
**Rayat Shikshan Sanstha's**

# SADGURU GADGE MAHARAJ COLLEGE, KARAD

**(An Empowered Autonomous College)**

**Accredited By NAAC with 'A$^{+}$ (3.63 CGPA)' Grade**

**ISO- 9001-2015 Certified**

**Affiliated to Shivaji University, Kolhapur**

**Bachelor of Science (B. Sc.)**

**DEPARTMENT OF FOOD SCIENCE (ENTIRE)**

**Under the Faculty of Science and Technology**

**Choice Based Credit System (CBCS)**

Regulations in accordance with **National Education Policy 3.0**

To be implemented from Academic Year 2027-28

**Syllabus For**

## B. Sc. Part – III (Food Science-Entire)

**SEMESTER V & VI**

**(Syllabus to be implemented from June 2027)**

**Rayat Shikshan Sanstha's**

**SADGURU GADGE MAHARAJ COLLEGE, KARAD.**

**(An Empowered Autonomous College)**

**Regulations and Guidelines**

**Choice Based Credit System (CBCS)**

**Syllabus for Bachelor of Science Part- III (Food Science-Entire)**

- ❖ Guidelines shall be as per B.Sc. Regular Program.
- ❖ Rules and Regulations shall be as per B.Sc. Regular Program.
- ❖ Structure of Program and List of Courses.

**1. Title:** B.Sc. III Food Science (Entire)
**2. Year of Implementation:** 2027-2028
**3. Duration:** One Year
**4. Pattern:** Semester wise CBCS
**5. Medium of Instruction:** English
**6. Structure of Course:**

a. Semester V:
Theory: 06 Papers
b. Semester VI:
Theory: 06 Papers
c. Practical (Semester V & VI): 02 Papers
d. Reaserch project: 01 Paper
e. On job training: 01 Paper

**7. Examination Pattern:**

- ❖ Internal Evaluation for Theory Paper – Each theory paper having **10 Marks**
- ❖ Home Assignments /Unit test/ Project Work/Viva / Online /Offline Test
- ❖ There shall be 06 theory papers each having **40 Marks**
- ❖ Practical Examination will be Conducted Semester Wise – **50 Marks** for per subject.
- ❖ Reaserch project examination will conducted - **50 Marks**
- ❖ On job training examination will conducted - **50 Marks**

## 8. Preamble:

This syllabus is framed to accommodate the widening horizons of the discipline of food Science and reflect the current changing needs of the students. Students learn Food Science as a separate subject from B.Sc. I, which increase the employability of students in food Industry. The exposureof students to the subject, will enable them of independent handling of food processing and packaging unit. The syllabus is based on basic and applied approach with vigor and depth. At the same time precaution is taken to make the syllabus comparable to the syllabi of other universities and the needs of industries and research. The units of the syllabus are well defined, taking into consideration the level and capacity of students.

## 9. Program Outcomes:

1. The students will graduate with proficiency in subject of their choice.
2. The students will be eligible to continue higher studies and abroad in their subject.
3. The students will be eligible to appear for the examination for jobs in government organization.
4. The students will be eligible to apply for jobs with a minimum B.Sc. Food Science program.

## 10. General Objectives:

a. Enrichment of basic knowledge in areas of Food Science.

b. Reconstruction and redesigning of the courses to suite local needs.

c. To develop aptitude of students in the field of research.

d. More emphasis on applied aspects of Food Science.

e. To develop industrial skill and knowledge in students.

## Third Year Bachelor of Science (Level-6) Program Structure (NEP-3.0)

## Structure of B. Sc. III Program Semester – V & VI

| Rayat Shikshan Sanstha's | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SADGURU GADAGE MAHARAJ COLLEGE, KARAD. | | | | | | | | | | | | | | | | | | |
| COURSE STRUCTURE UNDER AN AUTONOMY | | | | | | | | | | | | | | | | | | |
| B. Sc. Food Science (ENTIRE) | | | | | | | | | | | | | | | | | | |
| B. Sc. III SEMESTER– V (Duration – 6 Months) | | | | | | | | | | | | | | | | | | |
| Sr. No. | COURSE CODE | TEACHING SCHEME | | | | | | | EXAMINATION SCHEME | | | | | | | | | |
| | | THEOY | | | | PRACTICAL | | | THEORY | | | | | PRACTICAL | | | | |
| | | Credit | No. of lectures | Hours | COURSE CODE | Credits | No. of lectures | Hours | Hours | Theory | Intern. | Total Marks (Min.) | Total Marks | | Max Marks | Min Marks | | |
| 1 | N-MJT-BFS-501 | 2 | 3 | 2.4 | N-MJP - BFS- 505 | 8 | 6.4 | 16 | 2 | 40 | 10 | 16+4=20 | 50 | As per BOS Guid - lines | 100 | 40 | | |
| 2 | N-MJT-BFS-502 | 2 | 3 | 2.4 | | | | | 2 | 40 | 10 | 16+4=20 | 50 | | | | | |
| 4 | N-MJT-BFS-503 | 2 | 3 | 2.4 | | | | | 2 | 40 | 10 | 16+4=20 | 50 | | | | | |
| 6 | N-MJT-BFS-504 | 2 | 3 | 2.4 | | | | | 2 | 50 | 10 | 16+4=20 | 50 | | | | | |
| 7 | N-MNT-BFS-506 | 2 | 3 | 2.4 | - | | | | 2 | 50 | 10 | 16+4=20 | 50 | | | | | |
| 8 | N-AEC-C | 2 | 3 | 2.4 | | - | - | - | 2 | 50 | 10 | 16+4=20 | 50 | | 50 | 20 | | |
| 9 | N-FP | 2 | 3 | 2.4 | | | | | - | - | - | ------ | 50 | | | | | |
| Total of SEM V | | 12 | 24 | 19.2 | | 10 | 19.2 | 24 | 16 | 350 | | | | 100 | | | | |
| | | | | | | | | | Total = 300+100+50 = 450 | | | | | | | | | |
| TOTAL NO OF CREDITS FOR SEMESTER – V : 22 | | | | | | | | | | | | | | | | | | |

