Manav Rachna International Institute of Research And Studies

(Deemed to be University under section 3 of the UGC Act, 1956)

SCHOOL OF ALLIED HEALTH SCIENCES

DEPARTMENT OF NUTRITION AND DIETETICS

Curriculum
And
Scheme of Examination

B.Sc.(H) Food Science & Technology
Batch: 2023-26

FOREWORD

This is to certify that this booklet contains the entire Curriculum and Scheme of Examination of **Bachelor of Hons Food Science & Technology** being offered at **Faculty of Allied Health Sciences** of this University. This has been duly vetted and finally approved by the Academic Council of the University vide its **36th meeting** held on **27-04-2021** and changes, if any deemed appropriate, shall be duly incorporated after the necessary approval by the Academic Council.
This Curriculum and Scheme of Examination of **Bachelor of Hons Food Science & Technology** shall be implemented w.e.f. AY 2020-2021.

Prof. (Dr.) Naresh Grover

Date: **Dean-Academics, MRIIRS**

Preamble

Food Science & Technology is an important discipline encompassing various facets related to food processing, technology and preservation. The advent of technological advancements in the field of food and allied areas, ease of access to variety of food has led to change in life style patterns, resulting into emergence of conventional and unconventional nutritional and health related issues. In order to address the issue pedantically, there is a need for specialized course in the area of Food Science & Technology enclosing technical know-how, in-depth knowledge of the subject so as to offer appropriate advice and services.

B.Sc (H) Food Science & Technology is a course based on a scientific and research based approach for understanding, envisaging and addressing the core of the subject to deal with the emerging technologies related to food. The specific objectives envisioned are in synchronization with PEOs following the core values of customer focus, integrity, innovation, social responsibility and diversity along with a dedication to evidence-based research and practice. The curriculum is aimed at providing updated knowledge, technical skills and research aptitude to students.

The degree programme includes six semesters with courses focusing on employability, entrepreneurship and research skill development. The objectives of all courses are well mapped with the PO defining demonstration of technical knowledge and engagement in independent and life-long learning. The curriculum offers core, ability enhancement courses and domain specific electives. To carve the skills of students open elective courses are also offered each semester. This course aims to develop a holistic and multidimensional understanding of the various topics. The syllabus covers basic aspects of food science, nutrition, nutritional biochemistry, food processing, and food preservation, food microbiology concerns in various stages of life cycle, food safety, and food security. This course aims to develop a holistic and multidimensional understanding of the various topics. The course included earning of minimum 142 credits during the 3 year duration of the programme in 6 semesters. The total credits required to be earned are further divided as Compulsory Courses and Elective Courses. The total 107 credits required to be earned under Compulsory Courses and 35 credits under “Elective Courses. The choice of elective courses is open ended can be chosen as by the Department as well as offered by other Departments of the Institute. The course also pays attention to holistic approach and offers various opportunities to students to participate and to complete 25xN point from Manav Rachna Life Skill Programme. Research project and industrial internship are the key highlights of programme which are based on current demands of industry.

The curriculum of the programme is updated and for that inputs have been included for industry experts, stake holders including student, parents and alumni of the department. Time to time feedback facility

provides scope for improvement in curriculum as per the need of the hour. The subjects focusing on regional, national and global development, focusing on Entrepenureship, Employability and Skill development and focusing on Professional ethics, Environment and sustainability, Gender Equality and Human values are enlisted in Appendix A, B and C respectively.

CONTENTS

VISION OF THE COURSE

To bestow excellence in knowledge, training, research and entrepreneurial skills in Food Science and Technology with insistence on value addition of agricultural produce, nutritional goodness, processing technology driven preservation of food, food security and safety assurance through stakeholder sensitization.

MISSION

- To provide exemplary education and state-of-art training to individuals preparing for careers in food science and technology
- To conduct basic and applied research in food science and technology for the ultimate benefit of the food industry and consumers.
- To Invoke and develop entrepreneurial skills among students to revolutionize in this field.

ABOUT THE DEPARTMENT

Nutrition and Dietetics department was established in the year 2006 under Faculty of FIT (Faridabad Institute of Technology) which was later merged under Faculty of Allied Health Sciences. The department offers an integrated and a professional program In nutrition and dietetics preparing students to work in various disciplines of Nutritional Sciences, explore how it affects the health of the individual and the nation and also to discover how diet can be used in the treatment of communicable and non-communicable disease. It is a health-related career which involves translating the sciences of nutrition and food to promote good health. It is a vital and growing profession with ample career opportunities. The internship/training program with various hospitals, food industries, research labs, sports organizations etc. provide opportunities to practice and master the core competencies to place its students in covetable jobs. The Master's program in this discipline, introduced in 2009 aims at developing research skills and abilities in nutritional issues of contemporary interest. The highlights of this course at Faculty of Allied Health Sciences are focused on teaching, strong research and outreach in Clinical Nutrition, Sports Nutrition, Food Science and Technology, and Public Health Nutrition. The Department offers a plethora of Academic and Co-curricular activities at various platforms be it a school, community or corporate like NTPC, ONGC, IBM that shapes students' careers and make them distinct from others in their chosen field of specialization. In 2020, a 3-year B. Sc. (Honors) Food Science & Technology program is introduced. It is a multidisciplinary field that prepares students with a comprehensive knowledge of the biological, chemical, physical and engineering sciences to develop new food products and packaging techniques, design innovative processing technologies to improve food quality and nutritive value and enhance the safety of foods. The programme has been designed to build and enhance skills of the students to meet industry requirements. The Department pays special attention to Industry-University Collaboration to leverage student's placements, Joint R&D Projects with various National and International Organizations.

Bachelor of Science (Hons.) Food Science & Technology

Program Education Objectives:

PEO 1 Prepare qualified entry level professionals with a strong practical and theoretical knowledge by providing expected domain knowledge.

PEO 2 Prepare a socially committed individual having high ethical values and empathy to cater the need of society.

PEO 3 Graduates are trained to develop innovative ideas, teams work and professional skills to accomplish a common goal.

PEO 4 Produce lifelong learner graduates to successfully meet the professional demands and challenges in national, multinational organization

Program Outcomes:

The learning outcomes-based curriculum framework is based on the premise that every student and graduate is unique. Each student or graduate has his/her own characteristics in terms of previous learning levels and experiences, life experiences, learning styles and approaches to future career-related actions. The quality, depth and breadth of the learning experiences made available to the students while at the higher education institutions help develop their characteristic attributes. The graduate attributes reflect disciplinary knowledge and understanding, generic skills, including global competencies, that all students in different academic fields of study should acquire/attain and demonstrate. Some of the characteristic attributes that a graduate should demonstrate areas follows:

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2.Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Program Specific Outcomes:

PSO 1 Enable students to acquire scientific knowledge of various areas related to Food science and technology.

PSO 2 Expressing a broad understanding of the food composition and its physico- chemical, nutritional, microbiological and sensory aspects.

PSO 3 Enhance practical knowledge of food science and the principles underlying food processing, preservation techniques, food engineering, packaging methods etc. to apply in research and development.

PSO 4 Understand significance of food safety and quality, food laws and regulations, control and management in food industry.

Mapping of PEOs with POs and PSOs

Articulation Matrix (Mapping is labeled as strongly with 3, moderately with 2 and low with 1)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3	PSO-4
PEO-1	3	3	3	3	3	3	2	3	3	3	3
PEO-2	3	3	3	3	3	3	2	2	3	2	3
PEO-3	3	3	3	3	3	3	3	3	2	3	3
PEO-4	3	3	3	3	3	2	3	3	3	3	3

Semester and CBCS System

Credit based system of study and student's performance/progress is measured by the number of credits that he/she has earned, i.e. completed satisfactorily. Based on the course credits and grade obtained by the student, grade point average is calculated

(a) Course credits assignment

Each course has a certain number of credits assigned to it depending upon its duration in periods for lecture, tutorial and laboratory/clinical practice in a week. A few courses/activities are without credit (s) and are referred to as Audit Pass Courses (APC) but are mandatory to pass as a partial fulfillment of award of degree.

(b) Earning of credits

At the end of every course, a letter "Grade" shall be awarded in each course for which a student has registered. On obtaining a minimum Pass Grade, student shall accumulate the course credits as Earned Credits. A student's performance shall be measured by the number of credits that he/she has earned and by the weighted grade point average. Grades obtained in the audit courses shall not be counted for computation of grade point average, however shall be mandatory to pass as a partial fulfillment of award of degree.

Choice Based Credit System

For Award of Degree of a programme B.Sc. (H) Food Science & Technology, he/she has to earn minimum 142 credits during the 3-year duration of the programme in 6 semesters.

The total credits required to be earned have been further classified under two baskets of courses: "Compulsory Core Courses Basket", and "Elective Courses Basket". The total 114 credits required to be earned under "Compulsory Courses Basket" and 28 credits under "Elective Courses Basket".

All courses under "Compulsory Core Courses Basket", are required to be qualified and cleared/pass by each and every student enrolled under the programme and are semester-wise listed in the study scheme along with credits assigned to each course.

Under Elective Courses Basket, there will be three types of courses:

- Semester-wise courses offered by the department itself (Discipline specific electives and skill enhancement courses)
- Open/Inter-disciplinary courses offered at the Institute/University level notified from the office of Dean-Academics.
- Massive Open Online Courses (MOOCs) available on SWAYAM Platform or any other platform as recommended by UGC/AICTE and notified from the office of Dean-Academics.

Each course shall have credits assigned to it. Student shall be required to register courses every semester for as many courses/credits specified under "Elective Courses Basket" depending upon his/her interest, capability/pace of learning and availability of time slot (without any clash in time-table) so as to earn all required total credits under the "Elective Courses Basket" during the entire programme duration.

However, for registration of courses (including courses under "Compulsory Courses Basket", "Elective Courses Basket" and Previous Semester Courses (wherein he/she was declared in-eligible on the basis of attendance or he/she could not clear the course within permissible given chances), if any the maximum limit in a semester shall be 30 credits.

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES **ANNEXURE IV**

Deemed to be University under section 3 of the UGC Act 1956)

Study Scheme

B. Sc. (Hons.) Food Science & Technology SEMESTER-I														
Course Type	**Course Code**	**Course**	**Pre-requisite Course, if any**		**Periods/Week**				**Marks**			**Duration of Exam (Hrs.)**	**Credits**
			Title	**Code**	**L**	**T**	**P**	**Total**	**Continuous Evaluation**	**End semester exam**	**Total**		
COMPULSORY COURSES													
Ability Enhancement Courses	CDC-ND-111	Professional Communication-I			2	0	0	2	50	50	100	1.5	2
Foundation Course	BFST-DS-101	Mathematics			4	0	0	4	100	100	200	3	4
	BFST-DS-102	Life Sciences			4	0	0	4	100	100	200	3	
Core	BFST-DS-103	Principles of Food Science & Technology			4	0	0	4	100	100	200	3	4
	BFST-DS-153	Principles of Food Science & Technology (Practical)			0	0	2	2	50	50	100	3	1
	BFST-DS-104	Principles of Food processing & Preservation			4	0	0	4	100	100	200	3	4
	BFST-DS-154	Principles of Food processing & Preservation (Practical)			0	0	2	2	50	50	100	3	1
TOTAL								**22**					**16**

Note: 1 Theory/Tutorial Hour = 1 credit, 2 Practical /Seminar Hours= 1 credit

Regarding Discipline Specific theory subjects, correspondent practical should be opted.

B. Sc. (Hons.) Food Science & Technology SEMESTER-II														
Course Type	Course Code	Course	Pre-requisite Course, if any		Periods/Week				Marks			Duration of Exam (Hrs)	Credits
			Title	Code	L	T	P	Total	Continuous Evaluation	End semester exam	Total		
COMPULSORY COURSES													
Value Added	BFST-201	Manav Rachna Life Skills-I			**Audit Pass Course**								
	CH-202B	Environmental Studies			3	0	0	3	100	100	200	3	3*1
Ability Enhancement Courses	CDC-ND-112	Professional Communication-II			2	0	0	2	50	50	100	1.5	0
Core	BFST-DS-201	Technology of Cereals, Pulses and Oilseeds			4	0	0	4	100	100	200	3	4
	BFST-DS-251	Technology of Cereals, Pulses and Oilseeds (Practical)			0	0	2	2	50	50	100	3	1
	BFST-DS-202	Technology of Milk and milk products			4	0	0	4	100	100	200	3	4
	BFST-DS-252	Technology of Milk and milk products (Practical)			0	0	2	2	50	50	100	3	1
	BFST-DS-203	Food and Nutrition			4	0	0	4	100	100	200	3	4
	BFST-DS-253	Food and Nutrition (Practical)			0	0	2	2	50	50	100	3	1
TOTAL								**21**					**19**
ELECTIVE COURSES*													

Discipline Specific	BFST-DS-204	Food Laws & Regulations			2	0	0	2	100	100	200	3	2
	BFST-DS-205	Enzymes in Food Processing			2	0	0	2	100	100	200	3	2

Note: 1 Theory/Tutorial Hour = 1 credit, 2 Practical /Seminar Hours= 1 credit ****1 is for the field work***
Regarding Discipline Specific theory subjects, correspondent practical should be opted
Student has to complete 25xN point from Manav Rachna Life Skill Programme

B. Sc. (Hons.) Food Science & Technology SEMESTER-III														
Course Type	**Course Code**	**Course**	**Pre-requisite Course, if any**		**Periods/Week**				**Marks**			**Duration of Exam (Hrs)**	**Credits**
			Title	**Code**	**L**	**T**	**P**	**Total**	**Continuous Evaluation**	**End semester exam**	**Total**		
COMPULSORY COURSES													
Ability Enhancement Courses	CDC-ND-211	Professional Competency Enhancement-I			2	0	0	2	50	50	100	1.5	0
Core	BFST-DS-301	Technology of Fruits & Vegetables			4	0	0	4	100	100	200	3	4
	BFST-DS-351	Technology of Fruits & Vegetables (Practical)			0	0	4	4	50	50	100	3	2
	BFST-DS-302	Food Microbiology and Food Safety			4	0	0	4	100	100	200	3	4
	BFST-DS-352	Food Microbiology and Food Safety (Practical)			0	0	2	2	50	50	100	3	1
	BFST-DS-303	Food Chemistry-I			4	0	0	4	100	100	200	3	4
	BFST-DS-353	Food Chemistry-I (Practical)			0	0	2	2	50	50	100	3	1
	RIC -300	Research and Innovation Catalyst-I			0	0	1	1	50	-	50	-	0.5
Skill Enhancement	BFST-DS-354	Bakery & Confectionary Technology (Practical)			0	0	4	4	50	50	100	3	2
	BFST-DS-355	Food Product Development (Practical)											

Courses													
TOTAL								**25**					**18.5**
ELECTIVE COURSES*													
Discipline Specific	BFST-DS-306	Technology of Spices, Herbs & Plantation Crops			2	0	0	2	100	100	200	3	2
	BFST-DS-307	Food Plant Hygiene, Sanitation & Waste Management			2	0	0	2	100	100	200	3	2

*** Under Elective Courses, beside the mentioned Domain Specific Elective Courses, other Inter-disciplinary, Generic, on-line Courses (MOOCs etc.) and other approved courses shall be offered, which shall be notified well before start of the semester. The student shall be required and allowed to opt the courses out of offered courses as per maximum limit for maximum credits and for the category of Elective Courses under University Rules.**

Note: 1 Theory/Tutorial Hour = 1 credit, 2 Practical /Seminar Hours= 1 credit
Regarding Discipline Specific theory subjects, correspondent practical should be opted.

