use of enzymes for determining milk quality enzymes in cheese manufacturing. Endogenous microbial enzymes, exogenous enzymes, Coagulant technology, enzymes in cheese preservation.

**Unit-III:**

**Enzymes in beverage:** Application of enzymes in tea and cocoa processing .Application of enzymes in alcoholic beverages as beer, whisky, wine and ciders. Role of the enzymes in fruit juice production, enzymatic clarification of apple and guava juices, factors affecting the clarity of fruit juices.

**Unit-IV:**

**Enzymes in baking industry:** Introduction, Enzymes for baking industry. Use of the proteinases, lipases and pentosans in baking industry, Starch degrading enzymes: sources, analysis and application of starch degrading enzymes.

**Unit-V:**

**Hemicellulase:** sources, analysis and application Enzymes in the processing of fats and oils: specificity, stability and application of lipases and related enzymes. Role of enzymes in hydrolysis of triglycerides, inter esterification and randomisation.

**5. CO-PO PSO Mapping:**

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | | | | 1 | | 1 | | 3 | 2 | | |
| CO-2 | | | 3 | 2 | ◦ | | | | | | 3 | |
| CO-3 | 3 | 2 | | | | 1 | | | | 2 | | 1 |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods:**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 03 |
| 1. Demonstration using Videos | 03 | |
| 2. Demonstration using Physical Models | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | |

| | | |
|---|---|---|
| 1. Course Laboratory | | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 07 |
| 1. Case Study Presentation | 02 | |
| 2. Guest Lecture | 02 | |
| 3. Industry / Field Visit | | |
| 4. Brain Storming Sessions | | |
| 5. Group Discussions | 02 | |
| 6. Discussing Possible Innovations | 01 | |
| Term Test and Written Examination | | 05 |
| Total Duration in Hours | | **45** |

**7. Course Assessment**

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.

The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| **Focus of Course Learning Outcomes in each component assessed** | | | | |
|---|---|---|---|---|
| | **CE (50% Weightage)** | | | **SEE (50% Weightage)** |
| | **SC1** | **SC2** | **SC3** | **SEE Theory** |
| | 50 Marks | 25 Marks | 25 Marks | 100 Marks |
| **CO-1** | ✓ | x | ✓ | ✓ |
| **CO-2** | x | ✓ | ✓ | ✓ |
| **CO-3** | ✓ | ✓ | x | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

## 8. Achieving Course Learning Outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | ------- |
| 6. | Practical Skills | ------- |
| 7. | Group Work | Assignment/ Class Presentations |
| 8. | Self-Learning | Assignment, Examination |
| 9. | Written Communication Skills | Assignment |
| 10. | Verbal Communication Skills | Class Presentations |
| 11. | Presentation Skills | Class Presentations |
| 12. | Behavioral Skills | ------- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | Assignment, Examination |
| 15. | Leadership Skills | Effective management of learning, time management, achieving the learning outcomes |

## 9. Course Resources

1. **References**
   a. Flickinger MC and Drew SW. 1999. Encyclopedia of Bioprocess Technology. A Wiley- Inter Science Publ.
   b. Kruger JE. et al. 1987. Enzymes and their Role in Cereal Technology. American Association of Cereal Chemists Inc.
   c. Nagodawithana T and Reed G. 1993. Enzymes in Food Processing. Academic Press.
   d. Tucker GA and Woods LFJ. 1991. Enzymes in Food Processing.
   e. Whitehurst R and Law B. 2002. Enzymes in Food Technology. Blackwell Publication
2. **Magazines and Journals**
   a. FOOD SCIENCE and TECHNOLOGY-Magazine
   b. Journal of Food Science and Technology (AFSTI)
3. **Websites**
   a. https://khni.kerry.com/news/articles/enzymes-in-food-and-nutrition/
   b. https://www.fssai.gov.in/upload/advisories/2021/07/60ec3e1719321Direction_Processing_Aids_12_07_2021.pdf

4. **Other Electronic Resources**

https://iubmb.qmul.ac.uk/enzyme/

**10. Course Organization**

| | | | |
|---|---|---|---|
| **Course Code** | FTC506A | | |
| **Course Title** | Enzymes in Food Processing | | |
| **Course Leader/s Name** | | Allotted as per time table | |
| **Course Leader Contact Details** | | **Phone:** | 080-49066666 |
| | | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | | June 2024 | |
| **Next Course Specifications Review Date** | | July 2026 | |

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# SEMESTER-II

DEAN
Faculty of Life & Allied Health Sciences
M.S. RAMAIAH UNIVERSITY OF APPLIED SCIENCES
BANGALORE-560 054



DEAN
Faculty of Life & Allied Health Sciences
M.S. RAMAIAH UNIVERSITY OF APPLIED SCIENCES

**Course Specifications: Nutraceuticals and Functional Foods**

| | |
|---|---|
| **Course Title** | Nutraceuticals and Functional Foods |
| **Course Code** | FTC507A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

**1. Course Summary**

The aim of this course is to familiarize students with the role of nutraceuticals and functional foods in health and disease and their importance in the food processing industry. Students will be enabled to understand the concept of nutraceuticals, functional foods, and their classifications. They will be trained to formulate functional foods for different disease conditions. Students will be educated regarding adverse effects, toxicity, labelling, and marketing issues associated with nutraceuticals and functional foods.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 03+01 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 30 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**Teaching, Learning and Assessment**

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Describe the role of nutraceuticals and functional foods in health and disease.

**CO-2.** Describe the manufacturing, clinical testing and adverse effects of nutraceuticals and functional foods.

**CO-3.** Explain the role of probiotics, prebiotics, antioxidants and dietary fibre in human health.

**CO-4.** Formulate functional foods and perform sensory evaluations of formulated products.

**4. Course Contents**

**Unit-I:**

**Nutraceuticals and functional Foods** –Definition, concept, history and market; Evolution of nutraceuticals and functional foods market. Classification of nutraceuticals and functional foods. Significance and relevance of nutraceuticals and functional foods in the management of diseases and disorders.

**Unit-II:**

**Angiogenesis:** Concept of angiogenesis and the role of nutraceuticals/functional foods.

**Unit-III:**

**Role of functional food and nutraceuticals in health and disease:** Polyphenols, Flavonoids, catechins, tannins, Phytoesterogens, Glucosinolates, Organo Sulphur, Phytates, Protease and their role in health and disease.

**Unit-IV:**

**Manufacturing aspects of nutraceuticals:** lycopene, isoflavonoids, glucosamine, phytosterols.

**Unit-V:**

**Prebiotics, probiotics and Synbiotics**: their health benefits, selection criteria, types and food formulations

**Unit VI:**

Antioxidants, dietary fiber and their health benefits

**Unit VII**

**Clinical testing** of nutraceuticals and health foods, adverse effects and toxicity of nutraceuticals. Formulation of functional foods containing nutraceuticals -stability, analytical, labelling and marketing issues.

**Practical**

1. Market survey of existing health foods
2. Development of protein enriched biscuits as a functional food
3. Production of functional food for diabetic patient
4. Production of flavonoid rich food product
5. Development of labels for health foods
6. Preparation of symbiotic yoghurt/ dahi and its sensory evaluation
7. Determination of antioxidants by DPPH method
8. Production of carotenoids from pumpkin powder
9. Production of ginger and turmeric oleoresins used in food products
10. Visit to Functional food/ Nutraceuticals manufacturing industry

## 5. CO-PO PSO Mapping:

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | | | | | | 1 | 2 | 2 | | | |
| CO-2 | 3 | | | | | | 1 | | 2 | | | |
| CO-3 | 3 | | 2 | | | | | | | 2 | | |
| CO-4 | | 3 | | | | | 1 | 2 | | | 3 | 2 |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

## 5. Course Teaching and Learning Methods:

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 02 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 05 |
| 1. Case Study Presentation | | |
| 2. Guest Lecture | 02 | |
| 3. Industry / Field Visit | 01 | |
| 4. Brain Storming Sessions | | |
| 5. Group Discussions | | |
| 6. Discussing Possible Innovations | 02 | |
| Term Tests, Laboratory Examination/Written Examination, Presentations | | 08 |
| Total Duration in Hours | | **75** |

## 7. Course Assessment

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.

The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table.

| | Focus of Course Learning Outcomes in each component assessed | | | | |
|---|---|---|---|---|---|
| | CE (50% Weightage) | | | SEE (50% Weightage) | |
| | SC1 (Midterm) | SC2 (Innovative + Lab assignment) | SC3 (Written Assignment) | SEE (Theory) | SEE (Laboratory) |
| | 50 marks | 25 marks | 25 marks | 100 marks | 50 marks |
| CO-1 | ✓ | x | x | ✓ | ✓ |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ |
| CO-3 | x | x | ✓ | ✓ | ✓ |
| CO-4 | x | ✓ | ✓ | ✓ | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

**8. Achieving Course Learning Outcomes**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | ------ |
| 6. | Practical Skills | Laboratory exercises |
| 7. | Group Work | Assignment/ Class Presentations |
| 8. | Self-Learning | Assignment, Examination |
| 9. | Written Communication Skills | Assignment |
| 10. | Verbal Communication Skills | Class Presentations |
| 11. | Presentation Skills | Class Presentations |
| 12. | Information Management | Assignment |
| 13. | Leadership Skills | Effective management of learning, time management, achieving the learning outcomes |

**9. Course Resources**



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Faculty of Life & Allied Health Sciences

1. **References**

   a. Robert EC. 2006. Handbook of Nutraceuticals and Functional Foods. 2nd Ed. Wildman.
   b. Shi J. (Ed.). 2006. Functional Food Ingredients and Nutraceuticals: Processing Technologies. CRC Press.
   c. Webb GP. 2006. Dietary Supplements and Functional Foods. Blackwell Publ.
   d. Neeser JR and German BJ. 2004. Bioprocesses and Biotechnology for Nutraceuticals. Chapman and Hall.
   e. Tomar S.K. 2011. Functional Dairy Foods Concepts and Applications. Satish Serial Publishing House, Delhi.
   f. Mingruo Guo. 2009. Functional food: principle and technology. CRC Press .Woodhead publishing limited. New Delhi

2. **Magazines and Journals**
   a. FOOD SCIENCE and TECHNOLOGY-Magazine
   b. Current Nutraceuticals
   c. Journal of Nutraceuticals, Functional and Medical Foods
3. **Websites**
   a. http://www.nutraceuticalinstitute.com
   b. http://www.nutraceuticalalliance.com
   c. https://swayam.gov.in/NPTEL

**10. Course Organization**

| | | |
|---|---|---|
| **Course Code** | FTC507A | |
| **Course Title** | Nutraceuticals and Functional Foods | |
| **Course Leader/s Name** | Allotted as per time table | |
| **Course Leader Contact Details** | **Phone:** | 080-49066666 |
| | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | June 2024 | |
| **Next Course Specifications Review Date** | July 2026 | |

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| Course Specifications: Food Quality and Sensory Analysis | |
|---|---|
| **Course Title** | Food Quality and Sensory Analysis |
| **Course Code** | FTC508A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

**1. Course Summary**

The aim of this course is to introduce students to attributes of quality and their analysis methods. Students are introduced to organoleptic properties such as appearance, flavor, color, texture, and their significance in assessing or measuring the quality of food products. Students will also be introduced to modern analytical equipment used for food quality testing.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 03+01 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 30 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**Teaching, Learning and Assessment**

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the organoleptic properties of food products..
- **CO-2.** Describe the sensory evaluation methods used to assess the quality of food products.
- **CO-3.** Discuss the significance of quality testing methods and the advanced equipment employed.
- **CO-4.** Assess the quality of food products based on their physical attributes, taste, odor, color, and texture.
- **CO-5.** Apply sensory evaluation methods and analytical tools to various food products.

**4. Course Contents**

**Unit-I:**

**Introduction:** Importance of food quality, Definition of quality, Quality specifications and quality attributes of different foods. Aspects of food quality: Introduction to organoleptic properties- Appearance, colour, taste, flavor, textural factors and additional quality factors, Introduction to sensory evaluation- Types

**Unit-II:**

**Appearance** –Size, shape, Texture- gloss, consistency. Colour - Introduction to natural and synthetic colours, functions of colour in foods, Optical aspect of colour, perception of colour, objective evaluation, colour measurement using different systems- Munsell colour system, CIE colour system, qualitative and quantitative analysis of colour, reflectance spectrophotometry and Colorimetry

**Unit-III:**

**Texture** –Introduction, Definition and classification of texture profile , Subjective evaluation, phases of oral processing, Objective analysis, rheological methods of texture measurement including rheological models , Measurement of texture in various food groups viz. cereals, dairy, fruits and vegetables, meat and meat products

**Unit-IV:**

**Taste**- Introduction, organs involved in taste perception- tongue, papillae, taste buds, salivary glands, mechanism of taste perception , chemicals responsible for sweet, salt, sour, and bitter taste their structure and chemical dimensions, Factors affecting taste quality, reaction time and factors affecting it, absolute and recognition threshold, taste abnormalities.