## B. Sc. III SEMESTER– VI (Duration – 6 Months)

| Sr. No. | COURSE CODE | TEACHING SCHEME: THEORY Credit | No. of lecture | Hours | COURSE CODE | PRACTICAL Credit | No. of lecture s | Hours | EXAMINATION SCHEME: THEORY Hours | Theory | Intern. | Total Marks (Min.) | Total Marks | PRACTICAL | Max Marks | Min Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **N-MJT - BFS-601** | 2 | 3 | 2.4 | **N-MJP - BFS- 605** | 8 | 6.4 | 8 | 2 | 40 | 10 | 16+4=20 | 50 | **As per BOS Guid - lines** | 100 | 40 |
| 2 | **N-MJT BFS-602** | 2 | 3 | 2.4 | | | | | 2 | 40 | 10 | 16+4=20 | 50 | | | |
| 3 | **N-MJT- BFS-603** | 2 | 3 | 2.4 | | | | | 2 | 40 | 10 | 16+4=20 | 50 | | | |
| 4 | **N-MJP- BFS-604** | 2 | 3 | 2.4 | | | | | 2 | 50 | 10 | 16+4=20 | 50 | | | |
| 5 | **N-MNP- BFS-606** | 2 | 3 | 2.4 | - | | | | 2 | 40 | 10 | 16+4=20 | 50 | | | |
| 6 | **AEC N-AEC-D** | 2 | 3 | 2.4 | - | | | | 2 | 40 | 10 | 16+4=20 | 50 | | | |
| 7 | **N-OJT** | | | | | - | - | - | - | - | - | - | 50 | | | |
| **Total of SEM VI** | | **12** | **24** | **19.2** | | **10** | **19.2** | **24** | **16** | **350** | | | | | **150** | |
| **Grand Total** | | **32** | **48** | **38.4** | | **22** | **38.4** | **48** | **--** | **300 + 100+ 50 = 450** | | | | | | |

**TOTAL NO OF CREDITS FOR SEMESTER - VI: 22**

**TOTAL NO. OF CREDITS FOR SEMESTER - V + VI : (22+22) = 44**

- Student contact hours per week : 28.8 Hours (Min.)
- Theory lectures and practical : 48 Minutes Each
- Total Marks for B.Sc.-III (Including AECC & OJT) : **900**
- Total Credits for B.Sc.-III (Semester V & VI) : **44**

- **BFS – N-MJT Bachelor in Food Science Major Entire Theory:** for Semester- V (N-BFS- MJT - 501 to N-BFS-MJT - 504) and for Semester- VI (N-BFS – MJT - 601 to N-BFS -MJT - 604)
- **BFS – MNT Bachelor in Food Science -Minor Entire Theory** : for Semester –V (N-BFS-MNT - 506) and for Semester – IV (N-BFS-MNT - 606)

- **N-RP and N-OJT** : for Research Project and On Job Training ( Practical – 100)

- **BFS – MJP Food Science (Entire) Practical:** for (N-MJP-BFS – 505 and N-MJP-BFS -605)
- Practical Examination will be conducted Semester wise for 100 Marks per course (subject).
- There shall be separate passing for theory and practical courses.
- The examination of each course will be of 50 marks. Minimum 20 marks (40%) out of 50 are required for passing. Separate passing for SEE and CCE (Theory and Internal examination having separate passing).
- Students can exit after Level 5 with Certificate Course in Science (with the completion of courses equal to minimum of 52 credits).

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| ● Students can exit after Level 6 with Diploma in Science (with the completion of courses equal to minimum of 104 credits). |
| ● Students can exit after Level 7 with Bachelor of Science (with the completion of courses equal to minimum of 140 credits). |
| ● SEC: Skill Based Courses (4 credits). Students have to select one for each semester from the pool of courses available at their respective colleges. |

## Structure of the course: B.Sc. III Food Science

| Level | Year | Sem. | Course Type | Course code | Course Tittle | Credit | No. of Lecture/Practical |
|---|---|---|---|---|---|---|---|
| 4.5 | III | Sem. V | Major | N-MJT-BFS-501 | Meat and Poultry Technology | 2 | 30 |
| | | | Major | N-MJT-BFS-502 | Cereal Processing | 2 | 30 |
| | | | Major | N-MJT-BFS-503 | Food Plant Design & Layout | 2 | 30 |
| | | | Major | N-MJT-BFS-504 | Food Packaging | 2 | 30 |
| | | | Major | N-MJP-BFS-505 | Laboratory Exercise in – 501,502,503 & 504 | 8 | 15 |
| | | | Minor | N-MNT-BFS-506 | Food Microbiology: Enzyme Technology | 2 | 30 |
| | | | AEC | N-AEC-C | English for Communication - III | 2 | 30 |
| | | | RP | N-FP | Field Project | 2 | 30 |
| | | Sem.VI | Major | N-MJT-BFS-601 | Food Beverages and snack food technology | 2 | 30 |
| | | | Major | N-MJT-BFS-602 | Food Quality and Sensory Evaluation | 2 | 30 |
| | | | Major | N-MJT-BFS-603 | Unit Operations in Food Industry | 2 | 30 |
| | | | Major | N-MJT-BFS-604 | Food Engineering | 2 | 30 |
| | | | Major | N-MJP-BFS-605 | Laboratory Exercise in – BFS- 601,602,603 & 604 | 8 | 30 |
| | | | Minor | N-MNT-BFS-606 | Food Microbiology: Food Industrial Microbiology | 2 | 30 |
| | | | AEC | N-AEC-D | English for Communication –IV | 2 | 30 |
| | | | OJT | N-OJT | On Job Training | 2 | 30 |