B. Sc. (Hons.) Food Science & Technology SEMESTER-IV														
Course Type	**Course Code**	**Course**	**Pre-requisite Course, if any**		**Periods/Week**				**Marks**			**Duration of Exam (Hrs)**	**Credits**
			Title	**Code**	**L**	**T**	**P**	**Total**	**Continuous Evaluation**	**End semester exam**	**Total**		
COMPULSORY COURSES													
Value Added	BFST-401	Manav Rachna Life Skills-II	**Audit Pass Course**										
	BFST-402	Biostatistics & Research Methodology			3	0	0	3	100	100	200	3	3
Ability Enhancement Courses	CDC-ND-212	Placement Preparatory Programme			2	0	0	2	50	50	100	1.5	0
Core	BFST-DS-401	Food Chemistry-II			4	0	0	4	100	100	200	3	4
	BFST-DS-451	Food Chemistry-II (Practical)			0	0	4	4	50	50	100	3	2
	BFST-DS-402	Food Packaging Technology			4	0	0	4	100	100	200	3	4

	BFST-DS-452	Food Packaging Technology (Practical)			0	0	2	2	50	50	100	3	1
	BFST-DS-403	Food Quality Evaluation & Management			4	0	0	4	100	100	200	3	4
	BFST-DS-453	Food Quality Evaluation & Management (Practical)			0	0	4	4	50	50	100	3	2
	RIC -400	Research and Innovation Catalyst-II			0	0	1	1	50	-	50	-	0.5
TOTAL								**26**					**20.5**
ELECTIVE COURSES*													
Discipline Specific	BFST-DS-404	Scientific Writing in Agricultural Sciences			2	0	0	2	100	100	200	3	2
	BFST-DS-405	Food Beverages			2	0	0	2	50	50	100	3	2

*** Under Elective Courses, beside the mentioned Domain Specific Elective Courses, other Inter-disciplinary, Generic, on-line Courses (MOOCs etc.) and other approved courses shall be offered, which shall be notified well before start of the semester. The student shall be required and allowed to opt the courses out of offered courses as per maximum limit for maximum credits and for the category of Elective Courses under University Rules.**

B. Sc. (Hons.) Food Science & Technology SEMESTER-V													
Course Type	**Course Code**	**Course**	**Pre-requisite Course, if any**		**Periods/Week**				**Marks**			**Duration of Exam (Hrs)**	**Credits**
			Title	**Code**	**L**	**T**	**P**	**Total**	**Continuous Evaluation**	**End semester exam**	**Total**		

COMPULSORY COURSES													
Core	BFST-DS-501	Instrumentation & Analytical Techniques			4	0	0	4	100	100	200	3	4
	BFST-DS-551	Instrumentation & Analytical Techniques (Practical)			0	0	4	4	50	50	100	3	2
	BFST-DS-502	Technology of Meat, Seafood, Poultry and Honey			4	0	0	4	100	100	200	3	4
	BFST-DS-552	Technology of Meat, Seafood, Poultry and Honey (Practical)			0	0	2	2	50	50	100	3	1
	BFST-DS-553	Industrial Training			0	0	-	-	100	200	300	3	10
	RIC -500	Research and Innovation Catalyst-III			0	0	2	2	50	-	50	-	1
TOTAL								**15**					**22**
ELECTIVE COURSES*													
Discipline Specific Elective	BFST-DS-504	Emerging Food Processing Technologies			2	0	0	2	100	100	200	3	2
	BFST-DS-505	Food Plant Equipment & Process Design			2	0	0	2	100	100	200	3	2

*** Under Elective Courses, beside the mentioned Domain Specific Elective Courses, other Inter-disciplinary, Generic, on-line Courses (MOOCs etc.) and other approved courses shall be offered, which shall be notified well before start of the semester. The student shall be required and allowed to opt the courses out of offered courses as per maximum limit for maximum credits and for the category of Elective Courses under University Rules.**

Note: 1 Theory/Tutorial Hour = 1 credit, 2 Practical /Seminar Hours= 1 credit
Regarding Discipline Specific theory subjects, correspondent practical should be opted.
Industrial Training for 12 week

B. Sc. (Hons.) Food Science & Technology SEMESTER-VI							
Course Type	**Course Code**	**Course**	**Pre-requisite**	**Periods/Week**	**Marks**	**Duration of Exam**	**Credits**

			Course, if any										
			Title	Code	L	T	P	Total	Continuous Evaluation	End semester exam	Total	(Hrs)	
COMPULSORY COURSES													
Value Added	BFST-601	Manav Rachna Life Skills-III	**Audit Pass Course**										
Core	BFST-DS-601	Fundamentals of Food Engineering			4	0	0	4	100	100	200	3	4
	BFST-DS-651	Fundamentals of Food Engineering (Practical)			0	0	4	4	50	50	100	3	2
	BFST-DS-652	Research Project			0	0	12	12	200	200	400	3	6
Total								**20**					**12**
ELECTIVE COURSES*													
Discipline Specific	BFST-DS-603	Nutraceuticals & Functional Foods			2	0	0	2	100	100	200	3	2
	BFST-DS-604	Food Biotechnology			2	0	0	2	100	100	200	3	2

Note: 1 Theory/Tutorial Hour = 1 credit, 2 Practical /Seminar Hours= 1 credit
Regarding Discipline Specific theory subjects, correspondent practical should be opted.
Student has to complete 25xN point from Manav Rachna Life Skill Programme

Note: To earn total **142 credits**, the student needs to score 34 credits from open elective basket (Discipline Specific, Interdisciplinary and Generic Elective) offered across the university. The students can choose from Open elective basket offered by the Department as well as offered by other Departments of the University.

ANNEXURE: 5

SYLLABUS: B.Sc. (H) Food Science and Technology

Academic Session: 2020-2023

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-101: Communication skills (Theory)

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0 P: 0	2	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Ability Enhancement Course

Course Outcomes: The student will be able
BFST-101.1: To classify different types of communication
BFST-101.2: To outline various mode of communication
BFST-101.3: To elaborate different kinds of Speaking Skill
BFST-101.4: To develop good communication and writing skills

PART-A

Unit 1: Introduction & Language of Communication
1.1 Theory of Communication
1.2 Types and modes of Communication
1.3 Verbal and Non-verbal (Spoken and Written)
1.4 Personal, Social and Business
1.5 Barriers and Strategies
1.6 Intra Personal, Inter Personal and Group Communication

Unit 2: Speaking Skills
2.1 Monologue, Dialogue, Group Discussion
2.2 Effective Communication/ Mis- Communication
2.3 Interview
2.4 Public Speech

PART-B

Unit 3: Reading and Understanding
3.1 Close Reading, Comprehension, Summary Paraphrasing
3.2 Analysis and Interpretation
3.3 Translation (from Indian language to English and vice-versa)
3.4 Literary/Knowledge Texts

Unit 4: Writing Skills
4.1 Documenting
4.2 Report Writing
4.3 Making notes
4.4 Letter Writing

Suggested Text/Reference Books:

1. M. K. Garg, 2018, English communication, theory & practice, 4th Ed., Scholar tech press.
2. P. Verma, 2015, Fluency in English - Part II, Oxford University Press.

3. S.P. Kumar, 2012, Language, Literature and Creativity, Orient Blackswan, New Delhi.
4. G. Mishra, R. Kaul, B. Biswas, 2016, Language through Literature 1st Ed., Primus Books, New Delhi.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-101.1		3	2	2	-	-	3	1	-	-	-
BFST-101.2	1	2	2	2	1	-	2	-	-	-	-
BFST-101.3	1	2	2	1	1	1	2	1	-	-	-
BFST-101.4	3	2	2	1	1	-	2	-	-	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-101: Mathematics

Periods/week	Credits	Max. Marks: 200
L: 4 T: 0 P: 0	4	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Foundation Course

Course Outcomes: The Students will be able:
BFST-DS-101.1: To understand the role of mathematics in food technology.
BFST-DS-101.2: To demonstrate the knowledge of Matrix Algebra.
BFST-DS-101.3: To interpret the concepts of integration, differentiation and matrices to solve real life problems.
BFST-DS-101.4: To apply the basic concepts of area and volume in packaging.

PART - A

Unit 1: Basic concepts
1.1 Area, volume and surface area of solids and its applications in packaging.
1.2 Permutations and combination
1.3 Basic probability and its application in food industry.

Unit 2: **Matrix Algebra**
2.1 Types of matrix, transpose, symmetrical and skew symmetric
2.2 Addition and multiplication of matrix
2.3 Determinants and its properties
2.4 Inverse of matrix.

Unit 3: Differential Calculus
3.1 Differential of function of one variable
3.2 Product rule, Quotient rule, Chain rule

PART-B

Unit 4: Application of differential calculus of one variable
4.1 Rate measure
4.2 Error and approximation of functions
4.3 Maxima and Minima

Unit 5: Integral calculus
5.1 Integration: Definite and indefinite.
5.2 Integration by parts
5.3 Properties of definite integration

Unit 6: Application of integral calculus

6.1 Area bounded between the regions with related Problems of food and packaging

Suggested Text/Reference Books:

1. H.K. Das, R. Verma, 2010, A text Book of Engineering Mathematics, Vol. I: S, Chand Publishing.
2. R.D. Sharma, 2018, Mathematics for class 11 & 12, Dhanpat Rai Publication.
3. G.B. Thomas, R.L. Finney, 2002, Calculus and Analytic Geometry, 9th Ed., Pearson publication.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-101.1	3	1	1	1	1	1	3	3	3	3	2
BFST-DS-101.2	3	1	1	1	-	1	3	3	1	2	1
BFST-DS-101.3	3	1	-	1	1	1	3	3	1	1	2
BFST-DS-101.4	3	1	1	1	2	3	3	3	1	3	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-102: Life Sciences

Periods/week	Credits	Max. Marks: 200
L: 4 T: 0 P: 0	4	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination:100

Course Type: Foundation Course

Course Outcomes: Students will be able:
BFST-DS-102.1: To describe the general structure cell, micro-organisms.
BFST-DS-102.2: To understand the concept of genetic material in cell.
BFST-DS-102.3: To classify living organisms into different categories.
BFST-DS-102.4: To summarize the physiology of plants and animal.

PART-A

Unit1: Cell & Molecular Biology

1.1 Cell theory, Prokaryotic cell, eukaryotic cell
1.2 Cell organelles and their function
1.3 Transport of nutrients across the cell membrane

Unit 2: Cell cycle and cell division

2.1 Mitosis, meiosis, amitosis
2.2 Study of genetic material: Structure of DNA and RNA, replication, transcription, genetic code, translation & DNA repair.

Unit3:Microbiology

3.1Classification of micro-organisms
3.2Structure, morphological and cultural characteristics of bacteria, yeast, mold, viruses, algae.
3.3Growth and reproduction in micro-organisms

PART-B

Unit 4: Plant biology

4.1Plant Tissue structure and their classification
4.2 Functions of plant tissues
4.3 Plant pigments

Unit 5: Animal biology

5.1 Digestion and absorption of macronutrients
5.2 Physiology and function of circulatory and excretory system,
5.3 Physiology and function of muscular and endocrine system.

Unit 6: Biotechnology and its applications in food industry

6.1 Recombinant DNA technology, applications in agriculture, health and industry
6.2 Genetically modified organisms, human insulin vaccine and antibiotic production
6.3 Plant breeding, tissue culture, single cell protein, transgenic plants and animals, bio-flavor and bio-color.

Suggested Text/Reference Books:

1. G.J. Tortora, B.R. Funke, C.L. Case, 2010, Microbiology: An Introduction, 10th Ed. Pearson Benjamin Cummings, U.S.A.
2. P.H. Raven, G.B. Johnson, J.B. Losos, S.R. Singer, 2005, Biology, Tata McGraw Hill, Delhi, India.
3. A.K. Jain, 2001, Textbook of Physiology, Avichal Publishing Co., New Delhi.
4. H. Lodish, A. Berk, C.A. Kaiser, P. Matsudaria, M. Krieger, J. Darnell, M.P. Scott, 2004, Molecular Cell Biology, 5th Ed. W. H. Freeman.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-102.1	2	2	1	1	2	1	2	3	2	3	2
BFST-DS-102.2	2	1	1	1	2	1	2	3	1	1	1
BFST-DS-102.3	2	1	1	1	2	1	2	3	1	1	1
BFST-DS-102.4	2	2	1	1	3	1	2	3	1	1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-103: Principles of Food Science & Technology (Theory)

Periods/week	Credits	Max. Marks: 200
L: 4 T: 0 P: 0	4	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Core Subject Theory

Course Outcomes: The students will be able:
BFST-DS-103.1: To summarize historical evolution of food processing in India and World.
BFST-DS-103.2: To outline basic structure, composition, and nutritional value of foods
BFST-DS-103.3: To interpret the concepts of food packaging, food dispersion and sensory science.
BFST-DS-103.4: To classify and discuss various types of processed foods.

PART-A

Unit1: Introduction
1.1 Definition and scope of Food Science and Technology
1.2 History and evolution of food processing in India and world scenario.