**Unit-V:**

**Olfactory** – Introduction and definition, anatomy of nose, mechanism of odour perception, Prerequisites for odour perception, odour classification, chemical specificity of odour. Measurement of odour using different techniques – primitive, double tube olfactometer, Elseberg techniques, Wenzel's olfactometer, sniffing, merits and demerits of each methods, olfactory abnormalities. Food Adulterants and Food contaminants (Physical, chemical and microbiological).

**Unit-VI:**

**Introduction to modern analytical equipment used for food quality testing**: Scanning Electron Microscopy, Gas Chromatography-Mass Spectrometry, High Performance Liquid Chromatography, Column chromatography, Thin layer Chromatography, spectrophotometer and electrophoresis, Microbiological methods, ELISA.

**Practical**

1. Training of sensory panel for flavor perception
2. To perform sensitivity tests for four basic tastes
3. Sensory evaluation of milk and detection of flavor defects in milk

4. Sensory evaluation of biscuit samples for textural properties
5. Quality evaluation of product for physical attributes
6. Textural evaluation of various food products using texture-meter
7. Simple tests for detection of common adulterants- formaldehyde, starch, cane sugar, hydrogen peroxide, sodium bicarbonate in milk.
8. Extraction of pigments from various fruits and vegetables and influence of heating time and pH
9. Colour estimation by Tintometer
10. Analysis of pesticide residues in fruits and vegetable using GCMS and HPLC

**5. CO-PO PSO Mapping:**

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | 1 | | | 1 | | | 2 | | 2 | | |
| CO-2 | 2 | 2 | | | | | | | | 2 | 3 | |
| CO-3 | | 3 | 2 | | | 1 | | | | | 2 | 1 |
| CO-4 | 3 | | 1 | | | | 1 | 2 | | 1 | 2 | 1 |
| CO-5 | | 3 | 1 | | | | | 2 | | 2 | | |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods:**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 32 |
| **Demonstrations** | | 02 |
| 1. Demonstration using Videos | 2 | |
| 2. Demonstration using Physical Models | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 06 |
| 1. Case Study Presentation | | |
| 2. Guest Lecture | 01 | |
| 3. Industry / Field Visit | | |
| 4. Brain Storming Sessions | 03 | |



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| | | |
|---|---|---|
| 5. Group Discussions | 02 | |
| 6. Discussing Possible Innovations | | |
| Term Tests, Laboratory Examination/Written Examination, Presentations | | 05 |
| Total Duration in Hours | | **75** |

**7. Course Assessment**

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.
The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| **Focus of Course Learning Outcomes in each component assessed** | | | | | |
|---|---|---|---|---|---|
| | **CE (50% Weightage)** | | | **SEE (50% Weightage)** | |
| | **SC1 (Midterm)** | **SC2 (Innovative + Lab assignment)** | **SC3 (Written Assignment)** | **SEE (Theory)** | **SEE (Laboratory)** |
| | 50 marks | 25 marks | 25 marks | 100 marks | 50 marks |
| **CO-1** | ✓ | x | x | ✓ | x |
| **CO-2** | ✓ | x | ✓ | ✓ | ✓ |
| **CO-3** | ✓ | x | ✓ | ✓ | ✓ |
| **CO-4** | x | ✓ | x | ✓ | ✓ |
| **CO-5** | x | ✓ | x | x | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

**8. Achieving Course Learning Outcomes**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Practical Skills | Laboratory exercises |



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| | | |
|---|---|---|
| 6. | Group Work | Assignment/ Class Presentations |
| 7. | Self-Learning | Assignment, Examination |
| 8. | Written Communication Skills | Assignment |
| 9. | Verbal Communication Skills | Class Presentations |
| 10. | Presentation Skills | Class Presentations |
| 11. | Information Management | Assignment |
| 12. | Personal Management | Assignment, Examination |
| 13. | Leadership Skills | Effective management of learning, time management, achieving the learning outcomes |

**9. Course Resources**

1. **References**
   a. ManoranjanKalia, 2010, Food quality management, Agrotech publishing academy Udaipur G. Woodman., Food Analysis, Axis book
   b. InteazAlli. 2004. Food Quality Assurance: Principles and Practices. CRC Press, Boca Raton, FL, USA.
   c. Meilgard, 1999, Sensory evaluation Techniques, USA, CRC Press LLC
   d. Yeshajahu Pomeranz and Clifton E. Meloan, 2002, Food Analysis and Theory and Practice, New Delhi, CBS Publisher and Distributors
   e. R.E. Hester and R.M. Harrison. 2001. Food Safety and Food Quality. Royal Society of Chemistry, Cambridge, UK.
2. **Magazines and Journals**
   a. https://www.foodqualityandsafety.com/
3. **Websites**
   https://fssai.gov.in/cms/product-standards.php
4. **Other Electronic Resource**
   https://eatrightindia.gov.in/

**10. Course Organization**

| | | | |
|---|---|---|---|
| **Course Code** | FTC508A | | |
| **Course Title** | Food Quality and Sensory Analysis | | |
| **Course Leader/s Name** | | Allotted as per time table | |
| **Course Leader Contact Details** | | **Phone:** | 080-49066666 |
| | | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | | June 2024 | |
| **Next Course Specifications Review Date** | | July 2026 | |

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**Course Specifications: Food Production and Operations Management**

| | |
|---|---|
| **Course Title** | Food Production and Operations Management |
| **Course Code** | FTC509A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

**1. Course Summary**

The aim of this course is to equip students with knowledge and understanding of operations management relating to the design, planning, control, and production of food products. This course in operations management covers key concepts and theories of operations, process, and project management. It is designed to introduce students to the challenges faced by organizations, from the order to the delivery of goods and/or services. Students are also to be enabled to address these challenges.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 03 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 0 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**Teaching, Learning and Assessment**

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Demonstrate knowledge and understanding of the principles and concepts of operations management and core operations techniques.
- **CO-2.** Critically analyze and evaluate the advantages and disadvantages of different techniques and approaches to operations management.
- **CO-3.** Evaluate operations strategy, supply network design, and process redesign.
- **CO-4.** Apply techniques and approaches to operations management to solve practical operations management problems.

**4. Course Contents**

**Unit-I:**

**An overview of Operations Management:** Operations Management: Introduction and Overview, Historical Evolution - Changes and Challenges. Concept of Production, Production System, Classification of Production System. Objectives and Scope of Operations Management. Productivity, Factors Affecting Productivity.

**Unit-II:**

**Operations Strategy:** Strategic Role of Operations, Strategic Planning. Product Strategy and integrated product development, Process Strategy. Characteristics of decision and decision methodology. Capacity Planning Decisions. Facilities Location Strategies.

**Unit-III:**

**Product Design and Process Selection:** Product design. Process design. Process technology and its choices. Plant Layout, Classification of layout. Job design and work organization.

**Unit-IV:**

**Planning and managing operations:** Demand Forecasting. Value chain and Supply chain Management. Purchasing, vendor selection and material management, Inventory Management and Just-in-Time Systems. Materials Requirement, Planning and ERP Scheduling, sequencing and dispatching. Project planning and control.

**Unit-V:**

**Managing Quality:** What is quality and why is it so important?. Statistical process control (SPC), Measuring and improving performances, Failure detection and analysis. Total Quality management, Value analysis and Value Engineering.

**5. CO-PO PSO Mapping:**

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | | | | 1 | | 1 | | 3 | | | |
| CO-2 | | | 3 | 2 | | | | | | | 2 | |
| CO-3 | 3 | 2 | | | | 1 | | | | 2 | | 1 |
| CO-4 | | 3 | | 2 | | | | | | 2 | | 3 |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods:**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| Face to Face Lectures | | 28 |
| Demonstrations | | 03 |

| | | |
|---|---|---|
| 1. Demonstration using Videos | 03 | |
| 2. Demonstration using Physical Models | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | |
| 1. Course Laboratory | | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | |
| 1. Case Study Presentation | 02 | |
| 2. Guest Lecture | 02 | |
| 3. Industry / Field Visit | | 09 |
| 4. Brain Storming Sessions | | |
| 5. Group Discussions | 05 | |
| 6. Discussing Possible Innovations | | |
| Term Test and Written Examination | | 05 |
| Total Duration in Hours | | **45** |

**7. Course Assessment**

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.

The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| **Focus of Course Learning Outcomes in each component assessed** | | | | |
|---|---|---|---|---|
| | **CE (50% Weightage)** | | | **SEE (50% Weightage)** |
| | **SC1** | **SC2** | **SC3** | **Theory** |
| | 50 Marks | 25 Marks | 25 Marks | 100 Marks |
| **CO-1** | ✓ | x | ✓ | ✓ |
| **CO-2** | x | ✓ | ✓ | ✓ |
| **CO-3** | ✓ | ✓ | x | ✓ |
| **CO-4** | ✓ | ✓ | x | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

## 8. Achieving Course Learning Outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | ------ |
| 6. | Group Work | Assignment/ Class Presentations |
| 7. | Self-Learning | Assignment, Examination |
| 8. | Written Communication Skills | Assignment |
| 9. | Verbal Communication Skills | Class Presentations |
| 10. | Presentation Skills | Class Presentations |
| 11. | Behavioral Skills | ------- |
| 12. | Information Management | Assignment |
| 13. | Personal Management | Assignment, Examination |
| 14. | Leadership Skills | Effective management of learning, time management, achieving the learning outcomes |

## 9. Course Resources

**1. References**


a. Chary SN (2004), Production and Operations Management, Tata Mc Graw Hill III Edition.
b. Anil Kumar, S and Suresh, N (2009), Operations Management, New Age International (P) Ltd., Publishers, New Delhi
c. Parvinder Bali (2014), Food Production Operations, Oxford University Press, II Edition,
d. Joseph G. Monks(1997), Operations Management Theory and Problems, Mc. Graw Hill III Edition Nigel Slack and Alistair Brandon-Jones (2019) Operations Management, Pearson Education Ltd., Essex, UK
e. Bizmanulz (2008), ISO 22000 Standard Procedures for Food Safety Management Systems


**2. Magazines and Journals**

a. FOOD SCIENCE and TECHNOLOGY-Magazine
b. Journal of Food Science and Technology (AFSTI)

**3. Websites:**

https://www.startus-insights.com/innovators-guide/food-operations-management-startups/

4. **Other Electronic Resources**

https://www.fssai.gov.in/upload/uploadfiles/files/L-and-R%20oper%20content_merged.pdf

**10. Course Organization**

| | | | |
|---|---|---|---|
| **Course Code** | FTC509A | | |
| **Course Title** | Food Production and Operations Management | | |
| **Course Leader/s Name** | | Allotted as per time table | |
| **Course Leader Contact Details** | | **Phone:** | 080-49066666 |
| | | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | | June 2024 | |
| **Next Course Specifications Review Date** | | July 2026 | |

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DEAN
Faculty of Life & Allied Health Sciences
M.S. RAMAIAH UNIVERSITY OF APPLIED

**Course Specifications: Advances in Fermentation Technology**

| | |
|---|---|
| **Course Title** | Advances in Fermentation Technology |
| **Course Code** | FTC510A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

**1. Course Summary**

The aim of this course is to enable the students with knowledge of basic fermentation technology and processing of fermented foods and beverages. The students will be able to understand the fermentation technology and types of fermentation. They will also be familiarized with preparation of fermented food products. The course will also educate students with advance technology of microbiology.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 03+01 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 30 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**Teaching, Learning and Assessment**

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Explain the types of fermentation.

**CO-2.** Discuss mushrooms-cultivation and preservation.

**CO-3.** Prepare and demonstrate the various fermented food products.

**CO-4.** Describe the advance technologies in microbiology.

**4. Course Contents**

**Unit- I**

**Introduction to Fermentation**- historical development; fermented food products of India; worldwide fermented food products; classification of fermented food products. Basic principles

involved in fermentation; types of fermentation; starter culture; preparation and maintenance of bacterial, yeast and mold cultures for food fermentations.

**Unit- II**

**Fermented Milk Products-** Processing, manufacture, storage and packaging of acidophilus milk, cultured butter-milk and other fermented milk; bio-chemical changes occurring during manufacture of fermented milks; factors affecting these changes and effects of these changes on the quality of finished products.

**Unit- III**

**Fermented Vegetables Products-** Technological aspects of pickled vegetables, sauerkraut, cucumbers; mushrooms-cultivation and preservation.

**Unit- IV**

**Fermented cereal and Pulse Products**- Fermented soy sauce; soy sauce manufacturing methods; miso fermentation- raw materials and microorganism for fermentation; comparison of Indigenous and modern processing; spoilage microbes; tempeh- production and consumption, essential steps of fermentation.

**Unit- V**

**Fermented Fish and Meats Product**- fish sauces, fermented fish pastes; fermented sausages process for manufacture of fermented sausage biochemical and microbiological changes during sausage ripening.

