

SHIVAJI UNIVERSITY, KOLHAPUR



Estd. in 1962
'A⁺⁺' Accredited by NAAC (2021) with CGPA 3.52

CHOICE BASED CREDIT SYSTEM

Syllabus For B.Sc.

Part - III

Food Science (Entire)

SEMESTER V AND VI

(Syllabus to be implemented from June-2023)

B.Sc. Part-III

Food Science (Entire)

SEMESTER V AND VI

(Syllabus to be implemented from June, 2023 onwards)

- ❖ Guidelines shall be as per B.Sc. Regular Program
- ❖ Rules and Regulations shall be as per B.Sc. Regular Program except CBCSR. B. Sc. 3 Structure of Program and List of Courses.
- ❖ Preamble:

This syllabus is framed to give sound knowledge with understanding of Food Science subject to undergraduate students of B.Sc. Food Science (Entire) Program. Students will learn Food Science as a separate course (Subject) from B.Sc. Part-I.

The goal of the syllabus is to make the study of Food Science more popular, generate an interest amongst the students about the field and encourage them for higher studies including research.

- ❖ Structure of Program and List of Courses are as follows

CBCS B. Sc. Food Science (Entire): List of courses

B. Sc Food Science Part-III (Semester V & VI)

THEORY

Course code	Name of Course	Course code	Name of Course
Semester-V		Semester-VI	
DSE FS-E1	Principles of Food Packaging	DSEFS-F1	Food Additives
DSE FS-E2	Snack Food Processing	DSE FS-F2	Sugar and Confectionery Processing
DSE FS-E3	Food Safety Management System	DSE FS-F3	Food Business Entrepreneurship
DSE FS-E4	Fundamentals of Research Methodology	DSE FS-F4	Fundamentals of New Product Development
AECC-E	English – III	AECC-F	English – IV

PRACTICAL

DSE FS-P8	Lab Course VIII (Based on DSE FS-E1 & DSE FS-E2)
DSE FS-P9	Lab Course IX (Project Phase I)
DSE FS-P10	Lab Course X (Based on DSE FS-F1 & DSE FS-F2)
DSE FS-P11	Lab Course XI (Project Phase-II)

B.Sc. Part III, Semester V
DSE FS-E1 PRINCIPLES OF FOOD PACKAGING
Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48

Unit I	Hours
Introduction to Food Packaging Package functions Need of Packaging Classification of packages-Primary, secondary & Tertiary Introduction of Packaging Material Different packaging and its properties Types of Packaging materials : Metal, Glass and Paper	15
Unit II	
Packaging Accessories Active packaging Controlled and modified atmospheric packaging (CAP and MAP) Aseptic packaging Packages for microwave ovens Biodegradable packaging Edible gums and coating Packaging Machines Vacuum packaging machine CA & MA packaging machine Gas Packaging machine Seal and Shrink packaging machine Form and Fill Sealing machine Retort pouches Bottling machine and carton making machine Different forms of packaging material Principles in development of safe and protective packing	15

Suggested Reading:

1. International Pvt. Ltd. New Delhi- 110 002A Handbook on Food Packaging, P.Jacob John
2. Food Packaging, Prof.NeelamKhetarpaul and Dr.DarshanPunia
3. Food Packaging, Takashi Kadoya
4. Handbook of Food Processing, Packaging and Labelling, Jerry D'souza and Jatin Pradhan
5. Aseptic Processing & Packaging of Food A Food Industry Perspective, Jairus R. D. David, Ralph H. Graves and V.R. Carlon
6. International Pvt. Ltd. New Delhi- 110 002A Handbook On Food Packaging ,P.Jacob John
7. Food Packaging, Prof.NeelamKhetarpaul and Dr.DarshanPunia
8. Food Packaging , Takashi Kadoya
9. Handbook of Food Processing, Packaging and Labelling, Jerry D'souza and Jatin Pradhan
10. Aseptic Processing & Packaging of Food A Food Industry Perspective, Jairus R.D David, Ralph H. Graves and V.R. Carlon
11. Innovations in Food Packaging (second Edition), Jung H. Han