Unit 2: Nutritional composition of Foods
2.1 Nutritional composition aspects of Plant Foods (course cereal, pulses, nuts & oils, Fruits & vegetables)
2.2 Nutritional composition aspects of Animal foods (milk, meat, fish and poultry)

Unit 3: Introduction to Sensory Evaluation
3.1 Definition, scope, significance and application
3.2 Type of food panels, characteristics of panel member
3.3 Layout and pre-requisites of sensory evaluation laboratory
3.4 Classification of Sensory Tests

PART-B

Unit 4: Introduction to Food Packaging
4.1 Definitions, types, importance and functions
4.2 Packaging requirements and selection of packaging materials
4.3 Types and uses of packaging materials: paper, glass, metal (tin, aluminium),
4.4 Plastic packaging, laminated plastic materials, coextrusion
4.5 Edible films and biodegradable plastics.

Unit 5: Processed food products
5.1 Primary processing, secondary processing in food industry

5.2 Types of food products, e.g. quick cooking, fast foods, fabricated foods, designer foods,3-D printed foods.
5.3 Frozen foods, extruded snacks, convenience foods (RTE, RTS etc.), infant foods, Fortified foods.

Unit 6: Colloidal Chemistry
6.1 Classification of food dispersions
6.2 Characteristics, sols, gels, pectin gels, colloidal sols,
6.3 Emulsions, properties of emulsions, emulsifying agent,
6.4 Food foams, foam stability and destruction of foam
6.5 Application of colloidal chemistry to food preparation.

Suggested Text/Reference Books:

1. A.S. Bawa, P.S. Raju, O.P. Chauhan, 2013, Food Science, 1st Ed., New India Publishing agency.
2. N.N. Potter, J.H. Hotchkiss, 1999, Food science. 5th Ed., Springer.
3. R. Coles, D. McDowell, M.J. Kirwan, 2003, Food Packaging Technology, 1st Ed., Blackwell Publishing, CRC Press.
4. G.F. Stewart, M.A. Amerine, 2012, Introduction to Food Science and Technology, 2nd Ed., Elsevier.
5. W.C. Frazier, D.C. Westhoff, 2014, Food Microbiology, 5th Ed., McGraw Hill Education (India) Private Limited.
6. S. Ranganna, 2004, Handbook of Analysis and Quality Control for Fruits and Vegetable Products, 2nd Ed., McGraw Hill Education (India) Private Limited.
7. G. Banwart, 1989, Basic Food Microbiology, 2nd Ed., Springer US.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O 1	PS O 2	PS O 3	PS O 4
BFST-DS-103.1	-	2	2	1	1	1	2	3	1	1	1
BFST-DS-103.2	2	1	1	1	1	2	3	2	3	3	1
BFST-DS-103.3	3	1	1	1	1	2	3	2	3	3	3
BFST-DS-103.4	3	1	1	1	2	2	3	2	2	2	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-153: Principles of Food Science & Technology (Practical)

Periods/week	Credits	Max. Marks: 100
L: 0 T: 0 P: 2	1	Continuous Evaluation: 50
Duration of Examination: 3 Hours		End Semester Examination: 50

Course Type: Core Subject Practical

Course Outcomes: The Students will be able:
BFST-DS-153.1: To describe the basic food packaging materials.
BFST-DS-153.2: To develop food dispersions like foam and emulsions
BFST-DS-153.3: To analyze four basic tastes and differentiate between tastes
BFST-DS-153.4: To recognize various categories of food products available in market

Practical

2. To study gelatinization behavior of various starches
3. To perform recognition and sensitivity tests for basic tastes.
4. To perform duo-trio, paired comparison and triangle test.
5. Preparation of foam and check foam stability.
6. Preparation of oil-in-water and water-in oil emulsion.
7. Market survey and identification of packaging materials used in food industry.
8. Quality inspection of egg.
9. Market survey and identification of different types of food product categories.

Suggested Text/Reference Books:

1. N.N. Potter, J.H. Hotchkiss, 1999, Food science, 5th Ed., Springer.
2. S. Ranganna, 2004, Handbook of Analysis and Quality Control for Fruits and Vegetable Products, 2nd Ed., McGraw Hill Education (India) Private Limited.

Continuous Evaluation table

Viva- I	**30%**
Viva- II	**30%**
Practical Record	**20%**
Class Performance	**10%**
Attendance	**10%**

Assessment Tools:
Practical Record
Viva I & II
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-153.1	1	1	1	1	1	2	3	2	2	1	1
BFST-DS-153.2	3	3	2	1	1	1	2	3	3	3	1
BFST-DS-153.3	3	1	1	1	2	2	3	3	3	2	1
BFST-DS-153.4	1	3	3	1	1	1	3	2	2	1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-104: Principles of Food Processing & Preservation (Theory)

Periods/week	Credits	Max. Marks: 200
L: 4 T: 0 P: 0	4	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Core Subject Theory

Course Outcomes: Students will be able:

BFST-DS-104.1: To understand the basics of various food processing and preservation technologies.
BFST-DS-104.2: To describe principles of different techniques used in processing and preservation of foods.
BFST-DS-104.3: To summarize the different processing equipment used for processing and preservation.
BFST-DS-104.4: To analyze the effect of various food processing operations on the nutrients of foods.

PART – A

Unit 1: Introduction to Food Processing and Preservation

1.1 Historical perspective of food processing & preservation,
1.2 Concept of Shelf life, classification of food based on shelf life, pH etc. Food spoilage and types of spoilage
1.3 Principles and methods involved in processing (distillation, extraction, washing, filtration, sedimentation, sieving and centrifugation)
1.4 Various principles of food preservation

Unit 2: Processing and Preservation by High temperature

2.1 Principles of thermal processing, Thermal resistance of microorganisms, Thermal Death Time
2.2 Principles of the method: blanching, pasteurization, Sterilization, Ultra-high temperature process, Canning and retorting
2.3 Equipment used in thermal processing

Unit 3: Processing and Preservation by Low Temperature

3.1 Introduction to chilling, refrigeration and cold storage
3.2 Principle of freezing, freezing curve, Types of freezing i.e. slow freezing, quick freezing
3.3 Changes occurring during freezing, Factors affecting freezing rate
3.4 Introduction to thawing, changes during thawing and its effect on food.

3.5 Types of freezers used in food industry

PART – B

Unit 4: Processing and Preservation by Moisture Removal

4.1 Water activity and its effect on the keeping quality, sorption isotherms

4.2 Normal drying curve, drying methods (Sun drying, mechanical, Evaporation), drier used (tray, tunnel, spray, drum, roller and fluidized bed drier), Application in food industry

4.3 Effect of food properties on dehydration rate, change in food during drying

4.4 Intermediate moisture foods (IMF)

Unit 5: Processing and Preservation by Radiation

5.1 Irradiation, Sources of radiations, Radiation units and doses for foods

5.2 Safe limits, irradiation mechanism, irradiation of packaging materials.

5.3 Microwave Heating: Principles and application in food processing.

Unit 6: Processing and Preservation by Chemicals and Microorganisms

6.1 Preservation of foods by class I and II preservatives.

6.2 Concept of smoking and pickling in processing and preservation

6.3 Role of fermentation in processing and preservation of foods

Text Books/Reference Books:

1. P.J. Fellows, 2009, Food Processing Technology, 3rd Ed., Woodhead Publishing Ltd. 2009.
2. N.N. Potter, J.H. Hotchkiss, 1999, Food science, 5th Ed., Springer.
3. M. Karel, D.B. Lund, 2003, Physical principles of Food Preservation, Vol. II, 2nd Ed., Marcel Dekker Inc. USA.
4. N.W. Desrosier, J.N. Desrosier, 2006, The Technology of Food Preservation, 4Th Ed., CBS Publication, New Delhi.
5. H.S. Ramaswamy, M. Marcott, 2005, Food Processing Principles and Applications, 1sT Ed., CRC Press.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Assessment Tools:

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-104.1	3	1	1	1	1	3	2	3	3	2	3
BFST-DS-104.2	3	1	2	2	2	2	3	3	3	3	3
BFST-DS-104.3	1	1	1	1	1	2	2	3	3	3	3
BFST-DS-104.4	3	2	1	1	3	1	3	2	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-154: Principles of Food Processing & Preservation (Practical)

Periods/week	**Credits**	Max. Marks: 100
L: 0 T: 0 P: 2	1	Continuous Evaluation: 50
Duration of Examination: 3 Hours		End Semester Examination: 50

Course Type: Core Subject Practical

Course Outcomes: Students will be able:
BFST-DS-154.1: To demonstrate the effect of blanching on quality of foods.
BFST-DS-154.2: To evaluate the effect of drying on shelf life of foods.
BFST-DS-154.3: To develop canned food products.
BFST-DS-154.4: To apply pickling and fermentation as method of preservation at home level

Practical

1. Determination of pH of different foods using pH meter.
2. To perform blanching of different plant foods.
3. Preservation of food by the process of freezing
4. Preservation of foods by drying using tray dryer
5. Preservation of fruits and vegetables by canning
6. Preservation of fruits by Osmotic dehydration
7. Preservation of vegetables by Pickling
8. Preservation of vegetables by Fermentation (Sauerkraut/ Kanji)

Text Books/Reference Books:

1. L.H. Meyer, 2006, Food Chemistry, 1st Ed., CBS, New Delhi.
2. A.S. Bawa, P.S. Raju, O.P. Chauhan, 2013, Food Science, 1st Ed., New India Publishing agency.
3. S. Ranganna, 2004, Handbook of Analysis and Quality Control for Fruits and Vegetable Products, 2nd Ed., McGraw Hill Education (India) Private Limited.
4. N.W. Desrosier, J.N. Desrosier, 2006, The Technology of Food Preservation, 4Th Ed., CBS Publication, New Delhi.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous Evaluation table

Viva- I	**30%**
Viva- II	**30%**
Practical Record	**20%**
Class Performance	**10%**
Attendance	**10%**

Assessment Tools:
Practical Record
Viva I & II
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O 1	PS O 2	PS O 3	PS O 4
BFST-DS-154.1	3	2	2	1	1	1	3	2	3	2	2
BFST-DS-154.2	3	1	2	1	1	1	3	2	3	3	3
BFST-DS-154.3	3	1	1	1	2	1	3	2	3	3	3
BFST-DS-154.4	3	2	2	1	1	1	3	2	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

CH-202B: Environmental Studies

Periods/week	Credits	Max. Marks: 200
L: 3 T: 0	3+1*	Continuous Evaluation: 100
Duration of Examination: 3 hr		End Semester Exam: 100

Prerequisite: The students should have the knowledge of environment, biodiversity, atmospheric pollution and importance of environmental studies. They should have the knowledge of causes and effects of disasters and various environmental problems.

Course Type: Value added

Course Outcomes

CH-202B.1. The students will be able to determine whether equitable use of natural resources would be appropriate to conserve biodiversity and protection of environment.

CH-202B.2. The students will determine the reason behind the atmospheric pollution and global issues related to environment like natural disasters and will be able to compare the different acts for pollution control.

CH-202B.3. The students will be able illustrate major health issues of women and children will gain knowledge of Mortality and Mortality rate.

CH-202B.4. The students will be able to relate different ecosystems and energy flow in ecosystem.

CH-202B.5. The students will be able to practically evaluate different environment assests and ecosystems

PART- A

Unit 1: Introduction to environmental studies

1.1 Multidisciplinary nature of environmental studies

1.2 Scope and importance; Concept of sustainability and sustainable development.

Unit 2: Ecosystems

2.1 What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems:

a) Forest ecosystem
b) Grassland ecosystem
c) Desert ecosystem
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 3: Natural Resources (Renewable and Non-renewable Resources)

3.1 Land resources and landuse change; Land degradation, soil erosion and desertification.

3.2 Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.

3.3 Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
3.4 Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit 4: Biodiversity and Conservation

4.1Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots
4.2India as a mega-biodiversity nation; Endangered and endemic species of India
4.3Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biologicalinvasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
4.4Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

PART-B

Unit 5: Environmental Pollution

5.1 Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution
5.2 Nuclear hazards and human health risks
5.3 Solid waste management: Control measures of urban and industrial waste.
5.4 Pollution case studies.

Unit 6: Environmental Policies & Practices

6.1 Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture.
6.2 Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
6.3 Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit 7: Human Communities and the Environment

7.1 Human population growth: Impacts on environment, human health and welfare.
7.2 Resettlement and rehabilitation of project affected persons; case studies.
7.3 Disaster management: floods, earthquake, cyclones and landslides.
7.4 Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan.
7.5 Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
7.6 Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Unit 8: Chemistry for peaceful purposes

8.1 The duality of chemistry: Chemistry for peaceful purposes versus Chemical Weapons
8.2 Dual – use nature of toxic and precursor chemicals
8.3 Weapons of mass destructions, disarmament

Unit 9: Field work*

9.1 Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
9.2 Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
9.3 Study of common plants, insects, birds and basic principles of identification.
9.4 Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Text Books/ Reference Books

1. R. Carson, 2002, Silent Spring, Houghton Mifflin Harcourt.
2. M. Gadgil, R. Guha, 1993, This Fissured Land: An Ecological History of India, Univ. of California Press.
3. B. Gleeson, N. Low, 1999, Global Ethics and Environment, London, Routledge.
4. P.H. Gleick, 1993, Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security, Stockholm Env. Institute, Oxford Univ. Press.
5. G.J. Martha, G.K. Meffe, C.R. Carroll, 2006, Principles of Conservation Biology, Sunderland: Sinauer Associates.
6. R.E. Grumbine, M.K. Pandit, 2013, Threats from India's Himalaya dams. Science, 339: 36--37.
7. P. McCully, 1996, Rivers no more: the environmental effects of dams(pp. 29--64). Zed Books.
8. J.R. McNeill, 2000, Something New Under the Sun: An Environmental History of the Twentieth Century.
9. I.L. Pepper, C.P. Gerba, M.L. Brusseau, 2011, Environmental and Pollution Science, Academic Press.
10. M.N. Rao, A.K. Datta, 1987, Waste Water Treatment, Oxford and IBH Publishing Co. Pvt. Ltd.
11. P.H. Raven, D.M. Hassenzahl, L.R. Berg, 2012, Environment, 8th Ed., John Wiley & Sons.
12. A. Rosencranz, S. Divan, M.L. Noble, 2001, Environmental law and policy in India, Tripathi 1992.
13. R. Sengupta, 2003, Ecology and economics: An approach to sustainable development, OUP.
14. J.S. Singh, S.P. Singh, S.R. Gupta, 2014, Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
15. N.S. Sodhi, L. Gibson, P.H. Raven, 2013, Conservation Biology: Voices from the Tropics, John Wiley & Sons.
16. V. Thapar, 1998, Land of the Tiger: A Natural History of the Indian Subcontinent.
17. E.O. Wilson, 2006, The Creation: An appeal to save life on earth, New York: Norton.
18. World Commission on Environment and Development, 1987, Our Common Future, Oxford University Press.