**Unit- VI**

**Alcoholic Fermentation Products**- Technology for processing of wine, cider, beer; microbiological and biochemical aspects. Methods of manufactures: Acetic acid/vinegar, baker's yeast, microbial protein, lactic acid etc.

**Unit- VII**

**Future of Fermented Foods**: Advances in microbiology, role of intestinal bacteria in human health in future, regulation and health claims for fermented foods.

**Practical**

1. Isolation and identification of Probiotic bacteria from foods
2. Preparation of Dairy-based fermented foods
3. Preparation of Sauerkraut
4. Preparation of fermented cereal products
5. Preparation of alcoholic products and estimation of Alcohol
6. Production of enzymes from microbial cultures
7. Fermentation industry visit

## 5. CO-PO PSO Mapping:

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | 1 | | | | | | | 2 | 2 | | |
| CO-2 | 3 | 1 | | | | | | 2 | 1 | 2 | | 1 |
| CO-3 | | 2 | 2 | | | | | | | | 3 | 2 |
| CO-4 | | 2 | 2 | | | | | | | 3 | | 1 |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods:

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 32 |
| **Demonstrations** | | 02 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 06 |
| 1. Case Study Presentation | | |
| 2. Guest Lecture | 01 | |
| 3. Industry / Field Visit | | |
| 4. Brain Storming Sessions | 03 | |
| 5. Group Discussions | 02 | |
| 6. Discussing Possible Innovations | | |
| Term Tests, Laboratory Examination/Written Examination, Presentations | | 05 |
| Total Duration in Hours | | **75** |

## 7. Course Assessment

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.

The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| Focus of Course Learning Outcomes in each component assessed | | | | | |
|---|---|---|---|---|---|
| | CE (50% Weightage) | | | SEE (50% Weightage) | |
| | SC1 (Midterm) | SC2 (Innovative + Lab assignment) | SC3 (Written Assignment) | SEE (Theory) | SEE (Laboratory) |
| | 50 marks | 25 marks | 25 marks | 100 marks | 50 marks |
| CO-1 | ✓ | x | x | ✓ | x |
| CO-2 | ✓ | ✓ | x | ✓ | ✓ |
| CO-3 | x | ✓ | ✓ | ✓ | ✓ |
| CO-4 | x | x | ✓ | ✓ | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

**8. Achieving Course Learning Outcomes**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | -------- |
| 6. | Practical Skills | Laboratory exercises |
| 7. | Group Work | Assignment/ Class Presentations |
| 8. | Self-Learning | Assignment, Examination |
| 9. | Written Communication Skills | Assignment |
| 10. | Verbal Communication Skills | Class Presentations |
| 11. | Presentation Skills | Class Presentations |
| 12. | Behavioral Skills | -------- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | Assignment, E✓amination |
| 15. | Leadership Skills | Effective management of learning, time management, achieving the learning outcomes |

## 9. Course Resources

**References**

1. **Reference books**

2. B. J. B. Wood (1998), Microbiology of fermented foods, Springer US
3. Robert W. Hutkins (2006), Microbiology and Technology of Fermented Foods, II Edition, IFT Press IFT Press, Ames, Iowa, Blackwell Pub.
4. K. H. Steinkrauss (1995), Handbook of Indigenous Fermented Foods , CRC Press
5. Sukumar De (1996), Outlines of Dairy Technology by, Oxford University Press

2. **Magazines and Journals**
   a. FOOD SCIENCE and TECHNOLOGY-Magazine
   b. Journal of Food Science and Technology (AFSTI)
3. **Websites**

http://ecoursesonline.iasri.res.in/course/view.php?id=460b.https://www.fssai.gov.in/upload/advisories/2021/07/60ec3e1719321Direction_Processing_Aids_12_07_2021.pdf

## 10. Course Organization

| | | | |
|---|---|---|---|
| **Course Code** | FTC510A | | |
| **Course Title** | Advances in Fermentation Technology | | |
| **Course Leader/s Name** | | Allotted as per time table | |
| **Course Leader Contact Details** | | **Phone:** | 080-49066666 |
| | | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | | June 2024 | |
| **Next Course Specifications Review Date** | | July 2026 | |

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BANGALORE

**Course Specifications: Research Methodology**

| | |
|---|---|
| **Course Title** | Research Methodology |
| **Course Code** | FTC511A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

**1. Course Summary**

The course aims to provide students with an insight into the research methodology and the associated responsibilities of a researcher. This course deals with the principles of research, research methodology, significant phases of research, and the role of systematic literature review. The course will also cover essential aspects of technical communication to develop effective scientific writing skills and presentation skills to communicate research findings effectively with the public.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 03 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 0 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**Teaching, Learning and Assessment**

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

**CO-1.** Analyze and represent research data using a suitable statistical method.

**CO-2.** Use various statistical tools to analyze the given data.

**CO-3.** Describe the scope, relevance, and mandatory steps of research.

**CO-4.** Understand the differences between academic, industrial, and clinical research.

**CO-5.** Write a scientifically sound research paper and submit proposals.



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**4. Course Contents**

**Unit-I:**

**Introduction to Research Methodology:** Research: Meaning, Objectives and Importance. Types of Research: Quantitative and Qualitative research in Food Sciences, Nutrition and Dietetics. Basic and Applied Research, Academic and Industrial Research. Pre-Clinical and Clinical Research

**Unit-II:**

**Introduction to Scientific Writing** - Types of Scientific Document: Research Paper, Review Paper, and Research Proposal. Identification of Research Gap, Problem Statement. Plagiarism, Authorship, References and Citations.

**Unit-III:**

**Design Strategies in Research** - Descriptive studies, Analytical studies, epidemiological research design in biological sciences. Bias in Research, Confounding effect. Research design: Types of Research Designs.

**Unit-IV:**

**Data Representation in Biosciences** - Components of Graph. Standard Deviation, Error Bar, Biological Replicates. Line diagrams, bar diagrams, Histograms, Pie diagrams, Scatter Plot, Dot Plot, and Heat Map. Skewness and Kurtosis.

**Unit-V:**

**Biostatistics I** - Definition, Application, descriptive statistics. Types of Sampling: Random and Non-Random Sampling. Sampling and Non-Sampling Errors. Probability and Rules of Probability

**Unit-VI:**

**Biostatistics II** - Correlation and Regression. Variance and Standard Deviation. Tests of Significance, P-value. T-Test; Chi-square test. ANOVA.

**Unit-VII:**

Tools for Statistical Analysis in Biological Research - Working with MS Excel, OriginPro.

**5. CO-PO PSO Mapping:**

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | | 2 | | | | | | 2 | | | 3 |
| CO-2 | | 3 | 2 | | | | | | | 2 | | 3 |
| CO-3 | 3 | | | | | | | | | | 3 | 2 |
| CO-4 | | 2 | | | | 1 | | | | | 1 | 3 |
| CO-5 | 2 | | | | | | | 3 | | | 3 | 2 |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

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BANGALORE-560 054

## 6. Course Teaching and Learning Methods:

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 01 |
| 1. Demonstration using Videos | 01 | |
| 2. Demonstration using Physical Models | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | 03 |
| 1. Solving Numerical Problems | 03 | |
| **Practical Work** | | |
| 1. Course Laboratory | | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 06 |
| 1. Case Study Presentation | 05 | |
| 2. Guest Lecture | | |
| 3. Industry / Field Visit | | |
| 4. Brain Storming Sessions | 01 | |
| 5. Group Discussions | | |
| 6. Discussing Possible Innovations | | |
| Term Test and Written Examination | | 05 |
| Total Duration in Hours | | **45** |

## 7. Course Assessment

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.

The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| Focus of Course Learning Outcomes in each component assessed | | | | |
|---|---|---|---|---|
| | CE (50% Weightage) | | | SEE (50% Weightage) |
| | SC1 | SC2 | SC3 | Theory |
| | 50 Marks | 25 Marks | 25 Marks | 100 Marks |
| CO-1 | ✓ | x | x | ✓ |
| CO-2 | ✓ | x | ✓ | ✓ |
| CO-3 | x | ✓ | ✓ | ✓ |
| CO-4 | x | ✓ | ✓ | ✓ |
| CO-5 | x | ✓ | ✓ | ✓ |



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The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

**8. Achieving Course Learning Outcomes**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Assignments, Seminar |
| 4. | Analytical Skills | Assignments, Seminar |
| 5. | Problem Solving Skills | Classroom lectures |
| 6. | Self-Learning | Assignment, Examination |
| 7. | Written Communication Skills | Assignment, , Class Tests |
| 8. | Presentation Skills | Assignments, Seminar |
| 9. | Information Management | A Assignments, Seminar |
| 10. | Personal Management | Assignment, Examination |
| 11. | Leadership Skills | Effective management of learning, time management, achieving the learning outcomes |

**9. Course Resources**

**1. References**


a. Kothari, CR. 2004. Research Methodology, Methods and Techniques, 2nd ed. New Age International Publishers.
b. Rao, K. V. 2007. Biostatistics - A Manual of Statistical Methods for use in Health Nutrition and Anthropology. Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
c. Dawson-Saunders, B and Trapp, RG. 1990. Basic and clinical biostatistics. Appleton and Lange, Connecticut.
d. Rohatgi, V.K. and Saleh, A.K. 2001. An Introduction to Probability and Statistics, John Wiley and Sons.
e. Rugg G. and Petre M. 2004. The Unwritten Rules of Ph.D research, Open University. McGraw-Hill Education, England
f. World Health Organization. 2011. Standards and operational guidance for ethics review of health-related research with human participants.
g. World Medical Association (WMA). 2008. Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects.


**2. Magazines and Journals**

eGyanKosh: MLIE-102 Research Methodology



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(https://egyankosh.ac.in/handle/123456789/4812)

**3. Websites**

https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm

**4. Other Electronic Resources**

IGNOU MFN-09 Study Material | IGNOUHelp.in (https://www.ignouhelp.in/ignou-mfn-09-study-material/#google_vignette)

## 10. Course Organization

| | | |
|---|---|---|
| **Course Code** | FTC511A | |
| **Course Title** | Research Methodology | |
| **Course Leader/s Name** | Allotted as per time table | |
| **Course Leader Contact Details** | **Phone:** | 080-49066666 |
| | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | June 2024 | |
| **Next Course Specifications Review Date** | July 2026 | |

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DEAN
Faculty of Life & Allied Health Sciences
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# ELECTIVE-I



DEAN
Faculty of Life & Allied Health Sciences

| Course Specifications: Post-Harvest Technology of Cereals and Pulses | |
|---|---|
| **Course Title** | Post-Harvest Technology of Cereals and Pulses |
| **Course Code** | FTE501A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

## 1. Course Summary

The aim of this course is to comprehend the various post-harvest processes of cereals and pulses and their applications. Students will understand the management of storage structures and losses during storage of cereals and pulses produced, and also understand the different drying and conveyor systems used in food production plants.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 03+01 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 30 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## Teaching, Learning and Assessment

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO 1.** Explain the importance of post-harvest and causes for post-harvest losses
- **CO 2.** Describe varies types of drying systems and storage structures
- **CO 3.** Discuss the different conveyors, elevators and its importance
- **CO 4.** Perform different physico-chemical properties for cereals and pulses

## 4. Course Contents

**Unit-I:**

**Post-Harvest Food losses and management:** Importance of post-harvest management of food; Causes of post-harvest losses. Post-harvest quality and quantity losses.

**Unit-II:**

**Unit operations in post-harvest technology.** Introduction of post-harvest technology: Harvesting, Handling cleaning, grading, sorting, drying, storage, milling, size reduction, expelling,

extraction, blending, heat treatment, separation, material handling (transportation, conveying, elevating),washing.

**Unit-III:**

**Drying and dehydration of Food:** Drying of Cereals and Pulses: importance of drying, principles of drying and factors affecting drying. Types of drying methods, sun drying and artificial drying.

**Unit-IV:**

**Types of dryers:** Artificial drying by mechanical means like Continuous Flow Dryers, L.S.V. Dryers, Spray Dryer, Fluidized Bed Dryers, Rotary Dryer, Spouted Beds, Freeze Dryer, Tray and Tunnel Dryers, Psychometric Chart.

**Unit-V:**

**Storage of food:** Storage of Cereals and Pulse: Introduction, need and importance, general principles of storage. Deep and shallow bins. Traditional and modern storage structures. Losses during storage and their control, space requirement of bag storage structure.

**Unit-VI:**

**Food material Handling and Conveying:** Types of material conveying Systems. Belt Conveyor, Bucket Elevator, Screw Conveyor.