## Semester-V

## Course Code and title: N-MJT-BFS-501 Meat and Poultry Technology

**Credits: 02** **Total Lectures: 30**

### Course Objectives:

- Learn the different types of meats and poultry, including beef, pork, lamb, chicken, and turkey.
- Understand the anatomy of meat and poultry, including the cuts and how they affect texture, flavor, and cooking methods.
- Understand the role of aging, marbling, and grading in meat quality.
- Learn various techniques for trimming, portioning, and deboning meats and poultry.

| Topic No. | Meat and Poultry Technology | Lectures |
|---|---|---|
| 1 | **Unit I: Introduction of meat and poultry industry**<br>Sources and developments of meat and poultry industries and importance in national economy. Overview of the meat industry (local, national, global). Definition and scope of meat and poultry technology, composition of meat. | 7 |
| 2 | **Unit II: Meat physiology, composition and concepts**<br>Definition of carcass, Structure and classification of meat, chemical composition and physico-chemical properties of meat muscle. Difference between red meat and white meat, tenderization of meat, ageing of meat. | 8 |
| 3 | **Unit III: Slaughtering and preservation**<br>Slaughtering of meat and its methods, Preservation methods of meat**:** Refrigeration and freezing, thermal processing: canning of meat, dehydration, meat curing. Meat products: Sausages - processing, RTE meat products. | 7 |
| 4 | **Unit IV: Poultry processing**<br>Pre-slaughter care and consideration; slaughtering of poultry, structure and composition and nutritive value of poultry meat. Antimortem and post-mortem inspection, grading of poultry meat, processing and preservation of poultry meat, manufacture of poultry products. | 8 |

**Course Outcomes:**

After completing the credits students should gain knowledge about:

- To understand need and importance of livestock and poultry industry
- To study structure, composition and nutritional quality of animal products.
- To study processing and preservation of animal foods.
- To understand technology behind preparation of various animal food products and by product utilization.

**Books:**


1. Fidel Toldra (2010), "Handbook of Meat Processing", John Wiley & Sons Publication.
2. Rao D.G. (2010), "Fundamentals of food engineering". PHI Learning Pvt. Ltd.
3. Isabel Guerrero- Legarreta (2010), "Handbook of Poultry Science and Technology, Secondary Processing", John Wiley and Sons Publication.
4. Casey M. Owens. (2010), "Poultry Meat Processing", Second Edition, CRC Press.
5. Leo M.L. Nollet and Fidel Toldra (2006), "Advanced Technologies For Meat Processing", CRC Press.

## Course Code and title: N-MJT-BFS-502 Cereal Processing

**Credits: 02** **Total Lectures: 30**

### Course Objectives:

- Study the chemical changes and transformations that occur during cereal processing.
- Learn the different cereal processing techniques, including milling, extrusion, fermentation, and puffing.
- Understand the criteria for grading raw cereals and the quality standards for processed cereal products.
- Gain practical knowledge of how cereals are used in the production of different food products.

| Topic No. | Cereal Processing | Lectures |
|---|---|---|
| 1. | **Unit I: Introduction to Cereal Processing**<br>Physico-chemical properties; chemical composition and nutritive value. Definition and classification of cereals. Cereal structure and composition (endosperm, germ, bran). | 7 |
| 2. | **Unit II: Processing and Concept-I**<br>Rice: Paddy processing and rice milling: conventional milling, modern milling, Milling machines, by products of rice milling. Parboiling: rice bran stabilization and its methods; Aging of rice, processed foods from rice – breakfast cereals, flakes, puffing, canning and instant rice. | 8 |
| 3. | **Unit III: Processing and Concept-II**<br>Wheat: Structure and composition. Milling of wheat. Products of wheat milling. Corn: Structure and composition. Corn milling – dry and wet milling. | 7 |
| 4. | **Unit IV: Processing and Concept-III**<br>Barley: Structure and composition. Malting and milling. Sorghum: Structure and composition. Milling, Malting, Pearling and industrial utilization. Millets: major and minor millets, composition, processing of millets for food uses. | 8 |

### Course Outcomes:

After successful completion of the course the students will be able to:

i. Demonstrate an understanding of the chemical and physical properties of cereals, including their nutritional composition, structure, and how these properties change during processing.

ii. Develop practical knowledge of various cereal processing methods and be able to apply this knowledge to the production of diverse food products.

iii. Evaluate the quality of cereal grains and processed products based on sensory attributes (e.g., texture, flavor) and technical parameters (e.g., moisture content, starch gelatinization).

iv. Use cereal processing knowledge to develop new cereal-based products, taking into consideration nutritional requirements, consumer preferences, and market trends.

**Books:**


1. Dendy DAV & Dobraszczyk BJ. (2001), "Cereal and Cereal Products", Aspen Publications.
2. Chakraverty, A. (1995), "Post-Harvest Technology of Cereals, Pulses and Oilseeds". Oxford and IBH Publishing Co,Calcutta
3. N.L.Kent andA.D.Evans: (1994)"Technology of Cereals" (4th Edition), Elsevier Science (Pergaman), Oxford,UK,
4. Samuel Matz: (1992), "The Chemistry and Technology of Cereals as Food and Feed, Chapman &Hall.