Instructions for paper setting /End Semester Examination: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B. Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Continuous evaluation table

Sessional- I	20 marks
Sessional- II	20 marks
Attendance	10 marks
Field work and Report writing	50 marks

Course Articulation Matrix

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
CH-202B.1	2	1	1	2	3	2	2	3	1	-	1
CH-202B.2	3	1	1	3	3	3	2	3	1	-	1
CH-202B.3	1	1	1	-	2	-	2	3	1	-	1
CH-202B.4	2	1	1	2	2	2	2	3	1	-	1
CH-202B.5	2	1	1	2	3	2	2	3	1	-	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-201: Technology of Cereals, Pulses & Oilseeds (Theory)

Periods/week	Credits	Max. Marks: 200
L: 4 T: 0 P: 0	4	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Core Subject Theory

Course Outcomes: The Students will be able:
BFST-DS-201.1: To state the importance of cereals, pulses & oilseeds in human diet
BFST-DS-201.2: To describe the structures of cereals, pulses & oilseeds
BFST-DS-201.3: To illustrate processes employed in the milling/extraction of grains/seeds through process flow diagrams
BFST-DS-201.4: To demonstrate the product(s) utilization in various facets

PART – A

Unit 1: Cereal Technology-I
1.1 Structure and composition of cereal grains (wheat, rice, maize & oats)
1.2 Wheat: Types, milling process, milling products classification, flour improvers, bread making process, cookie making process
1.3 Rice: Milling process, parboiling: types, advantages & disadvantages, rice product, utilization of rice bran.

Unit 2: Cereal Technology-II
2.1 Maize: types, milling process (wet and dry)
2.2 Barley: Germination & malting, uses
2.3 Millets: Types, nutritional value, milling and uses
2.4 Oats & Rye: nutritional value, Milling & uses

Unit 3: Pulse Technology-I
3.1 Overview of different pulses consumed in India, their importance in human diet, structure
3.2 Traditional milling process
3.3 Commercial milling process

PART - B

Unit 4: Pulse Technology-II
4.1 Processing techniques employed to enhance nutritional quality of pulses (soaking, cooking, germination, etc)
4.2 Anti-nutritional factors present in legumes

Unit 5: Oilseed Technology-I
5.1 Common oilseeds consumed in India along with their structure & composition
5.2 Oil extraction techniques: Screw expeller & solvent extraction

5.3 Refining of oils (soybean)

Unit 6: Oilseed Technology-II

6.1 Processing of extracted oil: Hydrogenation, interesterification & fractionation, winterization
6.2 Processing of de-oiled cake to protein isolates & concentrates
6.3 Use of isolates & concentrates

Text Books/Reference Books:

1. A.M. Samuel, 1999, The Chemistry and Technology of Cereals as Food and Feed, 2nd Ed., Springer US.
2. N.L. Kent, 2017, Technology of Cereals, 5th Ed., Woodhead Publishing.
3. A. Chakraverty, 2019, Post harvest technology of Cereals, Pulses and Oilseeds, 3rd Ed., Oxford Publishing.
4. R.H. Matthews, 1989, Legumes: Chemistry, Technology and Human Nutrition, 1st Ed., CRC Press, New York, U.S.A.
5. Y. Pomeranz, 1988, Wheat: Chemistry and Technology, 3rd Ed., American Association of Cereal Chemists, St. Paul, MN, U.S.A.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-201.1	2	3	2	1	1	1	3	3	3	3	3
BFST-DS-201.2	1	3	2	1	1	2	2	3	3	3	3
BFST-DS-201.3	2	3	2	1	1	2	2	3	3	3	3
BFST-DS-201.4	3	2	1	3	3	3	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-251: Technology of Cereals, Pulses & Oilseeds (Practical)

Periods/week	Credits	Max. Marks: 100
L: 0 T: 0 P: 2	1	Continuous Evaluation: 50
Duration of Examination: 3 Hours		End Semester Examination: 50

Course Type: Core Subject Practical

Course Outcome: The Students will be able:
BFST-DS-251.1: To state the importance of quality characteristics of cereal grains
BFST-DS-251.2: To describe cooking quality parameters for cereals & pulses
BFST-DS-251.3: To associate applications of various products w.r.t their properties
BFST-DS-251.4: To illustrate functional properties of cereal based flours

Practical

1. To study physical properties of cereal grains (bulk density, 1000 kernel weight, etc.)
2. To study cooking quality of rice using different cooking methods
3. To study cooking characteristics of different pulses
4. To prepare sprouted or germinated pulses/ beans
5. To estimate gluten content in different flour samples
6. To estimate Polenske Value of different flour samples
7. To evaluate smoke point of used and fresh refined oil

Text Books/Reference Books

1. N.L. Kent, 2017, Technology of Cereals, 5th Ed., Woodhead Publishing.
2. A. Chakraverty, 2019, Post harvest technology of Cereals, Pulses and Oilseeds, 3rd Ed., Oxford Publishing.
3. W.E. Marshall, J.I. Wadsworth, 1993, Rice Science and Technology, 1St Ed., CRC Press.

Continuous Evaluation table

Viva- I	**30%**
Viva- II	**30%**
Practical Record	**20%**
Class Performance	**10%**
Attendance	**10%**

Assessment Tools:
Practical Record
Viva I & II
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-251.1	3	3	1	1	2	3	2	3	3	3	3
BFST-DS-251.2	2	2	2	1	1	2	3	3	3	3	3
BFST-DS-251.3	3	2	1	1	1	2	3	3	3	3	3
BFST-DS-251.4	3	2	1	1	1	1	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-202: Technology of Milk and Milk Products (Theory)

Periods/week	Credits	Max. Marks: 200
L: 4 T: 0 P: 0	4	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Core Subject Theory

Course Outcomes: Students will be able:
BFST-DS-202.1: To understand the importance of dairy industry, the techniques that can be used for processing of milk.
BFST-DS-202.2: To describe the various physico-chemical properties of milk.
BFST-DS-202.3: To illustrate the technology of manufacturing of various products by flow charts.
BFST-DS-202.4: To summarize the importance of hygiene and sanitation practices in milk plant.

PART-A

Unit 1: Milk

1.1 Current Status of dairy industry in India.
1.2 Chemical composition and nutritive value of milk, Factors affecting composition of milk.
1.3 Physicochemical properties of milk (color, taste, pH and buffering capacity, refractive index, viscosity, surface tension, freezing, boiling point, specific heat, OR, electrical conductivity)

Unit 2: Lactose and milk fat

2.1 Lactose (alpha and beta forms and their differences), Significances of lactose in dairy industry.
2.2 Milk fat composition and structure, factors affecting melting point, boiling point, solubility and Refractive Index.

Unit 3: Milk proteins and enzymes

3.1 Protein General structure, amphoteric nature, difference between casein and serum protein, different types of casein (acid and rennet), uses of casein and whey.
3.2 Enzymes- catalase, alkaline phosphatase, lipases and proteases.

PART-B

Unit 4: Milk processing

4.1 Collection of milk, Reception, Platform testing,
4.2 Flow chart and discussion of Milk Processing: Filtration, Clarification, Standardization, Homogenization, Pasteurization/ sterilization/ UHT, packaging and distribution.

4.3 Various types of market milks: Toned, homogenized, fortified, recombined, reconstituted, flavored milk
4.4 Fermented milks

Unit 5: Technology of milk products

5.1 Definition, legal standards, manufacture and packaging of Dahi, butter, evaporated and condensed milk, Ice-cream, Cheese.
5.2 Principles and practices of manufacture, packaging of Khoa, shrikhand, paneer, rasogulla

Unit 6: Cleaning and Sanitation

6.1 Sanitary aspects: terms, definitions
6.2 Cleaning and disinfection agents
6.3 Cleaning and disinfections in a dairy industry
6.4 Cleaning in Place (CIP) and Cleaning out of Place (COP)**.**

Text Books/Reference Books:

1. S. De, 2001, Outlines of Dairy Technology, 1st Ed., Oxford: Oxford University Press.
2. N.P. Wong, 1988, Fundamentals of Dairy Chemistry, 1st Ed., Van Nostrand Reinhold Company Inc, USA.
3. P.F. Fox, P.L.H. McSweeney, 1998, Dairy Chemistry and biochemistry, 1st ed., Blackie Academic & Professional, UK.
4. R.P. Aneja, B.N. Mathur, R.C. Chandan, A.K. Banerjee, 2002, Technology of Indian Milk Products, 1st Ed., Dairy India Yearbook, New Delhi.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-202.1	3	1	1	1	1	3	3	3	3	3	1
BFST-DS-202.2	1	3	2	1	2	2	3	3	3	3	3
BFST-DS-202.3	3	2	2	1	1	2	3	3	2	3	3
BFST-DS-202.4	2	2	1	2	1	3	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-252: Technology of Milk and Milk Products (Practical)

Periods/week	Credits	Max. Marks: 100
L: 0 T: 0 P: 2	1	Continuous Evaluation:50
Duration of Examination: 3 Hours		End Semester Examination: 50

Course Type: Core Subject Practical

Course Outcomes: The Students will be able:
BFST-DS-252.1: To recognize and detect commonly used milk adulterants
BFST-DS-252.2: To understand the physio-chemical properties of milk
BFST-DS-252.3: To assess the microbiological quality of milk
BFST-DS-252.4: To develop milk products and understand the processing

Practical

1. To determine SNF and specific gravity of milk.
2. To estimate milk fat by Gerber method.
3. To determine pH and acidity of milk.
4. To perform COB and MBRT to check quality of milk.
5. Determination of Milk adulterants: Starch, Urea, Formaldehyde and Sugar.
6. To prepare casein and calculate its yield.
7. Preparation of flavored milk/ indigenous product.
8. Visit to dairy industry

Text Books/Reference Books

1. S. De, 2001, Outlines of Dairy Technology, 1st Ed., Oxford: Oxford University Press.
2. R.P. Aneja, B.N. Mathur, R.C. Chandan, A.K. Banerjee, 2002, Technology of Indian Milk Products, 1st Ed., Dairy India Yearbook, New Delhi.

Continuous Evaluation table

Viva- I	**30%**
Viva- II	**30%**
Practical Record	**20%**
Class Performance	**10%**
Attendance	**10%**

Assessment Tools:
Practical Record
Viva I & II
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-252.1	3	2	1	1	2	2	2	3	2		3
BFST-DS-252.2	3	2	1	1	2	2	2	3	3	2	3
BFST-DS-252.3	3	2	2	2	3	2	3	3	3	3	3
BFST-DS-252.4	3	1	1	1	2	2	2	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-203: Food and Nutrition (Theory)

Periods/week	Credits	Max. Marks: 200
L: 4 T: 0 P: 0	4	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Core Subject Theory
Course Outcomes: The Students will be able:
BFST-DS-203.1: To recognize the importance of balanced diet in human life.
BFST-DS-203.2: To understand the factors essential for meal planning
BFST-DS-203.3: To classify and understand macro and micronutrients present in food
BFST-DS-203.4: To apply the methods of cooking in prevention of food losses

PART – A

Unit 1: Introduction to Food and Nutrition
1.1 Basic Terminologies: Adequate nutrition, nutritional status, malnutrition, health, immunity and infection, RDA, RDI, BMR
1.2 Functions of foods- Physiological, social, and psychological.

Unit 2: Fundamental of Meal Planning
2.1 Essential of meal planning – factors affecting meal planning
2.2 Concept of five and seven food groups
2.3 Food Group on the basis of functions
2.4 Food pyramid and Concept of Balance Diet.
2.5 Food Exchange List

Unit 3: Macronutrients
3.1 Classification, Functions, RDA and Dietary Sources of Macronutrient
3.2 Role of fibres in human nutrition

PART - B

Unit 4: Micronutrient
4.1 Classification, Functions, RDA and Dietary Sources of Micronutrient
4.2 Bioavailability and deficiency of Calcium, Iron, Iodine, Sodium & Potassium
4.3 Water - as a nutrient, function, sources, requirement, water balance & effect of deficiency.
4.4 Interrelationship between nutrients

Unit 5: Malnutrition - Etiology, Prevalence, Clinical findings, Prevention & Treatment.
5.1 Nutritional anaemia
5.2 Protein Energy Malnutrition (PEM)
5.3 Iodine Deficiency Disorder (IDD)
5.4 Vitamin A Deficiency (VAD)
5.5 Obesity

Unit 6: Basics of cooking

6.1 Principles of cooking
6.2 Methods of cooking
6.3 Effect of cooking & heat processing on the nutritive value of foods.

Text Books/Reference Books:

1. K. Khanna, S. Gupta, S.J. Passi, R. Sethi, R. Mahna, S. Puri, 2016, Textbook of Nutrition and Dietetics, 2nd Ed., Elite Publishing House Pvt. Ltd
2. M.S. Bamji, N.P. Rao, V. Reddy, 1996, Textbook of Human Nutrition, 11th Ed., New Delhi (India): Oxford and IBH Publishing Co Pvt Ltd.
3. L. Buckingham, 2012, Molecular diagnostics: fundamentals, methods and clinical applications, 2nd Ed. Philadelphia.
4. T. Longvah, R. Ananthan, K. Bhaskarachary, K. Venkaiah, 2017, Indian Food Composition Tables, Telangana, India: National Institute of Nutrition.
5. N.N. Potter, J.H. Hotchkiss, 2007, Food Science, 5th Ed., CBC Publisher and Distributer Pvt. Ltd.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-203.1	1	1	1	1	1	1	2	2	2	1	2
BFST-DS-203.2	3	1	1	2	1	2	3	2	2	3	2
BFST-DS-203.3	1	1	2	1	1	2	3	2	2	2	1
BFST-DS-203.4	3	1	1	2	1	3	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-253: Food and Nutrition (Practical)

Periods/week	Credits	Max. Marks: 100
L: 0 T: 0 P: 2	1	Continuous Evaluation: 50
Duration of Examination: 3 Hours		End Semester Examination: 50

Course Type: Core Subject practical
Course Outcomes: The Students will be able:
BFST-DS-253.1: To recognize the basic food preparation and table setting.
BFST-DS-253.2: To Understand the principals involved in cooking
BFST-DS-253.3: To develop food products on the basis of different food group
BFST-DS-253.4: To apply the methods of cooking in prevention of food losses

Practical
1. Working instructions, weights and measures and table setting.
2. Basic food preparation, understanding the principles involved nutritional quality and portion size-based on different food groups and different methods of cooking.

