



**Rayat Shikshan Sanstha's
SADGURU GADAGE MAHARAJ COLLEGE, KARAD**

(An Autonomous)

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**
to be implemented from Academic Year 2024-25

Syllabus For

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

SEMESTER V & VI

(Syllabus to be implemented from June 2024)

Rayat Shikshan Sanstha's
SADGURU GADAGE MAHARAJ COLLEGE, KARAD.
(An 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: 2024-2025

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

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 08 theory papers each having **40 Marks**
- ❖ Practical Examination will be Conducted Annually – **100 Marks** for per subject.

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 exposure of 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 Specific 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 of the program

- 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

Third Year Bachelor of Science (Level-6) Program Structure
(NEP-2022Pattern) Structure of B. Sc. 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			COURSE CODE	PRACTICAL			THEORY				Total Marks	PRACTICAL
		Credit	No. of lectures	Hours		Credits	No. of lectures	Hours	Hours	Theory	Intern al	Total Marks (Min.)		
1	NBFST22-501	2	3	2.4	NBFSP22-505	4	6.4	8	2	40	10	16+4=20	50	Practical Examination is Annual
2	NBFST22-502	2	3	2.4					2	40	10	16+4=20	50	
3	NBFST22-503	2	3	2.4	NBFSP22-506	4	6.4	8	2	40	10	16+4=20	50	
4	NBFST22-504	2	3	2.4					2	40	10	16+4=20	50	
5	NSEC22-V	2	3	2.4					2	40	10	16+4=20	50	
6	NAECC22-E	4	3	2.4					2	40	10	16+4=20	50	
Total of SEM III		14	18	14.4		08	12.8	16	12	240 + 60 = 300				

TOTAL NO OF CREDITS FOR SEMESTER – V : 22

B. Sc. I SEMESTER– VI (Duration – 6 Months)

Sr. No.	COURSE CODE	TEACHING SCHEME							EXAMINATION SCHEME							
		THEORY			COURSE CODE	PRACTICAL			THEORY					PRACTICAL		
		Credit	No. of lecture	Hours		Credit No. of	lecture	Hours	Hours	Theory	Internal	Total Marks (Min.)	Total Marks	Max Marks	Min Marks	
1	NBFST2-601	2	3	2.4	NBFSP22-605	4	6.4	8	2	40	10	16+4=20	50	As per BOS Guid - lines	100	40
2	NBFST2-602	2	3	2.4					2	40	10	16+4=20	50			
3	NBFST2-603	2	3	2.4	NBFSP22-606	4	6.4	8	2	40	10	16+4=20	50		100	40
4	NBFST2-604	2	3	2.4					2	40	10	16+4=20	50			
5	NSEC22-VI	2	3	2.4					2	40	10	16+4=20	50			
6	NAECC22-F	4	3	2.4					2	40	10	16+4=20	50			
Total of SEM VI		14	18	14.4		08	12.8	16	12	240 + 60 = 300					200	
Grand Total		28	36	28.8		16	25.6	32	--	300 + 500 =800						

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
- **BFST-Bachelor of Food Science (Entire) Theory** : For Semester –V (NBFST22-501 to NBFST22-504) and for Semester –VI (NBFST22-601 to NBFST22-604)
- **AECC- Theory for Ability Enhancement Compulsory Course (AECC-E and AECC-F) NSEC-V AND NSEC-V (Skill Enhance Course) .**
- **BFSP – Bachelor of Food Science (Entire) ,Practical** : For (NBFSP22-605 and NBFSP22-606)
- Practical Examination will be conducted annually 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).
- 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.

• Total Marks for B.Sc.-I (Including AECC & SEC) :**800**

• Total Credits for B.Sc.-I (Semester I & II) : **44**

Note for SEC courses:

- SEC courses are of **Self Study mode**. The study material of all above courses will be made available on College website.
- The examination of each of the course will be of 50 marks having **25 MCQ questions**. Minimum 20 marks (40%) out of 50 are required for passing.
- The duration of examination shall be conducted at the college level.
- The list of candidates along with marks is to be submitted to the College.
- The degree will be awarded only after successful completion of these courses.