## Course Code and title: N-MJT-BFS-503 Food Plant Design and Layout

**Credits: 02** **Total Lectures: 30**

**Course Objectives:**

- Learn the key principles and factors involved in designing a food processing plant, including space utilization, workflow optimization, and safety considerations.
- Understand how to design an efficient layout that facilitates smooth workflow and minimizes contamination risks.
- Learn how plant layout can impact food safety and quality, with a focus on preventing contamination and ensuring traceability.

| Topic No. | Food Plant Design and Layout | Lectures |
|---|---|---|
| 1. | **Unit I: Introduction to Food Plant Design and Layout**<br>Plant Location, levels of Plant location. Location of layout: location factors, plant site selection. Location Theory and models, industrial buildings and grounds. Classification of Dairy and Food Plants, farm level collection and chilling center, space requirement. | 07 |
| 2. | **Unit II: Overall design of an enterprise**<br>Plant design, use of various metals, including plastic, glass, etc. in food industry, selection and specification – material design, concepts and manufacturing of various equipment's and machineries for food processing plant. | 08 |
| 3. | **Unit III: Preparation of a Plant Layout**<br>Plant Layout problem, importance, objectives, and classical types of layouts. Evaluation of Plant Layout. Advantages of good layout. Organizing for Plant Layout, Data forms Common Problems in Plant Layout and Process scheduling. | 07 |
| 4. | **Unit IV: Sitting of Process sections**<br>Equipment selection and capacity determination Arrangement of process, and service equipment. Estimation of Services and Utilities Office layout, line balancing, Flexibility. Building, Illumination and ventilation, Cleaning and sanitization, painting and colour coding, Fly and insect control. | 08 |

**Course Outcomes:**

After successful completion of the course the students will be able to:

i. Demonstrate the ability to design a food plant layout that ensures operational efficiency, safety, and compliance with regulatory standards.

ii. Optimize the use of available space in a food plant, ensuring that workflows are efficient and there is adequate room for production, storage, and utilities.

iii. Select and integrate appropriate processing equipment into the plant layout to meet production needs while considering factors like capacity, maintenance, and flexibility.

**Books:**


1. Milk Plant Layout H.S. Hall FAO Pub., Rome 1968.
2. Plant Layout and Design James M.Moore Mac Millan, New York 1971.
3. Textbook of Dairy Plant Layout and Design --- ICAR, New Delhi 2010.
4. Applied guide to process and plant design Sean Moran Elsevier, 2015.

## Course Code and title: N-MJT-BFS-504 Food Packaging

**Credits: 02** **Total Lectures: 30**

**Course Objectives:**

- Understand the importance, functions and types of food packaging.
- Know the properties and functions of wood and paper
- List the properties and functions of glass and metal packaging.
- Explain the different packaging techniques.

| Topic No. | Food Packaging | Lectures |
|---|---|---|
| 1. | **Unit I: Introduction to Food Packaging**<br>Definition, Functions of packaging – Containment, Protection, Preservation, Promotion, Convenience, Communication. Requirements of effective package, Types of food packaging- primary, secondary and tertiary packaging. | 07 |
| 2. | **Unit II: Types of packaging**<br>Rigid containers- Glass, Wooden boxes, metal cans- Aluminium and tin plate containers, Semi rigid containers- paperboard cartons, Flexible packaging-paper. Plastic pouches- Low density polyethylene, High density polyethylene and Polypropylene. | 08 |
| 3. | **Unit III: Advance packaging processes**<br>Lamination, Coating and Aseptic packaging, Active packaging, Intelligent packaging, modified atmospheric packaging and controlled atmospheric packaging, Shrink packaging, stretch packaging, Biodegradable packaging, Edible packaging, Tetra packs. | 07 |
| 4. | **Unit IV: Labelling information and Testing methods**<br>Rules and regulations for packaging, Machineries used in Food Packaging, Package testing-Thickness – Paper density - Basis weight – Grammage - Tensile Strength - Gas Transmission Rate (GTR) - Water Vapour Transmission Rate (WVTR). | 08 |

**Course Outcomes:**

After successful completion of the course the students will be able to:

- To familiarize with the different materials and methods used for packaging.
- To understand the technology behind packaging and packaging materials
- To have a basic idea about the materials used for food packaging and their testing.
- To know about the different forms in which a food can be packed.

**Books:**

1) Fundamentals of Food Packaging by F.A. Paine.

2) Packaging of Food Beverages by F.T. Day.

3) Food Packaging by Saccharow and Grifith.

4) Flexible Packaging of Foods by A.L. Brandy.

5) Principles of Food Packaging by R. Heiss.

6) Robertson, G.L. (2006). Food Packaging: Principles and Practice (2nd ed.), Taylor & Francis.

## Course title: Laboratory Exercise in Meat and Poultry Technology, Cereal Processing, Food Product Design and Layout and Food Packaging.

**Course Code: N-MJP-BFS-505** **Credit: 08**

| **Meat and Poultry Technology** | |
|---|---|
| **Sr. No.** | **Practical Name** |
| 1 | Slaughtering and dressing of poultry bird. |
| 2 | Determination of water holding capacity of meat. |
| 3 | Determination of meat pH. |
| 4 | Preservation and analysis of deboned chicken. |
| 5 | Estimation of total meat pigments. |
| 6 | Determination of extract release volume. |
| 7 | Preparation of meat product. |
| 8 | Preparation of poultry product. |

| **Cereal Processing** | |
|---|---|
| **Sr. No.** | **Practical Name** |
| 1 | Determination of physical properties of cereal grains. |
| 2 | Determination of chemical properties of cereal grains. |
| 3 | Germination of grains. |
| 4 | Studies on cooking quality of cereals (cooking time, grain elongation, etc.). |
| 5 | Determination of starch content of cereal. |
| 6 | Preparation of cereal based products. |
| 7 | Milling of cereal grains. |
| 8 | Visit to milling industry. |

| Food Plant Design and Layout | |
|---|---|
| **Sr. No.** | **Practical Name** |
| 1 | Layout of food storage wares and godowns. |
| 2 | Layout and design of cold storage. |
| 3 | Layout of pre-processing house. |
| 4 | Layout of milk and milk product plant. |
| 5 | Layout and design of bakery and related product plant. |
| 6 | Layout and design of fruit processing plant. |
| 7 | Layout and design of vegetable processing plant. |
| 8 | Preparation of project report. |

| Food Packaging | |
|---|---|
| **Sr. No.** | **Practical Name** |
| 1 | Identification of packaging materials. |
| 2 | Measurement of grammage and thickness of packaging films, papers and boards. |
| 3 | Determination of cobb's value of paper, paper boards. |
| 4 | Measurement of bursting strength of paper of paper boards. |
| 5 | Measurement tear strength of papers. |
| 6 | Determination of box compression strength of CFB. |
| 7 | Identification of flute types and dimensions of CFB. |
| 8 | Visit to Packaging industry. |

