



**ST ALOYSIUS**

**(DEEMED TO BE UNIVERSITY)**

MANGALURU 575003-INDIA

**Course structure and syllabus of**

**B.Sc. Food Science**

**Semester III and IV**

**Under NEP Regulations**

**2024 ONWARDS**

# ST ALOYSIUS

(DEEMED TO BE UNIVERSITY)

MANGALURU 575003 – INDIA

## School of Life Sciences

### BOS MEETING

BOS meeting of School of Life Sciences was held on 22<sup>th</sup> April 2024, at 9.30 am in Applied Biology Laboratory

#### LIST OF MEMBERS OF THE BOS IN LIFE SCIENCES

Sl no	Members with Address	Designation
1.	Dr Hemachandra <a href="mailto:hemachandra_amin@staloysius.edu.in">hemachandra_amin@staloysius.edu.in</a> 9035961509	Dean, School of Life Sciences
2.	Dr Renita Maria Dsouza <a href="mailto:renita@staloysius.edu.in">renita@staloysius.edu.in</a> 9945923172	Associate Dean, School of Life Sciences
3.	Dr Lyned Dafny Lasrado <a href="mailto:lyneddafny@staloysius.edu.in">lyneddafny@staloysius.edu.in</a> 9686021928	Assistant Dean, School of Life Sciences
4.	Dr Jyothi Miranda Department of Botany <a href="mailto:jyothi@staloysius.edu.in">jyothi@staloysius.edu.in</a> 7022560938	Professor
5.	Dr Asha Abraham Department of Post Graduate Studies & Research in Biotechnology <a href="mailto:drashaabraham@staloysius.edu.in">drashaabraham@staloysius.edu.in</a> 9449555802	Associate Professor
6.	Dr Hariprasad Shetty	Associate Professor

	<p>Department of Zoology</p> <p><a href="mailto:shettyhariprasad@staloysius.edu.in">shettyhariprasad@staloysius.edu.in</a></p> <p>9945886947</p>	
7.	<p>Dr S N Raghavendra</p> <p>Department of Post Graduate Studies &amp; Research in Food Science</p> <p><a href="mailto:raghavendra_sn@staloysius.edu.in">raghavendra_sn@staloysius.edu.in</a></p> <p>9945888845</p>	Assistant Professor
8.	<p>Dr Santhosh Wilson Goveas</p> <p>Department of Post Graduate Studies &amp; Research in Biotechnology</p> <p><a href="mailto:santhoshgoveas@staloysius.edu.in">santhoshgoveas@staloysius.edu.in</a></p> <p>9448724682</p>	Assistant Professor
9.	<p>Dr Chandrashekara G Joshi</p> <p>Chairperson</p> <p>Department of Biochemistry</p> <p>Mangalore University</p> <p><a href="mailto:josheejoshee@gmail.com">josheejoshee@gmail.com</a></p> <p>9448446641</p>	Subject expert in Biochemistry
10.	<p>Dr Shyama Prasad Sajankila</p> <p>Department of Biotechnology</p> <p>NMAMIT, Nitte, Karkala</p> <p><a href="mailto:shyama.sajankila@nitte.edu.in">shyama.sajankila@nitte.edu.in</a></p> <p>9611202842</p>	Subject expert in Biotechnology & Microbiology
11.	<p>Dr Smitha Hegde</p> <p>Professor &amp; Deputy Director</p> <p>NUCSER, Nitte University</p> <p>Deralakatte</p> <p><a href="mailto:smitha.hegde@nitte.edu.in">smitha.hegde@nitte.edu.in</a></p>	Subject expert in Biotechnology & Zoology