B.Sc. Part III (Semester V and VI)

Course code	Name of Course	Course code	Name of course
Semester V		Semester VI	
NBFST22-501	Snack Food and Extrusion Technology	NBFST22-601	Baking And Confectionary Technology
NBFST22-502	New Food Product Development	NBFST22-602	Enzymes In Food Processing
NBFST22-503	Food Packaging	NBFST22-603	Nutraceuticals And Functional Foods
NBFST22-504	Instrumentation and Process Control	NBFST22-604	Processing Technology of Beverages
NSEC22-V	Fundamental of Information Technology -I	NSEC22-VI	Fundamental of Information Technology -II
AECC-E	English for Communication - III	NAECC-F	English for Communication –IV

AECC-C and D – Ability Enhancement Compulsory Course: English for Communication

NBFSP22-506; NBFSP22-606	Laboratory Exercise in NBFST22-501, NBFST22-502 and NBFST22-601 , NBFST22-602
NBFSP22-507; NBFSP22-607	Laboratory Exercise in NBFST22-503, NBFST22-504 and NBFST22-603, NBFST22-604

Note. – Practical Examination will be Conducted Annually.

SEMESTER V

Subject code	Title of Paper
NBFST22-501	Snack Food and Extrusion Technology
NBFST22-502	New Food Product Development
NBFST22-503	Food Packaging
NBFST22-504	Instrumentation and Process Control
NSEC	
AECC-E	English for Communication -I

SEMESTER -V

Theory paper-I NBFST22-501 Snack Food and Extrusion Technology

Course Objective:

1. Remember the importance and scope of snack food.
2. Evaluate and formulate the ingredients and current practices for preparation of snacks.
3. Analyze extrusion & processing of snacks through extruders.
4. Understand packaging material required for snack foods & their quality control.

Credits= 02	Snack Food and Extrusion Technology	No.of hours per unit /credits
UNIT I	Introduction & Snack Food Ingredients	07
	a) Introduction to snacks, Domestic and Global status of Snack food Industry, Ingredients & additives commonly used in snack food, their attributes and functions. b) Starches for snack foods, Technology for grain-based snacks: whole grains – roasted, toasted, puffed, popped and flakes, coated grains-salted, spiced and sweetened; flour based – batter and dough based Products papads.	
UNIT II	Products and Processing	08
	a) Potato Chips, Meat based snacks, Snacks based on popcorn, baked snacks, Nut based snacks (salted, spiced and sweetened), Savory and Farsans. b) Processing of Papad, Chips and Wafers, Corn Chips and Simulated Potato Chips, Application of seasonings, Indian Savory Sweets.	
UNIT III	Extrusion & Extrusion Methods of Snack Foods	07

	Extrusion: definition, introduction to extruders, principles and types, Extruded products, Extruding Equipment, Uses of extruders in the snack food industry; Specialized Equipment for Popcorn Processing; Snack foods from formers & high shear extruders, Potato chip processing, Equipment for Frying, Baking, and Drying, Snack foods from cooking extruders.	
UNIT IV	Packaging & Quality Control of Snack Foods	08
	a) Product protection & packaging materials; Quality properties of snack foods, properties of snack food packaging materials, Packaging Materials & Packaging equipment's required for snack foods. b) Quality assurance and Quality control of snack foods; Evaluation methods- process control and product attributes and safety, Oil Content and Shelf Stability.	

Course Outcomes

Unit-I: After completion of the unit, Student are able to

1. Remember the ingredients used for snacks & their global status.
2. Know about the technology for grain-based snacks.

Unit-II: After completion of the unit, Students are able to

1. Recall the types of products and their processing.
2. Analyze application of seasonings and Indian savory snacks.

Unit-III: After completion of the unit, Students are able to

1. Remember the types of extruders, specific use in snack food industry.
2. Handle specialized equipment for potato chips, popcorn etc.

Unit-IV: After completion of the unit, Students are able to

1. Understand the type of packaging material required for snack foods.
2. Standardize quality control & quality assessment for snack foods & shelf life study.