B.Sc. Part III, Semester V
DSE FS-E2 SNACK FOOD PROCESSING
Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48

Unit I	Hours
<p>Introduction to Snack Food Ingredients Importance and scope of snack food technology Ingredients commonly used in snack food, their attributes and functions.</p> <p>Equipment and Packaging Equipment for frying, drying, baking, Equipment for popcorn processing. Quality Evaluation of Snack Food</p>	15
Unit II	
<p>Snack Food Products and Processing Potato Chips, Meat based snacks. Snacks based on popcorn, Puffed and flaked cereals, simulated potato chips, baked snacks. Nut based snacks (salted, spiced and sweetened) , Savory and Farsans, Processing of Papad, Chips and Wafers Application of seasonings Indian Savory Sweets</p> <p>Extruded Snack Foods. Extruded Snack Foods- Extrusion Process and Types of extrusion process. Single Screw and Twin Screw extruder, Hot and Cold Extrusion. Types of Extruded Snack food – First, Second and third generation snack food</p>	15

Suggested Reading:

1. Snack Foods Processing, Edmud W Luaas, Lloyd W Rooney, CRC Press, 2001.
2. Advances in Food Extrusion Technology, MedeniMaskan, Aylin Altan, illustrated edition, 2016.
3. Snack Foods, R. Gordon Booth, Springer, 5th edition, 2011.
4. The Complete Technology Book on Snack Foods, Dr.Himatri Panda, NIIR Project Company Services, 2nd edition, 2013.

B.Sc. Part III, Semester V
DSE FS-E3 FOOD SAFETY MANAGEMENT SYSTEM
Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48

Unit I	Hours
<p>Food safety and security. Food laws and standards – ISO 9000 and ISO 14000 Indian food laws and regulations – Prevention of Food Adulteration Act Food safety and standards act 2006 Functions of FSSAI , Enforcement of act, Food Licensing and Registration, Offences and penalties, regulations for labelling and packaging. Various Organizations in the area of Food standardization and quality Food and Agriculture organization, World Health organization, World Trade Organization United states Department of Agriculture, USFDA, Food and Drug Administration Codex Alimentations commission</p>	15
Unit II	
<p>Definition of food safety, Importance of food safety, Hazards-Types of hazards, biological, chemical, physical hazards, Factors affecting Food Safety, Importance of Safe Food, microbiological considerations in food safety. Acute toxicity, Mutagenicity and carcinogenicity, reproductive and developmental toxicity, neurotoxicity and behavioral effect Food safety Management System Voluntary Standards: BIS and AGMARK Objectives, Salient features TQM - concept and need for quality, components of TQM, HACCP ISO: 22000, FSSC, PRPs (GAP,GMP, GHP, GSP.)</p>	15

Suggested Reading:

1. Training manual for Food Safety Regulators, Vol II- Food Safety Regulations and Food Safety Management, 2010.
2. Food Quality and Safety Systems- A training manual on Food Hygiene and the Hazard Analysis and Critical Control Point(HACCP) system, Food and Agriculture Organization of the United Nations, Rome, Publishing Management Group, FAO Information Division, 1998.
3. Quality Control for Food Industry - Krammer&Twigg
4. Food Plant Sanitation: Design, Maintenance and Good Manufacturing Practices, Michael M. Cramer, CRC Press, 3rd edition, 2013.
5. Training manual for Food Safety Regulators, Vol II- Food Safety Regulations and Food Safety Management, 2010.
6. Food Quality and Safety Systems- A training manual on Food Hygiene and the Hazard Analysis and Critical Control Point(HACCP) system, Food and Agriculture Organization of the United Nations, Rome, Publishing Management Group, FAO Information Division, 1998.