**Practical**

1. Determination of physical properties of agricultural materials e.g. size, shape, density
2. Determination of angle of repose of Cereals, Pulses and Oil Seeds
3. Determination of moisture content of grains.
4. Study of different types of dryers.
5. Study on drying curve of fruits and vegetables and grains.
6. Study of domestic grain storage structures.
7. Determination of sedimentation value of the Maida.
8. Study of rice dehuller or dehukers
9. Determination of alcoholic acidity and water absorption capacity and Polenske value of wheat flour.
10. Determination of adulterant ($NaHCO_3$) in wheat flour/ Maida.
11. Visit to warehouses, Pack houses and cold-storage.

**5. CO-PO PSO Mapping:**

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | | | 1 | | | | | 2 | | 1 | |
| CO-2 | 3 | | 2 | 1 | | | | | | 3 | | |
| CO-3 | | | | 3 | | | | | | 2 | | |
| CO-4 | 3 | 2 | | | | | | | 3 | | 1 | |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods:**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 32 |
| **Demonstrations** | | 02 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 06 |
| 1. Case Study Presentation | | |
| 2. Guest Lecture | 01 | |
| 3. Industry / Field Visit | | |
| 4. Brain Storming Sessions | 03 | |
| 5. Group Discussions | 02 | |
| 6. Discussing Possible Innovations | | |
| Term Tests, Laboratory Examination/Written Examination, Presentations | | 05 |
| Total Duration in Hours | | **75** |

**7. Course Assessment**

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.

The assessment questions are set to test the course learning outcomes. In each component or

subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| Focus of Course Learning Outcomes in each component assessed | | | | | |
|---|---|---|---|---|---|
| | CE (50% Weightage) | | | SEE (50% Weightage) | |
| | SC1 | SC2 | SC3 | SEE Theory | SEE Lab |
| | 50 Marks | 25 Marks | 25 Marks | 100 Marks | 50 Marks |
| CO-1 | ✓ | x | x | ✓ | ✓ |
| CO-2 | ✓ | x | ✓ | ✓ | ✓ |
| CO-3 | x | ✓ | ✓ | ✓ | ✓ |
| CO-4 | x | ✓ | ✓ | ✓ | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

**8. Achieving Course Learning Outcomes**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | ---------- |
| 6. | Practical Skills | Laboratory exercises |
| 7. | Group Work | ---------- |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, class test |
| 10. | Verbal Communication Skills | ---------- |
| 11. | Presentation Skills | Assignment, Seminar |
| 12. | Behavioral Skills | ---------- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | Assignment, Examination |

**9. Course Resources**

1. **References**
   a. Chakraverty, Post-Harvest Technology of Cereal, Pulses, Oil seeds. Oxford and IBH Publication Co.
   b. Dr.K.M. Sahay and K.K Singh: Unit operation of agro processing engineering. Vikas

Publications.

c. Kulp, K. and Ponte, J. G. Hand Book of Cereal Science and Technology, (CRC Press, 2000)

2. **Magazines and Journals**
   a. FOOD SCIENCE and TECHNOLOGY-Magazine
   b. Journal of Food Science and Technology (AFSTI)
3. **Websites**
   http://ecoursesonline.iasri.res.in/course/view.php?id=460b.https://www.fssai.gov.in/upload/advisories/2021/07/60ec3e1719321Direction_Processing_Aids_12_07_2021.pdf

## 10. Course Organization

| | | |
|---|---|---|
| **Course Code** | FTE501A | |
| **Course Title** | Post-Harvest Technology of Cereals and Pulses | |
| **Course Leader/s Name** | Allotted as per time table | |
| **Course Leader Contact Details** | **Phone:** | 080-49066666 |
| | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | June 2024 | |
| **Next Course Specifications Review Date** | July 2026 | |

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| Course Specifications: Millet Processing Technology | |
|---|---|
| **Course Title** | Millet Processing Technology |
| **Course Code** | FTE502A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

## 1. Course Summary

The aim of this course is to equip the students with fundamental knowledge of millet processing technology. Students will be taught millet processing methods, processing equipment, and different millet processed products, and they will also understand the effect of processing on the nutritional value of millets.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 03+01 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 30 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## Teaching, Learning and Assessment

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO 1.** Describe the millet processing equipment
- **CO 2.** Explain the various millet processing methods and its effect on nutritional quality
- **CO 3.** Discuss the different traditional and bioprocess technologies
- **CO 4.** Perform various millet processing methods and prepare millet value added products

## 4. Course Contents

**Unit-I:**

Types of Millets, Characteristics – nutritional composition.

**Unit-II:**

**Processing of millet:** Milling machinery, major and minor products; Evaluation of millet processing machinery - cleaners, dehuskers, polishers, popping machines

**Unit-III:**

Domestic flour milling equipment used for pearling, grinding and flour sifting of sorghum, pearl millet and Finger millet; Popping of coarse millets – technique and equipment.

**Unit-IV:**

**Traditional and bioprocess technologies**: Germination or malting, Fermentation and enzymatic hydrolysis, Popping or puffing, Soaking and cooking.

**Unit-V:**

**Food Manufacturing and Formulation Technologies**: Conversion into pure-millet food products, blending into composite flours and food products, Fortification and supplementation.

**Practical**

1. Popping of coarse grains
2. Malting of ragi and preparation of weaning Food.
3. Dehulling studies of millets
4. Pearling studies of sorghum, pearl millet and ragi
5. Preparation of different millet based snacks
6. Malting techniques of millets
7. Finger millet product development
8. Calcium estimation in finger millet
9. Estimation of iron in finger millet by titrimetric method
10. Preparation of millet instant laddu mix
11. Preparation of extruded products from millets

**5. CO-PO PSO Mapping:**

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | | 1 | | | | | | | 2 | | |
| CO-2 | 2 | | 2 | | | | | | | | 2 | 2 |
| CO-3 | | | 2 | 1 | | | 2 | | | | 3 | |
| CO-4 | | | 3 | 2 | | | | 1 | | 1 | 2 | |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods:

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 32 |
| **Demonstrations** | | 02 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 06 |
| 1. Case Study Presentation | | |
| 2. Guest Lecture | 01 | |
| 3. Industry / Field Visit | | |
| 4. Brain Storming Sessions | 03 | |
| 5. Group Discussions | 02 | |
| 6. Discussing Possible Innovations | | |
| Term Tests, Laboratory Examination/Written Examination, Presentations | | 05 |
| Total Duration in Hours | | **75** |

## 7. Course Assessment

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.

The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| Focus of Course Learning Outcomes in each component assessed | | | | | |
|---|---|---|---|---|---|
| | CE (50% Weightage) | | | SEE (50% Weightage) | |
| | SC1 | SC2 | SC3 | SEE Theory | SEE Lab |
| | 50 Marks | 25 Marks | 25 Marks | 100 Marks | 50 Marks |
| **CO-1** | ✓ | x | x | ✓ | ✓ |
| **CO-2** | ✓ | ✓ | ✓ | ✓ | ✓ |
| **CO-3** | x | ✓ | ✓ | ✓ | ✓ |
| **CO-4** | x | x | ✓ | ✓ | ✓ |



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The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

**8. Achieving Course Learning Outcomes**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | --- |
| 6. | Practical Skills | Laboratory exercises |
| 7. | Group Work | --- |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, class test |
| 10. | Verbal Communication Skills | --- |
| 11. | Presentation Skills | Assignment, Seminar |
| 12. | Behavioral Skills | --- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | Assignment, Examination |

**9. Course Resources**

1. **References**
   a. Finger Millet: A Valued Cereal by K S Premavalli.2012, Nova Publishers
   b. Chakravarty, Post-Harvest Technology of Cereal, Pulses, Oil seeds. Oxford and IBH Publication Co.
   c. Dr.K.M. Sahay and K.K Singh: Unit operation of agro processing engineering. Vikas Publications.
   d. Kulp, K. and Ponte, J. G. Hand Book of Cereal Science and Technology, (CRC Press, 2000)

2. **Websites:** https://www.foodprocessing.com/
3. **Magazines and Journals**
   a. FOOD SCIENCE and TECHNOLOGY-Magazine
   b. Journal of Food Science and Technology (AFSTI)

**10. Course Organization**

| | | | |
|---|---|---|---|
| **Course Code** | FTE502A | | |
| **Course Title** | Millet Processing Technology | | |
| **Course Leader/s Name** | | Allotted as per time table | |
| **Course Leader Contact Details** | | **Phone:** | 080-49066666 |
| | | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | | June 2024 | |
| **Next Course Specifications Review Date** | | July 2026 | |

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DEAN
Faculty of Life & Allied Health Sciences
M.S. RAMAIAH UNIVERSITY OF APPLIED SCIENCES

| Course Specifications: Fruits and Vegetable Processing Technology | |
|---|---|
| **Course Title** | Fruits and Vegetable Processing Technology |
| **Course Code** | FTE503A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

## 1. Course Summary

The aim of this course is to equip the students with fundamental knowledge of fruit and vegetable processing technology. Students will learn about different processing methods, processing equipment, and different fruit and vegetable processed products, and they will also understand the canning, MAP, and CAP of fruits and vegetables.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 03+01 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 30 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**Teaching, Learning and Assessment**

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO 1.** Explain the basic fruits and vegetables processing technologies
- **CO 2.** Discuss the various preservation methods
- **CO 3.** Discuss and apply advanced methods of processing and storage
- **CO 4.** Prepare different processed products using fruits and vegetables or optimize the process

## 4. Course Contents

**Unit I**

Current status and scope of production and processing of fruits and vegetables

**Unit II**

**Juice extraction**: juice, history of juicing, types of juices, process flow diagram for fruit juice production, juice extraction process- fruit selection, sorting, washing, juice extraction, de-aeration, straining/filtration, clarification, adding of sugars, fortification, bottling, sealing and storage; methods of juice preservation, causes of juice spoilage.

**Unit III**

**Canning:** Introduction, canning process - selection of fruits and vegetables, preparation of raw material, blanching, cooling, filling, exhausting, sealing, thermal processing, cooling and storage.

**Unit IV**

Minimally processed fruits and vegetables

**Unit V**

MAP and CAP of Fruits and vegetables

**Unit VI**

**Quality Control:** History of Statutory Provisions in India, FSSAI Guide Lines for Fruits and vegetables

**Practical**

1. Market survey of preserved fruit and vegetable products.
2. Sterilization of bottles
3. Preparation and packaging, sensory/objective evaluation and economics of ketchup (Tomato).
4. Preparation and packaging, sensory/objective evaluation and Economics of squash (pineapple)
5. Preparation and packaging, sensory/objective evaluation and economics of squash Syrup (rose and almond)
6. Preparation and packaging and labelling, sensory/objective evaluation and economics of jam (mixed fruits)
7. Preparation and packaging, labelling, sensory/objective evaluation and economics of Marmalade (orange)
8. Preparation and packaging of labelling, sensory/objective (TSS, pH) ) evaluation and costing of Pickle (green chilli, lemon, mixed vegetable)
9. Preparation and packaging of labelling, sensory/objective (TSS, pH) ) evaluation and costing of Preserve (carrot)
10. Dehydration of vegetables (green leafy vegetables, other vegetables and tubers)
11. Preparation of innovative products in bulk and organizing an exhibition-cum-sale

**5. CO-PO PSO Mapping:**

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | 2 | | | | | | | 3 | | | |
| CO-2 | 3 | | | 2 | | | | 1 | | 3 | 2 | |
| CO-3 | 2 | 2 | 3 | | | | | 1 | | | 2 | 3 |
| CO-4 | | 2 | 1 | 3 | | | | | | | | 3 |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods:

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 02 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models / Systems | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 05 |
| 1. Case Study Presentation | 02 | |
| 2. Guest Lecture | 01 | |
| 3. Industry / Field Visit | | |
| 4. Brain Storming Sessions | | |
| 5. Group Discussions | 02 | |
| 6. Discussing Possible Innovations | | |
| Term Tests, Laboratory Examination/Written Examination, Presentations | | 08 |
| Total Duration in Hours | | **75** |

## 7. Course Assessment

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.