Recommended readings

1. Matza S, Extruded foods. Springer, 2000-UNIT I.
2. N.D. Frame, Technology of Extrusion Cooking Springer, (Springer New York, NY 2012) 1-51 -UNIT I.
3. Riaz M.N., Extruders in Food Application CRC Press, 2000-UNIT II.
4. Samuel A .Matz, Snack food technology 3rd edition AVI Publ. 1993-UNIT II.
5. Gordon BR, Snack Foods, AVI Publ. 1997-UNIT III.
6. Mask an and Altan Advances in Food Extrusion Technology CRC Press, 2000-UNIT III.
7. Edmund W. Lusas & Lloyd W. Rooney, Snack Foods Processing CRC Press 2000-UNIT IV.

SEMESTER-V

Theory Paper –II NBFST22-502 New Food Product Development

Learning Objective: Student should:

1. Define New Product, Classification, and reason for food product development.
2. Understand product development process, Product launch process.
3. Understand the nutritional and sensory analysis, shelf life study of new product.
4. Understand the marketing of food product.

Credits=02	New Food Product Development	No.of hours per unit /credits
UNIT I	Introduction and Definition of New food Product	07
	Introduction, Definition of New Products, Reason for new food product development, Types new product, Concept of Novel food, Life cycle for a food product, Ideas for the development of a New Food Product: internal and external sources, Advantages and disadvantages of new product development process, Marketplace studies- Focus groups, Interviews, Consumer testing.	
UNIT II	Process of product development	08
	Concept of product development - product success and failure, factors for success, managing for product's success. Innovation strategy. Product development process - product strategy, product design and process development, product commercialization, product launch and evaluation.	
UNIT III	Analysis and Legal requirement for new product	07
	Nutritional and sensory evaluation of a new product, Shelf life testing- Static, accelerated and use/abuse tests, Packaging requirements of new product, Cost estimation, Direct and indirect costs, Legal aspects to be applied in New Food Product Development - Composition, labelling and claims.	
UNIT IV	Marketing of new product	08

	Role of consumers in product development, managing the product development process, improving the product development process - evaluating product development, innovative matrices, striving for continuous improvement, improving success potential of new products, market exploration and acquisition, legal aspects of new product launch.	
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Recommended Readings-

1. Clarke & Wright W. Managing New Product and Process Development, (Free Press, 1999.).
2. Earle and Earle, Creating New Foods, (Chadwick House Group, 2001).
3. Earle R, Earle R & Anderson A, Food Product Development, (Wood head Publ. 2001).
4. Fuller. New Food Product Development, (Concept to Market Place. CRC. 2004).
5. Moskowitz, Howard R. An Integrated Approach to New Food Product Development, (CRC Press, 2009.)

SEMESTER-V

Theory paper –III NBFST22-503 Food Packaging

Credits=02	Food Packaging	No.of hours per unit /credits
UNIT I	Introduction	07
	Definition and functions of Food packaging. <ul style="list-style-type: none">• Properties of packaging material in relation to these functions, package design.• Tests for flexible packaging materials.• Materials used in packaging- rigid, semi rigid and flexible.• Types of containers- primary & secondary, flexible & rigid, hermetic & non hermetic.	
UNIT II	Wood And Paper Packaging	08
	Packaging materials: <ul style="list-style-type: none">• Wood- structure, types, properties and wooden containers used in packaging, types of wooden boxes.• Paper and paper board- structure, making, properties, types and uses of paper and paper board, CFB boxes and their comparison with wooden containers.	
UNIT III	Glass and Metal Packaging	07
	Packaging materials: <ul style="list-style-type: none">• Glass – composition, properties, structure, types & manufacture of glass containers, their uses, breakage in glass, closure for glass containers.• Metals- properties of metals, different metals used in food packaging, steel plate and functions of various constituents of steel, formation of two piece and three piece cans, tinning process, tin free steel, aluminium containers, lacquering –type and applications, aluminium foil, corrosion of metal cans.	

UNIT IV	Packaging Methods	08
	Aseptic packaging of foods: sterilization of packaging material, food contact surfaces & aseptic packaging systems. <ul style="list-style-type: none"> • Active food packaging – definition, scope, physical and chemical principles involved, • Edible films and coatings. 	