	9886036077	
12.	<p>Dr Archana Prabhat</p> <p>Professor &amp; Coordinator</p> <p>Department of PG Studies in Food Science &amp; Nutrition</p> <p>Alva's College (Autonomous), Moodbidri</p> <p><a href="mailto:drarchanaprabhat@gmail.com">drarchanaprabhat@gmail.com</a></p> <p>9986665759</p>	Subject expert in Food Science
13.	<p>Dr Giby Kuriakose</p> <p>Assistant Professor</p> <p>PG Department of Botany, Sacred Heart College</p> <p>Kochi, Kerala-670106</p> <p><a href="mailto:giby.kuriakose@shcollege.ac.in">giby.kuriakose@shcollege.ac.in</a></p> <p><a href="tel:7012608038">7012608038</a></p>	Subject expert in Botany
14.	<p>Dr Shreelalitha Suvarna</p> <p>Assistant Professor</p> <p><a href="mailto:shreelalitha_suvarna@staloysius.edu.in">shreelalitha_suvarna@staloysius.edu.in</a></p> <p>9964215205</p>	<p>HOD</p> <p>UG &amp; PG</p> <p>Biotechnology</p>
15.	<p>Dr Swarnalatha</p> <p>Assistant Professor</p> <p><a href="mailto:swarnalatha@staloysius.edu.in">swarnalatha@staloysius.edu.in</a></p> <p>9900284662</p>	<p>HOD</p> <p>UG &amp; PG</p> <p>Biochemistry</p>
16.	<p>Ms Shilpa B</p> <p>Assistant Professor</p> <p><a href="mailto:shilpa_botany@staloysius.edu.in">shilpa_botany@staloysius.edu.in</a></p> <p>9535887279</p>	HOD Botany
17.	<p>Dr Daniella Ann L Chyne</p>	<p>HOD</p> <p>UG &amp; PG Food</p>

	Assistant Professor <a href="mailto:daniella_chyne@stalloysius.edu.in">daniella_chyne@stalloysius.edu.in</a> 9676389466	Science
	Dr Vaishali Rai Assistant Professor <a href="mailto:vaishali_rai@stalloysius.edu.in">vaishali_rai@stalloysius.edu.in</a> 9980313361	HOD Microbiology

### III SEMESTER

Paper	Instruction Hours/week	Duration of Exam (Hours)	Marks			Credits
			*CIA	Exam	Total	
Paper code <b>(Theory)</b> <b>Basics of food safety and quality control</b>	3	3	40	60	100	3
Paper code <b>(Practical)</b> <b>Basics of food safety and quality control-</b>	3	3	25	25	50	2
Paper code <b>(Open elective)</b>	3	3	40	60	100	3

### IV SEMESTER

Paper	Instruction Hours/week	Duration of Exam (Hours)	Marks			Credits
			*CIA	Exam	Total	
Paper code <b>(Theory)</b> <b>Fundamentals of food chemistry and microbiology</b>	3	3	40	60	100	3
Paper code <b>(Practical)</b> <b>Fundamentals of food chemistry and microbiology</b>	3	3	25	25	50	2
Paper code <b>(Open Elective)</b>	3	3	40	60	100	3

## **PROGRAMME OUTCOMES (PO)**

By the end of this programme, students will be able to:

**PO1:** Equip students with a thorough understanding of the importance of food safety in the food processing industry, including knowledge of national and international food regulatory agencies, food laws, and safety regulations.

**PO2:** Develop students' skills in implementing food safety pre-requisite programs such as Good Manufacturing Practices (GMPs), pest control, personal hygiene, and sanitation procedures, ensuring adherence to industry standards.

**PO3:** Enable students to identify, assess, and manage various physical, chemical, and biological hazards in food processing, applying the principles of Hazard Analysis Critical Control Point (HACCP) and understanding food safety regulations and certifications in India.

**PO4:** Equip students with a comprehensive understanding of the chemical composition and properties of food, including water, carbohydrates, proteins, lipids, vitamins, and minerals, and their reactions and functionalities in food systems.

**PO5:** Develop students' expertise in microbiology, focusing on the classification, growth, and interaction of microorganisms in food, as well as the mechanisms of foodborne illnesses and methods for controlling microbial contamination.

**PO6:** Enable students to apply advanced techniques such as lipid refining, hydrogenation, interesterification, and hurdle technology, ensuring the production of high-quality and safe food products through the control of microbial toxins and spoilage.

### **III Semester B.Sc. Food Science**

#### **Core Course Content**

#### **(Paper Code) BASICS OF FOOD SAFETY AND QUALITY CONTROL**

Credits: **3**

Total hours: **56**

#### **Course Outcomes:**

**CO1:** Recognize the significance of food safety in ensuring public health and consumer trust within the food processing industry.