The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| Focus of Course Learning Outcomes in each component assessed | | | | | |
|---|---|---|---|---|---|
| | CE (50% Weightage) | | | SEE (50% Weightage) | |
| | SC1 | SC2 | SC3 | SEE Theory | SEE Lab |
| | 50 Marks | 25 Marks | 25 Marks | 100 Marks | 50 Marks |
| CO-1 | ✓ | ✓ | x | ✓ | ✓ |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ |
| CO-3 | x | x | ✓ | ✓ | ✓ |
| CO-4 | x | x | ✓ | ✓ | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

**8. Achieving Course Learning Outcomes**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | --------- |
| 6. | Practical Skills | Laboratory exercises |
| 7. | Group Work | --------- |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, class test |
| 10. | Verbal Communication Skills | --------- |
| 11. | Presentation Skills | Assignment, Seminar |
| 12. | Information Management | Assignment |
| 13. | Personal Management | Assignment, Examination |
| 14. | Leadership Skills | --------- |

## 9. Course Resources

1. **References**
   a. R. P. Srivastava and Sanjeev Kumar Fruit and Vegetable Preservation: Principles and Practices International book distributing Co. Lucknow.
   b. Giridhari Lal, G.S. Siddappa and G.L. Tondon Preservation of Fruits and Vegetables CFTRI, ICAR, New Delhi -12.
   c. Y. H. Hui, S. Ghazala, D.M. Graham, K.D. Murrell and W.K. Nip Handbook of Vegetable Preservation and Processing Marcel Dekker (2003)
2. **Magazines and Journals**
   FOOD SCIENCE and TECHNOLOGY-Magazine
3. **Websites**
   https://www.foodprocessing.com/

## 10. Course Organization

| | | |
|---|---|---|
| **Course Code** | FTE503A | |
| **Course Title** | Fruits and Vegetable Processing Technology | |
| **Course Leader/s Name** | Allotted as per time table | |
| **Course Leader Contact Details** | **Phone:** | 080-49066666 |
| | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | June 2024 | |
| **Next Course Specifications Review Date** | July 2026 | |

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| Course Specifications: Spices and Flavour Technology | |
|---|---|
| **Course Title** | Spices and Flavour Technology |
| **Course Code** | FTE504A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

1. **Course Summary**

The aim of this course is to equip students with knowledge of basics of flavor and understanding of technologies of flavor extraction and encapsulation. The students will be able to understand the basic knowledge of flavor. They will also be familiarized with the extraction and encapsulation of essential oils. The course will also educate students regarding neutral and artificial flavoring substances and effects of cooking on flavor of food products.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 03+01 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 30 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**Teaching, Learning and Assessment**

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

- **CO 1.** Explain the methods of flavour extraction
- **CO 2.** Describe the artificial and natural flavouring compound
- **CO 3.** Discuss the techniques of flavor encapsulation
- **CO 4.** Demonstrate the process of essential oil extraction
- **CO 5.** Analyze the effects of cooking on flavor of food product

**4. Course Contents**

**Unit-I:**

Basics of flavour, smell and taste sensation, olfaction, flavor compounds, volatile flavor compounds. Methods of flavour extraction, isolation, separation; Distillation, solvent extraction, enzymatic extraction, static headspace, dynamic headspace.

**Unit-II:**

Principal types of flavorings used in foods, natural flavoring substances, Flavour constituents from Onion, garlic, cheese, milk, meat, vegetables, fruits, wine, coffee, tea, chocolate, spices and condiments.

**Unit-III:**

Nature-identical flavoring substances that are obtained by synthesis or isolated through chemical processes intended for human consumption. Artificial flavoring substances not identified in a natural product intended for human consumption, produced by fractional distillation and additional chemical manipulation of naturally sourced chemicals, crude oil or coal tar.

**Unit-IV:**

**Artificial Aroma compounds**: Diacetyl, Acetylpropionyl, Acetoin, Banana: Isoamyl acetate, Bitter almond, Cherry: Benzaldehyde, cinnamon: Cinnamaldehyde, fruity: Ethyl propionate, etc. Food acids their tastes and flavours :Glutamic acid salts, Glycine salts, Guanylic acid salts, acetic acid, malic acid etc.

**Unit-V:**

**Effect of processing on aroma and flavour**: flavour precursors flavour development on cooking, microwave heating, roasting, baking, smoking, boiling, cooling, freezing, storage Maillard reaction, caramalization and fermentation. Off flavour and off odour.

**Unit-VI:**

Principles and techniques of flavour encapsulation, types of encapsulation; Factors affecting stabilization of encapsulated flavour and their applications in food industry; Packaging and flavor compounds interaction, Effect of storage, processing, transportation and environmental conditions on flavour components / constituents

**Practical**

1. Qualitative identification of different flavouring compounds
2. Extraction of essential oil/ flavouring compound of basil leave by hydrodistillation
3. Extraction of essential oil/ flavouring compound of basil leave by SCFE
4. Comparison of the quality of flavouring component obtained by hydrodistillation and SCFE
5. Extraction of essential oil/ flavouring compound of ginger by SCFE
6. Effect of storage conditions on flavouring compound of ginger
7. To study effects of staling on food flavours and its adverse effects
8. Analysis of flavouring compound of ginger by gas chromatography system
9. Sensory evaluation of different flavors
10. To check effect of cooking on flavor of food sample
11. To check effect of fermentation on food flavor

**5. CO-PO PSO Mapping:**

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | 3 | | | 2 | 1 | 1 | | 3 | | | |
| CO-2 | | 3 | 2 | | | | | | 3 | | | |
| CO-3 | | 3 | | 2 | 2 | | | | | 3 | | |
| CO-4 | | | | | | 2 | 1 | | | | 2 | |
| CO-5 | | 3 | 3 | | 1 | 1 | 3 | | | | | 3 |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods:**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 32 |
| **Demonstrations** | | 02 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models / Systems | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 05 |
| 1. Case Study Presentation | 02 | |
| 2. Guest Lecture | 01 | |
| 3. Industry / Field Visit | | |
| 4. Brain Storming Sessions | | |
| 5. Group Discussions | 02 | |
| 6. Discussing Possible Innovations | | |
| Term Tests, Laboratory Examination/Written Examination, Presentations | | 06 |
| Total Duration in Hours | | **75** |

## 7. Course Assessment

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.

The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| Focus of Course Learning Outcomes in each component assessed | | | | | |
|---|---|---|---|---|---|
| | CE (50% Weightage) | | | SEE (50% Weightage) | |
| | SC1 | SC2 | SC3 | SEE Theory | SEE Lab |
| | 50 Marks | 25 Marks | 25 Marks | 100 Marks | 50 Marks |
| CO-1 | ✓ | x | x | ✓ | ✓ |
| CO-2 | ✓ | x | ✓ | ✓ | ✓ |
| CO-3 | x | ✓ | ✓ | ✓ | ✓ |
| CO-4 | x | ✓ | ✓ | ✓ | ✓ |
| CO-5 | x | ✓ | ✓ | ✓ | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

## 8. Achieving Course Learning Outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Practical Skills | Laboratory exercises |
| 6. | Group Work | ---------- |
| 7. | Self-Learning | Assignment |
| 8. | Written Communication Skills | Assignment, class test |
| 9. | Verbal Communication Skills | ---------- |
| 10. | Presentation Skills | Assignment, Seminar |
| 11. | Behavioral Skills | ---------- |

| | | |
|---|---|---|
| 12. | Information Management | Assignment |
| 13. | Personal Management | Assignment, Examination |
| 14. | Leadership Skills | ---------- |

**9. Course Resources**

**1. References**

a. Reineccius, G.(1993), Source Book of Flavors, Springer US
b. Heath, H. B.(1986) Flavour chemistry and technology, Springer.
c. Piggott, J. R., Paterson, (1994) A. Understanding Natural Flavors. Springer US
d. Morton, I. D., Macleod A. J. (1998) Food Flavor, Elsevier
e. Gabelman, A. (1994), Bioprocess Production of Flavor, Wiley
f. Ashurst P. R. (1991) Fragrance and Color Ingredients Food Flavorings.

**2. Magazines and Journals**

SpicE-Library(spices.res.in)
(http://www.spices.res.in/elibrary1/index.php/component/content/article?id=7)

**3. Websites**

Journal of Food Technology and Preservation (pubtexto.com) (https://www.pubtexto.com/journals/journal-of-food-technology-and-preservation/fulltext/usage-of-traditional-spice-and-condiments-preference-for-vegetables-among-students)

**4. Other Electronic Resources**

a. Spices and flavourings | SpringerLink (https://link.springer.com/chapter/10.1007/978-1-4757-6690-5_11)
b. eGyanKosh: Unit-17 Spices (https://www.egyankosh.ac.in/handle/123456789/16754)

**10. Course Organization**

| | | |
|---|---|---|
| **Course Code** | FTE504A | |
| **Course Title** | Spices and Flavour Technology | |
| **Course Leader/s Name** | Allotted as per time table | |
| **Course Leader Contact Details** | **Phone:** | 080-49066666 |
| | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | June 2024 | |
| **Next Course Specifications Review Date** | July 2026 | |

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# SEMESTER-III

**Course Specifications: Innovation and Entrepreneurship**

| | |
|---|---|
| **Course Title** | Innovation and Entrepreneurship |
| **Course Code** | FTC601A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

**1. Course Summary**

This course aims to assist students with product innovation management and entrepreneurial development. The students are taught the concepts of product life cycle management, technological innovation, business opportunity identification, enterprise establishment, and development.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 03 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 0 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**Teaching, Learning and Assessment**

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the phases of the product life cycle and the role of innovation in product management.
- **CO-2.** Apply product and innovation management concepts to the product development process.
- **CO-3.** Identify opportunities for new product development.
- **CO-4.** Discuss the entrepreneurial traits and characteristics of an enterprise or business.
- **CO-5.** Assess innovative ideas and strategies for nurturing an enterprise.



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**4. Course Contents**

**Unit-I:**

**Product Life Cycle and Strategy:** Phases of Product lifecycle, Product development processes and methodologies, Core functions, Functional applications, Product lifecycle management (PLM), Introduction to Product Data Management (PDM), PDM objectives, PDM benefits, PDM systems, PDM implementation

**Unit-II:**

**Technological Innovation:** Types and extent of innovation, Incremental and radical innovation, sources of innovation, measuring innovation and outcomes of innovation

**Unit-III:**

**Innovation Strategy:** Types of Innovation Strategy, Formulating Innovation Strategy, Building Innovation Capabilities and Returns from Innovation Strategies, Frugal Engineering

**Unit-IV:**

**Entrepreneurial traits:** Entrepreneurial types and characteristics of different entrepreneurial types and their positioning, Qualities and actions of entrepreneur, which influence the success and sustenance of business

**Unit-V:**

**Strategies for nurturing an enterprise:** Sources of ideas and its recognition, Idea processing and institutions / NGOs supporting innovation, Search for business idea and commercialization

**Unit-VI:**

Understanding the role and importance of entrepreneur growth using case studies of successful business houses. Fixed and working capital assessment for project report generation.

**5. CO-PO PSO Mapping:**

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | | | | 1 | | 1 | | 3 | 2 | | |
| CO-2 | | | 2 | 3 | | | | 1 | | 2 | 3 | |
| CO-3 | 3 | 2 | | | | 2 | | | | 2 | | 1 |
| CO-4 | 3 | | 2 | | | | | | | 3 | 1 | |
| CO-5 | 2 | | 3 | | | | 1 | | | 2 | | 2 |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |



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## 6. Course Teaching and Learning Methods:

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 32 |
| **Demonstrations** | | 01 |
| 1. Demonstration using Videos | 01 | |
| 2. Demonstration using Physical Models | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | |
| 1. Course Laboratory | | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 04 |
| 1. Case Study Presentation | 01 | |
| 2. Guest Lecture | 01 | |
| 3. Industry / Field Visit | | |
| 4. Brain Storming Sessions | | |
| 5. Group Discussions | 01 | |
| 6. Discussing Possible Innovations | 01 | |
| Term Test and Written Examination | | 08 |
| Total Duration in Hours | | **45** |

## 7. Course Assessment

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.

The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| Focus of Course Learning Outcomes in each component assessed | | | | |
|---|---|---|---|---|
| | CE (50% Weightage) | | | SEE (50% Weightage) |
| | SC1 | SC2 | SC3 | Theory |
| | 50 Marks | 25 Marks | 25 Marks | 100 Marks |
| **CO-1** | ✓ | x | x | ✓ |
| **CO-2** | x | x | x | ✓ |
| **CO-3** | ✓ | ✓ | ✓ | ✓ |
| **CO-4** | x | ✓ | ✓ | ✓ |
| **CO-5** | x | x | ✓ | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

**8. Achieving Course Learning Outcomes**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | ---------- |
| 6. | Practical Skills | ---------- |
| 7. | Group Work | Assignment/ Class Presentations |
| 8. | Self-Learning | Assignment, Examination |
| 9. | Written Communication Skills | Assignment |
| 10. | Verbal Communication Skills | Class Presentations |
| 11. | Presentation Skills | Class Presentations |
| 12. | Behavioral Skills | ---------- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | Assignment, Examination |
| 15. | Leadership Skills | Effective management of learning, time management, achieving the learning outcomes |

**9. Course Resources**

**1. References**

a. Mark Dodgson., David Gann., and Ammon Salter, 2008, The Management of Technological Innovation Strategy and Practice, UK, 1st Edition, Oxford University Press

b. Narayanan V K, 2003, Managing Technology and innovation for Competitive Advantage, UAS, 2nd Edition, Pearson Education

c. D.F. Kuratko and T.V. Rao, 2012, Entrepreneurship A South Asian Perspective, New Delhi, 3rd edition, Cengage Learning India Pvt. Ltd

**2. Magazines and Journals**

a. FOOD SCIENCE and TECHNOLOGY-Magazine

b. Journal of Food Science and Technology (AFSTI)

3. **Websites:**
   https://innovation-entrepreneurship.springeropen.com/
4. **Other Electronic Resources**
   https://www.education.gov.in/nep/innovation-entrepreneurship

**10. Course Organization**

| | | |
|---|---|---|
| **Course Code** | FTC601A | |
| **Course Title** | Innovation and Entrepreneurship | |
| **Course Leader/s Name** | Allotted as per time table | |
| **Course Leader Contact Details** | **Phone:** | 080-49066666 |
| | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | June 2024 | |
| **Next Course Specifications Review Date** | July 2026 | |

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**Course Specifications: Group Project**

| | |
|---|---|
| **Course Title** | Group Project |
| **Course Code** | FTP601A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

**1. Course Summary**

This module is intended to provide students with an opportunity to apply theoretical knowledge to solving a problem or developing a product. The students will learn skills related to problem identification, planning, management, and execution through working in a team. The group project will focus on the application of appropriate techniques and methodologies and the methodologies and the efficient utilization of resources for the project's execution.