Recommended 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 Griffith.
- 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
- 7) Athalye, A.S. (1992), Plastics in Packaging, Tata McGraw –Hill Publishing Co., New Delhi.
- 8) Rooney, M.L. (1995). Active Food Packaging, Blackie Academic & Professional, Glasgow,UK.
- 9) Bakker, M. (1986) The Wiley Encyclopaedia of Packaging Technology, John Willey & Sons. Inc; New York.
- 10) Food Packaging Technology Handbook. NIIR Board, National Institute of Industrial Research, 2003.
- 11) Ahvenainen, R. (Ed.) Novel Food Packaging Techniques, CRC Press, 2003
- 12) Han, J.H. (Ed.) Innovations in Food Packaging, Elsevier Academic Press, 2005.
- 13) Coles, R., McDowell, D. and Kirwan, M.J. (Eds.) Food Packaging Technology, CRC Press, 2003.

SEMESTER-V

Theory Paper –IV NBFST22-504 Instrumentation and Process Control

Learning Objectives: Students should:-

1. Understand the measurement of temperature , pressure, humidity.
2. Understand programmable logic controller.
3. Review lap lace transforms.
4. Understand signal flow graph reduction technique.

Credits=02	Instrumentation and Process Control	No.of hours per unit /credits
UNIT I	Measurement of various parameters	07
	Transducers: Measurement of temperature, flow, pressure, humidity, Gas concentration, Specific gravity, Concept of bio-sensors. Introduction to Fuzzy logic& neural networks.	
UNIT II	Data and Monitoring system	08
	Programmable logic controller, Data loggers, Data Acquisition Systems (DAS).Introduction to Direct Digital Control (DDC), Supervisory Control and Data Acquisition Systems (SCADA), Monitoring of plant parameters through Internet with SAP integration.	
UNIT III	Concept of Laplace Transform, Poles and zeros	07
	Review of Laplace Transforms, concept of poles and zeroes, open and closed loop systems, transfer function, block diagram reduction technique.	
UNIT IV	Signal flow , Stability concepts	08
	Signal flow graph reduction technique, Stability general concepts, absolute and relative stability, Routh stability criterion, Bode Plots.	

Recommended Readings

1. Doebelin EO, *Measurement System - Application and Design*. (McGraw Hill. Ernest O Doebelin. 1995).
2. Nachtigal CL, *Experimental Methods for Engineers*. (McGraw Hill. 1990).
3. John Wiley & Sons, *Instrumentation and Control Fundamentals and Application*.
4. Thomas A. Hughes, *Measurement and Control Basics* (ISA Press).
5. I.J Nagrath, M. Gopal, *Control systems engineering*, (New Age International).
6. Beck with TG, *Mechanical Measurements*, (Addison-Wesley 1996).

Course outcomes.

Unit I: After completion of the unit, Student are able to

1. Measure temperature, pressure, humidity.
2. Measure Gas concentration, Specific gravity.

Unit II: After completion of the unit, Student are able to

1. Understand programmable logic controller.
2. Monitor of plant parameters through Internet with SAP integration.

Unit III: After completion of the unit, Student are able to

1. Review lap lace transforms.
2. Understand block diagram reduction technique.

Unit IV: After completion of the unit, Student are able to

1. Understand the signal flow graph reduction technique.
2. Understand the Routh stability criterion, Bode Plots.

SEMESTER V
Theory Paper –V AECC-E English for Communication –I

Credits=02	English for Communication –I	No.of hours per unit /credits
MODULE I		11
	A. Interview Skills B. Enterprise - Nissim Ezekiel	
MODULE II		11
	A. E-Communication B. On Saying 'Please'- A. G. Gardiner	
MODULE III		11
	A. English for Competitive Examinations B. The Look-Out Man - Nicholas Bentley	
MODULE IV		12
	A. Forgetting Our Own History – Sudha Murty B. B. i. The Butterfly – Arun Kolatkar 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.