**CO2:** Develop and Implement Effective Food Safety and Hygiene Programs. .

**CO3:** Understand and apply quality control and assurance principles to ensure compliance with food safety standards in the food processing industry.

**CO4:** Conduct hazard analysis and risk assessments for different types of hazards in the food Industry.

#### **UNIT I: Food safety concept**

**14 Hours**

Importance of food safety in the food processing industry. Risk classification, National and international food regulatory agencies, General food laws and food safety regulations, Nutritional labelling regulation (mandatory and optional nutrients, nutritional descriptors and approved health claims); Microbial contamination (including cross-contamination/indirect contamination) Chemical contamination, Physical contamination, Allergen contamination.

#### **UNIT II: Food Safety Pre-requisite Programs**

**14 Hours**

Definitions and importance, Good Manufacturing Practices (GMPs), Pests and Pest Control Program, Facility Maintenance, Personal Hygiene, Supplier Control, Sanitary Design of Equipment and Infrastructure, Procedures for Raw Material Reception, Storage and Finished Product Loading, Product Identification, Tracking and Recalling Program, Preventive Equipment Maintenance Program, Education and Training Program.

#### **UNIT III: Food Hygiene & Sanitation Programs**

**14 Hours**

Training programs, Infrastructure, Personal habits, Hygiene verification, Sanitation Program. (Sanitation Standard Operating Procedures (SSOPs), Water in the food industry, Water sources, Water uses, Water quality, Treatments, Cleaning and sanitation, cleaning and sanitizing agents, Equipment and systems, Evaluation of sanitation efficacy, Quality Control



and Quality Assurance. First In, First Out (FIFO).

#### **UNIT IV: Hazard Analysis and Risk Assessment**

**14 Hours**

Physical hazards (metals, glass, etc), Chemical hazards (food additive toxicology, natural toxins, pesticides, antibiotics, hormones, heavy metals and packaging components), and Biological hazards (epidemiology of biological pathogens: virus, bacteria and fungi). Basics and Principles of Hazard Analysis Critical Control Point (HACCP) system, Designing a HACCP System plan. Risk management (Assessment, Monitoring & Control). Food Safety regulations in India: Registration and Licensing process. Food safety management systems and certifications.

#### **Recommended Books and References:**

1. Nielsen, S.S, 2004, Introduction to chemical Analysis of foods, CBS Publishers, New Delhi.
2. Ranganna. S., 2001, Handbook of Analysis & Quality control for Fruit & Vegetable Products, Tata McGraw Hill, New Delhi.
3. Walker, E., Pritchard, C., & Forsythe, S. (2003). Hazard analysis critical control point and prerequisite programme implementation in small and medium size food businesses. Food Control, 14(3), 169-174.
4. Mortimore, S., & Wallace, C. (2013). HACCP: A practical approach. Springer Science & Business Media.
5. King, H., & King, H. (2020). Design of Food Safety Management Systems Using the Process HACCP Plan and Prerequisite Control Program. Food Safety Management Systems: Achieving Active Managerial Control of Foodborne Illness Risk Factors in a Retail Food Service Business.
6. Debnath, 2005, Tools & Techniques of Biotechnology, Pointer Publishers, Jaipur.
7. Ingraham, John.L.2004, Introduction to Microbiology, 3 Ed., Thomson brocks/Cole Inc.
8. Tortora G.J et al, 2008, Microbiology: an introduction, Pearson Education
9. Nester, E.W, 2009, Microbiology, McGraw-Hill Higher Education
10. Dubey, R.C., Maheshwari, D.K., 2008, Textbook of Microbiology, S.ChandPublications,ND
11. Adams, M.R., Moss, M.O., 2007, Food Microbiology, New Age International Pvt. Ltd., ND.

12. Pelczar, Reid and Chan, 2008, Microbiology, McGraw hill Ed, ND
13. Ananthanarayan, Panikar, CKJ. 2006, Textbook of Microbiology, Oriental Longman Pvt. Ltd., Hyderabad.
14. Frazier, William, C. 2008, Food Microbiology, Tata McGraw Hill Ed., ND.
15. Gould, W.A and Gould, R.W. (2006). Total Quality Assurance for the Food Industries, CTI Publications Inc. Baltimore.
16. Bean Malicse (2012). Principles of food sanitation,safety and hygiene patima University

### III Semester B.Sc. Food Science

#### Core Lab Course Content

#### (Paper Code) **BASICS OF FOOD SAFETY AND REGULATORY ACT**

4 Hours/week

Credits: **2**

Total hours: **48**

#### Course outcomes

At the completion of this course, students will be able to

**CO1:** Students will develop a thorough understanding of microbiological instruments and will demonstrate proficiency in cleaning glassware, preparing media, and sterilization techniques.