This module will also enable the students to gain practical experience working in a project mode, requiring interactions with the domain specialist to meet the technical challenges of the project undertaken. The significant feature of the project will be the demonstration of its applicability and quantification of benefits.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 10 |
| **Total Hours of Classroom Interaction** | 0 |
| **Number of laboratory Hours** | 240 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**Teaching, Learning and Assessment**

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Work in a team and undertake a project in their area of specialization.
- **CO-2.** Apply appropriate research methodologies while formulating a project.
- **CO-3.** Apply their theoretical knowledge of food science and technology to executing the project.
- **CO-4.** Define specifications, analyze, develop, and evaluate a project.

**CO-5.** Prepare and present appropriate forms of audio-visual, verbal, and written documentation to describe the project, its execution, and its outcome.

**4. Course Contents**

1. Need for undertaking a project, problem identification, development of the project, evaluation, and presentation.
2. Project management
3. Costing, finance management, raw material procurement, product development, testing, project evaluation, exhibition, and presentation.
4. Team building, teamwork, and leadership skills

**5. CO-PO PSO Mapping:**

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 2 | | | | | 2 | 2 | | 1 | 1 | | 2 |
| CO-2 | | 2 | 3 | | | | | | | | 2 | 2 |
| CO-3 | | 2 | 2 | 1 | | | | | | 2 | 2 | |
| CO-4 | | 3 | 2 | 2 | | | | | | | 2 | 3 |
| CO-5 | | | | | | 1 | 2 | 3 | | | 2 | 3 |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods:**

| Topics | Teaching methods | Hours |
|---|---|---|
| Critical Review, Problem Formulation and stating Objectives | Reading Journal papers, books and Other relevant materials and problem formulation | 80 |
| | Presentation to Reviewers | 04 |
| Design | Group work with supervisor's guidance | 25 |
| Analysis | Group work with supervisor's guidance | 25 |
| Testing and Evaluation | Group work with supervisor's guidance | 20 |
| Verification/Validation | Group work with supervisor's guidance | 25 |
| Drawing Conclusions | Group work with supervisor's guidance | 05 |
| Presentation , Thesis/Report Writing and Viva Voce | Presentation and Viva voce-Group | 01 |
| | Thesis/Report writing - Group | 50 |
| | Tests/Examinations/Presentations | 05 |
| | Total | 240 |

## 7. Course Assessment

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.
The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| Focus of Course Learning Outcomes in each component assessed | | |
|---|---|---|
| | CE (50% weightage) | SEE (50% weightage) |
| | Presentations (50 Marks) | Project Report (50 Marks) |
| CO-1 | ✓ | ✓ |
| CO-2 | ✓ | ✓ |
| CO-3 | ✓ | ✓ |
| CO-4 | ✓ | ✓ |
| CO-5 | ✓ | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

## 8. Achieving Course Learning Outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Group Project work |
| 2. | Understanding | Group Project work |
| 3. | Critical Skills | Group Project work |
| 4. | Analytical Skills | Group Project work |
| 5. | Problem Solving Skills | Group Project work |
| 6. | Practical Skills | Group Project work |
| 7. | Group Work | Group Project work |
| 8. | Self-Learning | Group Project work |
| 9. | Written Communication Skills | Report writing |
| 10. | Verbal Communication Skills | Presentation |

| | | |
|---|---|---|
| 11. | Presentation Skills | Presentation |
| 12. | Behavioral Skills | Group Project work |
| 13. | Information Management | Group Project work |
| 14. | Leadership Skills | Effective management of learning, time management, achieving the learning outcomes |

## 9. Course Resources

**References**

Assigned reading relevant to the group project.

## 10. Course Organization

| | | |
|---|---|---|
| **Course Code** | FTP601A | |
| **Course Title** | Group Project | |
| **Course Leader/s Name** | Allotted as per time table | |
| **Course Leader Contact Details** | **Phone:** | 080-49066666 |
| | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | June 2024 | |
| **Next Course Specifications Review Date** | July 2026 | |

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# ELECTIVE-II

| Course Specifications: Advances in Dairy Processing | |
|---|---|
| **Course Title** | Advances in Dairy Processing |
| **Course Code** | FTE601A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

## 1. Course Summary

The aim of this course is to equip students with use of bio-protective factors for preservation of raw milk and to understand current trends in cleaning and sanitization of dairy equipment. Students will be thought lethality of thermal processing of milk. Students will also able to determine the pH, water activity and thermal load in milk and milk products.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 03+01 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 30 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**Teaching, Learning and Assessment**

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO 1.** Use of bio-protective factors for preservation of raw milk
- **CO 2.** Understand current trends in cleaning and sanitization of dairy equipment
- **CO 3.** Understand the lethality concept of thermal processing of milk
- **CO 4.** Determination of pH, water activity and thermal load in milk and milk products

## 4. Course Contents

**Unit-I:**

**Preservation of milk:** Use of bio-protective factors for preservation of milk. Effect of Chilling on physicochemical, microbial and nutritional properties of milk and milk products, present status of preservation of milk by chemical preservatives; thermal processing for preservation.

**Unit-II:**

**Thermal and non-thermal processing** :Methods of determining lethality of thermal processing, UHT processed milk products, their properties and prospects, types of UHT plants, aseptic fillers, heat stability and deposit formation aspects, effect on milk quality; techno- economic considerations; retort processing. Non-thermal processing techniques.

**Unit-III:**

**Equipment in dairy industry:** Principles and equipment for bactofugation and Bactotherm processes, Microfluidization of milk: Principle, equipment, effects and applications, Homogenization and their applications in dairy industry. Filtration system.

**Unit-IV:**

**Dehydration of dairy products:** advances in drying of milk and milk products, freeze dehydration, spray drying, physicochemical changes during dehydration.

**Unit-V:**

**Storage of dairy products:** Water activity; sorption behavior of foods, energy of binding water, control of water activity of different milk products in relation to their chemical; microbiological and textural properties; hurdle technology and its application in development of shelf stable and intermediate-moisture dairy products, Use of carbonation in extending the shelf life of dairy products.

**Unit-VI:**

**Cleaning and sanitization of dairy equipment:** Current trends in cleaning and sanitization of dairy equipment: biological, detergents, Automation, Ultrasonic techniques in cleaning, bio-detergents, development of sanitizers- heat; chemical; radiation, mechanism of fouling and soil removal; Biofilms, assessing the effectiveness of cleaning and sanitization of dairy products.

**Practical**

1. Determination of physicochemical properties of milk.
2. To study the Lactoperoxidase system for extension of keeping quality of raw milk.
3. Determination of thermal load during retort processing of milk and milk products.
4. Heat classification of milk powders.
5. Functional properties of powders: porosity, interstitial air content, occluded air content, flowability.
6. Determination of degree of browning-chemical/physical methods.
7. Freeze drying of milk/milk products, and heat sensitive products.
8. Homogenization efficiency.
9. Thermal process calculations.
10. Visit to Dairy / Milk Processing plant

**5. CO-PO PSO Mapping:**

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | 2 | 1 | | | | | | 3 | | 2 | |
| CO-2 | 2 | | 3 | | | | 1 | | 3 | | | 2 |
| CO-3 | 2 | 3 | | | | | | 1 | | 3 | 2 | |
| CO-4 | 3 | | | | 2 | | | 1 | 2 | | 3 | 1 |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods:**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 32 |
| **Demonstrations** | | 02 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 06 |
| 1. Case Study Presentation | | |
| 2. Guest Lecture | 01 | |
| 3. Industry / Field Visit | | |
| 4. Brain Storming Sessions | 03 | |
| 5. Group Discussions | 02 | |
| 6. Discussing Possible Innovations | | |
| Term Tests, Laboratory Examination/Written Examination, Presentations | | 05 |
| Total Duration in Hours | | **75** |

**7. Course Assessment**

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.

The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| Focus of Course Learning Outcomes in each component assessed | | | | | |
|---|---|---|---|---|---|
| | CE (50% Weightage) | | | SEE (50% Weightage) | |
| | SC1 | SC2 | SC3 | SEE Theory | SEE Lab |
| | 50 Marks | 25 Marks | 25 Marks | 100 Marks | 50 Marks |
| CO-1 | ✓ | x | x | ✓ | ✓ |
| CO-2 | ✓ | ✓ | x | ✓ | ✓ |
| CO-3 | x | ✓ | ✓ | ✓ | ✓ |
| CO-4 | x | x | ✓ | ✓ | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

**8. Achieving Course Learning Outcomes**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | -------- |
| 6. | Practical Skills | Laboratory exercises |
| 7. | Group Work | -------- |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, class test |
| 10. | Verbal Communication Skills | -------- |
| 11. | Presentation Skills | Assignment, Seminar |
| 12. | Behavioral Skills | -------- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | Assignment, Examination |

**9. Course Resources**

1. **References**
   a. Burton H. 1998. *Ultra-high Temperature Processing of Milk and Milk Products*. Elsevier.
   b. Fellow P. 1988. *Food Processing Technology*. Elliss Horwood Ltd.
   c. Gould GW. 1995. *New Methods of Food Preservation*. Blackie.

d. IDF Bulletin 1981. *New Monograph on UHT Milk*. Document No. 133, Intern. Dairy Fed., Brussels.
e. Smit G. 2003. *Dairy Processing – Improving Quality*. CRC-Woodhead Publ.
f. Troller JA and Christian HB. 1978. *Water Activity and Food, Food Science and Technology*. A Series of Monograph Academic Press, London.
g. Walstra P, Geurts TJ, Noomen A, Jellema A and Van Boekel MAJS. 1999. *Dairy Technology – Principles of Milk Properties and Processes*. Marcel Dekker.
h. Datta Nivedita, Tomasula Peggy M. 2015. Emerging Dairy Processing Technologies, Opportunities for the Dairy Industry, Willey publications


2. **Magazines and Journals**
   a. Advances in Dairy Research
   b. International Dairy Journal
   c. Indian Dairyman
3. **Websites**
   https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9265648/

## 10. Course Organization

| | | | |
|---|---|---|---|
| **Course Code** | FTE601A | | |
| **Course Title** | Advances in Dairy Processing | | |
| **Course Leader/s Name** | | Allotted as per time table | |
| **Course Leader Contact Details** | | **Phone:** | 080-49066666 |
| | | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | | June 2024 | |
| **Next Course Specifications Review Date** | | July 2026 | |

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Faculty of Life & Allied Health Sciences

| Course Specifications: Dairy Microbiology | |
|---|---|
| **Course Title** | Dairy Microbiology |
| **Course Code** | FTE602A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

## 2. Course Summary

The aim of this course is to introduce students to the concepts of microbial quality, safety and its importance in dairy processing industry. The students will be to understand the microbial aspects of dairy products. They will be able to identify suitable culture for preparation of fermented dairy products. They will also be familiarized about the treatment of dairy effluents and national and internal microbial standards of dairy industry.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 03+01 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 30 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

## Teaching, Learning and Assessment

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO 1.** Describe the effect of starter cultures on product quality
- **CO 2.** Differentiate beneficial and harmful bacteria's associated with dairy industry
- **CO 3.** Explain the bacteriological aspects of milk processing techniques
- **CO 4.** Describe national and international microbial standards
- **CO 5.** Describe the effect of starter cultures on product quality

## 4. Course Contents

**Unit-I:**

**Introduction to Dairy Microbiology:** Scope, factors influencing microbial growth, newer approaches for classifying microbes, types of microbes in normal and mastitic milk and importance of somatic cell counts, microflora of significance in dairy industry: their morphology, natural, physiological, spoilage and pathogenic characteristics, milk borne

diseases associated with dairy industry, microbial and chemical changes in raw milk during chilling and refrigeration. Bacteriological grading of raw and heat-treated milk.