7. Quality Control for Food Industry - Krammer&Twigg
8. Food Plant Sanitation: Design, Maintenance and Good Manufacturing Practices, Michael M. Cramer, CRC Press, 3rd edition, 2013

B.Sc. Part III, Semester V
DSE FS-E3 FUNDAMENTAL OF RESEARCH METHODOLOGY
Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48

Unit I	Hours
<p>Basic Concepts of Research Importance and scope of research in different fields of study, Types of research -Fundamental vs. Applied, Concept of researchable problem – research prioritization –selection of research problem, Approach to research – research process., Review of Literature</p> <p>Data Collection Methods Data collection Mailed questionnaire and interview schedule – structured, & unstructured, open ended and closed-ended questions. Interviewing techniques and field problems - methods of conducting survey</p>	15
Unit II	
<p>Sampling Techniques Sampling theory and sampling design – sampling error - methods of sampling Research design and techniques – Types of research design., Hypothesis – meaning - characteristics - types of hypothesis –testing of hypothesis.</p> <p>Report Writing Meaning of Report, Types of Research Reports, Contents or Structure of Research reports, Characteristics of a good research report, Practical vs Academic Report, Importance of proof reading, Significance of good layout, Ethics in Research and Reporting</p>	15

Suggested Reading:

1. Black TR. 1993. Evaluating Social Science Research - An Introduction. SAGE Publ.
2. Creswell JW. 1999. Research Design - Qualitative and Quantitative Approaches. SAGE Publ.
3. Dhondyal SP. 1997. Research Methodology in Social Sciences and Essentials of Thesis Writing. Amman Publ. House, New Delhi.
4. Kothari CR. 2016. Research Methodology - Methods and Techniques. WishwaPrakashan, Chennai.
5. Rao KV. 1993. Research Methodology in Commerce and Management. Sterling Publ.,New Delhi. Singh AK. 1993. Tests, Measurements and Research Methods in Behavioral Sciences, Tata McGraw-Hill.
6. Black TR. 1993. Evaluating Social Science Research - An Introduction. SAGE Publ.
7. Creswell JW. 1999. Research Design - Qualitative and Quantitative Approaches. SAGE Publ.

8. Dhondyal SP. 1997. Research Methodology in Social Sciences and Essentials of Thesis Writing. Amman Publ. House, New Delhi.
9. Kothari CR. 2016. Research Methodology - Methods and Techniques. WishwaPrakashan, Chennai.
10. Rao KV. 1993. Research Methodology in Commerce and Management. Sterling Publ.,New Delhi. Singh AK. 1993. Tests, Measurements and Research Methods in Behavioural Sciences, Tata McGraw-Hill.

SEMESTER V AECC E

MODULE I

- A. Interview Skills
- B. Enterprise - Nissim Ezekiel

MODULE II

- A. E-Communication
- B. The Ant and the Grasshopper – W.S. Maugham

MODULE III

- A. English for Competitive Examinations
- B. The Look-Out Man - Nicholas Bentley

MODULE IV

- A. Forgetting Our Own History -
Sudha Murty
- B.(i) The Butterfly –
Arun Kolatkar
- (ii) For Your Lanes, My Country --Faiz Ahmed Faiz

***Note: Semester V: 10 Marks for Internal Evaluation: STUDENTS' SEMINAR**

B.Sc. Part III, Semester VI
DSEFS- F1 FOOD ADDITIVE
Credits 2 (Marks 50) Hours 30, 37.5 Lectures 48

Unit I	Hours
<p>Introduction of food additives. Additives in food processing and preservation – classification and their functions, ADI, GRAS and naturally occurring compounds, Nutritional and non- nutritional food additives. Safety and quality evaluation of food additives and contaminants, International numbering system for food additives.</p> <p>Direct food additives Introduction to different food additive their chemistry, types and functions.</p>	15
Unit II	
<p>Sweeteners- Natural and low calorie/ Non –nutritive sweeteners, Their Chemistry Food Contaminants– Definition, Types, Food Toxicants– Definition, Types, Terminologies in Toxicology Acute and Chronic studies, LD50 Value Methods for Detection of Food Additives,</p>	15

Suggested Reading:

1. Fennema, O.R. Marcel Dekker Principles of Food Science: Part-I Food Chemistry,, New York, Ed. 1976
2. Potter, N.N. AVI Food Science, , Westport. 3rd Ed. 1978.
3. Furia T.E. Handbook of food additives. VolII and VolIII, 1980
4. George A.B Encyclopedia of food coloradditives, , VolIII; CRC Press, 1996.