- Beverages
- Soups
- Snacks
- Main Meal Dishes
- Salads
- Desserts

Text Books/Reference Books:

1. K. Khanna, S. Gupta, S.J. Passi, R. Sethi, R. Mahna, S. Puri, 2016, Textbook of Nutrition and Dietetics, 2nd Ed., Elite Publishing House Pvt. Ltd
2. N.N. Potter, J.H. Hotchkiss, 2007, Food Science, 5th Ed., CBC Publisher and Distributer Pvt. Ltd.

Continuous Evaluation table

Viva- I	**30%**
Viva- II	**30%**
Practical Record	**20%**
Class Performance	**10%**
Attendance	**10%**

Assessment Tools:
Practical Record
Viva I & II
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-253.1	1	1	1	1	2	1	3	2	2	2	2
BFST-DS-253.2	3	2	2	1	1	2	2	3	2	3	1
BFST-DS-253.3	3	3	2	1	2	3	3	3	3	3	2
BFST-DS-253.4	2	-	-	2	-	3	2	2	2	-	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-204: Food Laws, Regulations & Standards

Periods/week	Credits	Max. Marks: 200
L: 2 T:0 P:0	2	Continuous Evaluation: 100
Duration of Examination: 3		End Semester Examination: 100

Course Type: Discipline Specific Elective Course

Course Outcomes: The student will be able
BFST-DS-204.1: To acquire basic understanding about food safety and its significance in processing.
BFST-DS-204.2: To associate importance of Food laws with respect to specific food products.
BFST-DS-204.3: To Understand different adulterants and hazards and their safety measures.
BFST-DS-204.4: To understand the different National & International Food laws and safety regulations

PART-A

Unit 1: Introduction to Food Laws and Standards
1.1 Historical Perspective of Food Laws & Regulations (Mandatory Food Laws, Voluntary food Laws in India)
1.2 Regulation of food safety and food laws with respect to India
1.3 Current challenges in food safety in India

Unit 2: Food Laws and Acts:
2.1 Food Safety and Standards (FSS)- Rules and regulation, 2011
2.2 Agricultural Produce Act, 1937 (Grading and Marketing), AGMARK
2.3 Sugar Control Order
2.4 Export (Quality Control & Inspection), Act, 1963 and Rules
2.5 Bureau of Indian Standards.
2.6 Legal Metrology
2.7 Weight and Measurement act
2.8 Introduction to Factory Act.

PART-B

Unit 3: Role of International regulatory agencies
3.1CODEX Alimenterius Commission
3.2 EFSA (European Food Safety Authority)
3.3 USFDA (United States Food and Drug Administration)
3.4 WTO (World Trade Organization)
3.5 ISO and its standards for food quality and safety [ISO 9000 series, ISO 22000, ISO 14000, FSMA 22000 (2015)
3.6 Food and drug administration (USFDA, EU, NZ).
3.7 WHO/FAO Expert Bodies (JECFA/ JEMRA/JMPR).
3.8 FSIS and FGIS part of USFDA

Unit 4 Food Quality and Safety

4.1 Food hazards and contaminations - biological (bacteria, viruses and parasites), chemical (toxic constituents / hazardous materials) pesticides residues / environmental pollution / chemicals) and physical factors.

4.2 Role of HACCP, GMP, GHP in food safety

4.3 Export inspection council

4.4 Environmental protection agency's (EPA) and their role in food safety system.

Text Books/Reference Books:

1. P. Mathur, 2018, Food Safety and Quality Control, 1st Ed., The Orient Blackswan
2. A.K. Jain, 2015, Food Safety and Standards Act, Rules & Regulations, 13th Ed., Akalank Publications
3. M.D. Masson Matthee, 2007, The Codex Alimentarius Commission and Its Standards, 1st Ed., Asser Press.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-204.1	1	1	1	1	1	1	2	2	1	2	2
BFST-DS-204.2	2	1	-	-	1	2	3	2	2	2	2
BFST-DS-204.3	1	-	-	1	3	2	3	2	2	2	2
BFST-DS-204.4	1	-	-	-	2	2	2	2	2	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-205: Enzymes in Food Processing (Theory)

Periods/week	Credits	Max. Marks: 200
L: 2 T: 0 P: 0	2	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Discipline Specific Elective Course

Course Outcomes: The student will be able
BFST-DS-205.1: To summarize classification, properties, characterization of enzymes
BFST-DS-205.2: To outline mechanism of immobilized enzymes and enzyme inhibitors
BFST-DS-205.3: To elaborate the application of enzymes in food processing
BFST-DS-205.4: To discuss role of enzymes in baking, brewing and flavor production

PART-A

Unit 1: Introduction to enzymes
1.1 Enzymes classification, properties, characterization
1.2 kinetics and immobilization; Factors affecting rate of enzyme catalyzed reactions
1.3 Enzyme inhibitors, Immobilized enzymes
1.4 Fermentative production of enzymes used in food industry and their downstream processing.

Unit 2: Enzyme for food modification
2.1 Enzymes for starch modification (maltodextrins and corn syrup solids: liquefaction, saccharification, dextrinization, isomerization)
2.2 Production of high-fructose-corn-syrup, fructose and fructo- oligosaccharides
2.3 Enzymes for protein modification (hydrolysates and bioactive peptides), Enzymes for Lipid modification.

PART-B

Unit 3: Application of enzymes in animal foods
3.1 Role of enzymes in Dairy processing (cheese making and whey processing).
3.2 Role of enzymes in meat processing (tenderization and flavour development), Egg processing.
3.3 Fish processing (De-skinning, collagen extraction etc.,)

Unit 4: Role of enzymes in Brewing, Baking and flavour production
4.1 Fungal -amylase for bread making, Maltogenic -amylases for anti-staling, Lipases, xylanses and pentosanases as dough conditioners, Oxidases as replacers of chemical oxidants
4.2 Use of enzyme in beverages - fruit juices, beer, wine.
4.3 Role of enzymes in the production of flavours (enzyme-aided extraction of plant materials for production of flavours, production of flavour enhancers such as nucleotides, MSG; flavours from hydrolyzed vegetable/animal protein)

Suggested Text/Reference Books:
1. R.J. Whitehurst, M. Van-Oort, 2010, Enzymes in Food technology, 2nd Ed., Blackwell Publishing Ltd
2. W. Aehle, 2007, Enzymes in Industry: Production and application, 3rd Ed., Wiley, Weinheim.
3. R. Rastall, 2007, Novel enzyme technology for food applications, 1st Ed., Woodhead Publishing Limited, Cambridge, England.
4. Wong, W.S. Dominic, 1995, Food Enzymes: structure and mechanism, 1st Ed., Springer, New York, USA.
5. J.M. DeMan, 1999, Principles of Food Chemistry, 3rd Ed., An Aspen Publication, USA.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-205.1	-	-	-	-	-	2	2	2	2	2	2
BFST-DS-205.2	2	-	-	-	1	2	3	2	2	3	2
BFST-DS-205.3	2	1	1	1	1	1	2	2	2	3	3
BFST-DS-205.4	2	2	2	1	2	2	3	2	2	3	3

III semester

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-301: Technology for Fruit and Vegetable Processing (Theory)

Periods/week	Credits	Max. Marks: 200
L: 4 T: 0 P: 0	4	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Core course theory
Course Outcomes: The students will be able:
BFST-DS-301.1: To gain knowledge about the composition of different fruits and vegetables.
BFST-DS-301.2: To understand the physiology of different fruits and vegetables for processing.
BFST-DS-301.3: To apply the various processing techniques in production of fruit and vegetable products.
BFST-DS-301.4: To evaluate the fruit and vegetable product standards and regulations prevalent in India.

PART – A

Unit 1: Introduction to fruit and vegetable processing
1.1 Current scenario of fruit and vegetables production and processing in India
1.2 Classification and Composition of various fruits and vegetables
1.3 Pre and post-harvest physiology of fruits and vegetables (climacteric and non-climacteric, plant growth hormones)

Unit 2: Post-harvest handling & Storage of fruits and vegetables
2.1 Post-harvest handling of fruits and vegetables (harvesting containers, tools, cleaning, disinfecting, precooling, transportation, etc.)
2.2 Types of storage- Modified atmospheric storage (MAS), Controlled atmospheric Storage (CAS), hypobaric storage
2.3 Factors affecting fruits and vegetable storage (warehouse design, packaging, gas composition, temperature, relative humidity etc.)

Unit 3: Processing by removal of moisture
3.1 Dehydration of fruits and vegetables
3.2 Fruit preserves and candied fruits
3.3 Pickles and fermented vegetables
3.4 Causes of and types of spoilage, methods of preservation

PART - B

Unit 4: Tomato based products
4.1 Processing of tomato puree, sauce, ketchup, chutneys, and soups
4.2 Causes and types of spoilage
4.3 Methods of preservation

Unit 5: Beverages
5.1 Techniques for processing of fruit Juice, ready to serve (RTS), nectar, cordial, squash, crush, processing of syrups, fruit juice concentrate, fruit juice powder, carbonated beverages
5.2 Utilization of waste from fruit and vegetables processing plant.
5.3 Causes of and types of spoilage, methods of preservation

Unit 6: Canning of Fruits and Vegetables

6.1 Canning process for fruits and vegetables
6.2 Types of cans used in canning
6.3 Spoilage of canned products
6.4 Processing of pectin products (jams, jellies and marmalades)
6.5 Product specifications, Defect/ spoilage and preservation

References:

1. GiridhariLal, G,S. Siddappa and G.L. Tondon, 2019, Fruit and Vegetable Preservation Principles and Practices, 3rd edition, CFTRI, ICAR, New Delhi -12.
2. R.P. Srivastava and S. Kumar, 2002, Fruit and Vegetable Preservation: Principles & Practices, 3rd edition, International book distributing Co., Lucknow.
3. A.K. Thompson, 2003, Fruit and Vegetables: Harvesting, Handling and Storage, 2nd Edition, Wiley-Blackwell.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-301.1.	2	1	1	2	2	2	1	2	1	1	1
BFST-DS-301.2.	2	2	1	1	1	2	1	2	3	2	1
BFST-DS-301.3.	2	2	2	2	3	2	2	2	1	3	1
BFST-DS-301.4.	2	1	2	3	3	3	2	2	1	1	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-351: Technology for Fruits and Vegetables (Practical)

Periods/week	Credits	Max. Marks: 100
L: 0 T: 0 P: 4	2	Continuous Evaluation: 50
Duration of Examination: 3 Hours		End Semester Examination: 50

Course Type: Core course Practical

Course Outcomes: The students will be able

BFST-DS-351.1: To understand about the composition of different fruits and vegetables for carrying out its processing.

BFST-DS-351.2: To associate the relationship between the type of processing technology used with the nature of fruits and vegetables.

BFST-DS-351.3: To apply their knowledge in testing of various fruit and vegetable products.

BFST-DS-351.4: To evaluate the various tests used in the processing of fruits and vegetables.

Practical

1. Estimation of tannin content in fruit/vegetable using spectrophotometer.
2. Estimation of sugar-acid ratio in fruit products.
3. Preparation of jam/jelly and estimation TSS & acidity.
4. Determination of efficiency of blanching in different vegetables.
5. Preparation of fruit beverage like squash/cordial.
6. Canning of a fruit/vegetable product
7. Preparation of tomato ketchup/ sauce and estimation of TSS & acidity.
8. Estimation of ascorbic acid content of fruit and vegetables and study effect of different drying methods on the ascorbic acid content of fruit and vegetables.
9. Visit to any fruits and vegetable processing industry

References

1. Manual for Analysis of Fruit and Vegetable Products, FSSAI, 2016.
2. A Manual for Field Workers and Trainers, FAO, 2008.
3. GiridhariLal, G,S. Siddappa and G.L. Tondon, 2019, Fruit and Vegetable Preservation Principles and Practices, 3rd edition, CFTRI, ICAR, New Delhi -12.
4. R.P. Srivastava and S. Kumar, 2002, Fruit and Vegetable Preservation: Principles & Practices, 3rd edition, International book distributing Co., Lucknow.
5. S. Ranganna, 2017, Handbook of Analysis and Quality Control for Fruit and Vegetable Products, 2nd Edition, McGraw Hill Education.

Continuous Evaluation table

Viva- I	**30%**
Viva- II	**30%**
Practical Record	**20%**
Class Performance	**10%**
Attendance	**10%**

Assessment Tools:
Practical Record
Viva I & II
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-351.1.	1	1	1	1	1	2	2	1	2	1	1
BFST-DS-351.2.	2	1	2	1	1	2	2	2	1	2	1
BFST-DS-351.3.	3	2	2	2	2	2	2	1	1	2	2
BFST-DS-351.4.	3	2	2	2	2	2	1	1	1	2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-302 Food Microbiology & Food Safety (Theory)

Periods/week	Credits	Max. Marks: 200
L: 4 T: 0 P: 0	4	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Core Subject Theory

Course Outcomes: The Students will be able:
BFST-DS-302.1 To define the principles involved in food spoilage and preservation involving microorganisms
BFST-DS-302.2 To identify the characteristics of important pathogens and spoilage microorganisms in foods
BFST-DS-302.3 To explain the role of different factors associated with growth of microorganisms
BFST-DS-302.4 To illustrate the beneficial role of microorganisms in food

PART – A

Unit 1: Introduction to Food Microbiology
1.1 Definition & scope of food microbiology, applications, functions in allied sectors
1.2 Classification of microbes commonly associated with foods; their classification based on morphological structures & staining characteristics
1.3 Use of microbes in flavor, color & enzyme development

Unit 2: Microbial Growth
2.1 Growth curve: different stages and their characteristics
2.2 Factors affecting microbial growth (intrinsic & extrinsic)

Unit 3: Food Spoilage
3.1 Important food spoilage causing microbes
3.2. Sources of microbial contamination
3.3. Spoilage of food products: milk, meat, fish, cereals, fruits, vegetables, canned products, egg, etc.