**Unit-II:**

**Sources of contamination in raw milk spoilage:** Sources of contamination in raw milk, effect on milk quality during production, collection, transportation and storage, types of spoilages in heat-treated milk. Bacteriological aspects: Bacteriological aspects of milk processing techniques, germination, sporulation, prevention of post-processing contamination in heated milk. Heat induced damage and repair in bacterial cells. Role of resuscitation in recovery of heat injured microbial cells. Naturally occurring preservative systems in milk, Application of bacteriocins as bio-preservatives, Effect of residues (antibiotics, detergents, sanitizers, pesticides and aflatoxins) on microbes, biological consequences and mode of action on microbes.

**Unit-III:**

**Microbiological quality of dairy products:** Fat rich, frozen, concentrated and dried milks, factors influencing the microbial quality, microbial defects associated, their control, microbiological safety in relation to potential pathogens and their public health significance.

**Unit-IV:**

**Microbiology of starter cultures:** Lactic Acid Bacteria as starters, types of starter cultures and their classification, changes caused, their influence on taste and aroma compounds, judging of starter quality and activity; Starter defects; Starter failure; Intrinsic and extrinsic factors associated; Bacteriophages of dairy starters and their impact on dairy industry; Prevention and control of starter failures.

**Microbiology of cheese:** Role of starters culture and NSLAB in preparation, ripening and in producing varieties of cheese, accelerated ripening, microbial rennet substitutes, defects in cheese, Microbiological safety and their prevention and control, microbiological quality of indigenous dairy products, viz., lassi, ghee, etc. Sources of contamination, spoilage and their microbiological safety, modified packaging: antimicrobial packaging, controlled and modified atmosphere (CAP/ MAP) based technologies.

**Unit-V:**

**Waste Management:** Disposal of dairy effluents after microbial treatment; BOD and COD analysis in dairy effluents; Microbiological quality of air and water in Dairy Plants. National and International microbiological standards for dairy products.

**Practical**

1. Microbiological examination of raw and heat-treated milk
2. Microbial examination of indigenous dairy product
3. Production and estimation of lactic acid by Streptococcus Sp.
4. Production of fermented milk by *Lactobacillus acidophilus*.
5. Isolation of food poisoning bacteria from contaminated dairy product
6. Production of yogurt / cheese

7. Determination of microbial toxins produced in dairy products
8. Preparation of shreekhand
9. Analyzing microbial quality of fermented dairy products
10. Identification of microbes present in milk processing unit

**5. CO-PO PSO Mapping:**

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | | | | 1 | | 1 | | 3 | 2 | | |
| CO-2 | | | 2 | 3 | | | | | | 2 | 3 | |
| CO-3 | 3 | 2 | | | | 2 | | | | 2 | | 1 |
| CO-4 | 3 | | 2 | | 2 | | | 1 | 2 | | 3 | |
| CO-5 | 3 | | 2 | | | | | | | 2 | 3 | |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

**6. Course Teaching and Learning Methods:**

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 32 |
| **Demonstrations** | | 01 |
| 1. Demonstration using Videos | 01 | |
| 2. Demonstration using Physical Models / Systems | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 04 |
| 1. Case Study Presentation | 01 | |
| 2. Guest Lecture | 01 | |

| | | |
|---|---|---|
| 3. Industry / Field Visit | | |
| 4. Brain Storming Sessions | | |
| 5. Group Discussions | 01 | |
| 6. Discussing Possible Innovations | 01 | |
| Term Tests, Laboratory Examination/Written Examination, Presentations | | 08 |
| Total Duration in Hours | | **75** |

**7. Course Assessment**

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.
The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| **Focus of Course Learning Outcomes in each component assessed** | | | | | |
|---|---|---|---|---|---|
| | **CE (50% Weightage)** | | | **SEE (50% Weightage)** | |
| | **SC1** | **SC2** | **SC3** | **SEE Theory** | **SEE Lab** |
| | 50 Marks | 25 Marks | 25 Marks | 100 Marks | 50 Marks |
| **CO-1** | ✓ | x | x | ✓ | ✓ |
| **CO-2** | ✓ | x | x | ✓ | ✓ |
| **CO-3** | x | ✓ | ✓ | ✓ | ✓ |
| **CO-4** | x | ✓ | ✓ | ✓ | ✓ |
| **CO-5** | x | x | ✓ | ✓ | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

**8. Achieving Course Learning Outcomes**

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |

| | | |
|---|---|---|
| 5. | Problem Solving Skills | -------- |
| 6. | Practical Skills | Laboratory exercises |
| 7. | Group Work | --------- |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, class test |
| 10. | Verbal Communication Skills | -------- |
| 11. | Presentation Skills | Assignment, Seminar |
| 12. | Behavioral Skills | -------- |
| 13. | Information Management | Assignment |
| 14. | Personal Management | Assignment, Examination |

**9. Course Resources**

4. **References**
   a. Fundamentals of Dairy Microbiology by Prajapati.
   b. Dairy Microbiology by Robinson. Volume II and I
   c. Microbiology of Fermented Foods. Volume II and I. By Brian J. Wood. Elsiever Applied Science Publication.
   d. Microbiology of Foods by John C. Ayres. J. Orwin Mundt. William E. Sandinee. W. H. Freeman and Co.
5. **Magazines and Journals**
   b. FOOD SCIENCE and TECHNOLOGY-Magazine
   c. Journal of Food Science and Technology (AFSTI)
6. **Websites**
   http://ecoursesonline.iasri.res.in/course/view.php?id=460b.https://www.fssai.gov.in/upload/advisories/2021/07/60ec3e1719321Direction_Processing_Aids_12_07_2021.pdf
7. **Other Electronic Resources**
   https://agrimoon.com/dairy-technology-icar-ecourse-pdf-books/

**10. Course Organization**

| | | | |
|---|---|---|---|
| **Course Code** | FTE602A | | |
| **Course Title** | Dairy Microbiology | | |
| **Course Leader/s Name** | | Allotted as per time table | |
| **Course Leader Contact Details** | | **Phone:** | 080-49066666 |
| | | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | | June 2024 | |
| **Next Course Specifications Review Date** | | July 2026 | |

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| Course Specifications: Dairy Engineering | |
|---|---|
| **Course Title** | Dairy Engineering |
| **Course Code** | FTE603A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

## 1. Course Summary

Aim of this course is to comprehend various engineering properties of dairy and food materials and to understand the different processing technologies used in dairy plant. The students will be able to understand the engineering properties of milk and milk products. Students will gain knowledge on the thermal process, evaporation, drying and material handing process used in dairy plant.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 03+01 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 30 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**Teaching, Learning and Assessment**

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO 1.** Various engineering properties of dairy products
- **CO 2.** Thermal processing and evaporation process used in dairy plant
- **CO 3.** Illustrate the drying and material handling process carried out in dairy plant
- **CO 4.** Demonstrate the dairy processing and handling equipment

## 4. Course Contents

**Unit-I:**

**Handling and transportation of milk:** BMCS of milk and their significance in equipment design; processing and handling of dairy and food products.

**Unit-II:**

**Homogenization of milk:** Principle of homogenization, Effect of homogenization, Technical execution, valves and pumps, single and double stage homogenizers, care and maintenance of

homogenizers, Efficiency of homogenization, design principles of homogenizers, operation and maintenance, application of homogenization in dairy industry. Recent advances in homogenization.

**Unit-III:**

**Thermal processing of milk and milk products**: Pasteurization; batch, flash and continuous pasteurizer, HTST pasteurizer and design principle and thermal death kinetics, care and maintenance, UHT processing of milk, quality changes during processing of milk and milk products.

**Unit-IV:**

**Designs of equipment:** Tanks, pumps, stirrer mixtures and centrifugation: Designs and equipment of tank, types of tanks, pumps in dairy industry, Agitation and mixing, construction of agitators and patterns of flow. Factors in mixing, types, operation, mixing gas, liquid and solid, heat transfer in mixers, power requirement, transmission, scale-up of models. Separation by gravity and centrifugal force, clarifiers and separators, centrifugal separator and efficiency of separation, flow rate and power consumption.

**Unit-V:**

**Evaporation**: Classification, design of multiple-effect evaporator, temperature distribution, boiling point elevation, operation, feeding methods, condensate and air removal, scale formation and removal, heat and mass balance, vapor recompression, design of recovery system, selection and design of auxiliary equipment.

**Unit-VI:**

**Spray and drum drying**: Theory of drying, estimation of drying rates and drying time, drying equipment, particle size calculation, design of spray and drum dryer, skim milk and whole milk powders manufacturing methods. Fluidized bed drying, Principle s of fluidized bed method, Types of fluidized bed drier, Drying and cooling times in fluidized bed; Freeze drying; Agglomeration, Problems of reconstitution, Methods of Agglomeration, The effect of drying on milk products. Recent advances in drying. Design data performance and selection and design of dryer.

**Practical**

1. Study of milk pasteurizing / sterilizing equipment.
2. Study of fat handling equipment.
3. Study of condensing / drying equipment.
4. Study of ice-cream and frozen products equipment.
5. Constructional details, operation and maintenance of cream separators.
6. Constructional details, operation and maintenance of band and cup sealing machine.
7. Study of water treatment equipment, water supply and distribution.
8. Study of refrigeration plants, chilled water supply and distribution.
9. Study of compressed air generation, supply and distribution.
10. Visit to a dairy processing plant.

## 5. CO-PO PSO Mapping:

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | | 3 | | | 1 | | | | 3 | | | |
| CO-2 | 2 | 3 | | | | | | | | 3 | 2 | |
| CO-3 | | | | 2 | | | | 3 | | | | 3 |
| CO-4 | | 1 | 2 | 3 | | | | | | | 2 | 3 |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods:

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 30 |
| **Demonstrations** | | 02 |
| 1. Demonstration using Videos | 02 | |
| 2. Demonstration using Physical Models / Systems | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 05 |
| 1. Case Study Presentation | 02 | |
| 2. Guest Lecture | 01 | |
| 3. Industry / Field Visit | | |
| 4. Brain Storming Sessions | | |
| 5. Group Discussions | 01 | |
| 6. Discussing Possible Innovations | 01 | |
| Term Tests, Laboratory Examination/Written Examination, Presentations | | 08 |
| Total Duration in Hours | | **75** |



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## 7. Course Assessment

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.

The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| Focus of Course Learning Outcomes in each component assessed | | | | | |
|---|---|---|---|---|---|
| | CE (50% Weightage) | | | SEE (50% Weightage) | |
| | SC1 | SC2 | SC3 | SEE Theory | SEE Lab |
| | 50 Marks | 25 Marks | 25 Marks | 100 Marks | 50 Marks |
| CO-1 | ✓ | ✓ | x | ✓ | ✓ |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ |
| CO-3 | x | x | ✓ | ✓ | ✓ |
| CO-4 | x | x | ✓ | ✓ | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

## 8. Achieving Course Learning Outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | ---------- |
| 6. | Practical Skills | Laboratory exercises |
| 7. | Group Work | ---------- |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, class test |
| 10. | Presentation Skills | Assignment, Seminar |
| 11. | Information Management | Seminar, Assignment |
| 12. | Personal Management | Assignment, Examination |

## 9. Course Resources

### 1. References


a. Das H. 2005. Food Processing Operations and Analysis. Asian Books.
b. Fellows PJ. 1988. Food Processing Technology, Principle and Practices. Ellis Horwood.
c. Toledo RT. 2007. Fundamentals of Food Process Engineering. Springer.
d. Ahmed T. 1997. Dairy Plant Engineering and Management. 4th Ed. Kitab Mahal.
e. Gary Krutz, Lester Thompson and Paul Clear. 1984. Design of Agricultural Machinery. John Wiley and Sons.
f. Hall CW and Davis DC. 1979. Processing Equipment for Agricultural Products. AVI Publ.
g. Higgins L and Morrow LC. 1977. Maintenance Engineering Hand-Book. McGraw, Hill.
h. Stanier W. 1959. Plant Engineering Hand-Book. McGraw Hill


## 10. Course Organization

| | | | |
|---|---|---|---|
| **Course Code** | FTE603A | | |
| **Course Title** | Dairy Engineering | | |
| **Course Leader/s Name** | | Allotted as per time table | |
| **Course Leader Contact Details** | | **Phone:** | 080-49066666 |
| | | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | | June 2024 | |
| **Next Course Specifications Review Date** | | July 2026 | |

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| Course Specifications: Baking and Confectionery Technology | |
|---|---|
| **Course Title** | Baking and Confectionery Technology |
| **Course Code** | FTE604A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

## 1. Course Summary

The aim of this course is to enable students to understand the technology involved in bakery industries and familiarizing with the factors influencing product quality. The students will gain knowledge about baking equipment and special utensils required and bulk handling of ingredients in baking industry. They will understand the functions of various raw materials used in baking. They will also be educated about the importance of GMP in manufacture of confectionaries.