SEMESTER-V

Lab I NBFSP22-506 Laboratory Exercise in Snack Food and Extrusion Technology & New Food Product Development

Snack Food and Extrusion Technology

Sr.No	Practicals
1.	Preparation of Chips and its quality evaluation.
2.	Preparation of extruded snack food and its quality evaluation.
3.	Preparation of Wafers and its quality evaluation.
4.	Preparation of Flaked cereals (Poha) and its quality evaluation.
5.	Preparation of Puffed cereals (Churmura) and its quality evaluation.
6.	Preparation of Coated grains or nuts and its quality evaluation.
7.	Preparation of savory snack product and its quality evaluation.
8.	Preparation of popcorn and its quality evaluation.

New Food Product Development

Sr.No	Practical's
1.	Market survey of existing products.
2.	Idea generation and selection of topic.
3.	Cost analysis of product.
4.	Standardization of product.
5.	Development of new product.
6.	Proximate Analysis of new products.
7.	Sensory evaluation.
8.	Marketing.

SEMESTER-V
Lab II NBFSP22-507 Laboratory Exercise in Food Packaging & Instrumentation and Process Control

Food Packaging

Sr.No	Practical's
1.	Determination of Grammage and thickness of paper, paperboard and plastic films.
2.	Determination of grain direction, felt and wire side of paper.
3.	Determination of Cobb value of paper and board.
4.	Determination of bursting strength and burst factor of paper and CFB.
5.	Determination of Tearing Strength of paper.
7.	Identification of flute types and dimensions of CFB.
8.	Determination of Box Compression strength of a CFB.

Instrumentation and Process Control

Sr.No	Practical's
1.	Measurement of temperature.
2.	Measurement of liquid level.
3.	Measurement of Pressure.
4.	Measurement of Humidity.
5.	Measurement of Moisture .
6.	Measurement of Gas.
7.	Introduction to Transducers and its applications

SEMESTER-V
Project

Credits =2	Project	No. of hours per unit / credits
	<ol style="list-style-type: none">1. Self-study and reference work of relevant topics and concepts by the student.2. The Project Work must involve practical work(wet lab.) related to selected discipline3. Students are expected to work on “Project Work”for about 05 periods per week.4. The project work must be allotted individually.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.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 and Principal, before practical examination.	8

SEMESTER VI

Subject code	Title of Paper
NBFST22-601	Bakery And Confectionary Technology
NBFST22-602	Enzymes In Food Processing
NBFST22-603	Nutraceuticals And Functional Foods
NBFST22-604	Processing Technology of Beverages
NSEC-IV	
NAECC-F	English for Communication -II
NBFSP22-505; NBFSP22-605	Laboratory Exercise in NBFST22-501, NBFST22-502 and NBFST22-601, NBFST22-602
NBFSP22-506; NBFSP22-606	Laboratory Exercise in NBFST22-503, NBFST22-504 and NBFST22-603, NBFST22-604 + Project

SEMESTER VI

Theory Paper –I NBFST22-601 Bakery and Confectionary Technology

Credits=02	Bakery And Confectionary Technology	No.of hours per unit /credits
UNIT I	Introduction	07
	Raw materials required for bread making and their functional properties. Essential ingredients: Flour, yeast, water, salt. Other ingredients: Sugar, cooler, flavor, fat, milk and milk powder and bread improvers. Functions of various raw materials used in baking industries Materials of Baking. Leaveners and yeast foods, shortenings, emulsifiers and antioxidants, Sweeteners and, water and salt, Ingredients from milk and eggs. Fruits, vegetables, and nuts, Spices, flavors and colors. Preservation methods.	
UNIT II	Bakery Equipment	08
	Introduction to utensils and equipments used in bakery UNIT and their uses small equipments, big equipments and oven. 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	Biscuits And Cookies	07
	Production of cakes and 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. 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 IV	Confectionary Products	08
	Definition, importance of sugar confectionery and flour confectioner. Types of confectionery products-chocolate boiled sweets caramels toffees. Fondants. Manufacturing process and spoilage of confectionery products. Good manufacturing practices (GMP) in baking and confectionery industries. Computerization in plant and laboratory, Sanitation and safety.	