## Course Code and title: N-MJT-BFS-506 Enzyme Technology

**Credits: 02** **Total Lectures: 30**

**Course Objectives:**

- Study the biochemical properties of enzymes, including their structure, function.
- Understand how enzymes are applied in different industries such as food processing.
- Gain knowledge of enzyme purification techniques such as filtration, chromatography.
- Explore various methods for enzyme immobilization, including adsorption, entrapment.

| Topic No. | Enzyme Technology | Lectures |
|---|---|---|
| 1. | **Unit I: Introduction to Enzyme Technology**<br>Definition and characteristics of enzymes, Historical background and importance of enzyme technology, Enzyme classification, Industrial applications of enzymes, Structure of enzymes (primary, secondary, tertiary, and quaternary structure). | 07 |
| 2. | **Unit II: Source, Techniques and methods**<br>Microbial sources of enzymes, Screening and isolation of enzyme-producing microorganisms, Techniques for enzyme production (solid-state fermentation, submerged fermentation), Methods for enzyme purification (centrifugation, precipitation, and chromatography), and Protein concentration methods. | 08 |
| 3. | **Unit III: Applications of enzymes**<br>Types of immobilization (adsorption, covalent binding, entrapment, and encapsulation), Methods and materials used for enzyme immobilization, Advantages and applications of immobilized enzymes, Industrial applications of immobilized enzymes. Food industry (fermentation, food processing, brewing, dairy), Enzyme-based biosensors. | 07 |
| 4. | **Unit IV: Concepts on enzymes**<br>Principles of bio catalysis, Enzyme modification techniques (mutagenesis, directed evolution), Methods for measuring enzyme activity, Characterization of enzyme properties (substrate specificity, temperature stability, pH stability), Recent advances in enzyme technology: Future perspectives in enzyme production and industrial applications. | 08 |

**Course Outcomes:**

After successful completion of the course the students will be able to:

- Demonstrate an understanding of the structure-function relationship of enzymes and their catalytic mechanisms.
- Apply techniques for the production of enzymes from different biological sources, such as microorganisms, plants, and animals.
- Conduct enzyme purification using methods such as chromatography, centrifugation, and filtration, and analyze enzyme purity.
- Identify and apply various enzyme immobilization techniques suitable for industrial applications.

**Books:**


1. Principles of Enzyme Technology, Khan M.Y. and Khan F. PHI Publication, New Delhi 2015 ISBN 8120350413.
2. Enzymes in Industry: production and applications, Aehle W, Wiley- VCH Verlag GmbH & Co.
3. Enzymes in Food Processing – Fundamentals and potential application, Panesar P.S., Marwaha S.S. and Kumar H. IK International Publishing House, 2010 ISBN: 9380026331
4. Enzymes in Food Processing, G.A. Tucker and L.F.J. Woods Springer 2009
5. Microbial Enzyme Technology in Food Applications, Ray R.C. and Rosell C.M. CRC Press, London 2017, ISBN: 1498749844.
6. Enzymes in Food and Beverage Processing, Muthuswamy C. CRC Press, London 2015

## Course Code and title: N-AEC-C English for Communication –III

| Credits=02 | English for Communication –I | No. of hours per unit /credits |
|---|---|---|
| | **UNIT- I** | **11** |
| | A. Interview Skills<br>B. Enterprise - Nissim Ezekiel | |
| | **UNIT- II** | **11** |
| | A. E-Communication<br>B. On Saying 'Please'- A. G. Gardiner | |
| | **UNIT- III** | **11** |
| | A. English for Competitive Examinations<br>B. The Look-Out Man - Nicholas Bentley | |
| | **UNIT- IV** | **12** |
| | A. Forgetting Our Own History – Sudha Murty B.<br>B. i. The Butterfly – Arun Kolatkar<br>ii. For Your Lanes, My Country --Faiz Ahmed Faiz | |

**Reference Books:**


1. Sudha Murty, Wise and Otherwise: A Salute to Life, Penguin Books India,2006
2. Ability Enhancement Compulsory Course (Cbcs) For B. Sc. Part III English For Communication (Compulsory English) Shivaji University Press.2020.
3. The Oxford India Anthology of Twelve Modern Indian Poets (1992) ed. by Arvind Krishna Mehrotra and published by Oxford University Press, New Delhi.

## Course Code and title: N-FP Field Project

| Credits =2 | Research Project | No. of hoursper unit / credits |
|---|---|---|
| **1.** | Self-study and reference work of relevant topics and concepts by the student. | |
| **2.** | The Project Work must involve practical work related to selected discipline. | |
| **3.** | Students are expected to work on "Project Work" for about 03 periods per week. | |
| **4.** | The project work must be group allotted. | |
| **5.** | The student invests his energy, time and resources in a project. The project therefore should, if possible, have important bearing on some practical aspect. This will help student to justify his efforts on project. | |
| **6.** | It is the joint responsibility of student and project supervisor to maintain daily register book of his/her project work and has to be produced at the time of examination if asked. | **08** |
| **7.** | Submission Process: Student should prepare 2 copies of the Project Report. At the beginning, the respective Project Supervisor must approve both copies positively before final examination. Then respective Head or Coordinator approves both copies of the Project Report. | |
| **8.** | The student has to submit one of these approved copies of project report, duly signed by the project Supervisor, Head or Coordinator and Principal, before practical examination. | |

**Credits: 02**

## Semester- VI

## Course Code and title: N-MJT-BFS-601 Food Beverages and snack food technology

**Credits: 02** **Total Lectures: 30**

**Course Objectives:**

- Equip students with the skills to manage snack food and beverage operations efficiently.
- Teach students how to design balanced menus, optimize snack food and beverage offerings.
- Introduce students to current trends in the snack food and beverage industry, including sustainability.