PART - B

Unit 4: Food Fermentation
4.1 Definition, types of fermentation, application of fermentation
4.2 Introduction to traditional & commercial fermented food products, health benefits of fermented foods
4.3 Methods of production: yoghurt, miso, tempeh, soya sauce, sauerkraut, beer, cheese, etc

Unit 5: Food Borne Diseases & Public Health Concern
5.1 Types of food borne diseases and food infection
5.2 Food intoxication, mycotoxins, food borne parasites

Unit 6: Food Hygiene & Sanitation
6.1 Good Manufacturing Practices (GMP), Good Hygiene Practices (GHP) & HACCP

6.2 Maintenance of personal hygiene & health of food handlers

Textbooks/Reference Books:

1. M.R. Adam and M.O. Moss, 2008, Food Microbiology: Royal Society of Chemistry, Cambridge.
2. W.C. Frazier and D.C. Weshoff, 2015, Food Microbiology: Tata McGraw Hill Publication, New Delhi.
3. M.J. James, 2005, Modern Food Microbiology, 5th edition, CBS Publishers, New Delhi.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-302.1	1	1	1	1	1	2	2	2	3	3	2
BFST-DS-302.2	1	1	1	1	2	3	2	2	3	3	3
BFST-DS-302.3	1	1	1	1	2	2	2	3	3	3	2
BFST-DS-302.4	2	1	1	1	2	3	2	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-352 Food Microbiology & Food Safety (Practical)

Periods/week	Credits	Max. Marks: 100
L: 0 T: 0 P: 2	1	Continuous Evaluation: 50
Duration of Examination: 3 Hours		End Semester Examination: 50

Course Type: Core Course Practical

Course Outcome: The Students will be able:
BFST-DS-352.1 To list practical skills for carrying out sampling of foods to carry out microbial analysis
BFST-DS-352.2 To explain various sterilization techniques and further choose the most suitable technique for specific food.
BFST-DS-352.3 To interpret about microbiological analysis of food products
BFST-DS-352.4 To apply the role of factors affecting the growth of microbes in practical setup

Practical
1. To study various equipment's used in microbiology lab
2. To study different components of bright field microscope
3. To study different sterilization techniques
4. To perform Simple staining & Gram's staining
5. To prepare slants, stabs & plates
6. To isolate bacteria using serial dilution, pour plating & spreading & bacterial count: SPC
7. To assess microbiological quality of milk: MBRT
8. To assess bacteriological quality of water: MPN

Textbooks/Reference Books:

1. J. Garbutt, 1997, Essentials of Food Microbiology, Hodder Arnold Publication.
2. M.J. James, 2005, Modern Food Microbiology, 5th edition, CBS Publishers, New Delhi.
3. D. Roberts, 2003, Practical Food Microbiology, Wiley publication.

Continuous Evaluation table

Viva- I	**30%**
Viva- II	**30%**
Practical Record	**20%**
Class Performance	**10%**
Attendance	**10%**

Assessment Tools:
Practical Record
Viva I & II
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-352.1	2	1	1	1	2	2	2	3	2	3	2
BFST-DS-352.2	2	1	1	1	2	1	1	2	2	2	2
BFST-DS-352.3	2	1	1	1	1	2	2	2	2	2	1
BFST-DS-352.4	2	1	2	1	1	2	2	2	2	2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-303: Food Chemistry I (Theory)

Periods/week	Credits	Max. Marks: 200
L: 4 T: 0 P: 0	4	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Core Course (Theory)
Course Outcomes: The Students will be able:
BFST-DS-303.1: To understand and describe the general chemical structures of the major components of foods
BFST-DS-303.2: To analyze physical properties and reactivity of major food components.
BFST-DS-303.3: To evaluate how processing conditions are likely to change the reactivity of food components
BFST-DS-303.4: To apply knowledge of food properties in food processing and storage.

Part-A

Unit 1: Water

1.1 Definition of water in food, Types of water
1.2 Structure of water and ice
1.3 Sorption phenomenon, Phase transition of water molecule,
1.4 Water activity and shelf-life

Unit2: Carbohydrates

2.1 Monosaccharides: structure and nomenclature, conformation, physical and sensory properties, chemical reaction (oxidation, reduction with acid & alkali) and derivates.
2.2 Oligosaccharides: Structure and nomenclature, properties and reaction.
2.3 Polysaccharides: classification and structure, conformation, properties (starch, glycogen, cellulose, pectin, hemicellulose, gums)
2.4 Modified celluloses and starches

Unit 3: Proteins

3.1 Protein classification and structure
3.2 Peptides: Nomenclature, physical and sensorial properties,
3.3 Nature of food proteins (plant and animal proteins)
3.4 Functional properties of proteins (organoleptic, solubility, viscosity, binding, gelation / texturization, emulsification, foaming)

Part-B

Unit 4: Enzymes

4.1 Introduction, nomenclature, classification
4.2 General characteristics, Theory of Enzyme catalysis, Kinetics of Enzyme catalyzed reaction
4.3 Enzymes in food processing

Unit 5: Browning Reactions in Food

5.1 Enzymatic browning and its prevention

5.2 Non – Enzymatic browning: Maillard reaction, Caramelization reaction, Ascorbic acid oxidation

Unit6: Physico-chemical and nutritional changes occurring during food processing

6.1 Drying and dehydration

6.2 Irradiation

6.3 Freezing

6.4 Canning

Reference Books:

- J.M. DeMan, 1980, Principles of Food Chemistry, New York: AVI.
- Fennema and R. Owen, 1996, Food Chemistry, 3rd Ed., NewYork: Marcell Dekker.
- Whitehurst and Law, 2002, Enzymes in Food Technology, Canada: CRC Press.
- L.H. Meyer, 2004, Food chemistry, Cbs, paperback.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Assessment Tools:

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-303.1	3	3	-	1	1	2	3	3	3	3	1
BFST-DS-303.2	3	3	2	-	-	2	3	3	3	2	2
BFST-DS-303.3	3	3	2	2	3	3	3	3	3	3	3
BFST-DS-303.4	3	3	2	3	3	3	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-353: Food Chemistry I (Practical)

Periods/week	Credits	Max. Marks: 100
L: 0 T: 0 P: 2	1	Continuous Evaluation: 50
Duration of Examination: 3 Hours		End Semester Examination: 50

Course Type: Program Core

Course Outcomes: The Students will be able:

BFST-DS-353.1: To prepare and standardize reagents commonly used in food analysis

BFST-DS-353.2: To determine gelatinization properties of various starches and effect of additives

BFST-DS-353.3: To analyze the process of enzymatic and non- enzym3atic browning

BFST-DS-353.4: To describe various functional properties of food components

Practical

1. Preparation of primary and secondary solutions
2. Estimation of moisture content of foods.
3. Determination of gelatinization temperature range (GTR) of different starches and effect of additives on GTR.
4. Extend of non-enzymatic browning by extraction methods.
5. Determination of thermal inactivation time of enzymes in fruits and vegetables.
6. To study various functional properties of proteins (gelation, foaming, denaturation, coagulation)
7. To study the effect of dextrinization on physical and sensory properties of polysaccharides.
8. To study non-enzymatic browning in foods.

Reference Books:

- J.M. DeMan, 1980, Principles of Food Chemistry, New York: AVI.
- Fennema and R. Owen, 1996, Food Chemistry, 3rd Ed., NewYork: Marcell Dekker.
- Whitehurst and Law, 2002, Enzymes in Food Technology, Canada: CRC Press.
- L.H. Meyer, 2004, Food chemistry, Cbs, paperback.

- **Continuous Evaluation table**

Viva- I	**30%**
Viva- II	**30%**
Practical Record	**20%**
Class Performance	**10%**
Attendance	**10%**

- **Assessment Tools:**
- Practical Record
- Viva I & II
- Surprise questions during lectures/Class Performance
- Term end examination
-

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-353.1	3	1	1	-	1	2	3	2	-	3	2
BFST-DS-353.2	3	3	1	-	1	1	2	3	3	3	-
BFST-DS-353.3	3	2	1	1	1	2	3	3	3	3	1
BFST-DS-353.4	3	3	2	2	2	2	3	3	3	3	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956**)**

RIC-300: Research and Innovation Catalyst-I

Periods/week	Credits	Max. Marks : 50
P: 1	0.5	Continuous Evaluation : 50

Pre-requisites: Basic knowledge of Research
Course Type: Research & Training
Course Coordinator: Research Mentor of the Department

Course Outcomes:The students will be able
RIC-300.1. Tounderstand the importance of Research
RIC-300.2. To be in a position to describe the process and the procedure to carry out research
RIC-300.3. Tounderstand the research documentation that includes, journals, conferences etc.
RIC-300.4. Tounderstand and adopt the ethical practice that are to be followed in the research activities
RIC-300.5. To comprehend the benefits obtained by means of systematic research
RIC-300.6. To adapt working with group members

Unit 1: What is Research?

1.1 Capturing the current research trend
1.2 Insight about scientific research performed by renowned experts in the related field
1.3 Exploration and excavation of in-house and commercially available facilities
1.4 Model design about framing the research question – A motivational Approach
1.5 Do's and Don'ts pertaining to research

Unit 2: Insight about Scientific Documentation

2.1 Different types of Journals/Conferences
2.2 Different components of a research paper
2.3 Indexing of Journals
2.4 Parameters involved in publication
2.5 Scientific/technical writing and ethical practice

Unit 3: Understanding the Literature Survey (LS)

3.1 Finding research papers related to a topic
3.2 Understanding the different aspects of Literature search
3.3 Usage of different sources like Google scholar, WoS, PubMed, Scopus, ABDC, EBSCO etc.
3.4 Exploration of online library-Deepdyve for research papers
3.5 Usage of scholarly networking sites like Research Gate, Mendeley, Academia.edu etc.
3.6 Demo sessions on the usage of above mentioned sources

Unit 4: Implementation of Process

4.1 Understanding and selection of the research domain
4.2 Finding out the specific research problem in the relevant research area
4.3 Seeking information through published work w.r.t the problem
4.4 Reading & categorizing the downloaded/referred papers and structuring of the idea

Unit 5: Report Writing and Presentation skill Development

5.1 Report making on the surveyed literature to cater the basic idea of the author

5.2 Compiling and analyzing the published results to justify and understand the proposed ideas

5.3 Usage of MS-PowerPoint and other technical resources for the presentation

5.4 Development of presentation skills and group addressing

Course Articulation Matrix:

CO Statement (RIC-300)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
RIC-300.1		2				3	3			2	2
RIC-300.2	3	2	1	1		2	3	1		2	2
RIC-300.3	3	1	1	1			3			2	1
RIC-300.4		2	1	1	3		3		1	2	
RIC-300.5	2	2		1		2	3			2	2
RIC-300.6		3	3	2	3		3			2	1

'3' (Tick) or 'More' Substantial/High Correlation, '2' Moderate/Medium Correlation, '1' Slightly/Low Correlation,'Blank' No Correlation

Evaluation Criteria: The following evaluation parameters shall be considered for internal assessment by both research coordinators and faculty coordinator or research mentors:-

S.No:	Parameters	Description	Marks	
1.	**Attendance**	Percentage of classes attended by the students	**5**	**5**
2.	**Continuous Performance**	Group participation and response of the students to a given task:		**15**
		Judge individual student in the group	**5**	
		Meeting timelines as per lesson / activity plan	**10**	
3.	**Literature Review**	Student interaction with faculty mentors	**3**	**10**
		Relevance of the topic	**2**	
		Usage of Scientific Literature Databases. e.g., Scopus/ Web of Science/ etc.	**1**	
		Scientific/Technical writing	**2**	
		Number of relevant papers referred for the given topic	**2**	
4.	**PPT & Report**	Report structure and Slide sequence	**5**	**20**
		Contribution of individual group member towards the presentation and report	**5**	
		Reference listing	**5**	
		Plagiarism/Authenticity of the report	**5**	
		Max. Marks	**50**	**50**

References:

1. http://nptel.ac.in/courses/121106007/
2. http://public.wsu.edu/~taflinge/research.html

BOOKS

1. E. Harman & Montagnes, I. Ed., 1997, The thesis and the book, Now Delhi: Vistaar.
2. L.F. Locke and others, 1987, Proposals that work: A guide for planning dissertations.
3. C.J. Mullins, 1997, A guide to writing and publishing in social and behavioral.
4. R.J. Stemberg, 1991, The psychologist's companion: A guide to scientific writing forsciences, New York : John Wiley & Sons students & researchers, Cambridge: CUP.

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-354: Bakery & Confectionary Technology (Practical)

Periods/week	Credits	Max. Marks: 100
L: 0 T: 0 P: 4	2	Continuous Evaluation: 50
Duration of Examination: 3 Hours		End Semester Examination: 50

Course Type: Skill Enhancement Course (Practical)

Course Outcome: The Students will be able:
BFST-DS-354.1: To define the fundamentals of baking & confectionary
BFST-DS-354.2: To identify the ingredients used in various bakery & confectionary products
BFST-DS-354.3: To describe faults occurring while processing of products
BFST-DS-354.4: To illustrate skills required to work in a bakery & confectionary setup

Practical:
1. To study about ingredients used in breads/ buns, pizza bases and their common associated faults.
2. To prepare bread and perform its sensory analysis
3. To prepare biscuits & cookies and perform its quality evaluation
4. To prepare sponge/ cream cake
5. To study about hard-boiled candies(crystalline and non-crystalline candies) , toffees, fruit drops, chocolates and other confectionary products: ingredients, product quality parameters and faults
6. To prepare milk and dark assorted chocolates and its sensory evaluation
7. To prepare different fruit candies (hard boiled) and its sensory evaluation
8. To prepare fondant, fudge and brittles

Text Books/Reference Books:

1. A. Bent, E.B. Bennion, G.S.T. Bamford, 2011, The technology of cake making (6thed.) Blackie-Academic and Professional, UK.
2. Beckette, S.T. (2009). Industrial Chocolate Manufacture, Blackwell Publishing Ltd.
3. J.R. Manley Duncan, 2001, Technology of Biscuits, Crackers and Cookies, 3rded., Ellis Horwood Ltd.
4. M. Sethi, E. Rao, 2011, Food science- Experiments and applications, 2nd ed., CBS publishers & Distributors pvt ltd.
5. Raina, 2003, Basic Food Preparation-A complete Manual, 3rd Ed., Orient Longman Pvt. Ltd.