Text Books and Reference materials

1. Matz, Samuel A., “Bakery Technology and Engineering”, Third Edition, Chapman & Hall, London,
2. Caving, Stanley P, and Yound, Linda S., “ Technology of Bread Making”, Second Edition Aspen publication, Maryland, 2005.
3. Pomeranz. Y. “Modern Cereal Science and Technology”.MVCH Publications, New York.2003.
4. Samuel A., Matz., “ Equipment for Bakers”, Pan Tech International Publication, 2009.
5. Manley, Duncan., “ Biscuit Doughs Manual 2”, Woodhead Publishing Ltd., England. 2009.

SEMESTER VI

Theory Paper –II NBFST22-602 Enzymes in Food Processing

Credits=02	Enzymes In Food Processing	No.of hours per unit /credits
UNIT I		07
	Enzymes classification, properties, characterization, kinetics and immobilization; fermentative production of enzymes (amylases, proteases, celluloses', pectinases, xylanases, lipases) used in food industry and their downstream processing.	
UNIT II		08
	Enzymes for starch modification (maltodextrins and corn syrup solids: liquefaction, saccharification, dextrinization, isomerization for production of high-fructose-corn-syrup, fructose and fructo oligosaccharides). Enzymes for protein modification (hydrolysates and bioactive peptides), Enzymes for Lipid modification	
UNIT III		07
	Enzymes as processing aids: Role of enzymes in Dairy processing (cheese making and whey processing). Role of enzymes in meat processing (tenderization and flavour development) and fish processing (De-skinning, collagen extraction etc.,) Egg processing.	
UNIT IV		08
	Role of enzymes in Brewing, Baking (fungal -amylase for bread making; maltogenic -amylases for anti-staling; xylanases and pentosanases as dough conditioners; lipases or dough conditioning; oxidases as replacers of chemical oxidants; synergistic effect of enzymes).	

Text books and References

1. Whitehurst,R.J. & Van-Oort,M., (2010), Enzymes in Food technology, Second edition, Blackwell Publishing Ltd.
2. Aehle, W. (2007) Enzymes in Industry: Production and application. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim.
3. Rastall,R (2007) Novel enzyme technology for food applications Woodhead Publishing Limited, Abington Hall, Abington, Cambridge CB21 6AH, England.
4. Kalaichelvan, P.T., (2002), Bio process technology, MJP publishers, Chennai.

SEMESTER VI

Theory Paper –III NBFST22-603 Nutraceuticals And Functional Foods

Theory Objectives:

To develop comprehensive understanding of different nutraceuticals and functional foods

To understand the potential of various functional foods in promoting human health

Credits=02	Nutraceutical And Functional Foods	No .of hours per unit /credits
UNIT I	Introduction	07
	Background, status of nutraceuticals and functional food market, definitions, difference between nutraceuticals and functional foods, types of nutraceutical compounds and their health benefits, current scenario.	
UNIT II	Nutraceuticals	08
	Types of nutraceutical compounds – Phytochemicals, phytosterols and other bioactive compounds, peptides and proteins, carbohydrates (dietary fibers, oligosaccharides and resistant starch), prebiotics, probiotics and synbiotics, lipids (Conjugated Linoleic Acid, omega-3 fatty acids, fat replacers), vitamins and minerals; their sources and role in promoting human health.	
UNIT III	Functional Foods	07
	Cereal and cereal products, Milk and milk products, egg, oils, meat and products, sea foods, nuts and oilseeds, functional fruits and vegetables, herbs and spices, beverages (tea, wine etc.), Fermented foods – their health benefits and role in conditions like cardiovascular diseases, hypertension, diabetes etc. Future prospects of functional foods and nutraceuticals and their potential for use in improving health. Development in processing of functional foods .Formulation and fabrication of functional foods.	

UNIT IV	Legal Aspects	08
	Stability of nutraceuticals. Safety, Consumer acceptance and assessment of health claims, labeling, marketing and regulatory issues related to nutraceuticals and functional foods.	

Recommended readings:

1. Wildman REC, Handbook of Nutraceutical and Functional Foods, CRC Press 2001
2. Ghosh D et al, Innovations in Healthy and Functional Foods, CRC Press 2012
3. Pathak YV, Handbook of nutraceuticals Volume 2, CRC Press 2011
4. Various journals of food technology, food science and allied subjects.