| Topic No. | Food Beverages and snack food technology | Lectures |
|---|---|---|
| 1. | **Unit I: Introduction to Food Beverages**<br>Definition, Types of beverages, FSSAI specifications of Processing and Packaged drinking water and Fruit beverages, dairy based and whey based beverages. | 07 |
| 2. | **Unit II: Processing of beverages**<br>Specialty beverages, tea, coffee, etc., Synthetic, carbonated beverages, sports/energy drinks, alcoholic beverages. | 08 |
| 3. | **Unit III: Introduction & Snack Food Ingredients**<br>Introduction to snacks, Ingredients & additives commonly used in snack food, their attributes and functions, Specialized equipment for snack products. | 07 |
| 4. | **Unit IV: Products and Processing**<br>Meat based snacks, baked snacks, nut based snacks (salted, spiced and sweetened), Indian savory farsans and sweets. Processing of papad, chips and wafers, corn chips, popcorn and simulated potato chips. | 08 |

**Course Outcomes:**

- To study about the various beverage and snack foods.
- To study about the products made out of them.
- To provide a technical view of beverages and snack foods.
- To understand the manufacturing processes in the context of technology.

**Reference Books:**


1. Manay, N.S, Shandaksharaswamy, M., (2004), "Foods- Facts and Principles", New Age International Publishers, NewDelhi,
2. Potter, N.N, Hotchkiss, J.H.( 2000), "Food Science". CBS Publishers, NewDelhi.
3. Srilakshmi, B. Food Science ($3^{rd}$ Edition) (2003), New Age International (p) Limited Publishers, NewDelhi,
4. Nicholas Dege. (2011), "Technology of Bottled water". Blackwell publishing Ltd, UK.
5. Food Flavourings P.R. Ashust Springer, 2012.
6. Handbook of Alcoholic Beverages Alan Buglass John Wiley and Sons, 2011
7. Beverages Pare Jean Company's Coming Publishing Limited, 1997
8. Preservation of Fruit and Vegetable Products Girdharilal, Siddappa, Tondon Indian Council of Agricultural Research, Publications 1986.

## Course Code and title: N-MJT-BFS-602 Food Quality and Sensory Evaluation

**Credits: 02** **Total Lectures: 30**

**Course Objectives:**

- Equip students with the knowledge to assess and define food quality, focusing on appearance, texture, flavor, and aroma.
- Teach methods for conducting sensory evaluations, including taste tests, smell assessments, and texture analysis, using trained panels and consumer preferences.

| Topic No. | Food Quality and Sensory Evolution | Lectures |
|---|---|---|
| 1. | **Unit I: Introduction of food quality**<br>Food quality and its role in food industry, need of quality control, factors affecting quality control, quality attributes: dominant and hidden attributes. Color-role of colors in quality spectra, different types of colour measuring instruments. | 07 |
| 2. | **Unit II: Quality parameters**<br>Texture: classification, properties of texture, measurement of texture/ kinesthetic characteristics. Flavour: Definition and its role in food quality. Viscosity: types of fluids, different viscometers to measure viscosity. Consistency: methods used to measure consistency or product difference between viscosity and consistency. | 08 |
| 3. | **Unit III: Taste and odour**<br>Taste, classification, taste qualities, relative intensity, reaction time, effect of disease, temperature, and taste medium on taste, basic tastes and interaction of tastes. Odour: definition, classification, neutral - mechanisms, olfactory abnormalities, odour testing, techniques, thresholds, odour intensities. | 07 |
| 4. | **Unit IV: Sensory evaluation**<br>Definition of sensory evaluation, basic tastes, human senses and sensory perception, threshold, tongue surface, environment and test room design, | |

| | | |
|---|---|---|
| | product controls: sample preparation and presentation, panelist controls, classification of test methods. | 08 |

**Course Outcomes:**

1. To understand the principles and framework of food safety.
2. To understand food laws and regulations governing the quality of foods.
3. To identify the wide variety of parameters affecting food quality.

**Reference Books:**


1. Food Industry Quality Control System, Clute M. CRC Press, 2008
2. Sensory Evaluation Practices Stone, Bleibaum and Thomas Academic Press, 2012
3. Sensory Evaluation Practices, Taylor,Academic Press, 2012
4. Measurement and Control in Food Processing Bhuyan, CRC Press, 2006
5. Principles of Sensory Evaluation of Food Amerine MA, Pangborn RM & Rosslos EB Academic Press 1965.

## Course Code and title: N-MJT-BFS-603 Unit Operations in Food Industry

**Credits: 02** **Total Lectures: 30**

**Course Objectives:**

- To provide in-depth knowledge in basic concepts of various unit operations in a food industry.
- To learn basic principles, design and working of size reduction, evaporation, freezing, extraction.

| Topic No. | Unit Operations in Food Industry | Lectures |
|---|---|---|
| 1. | **Unit I: Size reduction**<br>Size reduction: Benefits, classification, sieve/screen analysis, principle and mechanisms of comminution of food, Size reduction equipment: Principal types, hammer mills, attrition mills, buhr mill, tumbling mills, cutting machines (slicing, dicing, shredding, and pulping). | 07 |
| 2. | **Unit II: Evaporation and Freezing**<br>Basic principle, need for evaporation, single effect, multiple effect, heat economy, type of evaporator-long tube, short tube, agitated film evaporator. Food freezing: Introduction, principles of food freezing, freezing systems, direct contact systems, air blast immersion, Changes in foods, frozen food properties, freezing time, factors influencing freezing time, freezing/thawing time. | 08 |
| 3. | **Unit III: Expression, Extraction**<br>Expression and extraction: liquid-liquid extraction processes, types of equipment and design for liquid-liquid extraction, continuous multistage counter current extraction. | 07 |
| 4. | **Unit IV: Crystallization and Distillation**<br>Crystallization and Distillation: Theory and principles, kinetics, applications in food industry, equipment for crystallization. Distillation: | 08 |

| | | |
|---|---|---|
| | Principles, vapour-liquid equilibrium, continuous flow distillation, batch/differential distillation, fractional distillation, steam distillation, distillation of wines and spirits. | |

**Course Outcomes:**

1. To understand the different operations performed in food industry.
2. To know details of working of different equipments.