Continuous Evaluation table

Viva- I	**30%**
Viva- II	**30%**
Practical Record	**20%**
Class Performance	**10%**
Attendance	**10%**

Assessment Tools:
Practical Record
Viva I & II
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-354.1	1	1	1	1	2	2	2	3	2	3	2
BFST-DS-354.2	2	1	1	1	1	2	2	2	3	3	3
BFST-DS-354.3	3	2	1	2	2	1	2	3	2	2	2
BFST-DS-354.4	3	2	2	2	2	3	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-355: Food Product Development (Practical)

Periods/week	Credits	Max. Marks: 100
L: 0 T: 0 P: 4	2	Continuous Evaluation:50
Duration of Examination: 3 Hours		End Semester Examination: 50

Course Type: Skill enhancement course

Course Outcomes: After completion of the course, students will be able:
BFST-DS-355.1: To outline various concepts of product development based on dietary requirements
BFST-DS-355.2: To identify objectives, tools/Methods for product development on the basis of techno-economic feasibility.
BFST-DS-355.3: To prepare and compare different product formulations for acceptability
BFST-DS-355.4: To evaluate product, its shelf life, and cost for commercialization & become entrepreneurs

Practical

1. Definition of NPD, Importance, Types, The Stage-Gate model, Need and Objectives of NPD, developing a Product to Meet the Requirements, Product life cycle. NPD success factors, new product design.
2. Market and literature survey, designing a questionnaire to find consumer needs for a product or a concept based on special dietary requirements, functionality, convenience and improvisation of existing traditional Indian foods.
3. Screening of product concept on the basis of techno-economic feasibility, Process design, equipment needed, establishing process parameters for optimum quality.
4. Development of prototype product and Standardization of formulation process and Process Design
5. Sensory and Proximate Analysis of New Product and shelf-life studies ((Product Stability; evaluation of shelf life; changes in sensory attributes and effects of environmental conditions)
6. Packaging, labeling
7. Cost analysis and Documentation and Report, Viva Voice.

Reference books

1. Fuller, W. Gordon, 2004, New Product Development- From Concept to Marketplace, CRC Press.
2. Moskowitz, Howard, R. Saguy and I. Sam, 2009, An Integrated Approach to New Food Product, CRC Press.
3. A. Kumar, S.C. Poornima, M.K. Abraham and K. Jayashree, 2004, Entrepreneurship Development, New Age International Publishers.
4. H. Jacqueline, M. Beckley, M.F. Elizabeth, J. Topp and J.C. Huang WitoonPrinyawiwatkul, 2007, Accelerating New Food Product Design and Development, Blackwell Publishing Company, IFT Press, USA
5. R. Howard, I. Moskowitz, S. Saguy and T. Straus, 2009, an Integrated Approach to New Food Product Development. Taylor and Francis Group, LLC.USA
6. D. Marie, Earle and L. Earle Richard, 2001, Creating New Foods, The Product Developer's Guide, Chadwick House Group Ltd., New Zeeland.

Continuous Evaluation table

Viva- I	**30%**
Viva- II	**30%**
Practical Record	**20%**
Class Performance	**10%**
Attendance	**10%**

Assessment Tools:

1.Practical Record
2. Viva I & II
3.Surprise questions during lectures/Class Performance
4.Term end examination

Course Articulation Matrix

CO Statement	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
BFST-DS-355.1	2	1	1	1	2	1	2	2	1	2	2
BFST-DS-355.2	2	2	2	2	1	2	2	3	2	3	2
BFST-DS-355.3	2	2	1	2	1	1	3	3	3	2	2
BFST-DS-355.4	3	2	3	3	1	3	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-306: Technology of spices, herbs and plantation crops (Theory)

Periods/week	Credits	Max. Marks : 200
L: 2 T: 0 P: 0	2	Continuous Evaluation : 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Discipline specific elective course

Course Outcomes: The students will be able
BFST-DS-306.1. To understand the production, technology and processing ofspices, herbs and plantation crops.
BFST-DS-306.2. To differentiate between the functional role of spices, herbs and plantation crops.
BFST-DS-306.3. Toanalyse the principles of processing techniques used.
BFST-DS-306.4. To evaluate the applications of spices, herbs and plantation crops in food industries.

PART A

Unit 1: Introduction to spices, herbs and plantation crops

1.1 History, scope and importance of spices,herbs and plantation crops in India
1.2 Classification of spices, herbs and plantation crops
1.3 Export potential of spices, herbs and plantation crops
1.4 Origin and distribution

Unit 2: Technology of spices

2.1 Pre-harvest and post-harvest problems in processing
2.2 Processing of major and minor spices (Black pepper, Cardamom, Turmeric, Ginger, Coriander, Clove, Nutmeg, Cinnamon)
2.3 Value added products
2.4 Extraction of essential oils
2.5 Applications in food
2.6 Spices as functional foods
2.7 Visit to a spice garden

PART B

Unit 3: Technology ofherbs

3.1 Classification and nutritive value of herbs
3.2 Functional role of herbs
3.3 Herb Gardening
3.4 Processing and storage of culinary herbs- Ajowan, coriander, parsley, mustard, oregano, rosemary, thyme, star aniseetc
3.5 Applications in food

Unit 4: Plantation Crops

4.1 Cultivation, harvesting and processing of coffee
4.2 Cultivation, harvesting and processing of Tea
4.3 Cultivation, harvesting and processing of cocoa

Reference Books

1. K.V. Peter, 2004, Handbook of Herbs and Spices, WoodHead Publishing Limited.
2. N. Kumar, 2018, Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants, 2nd Revised edition, Oxford & IBH Publishing Co Pvt. Ltd.
3. NIIR BOARD OF CONSULTANTS & ENGINEERS, 2013, Complete Book on Spices and Condiments With Cultivation Processing and Uses, 2nd Revised Edition, Asia Pacific Business Press.
4. V. Ponnuswami**,** M. Kumar**,** V. Arumugam, 2015, Text Book on Fruit & Plantation Crops, Narendra Publishing House.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance

Term end examination

Course Articulation Matrix

CO Statement	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-306.1 BFST-DS-306.1.	3	2	2	1	1	2	3	2	2	2	2
BFST-DS-306.2	3	1	1	2	2	1	3	3	3	1	2
BFST-DS-306.3	3	1	1	2	2	2	3	1	3	2	3
BFST-DS-306.4	3	1	1	2	1	2	2	1	2	2	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-307: Food Plant Hygiene, Sanitation & Waste Management

Periods/week	Credits	Max. Marks: 200
L: 2 T:0 P:0	2	Continuous Evaluation:100
Duration of Examination: 3		End Semester Examination:100

Course Type: Discipline specific elective course

Course Outcomes: The student will be able

BFST-DS-307.1: To remember the concept of food plant sanitation and waste management.
BFST-DS-307.2: To understand the quality management systems in food industries.
BFST-DS-307.3: To analyse the types of waste generation and laws and regulations associated with it.
BFST-DS-307.4: To apply strategies for waste reduction in food industries.

PART-A

Unit 1: Food plant hygiene and sanitation

1.1 Definition of sanitation, Importance of sanitation in food industry
1.2 Sanitary design of food process equipment (site selection, site preparation, construction and processing and design considerations)
1.3 Personal hygiene
1.4 Sanitizers and the methods of sanitizing used in food industry
1.5 CIP system

Unit 2: Food Quality management practices

2.2 Good hygiene practices (GHP) and Good manufacturing practices (GMP) in Food industry
2.3 Principle and application of HACCP in food handling
2.4 Quality control, quality assurance
2.5 Total quality management
2.5 Sanitary laws, regulations and guidelines

PART-B

Unit 3: Concept of Waste Management

3.1 Concept of waste management and importance of waste disposal
3.2 Types of waste (solid and liquid waste)/ Characterization of food industry waste
3.3 Characteristics of waste water
3.4 Quality assessment of waste water (BOD, COD, water hardness, ammonia, faecal coliforms, nitrates and nitrites, phosphates/phosphorus, pH, suspended solids)
3.5 EMS 14000

Unit 4: Methods of Waste Disposal

4.1 Primary, secondary and tertiary treatment of waste
4.2 Thermal treatment- Incineration, Gasification and Pyrolysis (Awareness - Not permitted)
4.3 Dumps and Landfills- Controlled dumps, Sanitary landfills, Bioreactor landfills

4.4 Biological Waste Treatment- Composting, Anaerobic Digestion
4.5 Effluent Treatment Plant (ETP) Design and Layout
4.6 By-products utilisation obtained from dairy plant, egg & poultry processing industry and meat industry.
4.7 Control methods - Physical and Chemical Agents, Pest and Rodent Control

Reference Books:

1. G.M. Norman and B.G. Robert, 2006, Principles of Food Sanitation, 5th edition.
2. D.G. Rao, 2010, Fundamentals of Food Engineering, Prentice Hall India Learning Private Limited.
3. P. Fellows, 2009, Food Processing Technology, 3rd Edition, Woodhead Publishing.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-307. 1	2	2	2	1	1	3	3	2	2	2	2
BFST-DS-307. 2	3	2	2	3	2	2	2	2	3	1	3
BFST-DS-307. 3	3	3	2	1	1	3	3	2	2	2	2
BFST-DS-307. 4	3	3	3	2	1	3	3	2	2	2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-402: Statistics and Research Methodology (Theory)

Periods/week	Credits	Max. Marks: 200
L: 3 T: 0 P: 0	3	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Program Core

Course Outcomes: The student will be able:
BFST-402.1: To understand the significance of Statistics and research methodology in nutrition research.
BFST-402.2: To classify the types, tools and methods of research.
BFST-402.3: To select appropriate research method for a particular research design.
BFST-402.4: To justify the appropriate statistical technique for the measurement/ scale and design.

PART A

Unit 1: Research – Definition and tools and techniques of Data Collection

1.1 Definition and Scope of research in nutrition
1.2 Introduction – Types of Data
1.3 Primary Data Collection
  1.3.1 Questionnaire and Schedule
  1.3.2 Rating and Attitude Scales
  1.3.3 Interviewing and observational methods
1.4 Secondary Data Collection
  1.4.1 Documents
  1.4.2 Office records
  1.4.3 Journals

Unit 2: Tabulation and organization of data

2.1 Processing and coding of Quantitative and Qualitative Data
2.2 Preparation of Mater sheet
2.3 Frequency and Cumulative frequency Distribution

PART B

Unit 3: Graphical representation of Quantitative and Qualitative Data

3.1 Normal Probability Distribution
3.2 Representation of Frequency Distribution
  3.2.1 Histogram
  3.2.2 Frequency Polygon
  3.2.3 Cumulative Percentage curves
3.3 Graphs for Nominal and Ordinal Data
  3.3.1 Pie Diagram and Bar charts
3.4 Graphs for relation between two variables
  3.4.1 Scattered graph and line diagrams

Unit 4: Measures of Central Tendency

4.1 Mean
4.2 Median
4.3 Mode
4.4 Standard deviation

Reference Readings:

1. R. Ahuja, 2001, Research Methods, 1st Edition, Rawat Publications, Jaipur & New Delhi.
2. S. Gupta, 2002, Research Methodology and Statistical Techniques, 2nd Edition, Deep and Deep Publications, New Delhi.
3. S.P. Gupta, 1987, Statistical Methods, 25th Edition, Sultan Chand and Sons, New Delhi.
4. C.R. Kothari, 1990, Research Methodology-Methods and Techniques, 2nd Edition, C.A. Wishwa Prakashan, division of Wiley Eastern Ltd., New Delhi.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous Evaluation table

Sessional- I	**30%**
Sessional- II	**30%**
Assignment	**20%**
Class Performance	**10%**
Attendance	**10%**

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BND-DS-502)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-402.1	3	3	3	3	2	3	3	2	3	2	3
BFST-402.2	3	2	3	3	2	3	3	2	3	2	3
BFST-402.3	3	3	3	3	2	3	3	2	3	2	3
BFST-402.4	3	2	3	3	2	3	3	2	3	2	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-401: Food Chemistry II (Theory)

Periods/week	Credits	Max. Marks: 200
L: 4 T: 0 P: 0	4	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Core Course Theory

Course Outcomes: The Students will be able:

BFST-DS-401.1: To define theories of flavor perception.

BFST-DS-401.2: To evaluate changes in fats during processing and storage

BFST-DS-401.3: To describe various natural food pigments and their importance.

BFST-DS-401.4: To understand the changes in vitamins and minerals during food processing

PART-A

Unit1: Lipids

1.1 Classification of lipids

1.2 Physical properties-melting point, softening point, specific gravity, refractive index, smoke, flash and fire point, turbidity point.

1.3 Chemical properties-RM value, Polenske Value, iodine value, peroxide value, saponification value.

1.4 Classification and properties of Phospholipids and glycolipids, Lipoproteins, waxes

Unit 2: Changes in fats during processing and storage

2.1 Effect of frying on fats

2.2 Changes in fats and oils- rancidity, lipolysis, flavor reversion

2.3 Auto-oxidation and its prevention

Unit3: Vitamins

3.1 Structure, Importance in diet

3.2 Water soluble vitamins (B, C)

3.3 Fat soluble vitamins (A, E, D, K)

3.4 Stability during food processing and storage

PART-B

Unit 4: Minerals

4.1 Macro and micro minerals

4.2 Stability during food processing and storage

4.3 Metal uptake in canned foods

4.4 Toxic metals

Unit 5: Flavor

5.1 Definition and basic tastes (sweet, salty, sour, bitter, umami)
5.2 Chemical structure and taste
5.3 Description of food flavors, Flavor enhancers
5.4 Importance flavors in food processing

Unit 6: Natural Food Pigments

6.1 Introduction and classification
6.2 Food pigments (chlorophyll, carotenoids, anthocyanins and flavonoids, beet pigments, caramel)
6.3 Changes due to processing

Textbooks/Reference Books:

1. J.M. DeMan, 1980, Principles of Food Chemistry, NewYork: AVI.
2. R. Owen Fennema, 1996, Food Chemistry, 3rd Ed., NewYork: Marcell Dekker.
3. Whitehurst and Law, 2002, Enzymes in Food Technology, Canada: CRC Press.
4. L.H. Meyer, 2004, Food chemistry. Cbs, paperback

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-401.1	3	3	1	2	1	3	3	3	3	3	1
BFST-DS-401.2	2	2	-	1	2	3	3	2	3	3	3
BFST-DS-401.3	3	3	1	2	3	3	3	3	3	3	3
BFST-DS-401.4	3	2	-	1	3	3	2	2	3	3	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-451: Food Chemistry II (Practical)

Periods/week	Credits	Max. Marks: 100
L: 0 T: 0 P: 4	2	Continuous Evaluation: 50
Duration of Examination: 3 Hours		End Semester Examination: 50

Course Type: Core Course practical

Course Outcomes: The Students will be able:

BFST-DS-451.1: To recognize different food pigments.
BFST-DS-451.2: To analyze fats for their physical properties
BFST-DS-451.3: To determine the chemical changes in fats during processing and storage
BFST-DS-451.4: To recognize and illustrate micro-organisms associated with food

Practical

1. Determination of smoke point and percent fat absorption for different fat and oils.
2. Determination of percent free fatty acids and acid value of oils
3. Determination of refractive index and specific gravity of fats and oils.
4. Estimation of saponification value of fat and oils.
5. Estimation of iodine value of fats and oils
6. Estimation of peroxide value of fats and oils
7. Study the effect of processing on natural pigments
8. Estimation of total ash and mineral content of food samples.
9. Estimation of RM-PV Value in fats.