## 2. Course Size and Credits:

| | |
|---|---|
| **Number of Credits** | 03+01 |
| **Total Hours of Classroom Interaction** | 45 |
| **Number of laboratory Hours** | 30 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**Teaching, Learning and Assessment**

## 3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO 1.** Discuss the role of ingredient in baking
- **CO 2.** Explain the effect of time and temperature on product quality
- **CO 3.** Apply hygiene and sanitation in bakery industry
- **CO 4.** Discuss the challenges of bulk handling of ingredients in processing plant

## 4. Course Contents

**Unit-I:**

**Essential ingredients:** Flour, yeast, water, salt. Other ingredients: Sugar, colour, flavor, fat, milk and milk powder and bread improvers. Functions of various raw materials in baking: leaveners and yeast foods, shortenings, emulsifiers and antioxidants, Sweeteners and, water and salt, Ingredients from milk, eggs, fruits, vegetables, nuts, Spices, flavors, colors and preservation methods.



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**Unit-II:**

**Bakery equipment:** utensils and equipment in bakery unit, small and big equipment, bulk handling of ingredients, dough mixing and mixers, dividing, rounding, sheeting, and laminating, fermentation enclosures and brew equipment. Ovens and Slicers, Packaging materials and equipment.

**Unit-III:**

**Bread manufacturing process:** Raw materials required and their functional properties. Straight and sponge, accelerated processing. Chorley wood bread process, dough retarding and freezing, stages in processing and advantages and disadvantages of various methods, characteristics of good bread: Internal characters; external characters. Bread defects/faults and remedies. Spoilage of bread, causes, detection and prevention.

**Unit-IV:**

**Biscuits and cookies:** Production of cookies/biscuits. Types of biscuit dough's – Developed dough, short dough's, semi-sweet, enzyme modified dough's and batters – importance of the consistency of the dough.

**Unit-V:**

**Cake making:** Ingredients and their function, structure builders, tenderizers, moisteners and flavor enhancers – Selection and preparation of mould, temperature and time required for different type of cake, problems of baking.

**Unit-VI:**

**Confectionery products:** Definition, importance of sugar confectionery and flour confectionery. Types of confectionery products: chocolate, boiled sweets, caramels, toffees, fondants. Manufacturing process and spoilage of confectionery products. GMP in baking and confectionery industries. Computerization in processing plant, sanitation and safety.

**Practical**

1. Identification of bakery utensils and equipment
2. Market survey of available lab scale baking equipment
3. Effect of baking time and temperature on product quality
4. Study of characteristics of commercially available breads
5. Preparation of bread by different methods
6. Preparation of biscuits
7. Preparation of cookies
8. Evaluation of baked product quality on storage
9. Preparation of pizza base
10. Preparation of indigenous sweets

## 5. CO-PO PSO Mapping:

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | | 1 | 2 | 2 | | | | 3 | | | |
| CO-2 | 3 | | | | | | | | | | 3 | |
| CO-3 | | | | 3 | | | 1 | | 3 | | | 2 |
| CO-4 | | | | 3 | | | 2 | | | | 2 | 2 |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods:

| Teaching and Learning Methods | Duration in hours | Total Duration in Hours |
|---|---|---|
| **Face to Face Lectures** | | 32 |
| **Demonstrations** | | 01 |
| 1. Demonstration using Videos | 01 | |
| 2. Demonstration using Physical Models / Systems | | |
| 3. Demonstration on a Computer | | |
| **Numeracy** | | |
| 1. Solving Numerical Problems | | |
| **Practical Work** | | 30 |
| 1. Course Laboratory | 30 | |
| 2. Computer Laboratory | | |
| 3. Engineering Workshop / Course/Workshop / Kitchen | | |
| 4. Clinical Laboratory | | |
| 5. Hospital | | |
| 6. Model Studio | | |
| **Others** | | 04 |
| 1. Case Study Presentation | 01 | |
| 2. Guest Lecture | 01 | |
| 3. Industry / Field Visit | | |
| 4. Brain Storming Sessions | | |
| 5. Group Discussions | 01 | |
| 6. Discussing Possible Innovations | 01 | |
| Term Tests, Laboratory Examination/Written Examination, Presentations | | 08 |
| Total Duration in Hours | | **75** |

## 7. Course Assessment

The components and subcomponents of course assessment are presented in the Academic Regulations documents pertaining to the Programme. The procedure to determine the final course marks is also provided in the Academic Regulations document as well.
The assessment questions are set to test the course learning outcomes. In each component or subcomponent, certain Course Outcomes are assessed as illustrated in the following table:

| Focus of Course Learning Outcomes in each component assessed | | | | | |
|---|---|---|---|---|---|
| | CE (50% Weightage) | | | SEE (50% Weightage) | |
| | SC1 | SC2 | SC3 | SEE Theory | SEE Lab |
| | 50 Marks | 25 Marks | 25 Marks | 100 Marks | 50 Marks |
| CO-1 | ✓ | x | ✓ | ✓ | ✓ |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ |
| CO-3 | x | ✓ | ✓ | ✓ | ✓ |
| CO-4 | x | x | ✓ | ✓ | ✓ |

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of the course outcomes in each component assessed in the above template beginning of the semester.

## 8. Achieving Course Learning Outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Classroom lectures, Assignments |
| 2. | Understanding | Classroom lectures, Assignments |
| 3. | Critical Skills | Classroom lectures, Assignments |
| 4. | Analytical Skills | Classroom lectures, Assignments |
| 5. | Problem Solving Skills | ---------- |
| 6. | Practical Skills | Laboratory exercises |
| 7. | Group Work | ---------- |
| 8. | Self-Learning | Assignment |
| 9. | Written Communication Skills | Assignment, class test |
| 10. | Verbal Communication Skills | ---------- |
| 11. | Presentation Skills | Assignment, Seminar |
| 12. | Behavioral Skills | ---------- |



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| | | |
|---|---|---|
| 13. | Information Management | Assignment |
| 14. | Personal Management | Assignment, Examination |
| 15. | Leadership Skills | ---------- |

**9. Course Resources**

**1. References**

a. NIIR Board of Consultants and Engineers. 2014. The Complete Technology Book on Bakery Products (Baking Science with Formulation and Production), 3rd Ed. NIIR, New Delhi.

b. Gisslen, Wayne (2018) Professional Baking, 9th Edition. John Wiley and Sons Inc.

**2. Magazines and Journals**

a. Duncan Manley (ed). 2011. Manley's technology of biscuits, crackers and cookies. Fourth edition. Woodhead Publishing Limited.

b. Stanley Cauvain and Linda Young. 2000. Baking problems solved. CRC Press, Woodhead Publishing Limited.

c. Hui, YH. 2006. Bakery Products science and technology. Blackwell publishing.

**3. Websites**

https://bakerpedia.com/

**4. Other Electronic Resources**

Essential Career Skills for Investment Banking and Finance | edX

**10. Course Organization**

| | | | |
|---|---|---|---|
| **Course Code** | FTE604A | | |
| **Course Title** | Baking and Confectionery Technology | | |
| **Course Leader/s Name** | | Allotted as per time table | |
| **Course Leader Contact Details** | | **Phone:** | 080-49066666 |
| | | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | | June 2024 | |
| **Next Course Specifications Review Date** | | July 2026 | |

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# SEMESTER-IV

**Course Specifications: Research project**

| | |
|---|---|
| **Course Title** | Research project |
| **Course Code** | FTI601A |
| **Department** | Food Technology |
| **Faculty** | Faculty of Life and Allied Health Sciences |

**1. Course Summary**

This Course is intended to give an insight to the students on application of principles of research methodology, preparation of research project proposals, research project management, and execution of research project and effective technical communication and presentation. It also emphasizes the need for and the relevance of a structured approach to identifying a research topic and undertaking research. This course provides an opportunity to apply theories and techniques learnt during programme work. It involves in-depth work in the chosen area of study.

**2. Course Size and Credits:**

| | |
|---|---|
| **Number of Credits** | 24 |
| **Total Hours of Classroom Interaction** | 0 |
| **Number of laboratory Hours** | 600 |
| **Number of Semester Weeks** | 16 |
| **Department Responsible** | Food Technology |
| **Pass Requirement** | As per the Academic Regulations |
| **Attendance Requirement** | As per the Academic Regulations |

**Teaching, Learning and Assessment**

**3. Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Critically review scholarly literature collected from various sources for the project purpose and formulate a research problem
- **CO-2.** Prepare and present a research proposal
- **CO-3.** Conduct research to achieve research objectives
- **CO-4.** Propose new ideas/methodologies or procedures for further improvement of the research undertaken
- **CO-5.** Create research document and write research papers for publications
- **CO-6.** Defend the research findings in front of scholarly audience.



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## 4. Course Contents

**The research project will cover the following:**

a. Defining / Identification of the Research Problem
b. Literature review/ Information search, retrieval and review
c. Framing Research Methodology
d. Problem solving - Evaluation, Interpretations and drawing conclusions
e. Proposing ideas or methods for further work
f. Thesis writing
g. Oral presentation/ Viva voce
h. Journal / Conference Identification
i. Writing journal paper based on research findings
j. Submission to Journal / Conference

## 5. CO-PO PSO Mapping:

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 3 | 2 | 1 | | 1 | | | 2 | 3 | 2 | 1 | |
| CO-2 | | | | 3 | | | | 2 | | 2 | 3 | |
| CO-3 | 3 | 2 | | | | 2 | | 1 | | 2 | | 1 |
| CO-4 | 3 | | 1 | 3 | | 2 | | 2 | | 3 | | 1 |
| CO-5 | | 3 | | | | 2 | | 2 | | | 2 | 1 |
| CO-6 | 3 | | | | 3 | | 3 | 2 | | 3 | | 1 |
| 3: High Influence, 2: Moderate Influence, 1: Low Influence | | | | | | | | | | | | |

## 6. Course Teaching and Learning Methods:

| Topics | Teaching methods | Hours |
|---|---|---|
| Information search, retrieval and review, Project definition and project planning | Reading Journal papers, books and other relevant materials and problem formulation | 100 |
| | Presentation to Reviewers | 40 |
| Use of methodology and execution of experiments | Individual work with supervisors guidance | 150 |
| Problem solving and Evaluation | Individual work with supervisors guidance | 100 |
| Interpretations and drawing conclusions | Individual work with supervisors guidance | 40 |



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| | | |
|---|---|---|
| Proposing ideas or methods for further work | Individual work with supervisors guidance | 10 |
| Presentation, Thesis/Report Writing and Viva Voce, Authoring Research paper | Thesis/Report writing, Authoring research paper | 100 |
| | Presentation and Viva voce | 10 |
| | Paper Publication | 50 |
| | **Total** | **600** |

## 7. Course Assessment

There are two components for assessment in this Course:

**Component-1: 50% weightage**

Presentations (Pre, Interim and Final with Viva-Voce and submission of research paper).

**Component-2: 50% weightage**

Project Thesis (will be moderated by a second examiner) and Paper publication presentation to peer-team.

The assessment questions are set to test the learning outcomes. In each component a certain learning outcomes are assessed. The following table illustrates the focus of learning outcome in each component assessed:

| Focus of Course Learning Outcomes in each component assessed | | |
|---|---|---|
| | **CE (50% weightage)** | **SEE (50% weightage)** |
| | **Presentations (150 Marks)** | **Presentation, Report and Publication (150 Marks)** |
| **CO-1** | ✓ | ✓ |
| **CO-2** | ✓ | ✓ |
| **CO-3** | ✓ | ✓ |
| **CO-4** | ✓ | ✓ |
| **CO-5** | x | ✓ |
| **CO-6** | x | ✓ |

## 8. Achieving Course Learning Outcomes

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

| S. No | Curriculum and Capabilities Skills | How imparted during the course |
|---|---|---|
| 1. | Knowledge | Dissertation work |
| 2. | Understanding | Dissertation work |

| | | |
|---|---|---|
| 3. | Critical Skills | Dissertation work |
| 4. | Analytical Skills | Dissertation work |
| 5. | Problem Solving Skills | Dissertation work |
| 6. | Practical Skills | Dissertation work |
| 7. | Group Work | Dissertation work |
| 8. | Self-Learning | Dissertation work |
| 9. | Written Communication Skills | Report writing |
| 10. | Verbal Communication Skills | Presentation |
| 11. | Presentation Skills | Presentation |
| 12. | Behavioral Skills | Dissertation work |
| 13. | Information Management | Dissertation work |
| 14. | Personal Management | Dissertation work |
| 15. | Leadership Skills | Effective management of learning, time management, achieving the learning outcomes |

## 9. Course Resources

**References**

Lecture Sessions on Dissertation, Thesis Preparation delivered by the concerned Head of Department

## 10. Course Organization

| | | |
|---|---|---|
| **Course Code** | FTI601A | |
| **Course Title** | Research Project | |
| **Course Leader/s Name** | Allotted as per time table | |
| **Course Leader Contact Details** | **Phone:** | 080-49066666 |
| | **E-mail:** | hod.ft.ls@msruas.ac.in |
| **Course Specifications Approval Date** | June 2024 | |
| **Next Course Specifications Review Date** | July 2026 | |

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