**Reference Books:**

1. Heat and Mass Transfer Nag P McGraw Hill, 2011

2. Heat and Mass Transfer – Fundamentals and Applications Yunus AC and Afshin JG McGraw Hill, 2015

3. Heat Transfer Gupta CP Prentice Hall of Media, New Delhi 1994

4. Heat Transfer J.P. Holman 10th Ed. McGraw-Hill Book Co., Boston, USA. 2010

## Course Code and title: N-MJT-BFS-604 Food Engineering

**Credits: 02**

**Total Lectures: 30**

**Course Objectives:**

- To study the various engineering properties of food materials under different condition
- To study about the different methods of determining the quality and properties of different foods

| Topic No. | Food Engineering | Lectures |
|---|---|---|
| 1. | **Unit I: Engineering properties of food materials**<br>Definition, Engineering properties of food materials: physical, thermal, aerodynamic, mechanical, optical and electromagnetic properties. | 07 |
| 2. | **Unit II: Mechanical Separations and Mixing**<br>Centrifugation, liquid-liquid centrifugation, liquid-solid centrifugation, clarifiers, desludging and decanting machine. Mixing: theory of solids mixing, criteria of mixer effectiveness and mixing indices<br><br>, Mixing equipment. | 08 |
| 3. | **Unit III: Refrigeration**<br>Definition , Principles of refrigeration, Concept and selection of a refrigerant, effect of low temperature on quality, equipment's and freeze drying, freezing time, Pressure enthalpy charts and tables, Calculation methods. | 07 |
| 4. | **Unit IV: Study of different Material Handling systems**<br>Classification, principles of operation, conveyor system selection/design<br>belt conveyor, chain conveyor, screw conveyor, elevator, pneumatic conveying system. | 08 |

**Course Outcomes:**

1. Understanding the physical, chemical, and biological properties of food materials.
2. Ability to design and analyze equipment and processes such as evaporators, dryers etc.
3. Ability to predict and control the shelf life of food products.

**References:**


1. M.A. Rao, Syed S.H. Rizvi, Ashim K. Datta, Jasim Ahmed, (2014), “Engineering Properties of Foods”, Fourth Edition, CRCPress.
2. M. Anandha Rao, (2010), “Rheology of Fluid and Semisolid Foods: Principles and Applications: Principles and Applications”, Springer Science & Business MediaPublishing.
3. Zeki Berk, (2008), “Food Process Engineering and Technology”, Academic Press Publishers.

**Course title: Laboratory exercise in Food Beverages and snack food technology, Food quality and Sensory Evaluation, Unit Operations in Food Industry and Food Engineering.**

**Course Code: N-MJP-BFS-605** **Credit: 08**

| **Food Beverages and snack food technology** | |
|---|---|
| **Sr. No.** | **Practical Name** |
| 1 | Preparation of RTS beverage |
| 2 | Preparation of Instant Tea/coffee |
| 3 | Preparation of fruits squash |
| 4 | Detection of sodium benzoate in beverage |
| 5 | Study the ingredients & additives commonly used in snack food |
| 6 | Preparation of different type nut based snacks. |
| 7 | Preparation of different types savory products. |
| 8 | Preparation of papad. |

| **Food quality and Sensory Evaluation** | |
|---|---|
| **Sr. No.** | **Practical Name** |
| 1 | Quality attributes of various food products. |
| 2 | Quality evaluation of product for colours. |
| 3 | Determination of viscosity of food products. |
| 4 | Determination of textural quality profile. |
| 5 | Evaluation of food products as per standards. |
| 6 | Sensory evaluation of different food products by hedonic Rating method. |
| 7 | Descriptive testing for sensory evaluation of food. |
| 8 | Consumer study for food quality. |

| **Unit Operations in Food Industry** | |
|---|---|
| **Sr. No.** | **Practical Name** |
| 1 | Study of Principle, working and demonstration of hammer mill, crushing roll, attrition mill. |
| 2 | Determination of reduction ratio of different size reduction machineries. |
| 3 | Study of Freezing of foods by different methods. |
| 4 | Determination of freezing time of a food material. |
| 5 | Study of crystallizer. |
| 6 | Study the different types of evaporators. |
| 7 | Study the types of equipment and design for liquid-liquid extraction process. |
| 8 | Visit to food industry. |

| Food Engineering | |
|---|---|
| **Sr. No.** | **Practical Name** |
| 1 | Study of engineering properties of food materials. |
| 2 | Study of centrifugal separation (centrifugal cream separation, centrifugal machine). |
| 3 | Study of different type mixing equipments. |
| 4 | Determination of mixing index of a feed mixer. |
| 5 | Study of basic refrigeration and air conditioning. |
| 6 | Study of various types of compressors, condensers, expansion valves used in refrigeration system. |
| 7 | Study of different materials handling equipment. |
| 8 | Visit to food engineering plant. |

## Course Code and title: N-MNP-BFS-606 Food Industrial Microbiology

**Credits: 02** **Total Lectures: 30**

**Course Objectives:**

- To study the commercial applications of industrially important organisms in fermentations and its application in foods.
- To study about microorganisms used industrial process.
- To understand media preparation for the industrial fermentation.