B.Sc. Part III, Semester VI
DSEFS- F2 SUGAR AND CONFECTIONERY PROCESSING
Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48

Unit I	Hours
<p>Introduction to Confectionary Present status and future scope of sugar and confectionery industries. Fundamentals of confectionery Processing of Invert sugar, Glucose syrup, High fructose corn syrup. Sugar based confectionery processing: High boiled sweets, Toffee, Fudge, and Caramel, Lozenges, fondants and chewing gums. Problems in confectionery products</p>	15
Unit II	
<p>Machinery and Additives in confectionery Types of machinery in confectionery industry Quality parameters of confectionary products Chocolate Processing Cocoa processing Chocolate processing: Ingredients, mixing, refining, conching, tempering, moulding, cooling, coating. Problems in Chocolate processing</p>	15

Suggested Reading:

1. Yogambal Ashok kumar, Textbook of Bakery and Confectionery , Prentice Hall India Learning Private Limited, 2012.
2. William P Edwards, The Science of Sugar confectionery, Royal Society of Chemistry, 2nd edition,2018.
3. Peter P. Greweling, Wiley, Chocolate and Confections; Formula, Theory and Technique for the Artisan Confectioner, 2nd edition, 2012.
4. Ferenc A. Mohos, Wiley-Blackwell, Confectionery and Chocolate Engineering: Principles and Applications, 2010.
5. Bakery and Confectionery, Acharya NG Ranga Agricultural University.
6. Yogambal Ashok kumar, Textbook of Bakery and Confectionery , Prentice Hall India Learning Private Limited, 2012.
7. William P Edwards, The Science of Sugar confectionery, Royal Society of Chemistry, 2nd edition,2018.
8. Peter P. Greweling, Wiley, Chocolate and Confections; Formula, Theory and Technique for the Artisan Confectioner, 2nd edition, 2012.
9. Ferenc A. Mohos, Wiley-Blackwell, Confectionery and Chocolate Engineering: Principles and Applications, 2010.
10. Bakery and Confectionery, Acharya NG Ranga Agricultural University

B.Sc. Part III, Semester VI
DSEFS- F3 FOOD BUSINESS ENTREPRENEURSHIP
Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48

Unit I	Hours
<p>Entrepreneurship and its support system Concept/ Meaning Need Qualities of an entrepreneur District industry centres (DICs), Small industrial development Bank of India(SIDBI) National bank for agriculture and rural development(NABARD), National Small Industry Corporation(NSIC), Khadi Village and industries commission(KVIC) Other relevant institutions/ organization/ NGOs at state level</p> <p>Business Planning and project report preparation Identification and guidance business plants Assessment, Procedures for registration of small scale industry, List of items reserved for exclusive manufacture in small scale industry, Considerations in product selection, Data collection for setting up small ventures Preliminary Project Report, Techno-Economic feasibility report, Project Viability</p>	15
Unit II	
<p>Managerial Aspects of Small Business Principles of Management (Definition, functions of management viz planning, organization, coordination and control) Marketing Techniques, Legal Aspects of Small Business Elementary knowledge of Income Tax, Sales Tax, Patent Rules, Excise Rules, Factory Act and Payment of Wages Act,</p>	15

Suggested Reading:

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
2. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
3. Environmental Engineering and Management by Suresh K Dhamija, SK Kataria and Sons, New Delhi
4. Environmental and Pollution Awareness by Sharma BR, Satya Prakashan , New Delhi

B.Sc. Part III, Semester VI
DSEFS- F4 FUNDAMENTAL OF NEW PRODUCT DEVELOPMENT
Credits 2 (Marks 50) Hours 30, 37.5 Lectures of 48

Unit I	Hours
<p>Basics of Food Product Development Definition, Classification of new food product Reason for new food, Product development– social concerns, Health concerns. Product development- Market place influences, Technological influences, Governmental influences Product life cycle New Product Development team, concept of market and marketing Steps in Food Product Development)</p>	15
Unit II	
<p>Technology for New Product & Scale up Trials Adaptable technology and sustainable technology for standardized formulation for process development Process control parameters Scale up production trials for new product development at lab and pilot scale Quality assessment of new developed products Market testing and marketing plan Costing and economic evaluation of developed products, Commercialization / product launch for marketing</p>	15