**CO2:** Students will acquire skills in detecting adulteration in various food products, including milk and milk products, using appropriate analytical methods.

**CO3:** Students will identify Critical Control Points (CCPs) specific to production lines in the Milk, Fruits & Vegetables, and Meat industries using Hazard Analysis Critical Control Point (HACCP) principles.

**CO4:** Students will Conduct Comprehensive Pathogen Screening and Microbial Analysis, Perform screening tests to detect pathogens and isolate microorganisms from food samples.

#### **List of Experiments**

1. Introduction and study of microbiological instruments.
2. Cleaning of glass wares, preparation of media, cotton plugging and Sterilization.
3. Detection of Adulteration in food ingredients.
4. Detection of Adulteration in milk & milk products.
5. Screening tests for the detection of pathogens
6. Isolation of microorganisms from food samples.
7. Study of the microbiological quality of milk by MBRT test.
8. Determine the Critical Control Points for production line of Milk, Fruits & Vegetables and Meat industry as per HACCP system.
9. To prepare a chart of specifications for different Food products as specified by BIS.
10. Sterility & Swab test.
11. Food Safety Audit.

### **Recommended Books and References:**

1. Miller, D. D., & Yeung, C. K. (2022). *Food chemistry: A laboratory manual*. John Wiley & Sons.
2. Yousef, A. E., & Carlstrom, C. (2003). *Food microbiology: A laboratory manual*. John Wiley & Sons.
3. Ranken, M. D. (Ed.). (2012). *Food industries manual*. Springer Science & Business Media.
4. Cooper, J., Leifert, C., & Niggli, U. (Eds.). (2007). *Handbook of organic food safety and quality*.
5. Khan, M. S., & Rahman, M. S. (2021). *Techniques to Measure Food Safety and Quality*. Springer International Publishing.

## IV Semester B.Sc. Food Science

### Core Course Content

#### (Paper Code) FUNDAMENTALS OF FOOD CHEMISTRY AND MICROBIOLOGY

Credits: 3

Total hours: 56

#### Course Outcomes:

**CO1:** Upon completion of this course, students will be able to:

Explain the definition and scope of food chemistry, recognize the importance of water in foods, and describe the structure and properties of water.

**CO2:** Classify carbohydrates, proteins and lipids, describe their structures and functional properties, and understand the key reactions they undergo.

**CO3:** Define and scope microbiology, understand the classification and interaction of microorganisms in food, and describe microbial growth factors.

**CO4:** Students will also learn about microbial toxins, foodborne illnesses, and various methods of controlling microorganisms, including hurdle technology.

#### Unit-I: Food chemistry

14 Hours

Introduction, importance and scope of food chemistry. Water in foods, structure and its properties. Water activity, free and bound moisture. **Carbohydrates:** Classification, Structure and functional properties. Reactions involving carbohydrates: Caramelization, Maillard reaction. **Proteins:** Classification, structure and their functional properties, Protein denaturation and its effects.

#### Unit-II: Lipids, Vitamins and Minerals

14 Hours

**Lipids:** Classification, structure, physical and chemical properties. Lipid oxidation and rancidity and its prevention, Thermal degradation of lipids, Technology of edible fats and oils - Refining, Hydrogenation and Interesterification. **Vitamins:** Classification and functions. Effect of processing on Vitamins. **Minerals:** Classification, sources and functions.

**Unit-III: Concepts of Microbiology****14 Hours**

Definition, scope and historical developments of general and food microbiology, prokaryotes and eukaryotes; Basics of microscopy, Classification of microorganisms-a brief account; Sources and types of microorganisms in food; Interaction between microorganisms in food, Microbial growth curve; factors affecting growth intrinsic and extrinsic factors, uses of microorganisms, Food borne illness and its types.