| Topic No. | Food Industrial Microbiology | Lectures |
|---|---|---|
| 1. | **Unit I: Introduction food Industrial Microbiology**<br>History of industrial microbiology, Primary and secondary metabolites produced by the microorganisms, Screening of microorganisms; Preservation of microorganisms; Organizations involved in microbiological work. | 07 |
| 2. | **Unit II: Fermentation process**<br>Fermentation media, Types of fermentation and fermenters. Fermenter: Components of a fermenter, parts of fermenters, peripheral parts and accessories, and microorganisms involved. | 08 |
| 3. | **Unit III: Probiotics and prebiotics**<br>Probiotics and prebiotics, Importance, role in fermented foods, beneficial effects, Industrially important secondary metabolites, their production, bio pesticides, antibiotics, enzymes, Production of microbial enzymes, Downstream processing. | 07 |
| 4. | **Unit IV: Cell disruption methods**<br>Mechanical disruption methods and non-mechanical disruption methods; Extraction; Purification; Concentration; Product recovery, Microbial cell products, Oriental and traditional fermented foods; Measures to improve yield of fermented products. | 08 |

**Course Outcomes:**

On completion of course students will be able to

- Expose to the industrial applications of fermentation process.
- Application of microorganisms for the food Processing.
- Expose to strategies for selection of various microbes, media for the fermentation.
- Familiarization with various methods of studying growth of microorganisms.
- Familiarization with various techniques used for the product separation and purification.

**References:**

1. Nduka Okafor. 2007. Modern Industrial Microbiology and Biotechnology. Science Publishers, Enfield, New Hampshire, USA.

2. Dennis E. Briggs, Chris A. Boulton, Peter A, Brookes and Roger Stevens. 2004. Brewing Science and Practice. Woodhead Publishing Ltd. Cambridge, England.

3. G. Reed. 2004. Prescott & Dunn's Industrial Microbiology, 4th Ed. AVI Publishers, Connecticut, USA.

4. Peter F. Stanbury, Allan Whitakar and Stephen J. Hall. 1995. Principles of Fermentation Technology, 2nd Ed. Elsevier Science Ltd., Burlington, MA, USA.

5. L.E. Casida Jr. 1968. Industrial Microbiology. New Age International Publishers, New Delhi.

## Course Code and title: N-AEC-D English for Communication –VI

| Credits=02 | English for Communication –II | No. of hours per unit /credits |
|---|---|---|
| | **UNIT-I** | **11** |
| | A. Group Discussion<br>B. Evolution - Alexie Sherman Alexie | |
| | **UNIT-II** | **11** |
| | A. Note Making ad Note Taking<br>B. Gateman's Gift - R. K. Narayan | |
| | **UNIT-III** | **11** |
| | A. Media Writing<br>B. When Ideas Make Money | |
| | **UNIT-IV** | **12** |
| | A. Bhaurao in America – P. G. Patil<br>B. (i) The Grass is Really Like Me- Kishwar Naheed<br>(ii) The Road Not Taken- Robert Frost | |

**Reference Books:**


1. R.Chaudhary, Media Writing, Anmol Publications, 2010
2. Bolton, Robert. People skills: how to assert yourself, listen to others, and resolve conflicts. New York: Simon & Schuster. 1986
3. Ability enhancement compulsory course (cbcs) for b. sc. part iii english for communication (Compulsory English) Shivaji University Press.2020
4. The bountiful banyan: A biography of karmaveer Bhaurao Patil, Br.P.G.Patil, Mcmillan India, 2002.
5. Malgudi Days, R.K.Narayan, Penguin Classic, 2006.

## Course code and title: N-OJT- On Job Training

**Course Objectives:**

- Expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
- Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job.
- Exposure to the current technological developments relevant to the subject area of training.

### Guidelines:

Internships may be full-time or part-time; they are full-time in the summer vacation and part-time during the academic session. Curriculum is flexible to adjust internship duration. Therefore, opportunities must be provided for experiences that cannot be anticipated when planning the course. The institutes have the flexibility to schedule internship, Project work, Seminar etc. according to the availability of the opportunities. However, requirement regarding Internship duration is minimum three weeks. During the vacation after 5th semester, students are ready for industrial experience. Therefore, they may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO‟s/ Government organizations/ Micro/ Small/ Medium enterprises and our college to make themselves ready for the industry.

Every student is required to prepare a file containing documentary proofs of the activities done by him. The evaluation of these activities will be done by Programmed Head/Cell In-charge/ Project Head/ faculty mentor or Industry Supervisor as specified in evaluation scheme.

### General Procedure:

| | |
|---|---|
| **Step 1:** | Upon request of student, request Letter/ Email from the department should go to industry to allot various slots of 4-8 weeks during vacation as internship periods for the students. Students request letter/profile/ interest are as may be submitted to industries for their willingness for providing the training. |
| **Step 2:** | Industry will confirm the training slots and the number of seats allocated for internships via Confirmation Letter/ Email. In case the students arrange the training themselves the confirmation letter will be submitted by the students in the department. Based on the number of slots agreed to by the industry, |

| | |
|---|---|
| | department will allocate the students to the industry. In addition, the internship slots may be conveyed through Telephonic or Written Communication (by Fax, Email, etc.) by Faculty members who are particularly looking after the Internship of the students. |
| **Step 3:** | Students on joining Training at the concerned Industry / Organization, submit the Joining Report/ Letters / Email. |
| **Step 4:** | Students undergo industrial training at the concerned Industry / Organization. In between faculty Member(s) evaluate(s) the performance of students once/twice by visiting/ coordination with the Industry/Organization and Evaluation Report of the students is submitted in department office. |
| **Step 5:** | Students will submit training report after completion of internship. |
| **Step 6:** | Training Certificate to be obtained from industry. |
| **Step 7:** | Presentation along with brief report on training to be given at the time of examinationfor final evaluation. |

## Course outcomes:

- Students will get exposure to the industrial environment becoming competent professionals for the industry.
- Students will learn, understand and sharpen the real time technical / managerial skills required at the job.
- Student will be exposed to the current technological developments relevant to the subject area of training.