SEMESTER VI

Theory Paper-IV NBFST22-604 Processing Technology of Beverages

Credits=02	Processing Technology Of Beverages	No .of hours per unit /credits
UNIT I		07
	History, importance of beverages and status of beverage industry, Processing of beverages, Packaged drinking water, juice based beverages, Synthetic ,still , carbonated ,low-calorie and dry beverages, isotonic And sports drinks, dairy based and alcoholic beverages.	
UNIT II		08
	Fruit beverages, speciality beverages, tea, coffee, cocoa, spices, plant extracts, etc.; FSSAI specifications for beverages, Ingredients, manufacturing and packaging processes and equipment for different beverages.	
UNIT III		07
	Water treatment and quality of water, Sweeteners, colorants, acidulants , clouding, clarifying and flavouring agents for beverages,	
UNIT IV		08
	Carbon dioxide and carbonation, Quality tests and control in beverages, Miscellaneous beverages: coconut water, sweet toddy, sugarcane juice, coconut milk, flavoured syrups.	

Textbooks

Sr. No.	Name of Book	Author	Publisher
1	Fruit and Vegetable Juices	Tressler D.K., Joslyn M.A. and Marsh G.C.	AVI publishing company New York 1971
2	Food and Beverage Technology International USA	Bernard and Alan	Sterling Publication, 1989
3	Beverages: Technology, Chemistry and Microbiology	Varnam and Sutherland	Springer, 1994
4	Manufacturing of Food and Beverages	NIIR Board	NIIR Publication, New Delhi

SEMESTER VI
Theory Paper –V AECC-F English for Communication –II

Credits=02	English for Communication –II	No.of hours per unit /credits
MODULE V		11
	A. Group Discussion B. Evolution - Alexie Sherman Alexie	
MODULE VI		11
	A. Note Making ad Note Taking B. Gateman’s Gift - R. K. Narayan	
MODULE VII		11
	A. Media Writing B. When Ideas Make Money	
MODULE VIII		12
	A. Bhaurao in America – P. G.Patil B. (i) The Grass is Really Like Me- KishwarNaheed (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.

SEMESTER-VI
Lab I NBFSP22-605 Laboratory Exercise in Bakery and Confectionary
Technology and Enzymes in Food Processing

Bakery and Confectionary Technology

Sr.No	Practical's
1.	Study of ingredients (major and minor): Characteristics of flour, yeast, shortening, sugar, egg and salts.
2.	Experiment on leavening action of baking powder, sodium-bicarbonate and ammonium-bi-carbonate.
3.	Estimation of water absorption power (atta and maida)
4.	Determination of yeast-ferment test and dough rising capacity
5.	Preparation of biscuits – different types
6.	Preparation of cookies-different types
7.	Preparation toffees.
8.	Preparation sugar boiled confectionary

Enzymes in Food Processing

Sr.No	Practical's
1.	Effect of pH & temperature on enzymes.
2.	Separation of enzymes - SDS Page.
3.	Effect of inhibitors on the activity of enzymes.
4.	Immobilization of enzyme by entrapment and comparison with free enzyme.
5.	Enzymes in meat tenderization

SEMESTER-VI

Lab II NBFSP22-606 Laboratory Exercise in Nutraceuticals and Functional Foods and Processing Technology of Beverages

Nutraceutical and Functional Foods

Sr.No	Practical's
1.	Identification of various nutraceuticals and functional foods available in the market.
2.	Estimation of chlorophyll content of green vegetable.
3.	Determination of lycopene in fruit/vegetable.
4.	Determination of total pectin in plant material.
5.	Estimation of crude fibre/dietary fibre content in cereals and their products.
6.	Estimation of anthocyanins in food sample.
7.	Preparation and evaluation of probiotic/prebiotic foods

Processing Technology of Beverages

Sr.No	Practical's
1.	Quality analysis of water from different sources and treatments.
2.	Detection of sodium benzoate in beverage.
3.	Measurement of pH and acidity of beverage.
4.	Preparation of Instant Tea/coffee.
5.	Preparation of RTS beverage.
6.	Preparation of carbonated beverage.
7.	Specifications for different fruit beverages and preparation of fruits squash.
8.	Preparation of artificial lemon juice.