Suggested Reading:

1. Food Product Development, M Earle, R Earle, A Anderson, Woodhead Publishing, 2001.
2. New Food Product Development: from Concept to Marketplace, Gordon W Fuller, CRC Press, 3rd edition, 2011.
3. Methods for Developing the New Food Products, FadiAramouni, Kathryn Deschenes, Desteh Publications, 2nd edition, 2017.
4. Strategies for Formulations Development: A step-by-step Guide using JMP, Ronald D. Snee, Roger W. Hoeri, SAS Institute; revised edition, 2016
5. New Food Product Design and Development: Beckley, Blackwell Publishing Oxford UK
6. Sensory and Consumer Research in Food Product Design and Development Moskowitz, Blackwell Publishing Oxford UK

SEMESTER VI

AECC F

MODULE V

- A. Group Discussion
- B. Evolution - Alexie Sherman Alexie

MODULE VI

- A. Note Making and Note Taking
- B. Gateman's Gift - R. K. Narayan

MODULE VII

- A. Media Writing
- B. Karma - Khushwant Singh

MODULE VII

- A. Bhaurao in America – P. G.Patil
- B. (i) The Grass is Really Like Me- Kishwar Naheed
- (ii) To Granny – Tejaswini Patil

***Note: Semester VI: 10 Marks for Internal Evaluation: STUDENTS' GROUP PROJECT**

Division of Teaching Hours 8 Modules x 15 Hours = 120 Hours

Practicals

DSE FS-P8	Lab Course VIII (Based on DSE FS-E1 & DSE FS-E2)
DSE FS-P9	Lab Course IX (Project Phase-I)
DSE FS-P10	Lab Course X (Based on DSE FS-F1 & DSE FS-F2)
DSE FS-P11	Lab Course XI (Project Phase II)

DSE FS – P8 Principles of Food Packaging, Snack Food Processing

1. Measurement of thickness of paper and paper boards
2. Measurement of water absorption of paper and paper boards
3. Measurement of bursting strength of paper and paper boards
4. Measurement Tear resistance of papers
5. Measurement of puncture resistance of paper and paperboard
6. Measurement of tensile strength of paper of paper boards
7. Determination of gas transmission rate of package films
8. Determination of WVTR and Gas transmission rate of film
9. Identification of Packaging materials
10. Edible packaging of Food Products (Fruits, Bread, Dairy)
11. Estimation of shelf life of packaged food stuff
12. Preparation of Papad and its quality evaluation.
13. Preparation of Chips and its quality evaluation.
14. Preparation of Flaked cereals (Poha) and its quality evaluation.
15. Preparation of Puffed cereals (Churmura) and its quality evaluation.
16. Preparation of Expanded snack and its quality evaluation.
17. Preparation of Roasted grains or nuts and its quality evaluation.
18. Preparation of Coated grains or nuts and its quality evaluation.
19. Preparation of instant food premixes and its quality evaluation.
9. Preparation of extruded snack food and its quality evaluation.
20. Preparation of popcorn and its quality evaluation.

DSE FS – P9 Project Phase I

DSE FS – P10 Food Additive, Sugar and Confectionary Processing

1. Detection/Estimation of adulterants in some foods
2. Determination of carotenoids content
3. Determination of chlorophyll content

4. Estimation of tannins content
5. Extraction of essential oils
6. Determination of vitamin c content
7. Effect of acidulants in food products
8. Effect of thickener in food products
9. Effect of natural sweeteners/ artificial sweeteners in food products
10. Effect of stabilizing agents in food products
11. Development of Invert Sugar by chemical method
12. Effect of a Boiling point on the solubility of sugar
13. Development of Jaggery based nutritious.
14. Development of Hard boiled candy
15. Development of fruit-based Toffee
16. Preparation of Fudge/ Fondant
17. Preparation of medicated lozenges
18. Effect of different emulsifier on chocolate quality
19. Preparation of caramel
10. Development Indian traditional sweet

DSE FS – P11 Project Phase II