**Unit-IV: Microbial Toxins and Control of Micro-organisms:****14 Hours**

Microbial Toxins, Aflatoxins - Definition and classification; Introduction and types of Food Spoilage. Control of Microorganisms: Physical, chemical and other biological agents, Hurdle technology.

**Recommended Books and References:**

1. Fennema, O. R., Damodaran, S., & Parkin, K. L. (2017). Introduction to food chemistry. In *Fennema's food chemistry* (pp. 1-16). CRC Press.
2. Doyle, M. P., Diez-Gonzalez, F., & Hill, C. (Eds.). (2020). Food microbiology: fundamentals and frontiers. John Wiley & Sons.
3. Ray, B., & Bhunia, A. (2007). Fundamental food microbiology. CRC press.
4. Pelczar Jr, M. J., Chan, E. C. N., & Krieg, N. R. Prescott, L. Harley, j. and Klein, D (2005) Microbiology, 6" edition, Tata McGraw-Hill.
5. Carr, F. J. (2017). Microbiology: a fundamental introduction. EC Microbiology, 8(3), 123-183.
6. Coultate, T. (2023). Food: the chemistry of its components. Royal Society of Chemistry.
7. Ananthanarayan, R. (2006). *Ananthanarayan and Paniker's textbook of microbiology*. Orient Blackswan.
8. Banwart, G. (2012). *Basic food microbiology*. Springer Science & Business Media.
9. Adams, M. R., & Moss, M. O. (2000). *Food microbiology*. Royal society of chemistry.
10. Casida, L. E. (1968). Industrial microbiology.
11. Dubey, R. C. (1993). *A textbook of Biotechnology*. S. Chand Publishing.
12. Belitz, I. H. D., & Grosch, I. W. (2013). *Food chemistry*. Springer Science & Business Media.

## IV Semester B.Sc. Food Science

### Core Lab Course Content

#### (Paper Code) Fundamentals of food chemistry and microbiology

4 Hours/week

Credits: 2

Total hours: 48

#### **Course Outcomes:**

Upon completion of this course, students will be able to:

**CO1:** Develop competence in using microbiological instruments and performing fundamental laboratory procedures, including cleaning glassware, media preparation, and sterilization.

**CO2:** Acquire skills in various staining techniques, enabling them to identify and differentiate between different types of microorganisms under a microscope

**CO3:** Determine the moisture, ash, and crude fiber content in food samples, providing a thorough understanding of the composition and quality of different foods.

**CO4:** They will become proficient in using standard laboratory techniques and equipment to perform these analyses, ensuring accurate and reliable results.

#### **List of Experiments:**

1. Introduction and study of microbiological instruments.
2. Basic activities in the food microbiology laboratory (Cleaning of glass wares, Preparation of media, cotton plugging and Sterilization).
3. Techniques to isolate, culture and sub-culture microbes
4. Viable cell counts by serial dilution technique
5. Staining techniques
6. Determination of moisture in a given food sample
7. Determination of ash in a given food sample.
8. Determination of crude fibre in a given food sample
9. Estimation of acidity of given food sample/beverage
10. Acid value of Fat /oil.
11. Determination of crude protein in a given food sample using Kjeldahl's apparatus

#### **Recommended Books and References**

1. Garg, N., Garg, K. L., & Mukerji, K. G. (2010). *Laboratory manual of food microbiology*. IK International Pvt Ltd.

2. Horwitz, W., & Latimer, G. W. (2000). Association of official analytical chemists. *Official methods of analysis of AOAC international*.
3. Miller, D. D., & Yeung, C. K. (2022). Food chemistry: A laboratory manual. John Wiley & Sons.
4. Weaver, C. M., & Daniel, J. R. (2003). The food chemistry laboratory: a manual for experimental foods, dietetics, and food scientists. CRC press.
5. Yousef, A. E., & Carlstrom, C. (2003). Food microbiology: A laboratory manual. John Wiley & Sons.
6. Garg, N., Garg, K. L., & Mukerji, K. G. (2010). Laboratory manual of food microbiology. IK International Pvt Ltd.



## EVALUATION – UNDERGRADUATE PROGRAMMES

CREDITS	FORMATIVE ASSESSMENT (40/20/25)					SUMMATIVE ASSESSMENT (60/30/25)
	40					60
	Internals (2 Internals)	Assignment	MCQ/Quiz	Seminar/ Presentation	Class Participation	End Semester Exam
4 Credits/3 Credits (Theory)	50 + 50 = 100	5	5	5	5	60
Assigned	20	5	5	5	5	60
CREDITS	Continuous Assessment	Model Practical Test	Record Keeping	Viva Voce	Class Participation	External Exam
2 Credits (Practicum)	15	20	5	5	5	Record Keeping – 10 Practical- 40
Assigned	20					30
CREDITS	Internals (2 Internals)		Assignment		Class Participation	End Semester Exam
2 Credits (Theory)	25 + 25 = 50		5		5	50
Assigned	20					30
CREDITS	Summative Assessment (30)			Formative Assessment (20)		
	Report Writing		Viva Voce (External Examiner)		Internal Assessment	Powerpoint Presentation
Internship (2 Credits)	20		10		10	10
CREDITS	Theory		Practical		Assignment/Attendance	
Yoga/ Health & Wellness (1 Credit each) = In total 02 Credits	10		10		5	
CREDITS	Attendance				Participation (Student	

		engagement at faculty level, at institutional level, at inter-institute level, other participation)
Extra-Curricular/ Co-Curricular (2 Credits)	20	30

### ASSESSMENT CRITERIA

**Theory: 60:40; Practicum: 50:50 converted as 25+25=50**

#### 1. Ratio of weightage (marks) between Internal & End Semester Examinations for

**THEORY: 60:40**

**THEORY INTERNAL COMPONENT: 40**

- Two internal tests: **50+50=20**
- Assignment: **05**
- Seminar: **05**
- Continuous Unit wise tests (objective/MCQ): **05**
- Class participation :**05**

#### 2. Practicum component marks: 50

**The internal component of practicum:50 (converted to 25)**

**Internal:**

- Continuous Assessment of all practical experiments: **15**
- Attendance: **05**
- Model practical Test: **20**
- Maintenance of Records: **10**
- Viva: 05
- Class participation: 05

**End semester Practicum: 40**

**Theory End Semester Examination Question Paper Pattern. Time 2.5 hours**

End Semester Theory Examinations will be common for all science departments.

The duration of the examination is 2.5 hours carrying 40 marks.

The question paper is divided into **Part–A, Part – B, and Part C.**

**Part –A** -Objective type carrying from each unit - 20 marks.

**Part-B** -Analytical questions carrying from each unit - 20 marks

**Part –C**- Descriptive answer for 20 marks.

**Question Paper Pattern Sample**

**I. Section-A** –Any 10 out of 12      2 x 10=20 marks.

Q. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

**II. Section-B** -Answer any 4 out of 6      5 x 4=20 marks

Q. 1, 2, 3, 4, 5, 6

**III. Section-C** -Answer any 2 out of 4      10 X 2 =20 marks

Q. 1, 2, 3, 4

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<b>Paper Code</b>	<b>Reg. No.:</b>							
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**St Aloysius (Deemed to be University)**

**Mangaluru 575003-India**

**End Semester Exam – Month Year**

**B.Sc. - Semester – III**

**Paper – I**

**Paper Title**

**Time: 2½ hrs.**

**Max Marks: 60**

**Instructions: Draw Diagrams wherever necessary.**

**Answer all three sections- A, B, and C.**

**SECTION–A**

**1. Define/Answer any TEN of the following: (2x10=20)**

**a)**

**b)**

**c)**

**d)**

**e)**

**f)**

**g)**

**h)**

**i)**

**j)**

**k)**

1)

**SECTION – B**

**Answer any FOUR of the following** **(5x4=20)**

1.

2.

3.

4.

5.

6.

**SECTION – C**

**Answer any TWO of the following** **(10x2=20)**

1.

2.

3.

4.

**\*\*\*\*\***

**Practical End Semester Examination Question Paper Pattern.**

**Time 3 Hours**

Q1. Major Experiment A- Experiment to be conducted and result to be reported

**10 Marks**

Q2. Minor Experiment B- Experiment to be conducted and result to be reported

**6 Marks**

Q3. Identification and Comment of Spotters C, D and E

**3 x 3 =09 Marks**

**Total -25 Marks**