Textbooks/Reference Books:

1. J.M. DeMan, 1980, Principles of Food Chemistry, NewYork: AVI.
2. R. Owen Fennema, 1996, Food Chemistry, 3rd Ed., NewYork: Marcell Dekker.
3. Whitehurst and Law, 2002, Enzymes in Food Technology, Canada: CRC Press.
4. L.H. Meyer, 2004, Food chemistry. Cbs, paperback

Continuous Evaluation table

Viva- I	**30%**
Viva- II	**30%**
Practical Record	**20%**
Class Performance	**10%**
Attendance	**10%**

Assessment Tools:
Practical Record
Viva I & II
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-451.1	3	2	2	1	1	3	2	3	3	3	1
BFST-DS-451.2	3	1	-	-	1	3	3	3	3	3	3
BFST-DS-451.3	2	1	1	-	1	2	2	3	3	3	2
BFST-DS-451.4	2	2	1	1	1	2	3	3	2	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-402: Food Packaging Technology (Theory)

Periods/week	Credits	Max. Marks: 200
L: 4 T: 0 P: 0	4	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Core Course Theory
Course Outcomes: The students will be able:
BFST-DS-402.1To understand about the different kinds of packaging materials.
BFST-DS-402.2To associate the relationship between the type of processing technology used with the nature of fruits and vegetables.
BFST-DS-402.3To apply their knowledge in testing of various packaging materials.
BFST-DS-402.4To evaluate the standards and regulations for food packaging materials prevalent in India.

PART A

Unit 1: Introduction to food packaging

1.1 Definition
1.2 Characteristics and Functions of packaging
1.3 Classification of packaging
1.4 Scope of packaging

Unit 2: Food Packaging Materials

2.1 Plastics- Polyvinyl chloride (PVC), Polyethylene and its varieties (PET, HDPE, LDPE), Polystyrene (PS)
2.2 Metals- steel, tin, aluminum cans
2.3 Glass- containers, jars
2.4 Wood, cardboard and papers
2.5 Forms of packaging- box, bottle, tetra, pouch, shrink, vacuum, gas

Unit 3: Testing of Packaging

3.1 Physical tests (WVTR, GTR, bursting strength, tensile strength, tearing strength, Drop test, Puncture test, Impact test, cobb test)
3.2 Chemical tests (Toxic Heavy Metals, Color Migration, Primary Amine, Phthalates, Benzophenone, Formaldehyde, Poly Chlorinated Biphenyl (PCB), Poly Aromatic Hydrocarbon (PAH), PentaChloro Phenol (PCP)

PART B

Unit 4: Methods of packaging

4.1 Active packaging
4.2 Modified atmosphere packaging
4.3 Controlled atmosphere packaging
4.4 Aseptic packaging
4.5 Intelligent Packaging

Unit 5: Equipment for packaging

5.1 Vacuum packaging machine

5.2 MAP machine
5.3 Seal and shrink-packaging machine
5.4 Form & fill sealing machine
5.3 Carton making machines

Unit 6: Laws and regulations

6.1 Packaging and labelling–Laws and regulations specific to different food products
6.2 Meat, fish, poultry, eggs
6.3 Milk and dairy products
6.4 Fruits and vegetables
6.5 Cereal grains, baked food, Snack products
6.6 Beverages

References

1. G.L. Robertson, 2013, Food Packaging: Principles and Practice (3rd Edition), CRC Press.
2. K.L. Yam, D.S. Lee and L. Piergiovanni, 2006, Handbook of Food Packaging, CRC Press.
3. R. Coles, D. McDowell and M.J. Kirwan, 2003, Food Packaging Technology, CRC Press.
4. Handbook of Packaging by Paine and Paine (2nd Edition), Springer, 1993
5. R.J. Kelsey, 2004, Handbook of Package Engineering (4th Edition), Boca Raton: CRC Press.
6. R. Ranganna, 2017, Handbook of Analysis and Quality Control for Fruit and Vegetable Products (Second Edition), McGraw Hill Education.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-402.1	2	1	1	1	1	2	2	2	2	1	1

BFST-DS-402.2.	3	2	1	2	2	2	2	2	1	2	2
BFST-DS-402.3.	3	2	2	3	2	2	2	2	2	2	2
BFST-DS-402.4.	3	2	2	3	2	1	2	1	1	2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-452: Food Packaging Technology (Practical)

Periods/week Credits Max. Marks: 100
L: 0 T: 0 P: 2 1 Continuous Evaluation: 50
Duration of Examination: 3 Hours End Semester Examination: 50

Course Outcomes: The student will be able
BFST-DS-452. 1.To identify the different types of food packaging materials available.
BFST-DS-452. 2.To understand the various methods of testing food packaging materials
BFST-DS-452. 3.To apply their knowledge in testing the various food packaging materials.
BFST-DS-452. 4.To evaluate the food packaging materials specific to different foods.

Practical

1. Identification of different types of packaging materials.
2. Determination of tensile strength of a packaging material.
3. Determination of water absorbance in paper/paperboard using Cobb test.
4. Determination of thickness of plastic packaging materials.
5. Determination of tin coating continuity
6. Determination of bursting strength
7. Determination of GSM of paperboard.
8. Performing non-destructive tests for glass containers

References

1. G.L. Robertson, 2013, Food Packaging: Principles and Practice (3rd Edition), CRC Press.
2. K.L. Yam, D.S. Lee and L. Piergiovanni, 2006, Handbook of Food Packaging, CRC Press.
3. R. Coles, D. McDowell and M.J. Kirwan, 2003, Food Packaging Technology, CRC Press.
4. Handbook of Packaging by Paine and Paine (2nd Edition), Springer, 1993.
5. R.J. Kelsey, 2004, Handbook of Package Engineering (4th Edition), Boca Raton: CRC Press.
6. R. Ranganna, 2017, Handbook of Analysis and Quality Control for Fruit and Vegetable Products (Second Edition), McGraw Hill Education.
7. ASTM standards for package material testing.

Continuous Evaluation table

Viva- I	**30%**
Viva- II	**30%**
Practical Record	**20%**
Class Performance	**10%**

Attendance	**10%**

Assessment Tools:
Practical Record
Viva I & II
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-452.1.	1	1	2	1	1	2	2	1	2	2	1
BFST-DS-452.2.	2	1	2	1	1	1	2	2	2	3	1
BFST-DS-452.3.	2	2	2	2	2	2	2	1	1	3	2
BFST-DS-452.4.	2	2	2	1	2	2	1	2	1	3	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-403 Food Quality Evaluation & Management (Theory)

Periods/week	Credits	Max. Marks: 200
L: 4 T: 0 P: 0	4	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Core Subject Theory

Course Outcomes: The Students will be able:
BFST-DS-403.1 To define the significance of quality management in food production chain
BFST-DS-403.2 To identify different physical, chemical & biological contaminants in foods
BFST-DS-403.3 To describe latest trends and techniques employed for quality enhancement of food
BFST-DS-403.4 To discuss significance of safe processing of foods

PART – A

Unit 1: Introduction to Food Quality evaluation (taste & odor)
1.1 Definition of quality, quality concepts, quality perception, quality attributes
1.2 Gustation: Structure and physiology of taste organs- tongue, papillae, taste buds, Mechanism of taste perception, Chemical dimensions of basic tastes- sweet, salt, sour, bitter and umami.
1.3 Olfaction: Introduction, definition and importance of odor and flavor; Anatomy of nose, physiology of odor perception; Mechanism of odor perception

Unit 2: Food Quality evaluation (color & texture)
2.1 Color: Introduction and importance of color, Dimensions of color and attributes of color, Measurement of color; Munsell color system, CIE color system, Hunter color system, Lovibond Tintometer, spectrophotometry and Colorimetry etc.
2.2 Texture: Introduction, definition and importance of texture, Rheology of foods, viscosity, plasticity; Texture classification, Texture measurement
2.3 Rheological analysis, textural profile analysis of foods

Unit 3: Food Additives
3.1 Definition of food additives, characteristics & types of food additives (with their major application w.r.t specific food products)
3.2 Safety of food additives, toxicological evaluation of food additives, toxicants produced while food processing

PART – B

Unit 4: Food Contamination
4.1 Definition of food hazard & contamination
4.2 Types of contamination: physical, chemical & biological
4.3 Food adulteration: intentional & unintentional.

Unit 5: Introduction to Food Quality Management

5.1 Concepts of quality management: Objectives, importance and functions of quality control and quality assurance

5.2 Quality management systems in India, Total quality Management (TQM)

Unit 6: Food Regulatory Regime, Risk Assessment & Quality Standards

6.1 Food Safety and Standards Act, 2006, Essential Commodities Act, 1955, Global Scenario, Codex Alimentarius, ISO

6.2 International Food Standards (European Commission, USFDA etc.). WTO: Introduction to WTO Agreements: SPS and TBT Agreement, Export and Import Laws and Regulations, Export (Quality Control and Inspection) Act, 1963

6.3 Risk assessment studies: Risk management, risk characterization and communication

Textbooks/Reference Books:

1. FSSAI website: www.fssai.gov.in
2. M.B. Jacob, 1939, The chemical analysis of foods and food products; CBS Publ. New Delhi
3. A.L. Pieternel, J.M. Willem, 2009, Food Quality Management Technological and Managerialprinciples and practices, Wageningen.
4. Y. Pomeranze, 2000, Food analysis - Theory and Practice; CBS Publications, New Delhi.
5. D.A. Shapton, 1993, Principles and practices of safe processing of foods; Butterworth Publication, London.
6. R.S. Singal, 1997, Handbook of indices of food quality and authenticity; Woodhead Publ. Cambridge, UK.
7. A.L. Winton, 2002, Techniques of food analysis; Allied Science Publications New Delhi.
8. E.S. Rao, 2013, Food Quality Evaluation, Variety Book Publishers

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-403.1	2	1	1	1	1	2	2	2	2	2	2

BFST-DS-403.2	1	2	1	1	1	1	1	2	2	2	1
BFST-DS-403.3	1	2	2	1	1	1	2	2	2	2	2
BFST-DS-403.4	2	1	2	2	1	2	1	2	3	1	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-453 Food Quality Evaluation & Management (Practical)

Periods/week Credits Max. Marks: 100
L: 0 T: 0 P: 4 2 Continuous Evaluation: 50
Duration of Examination: 3 Hours End Semester Examination: 50

Course Type: Core Course Practical

Course Outcome: The Students will be able:
BFST-DS-453.1 To identify different food additives commonly used in food products
BFST-DS-453.2 To describe quality characteristics of food products
BFST-DS-453.3 To differentiate food additives w.r.t their application in food industry

Practical

1. To qualitatively analyze hydrogenated fats, butter and ghee: refractive index, specific gravity, etc.
2. To perform quality inspection of cereals & pulses
3. To perform quality inspection of spices and condiments
4. To estimate Sulphur dioxide content in packaged foods (Squashes, preserves, dry fruits etc)
5. To quantitatively estimate color present in foods (chromatographic technique)
6. To estimate common salt different salts (rock, mineral salt) moisture content, MIW and total chlorides
7. To estimate benzoic acid in food products
8. To estimate sorbic acid in food products
9. To estimate colour by using Lovibond tintometer.

Textbooks/Reference Books:

1. D. Man, 2007, Principles of Food Chemistry, 3rd edition, Springer.
2. A.L. Pieternel and J.M. Willem, 2009, Food Quality Management Technological and Managerial principles and practices, Wageningen.

Continuous Evaluation table

Viva- I	**30%**
Viva- II	**30%**
Practical Record	**20%**
Class Performance	**10%**
Attendance	**10%**

Assessment Tools:
Practical Record
Viva I & II
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-453.1	2	1	2	1	1	2	1	2	2	2	2
BFST-DS-453.2	2	1	2	1	1	2	2	2	1	2	2
BFST-DS-453.3	1	1	1	1	2	2	2	2	2	3	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956**)**

RIC-400: Research and Innovation Catalyst-II

Periods/week	Credits	Max. Marks	: 50
P: 1	0.5	Continuous Evaluation	: 50

Pre-requisites: Research and Innovation Catalyst-I
Course Type: Research & Training
Course Coordinator: Research Mentor of the Department

Course Outcomes:The students will be able
RIC-400.1. Tocritically evaluate the work done by various researchers relevant to theresearch topic
RIC-400.2. To integrate the relevant theory and practices followed in a logical way and draw appropriate Conclusions
RIC-400.3. Tounderstand the research methodologies/approaches/techniques used in the literature
RIC-400.4. Tostructure and organize the collected information or findings through an appropriate abstract, headings, reference citations and smooth transitions between sections
RIC-400.5. To learn the structuring of the paper in the form of Power Point Presentation
RIC-400.6. To adapt working with group members

Unit 1: Literature Survey (LS)
1.1 Collection of research papers related to previously identified gap/problem
1.2 Comprehend and arrange the literature based on the idea framed
1.3 Presenting the collected data and inferring it with the further scope of expansion

Unit 2: Structuring of Review Paper
2.1 Analysis of different approach/methodology adopted by various researchers
2.2 Listing out the components of the paper wrt the problem
2.3 Identification of suitable Journal or Conference
2.4 Formatting/Styling the paper according to the respective template

Unit 3: Presenting the findings
3.1 Structuring and preparation of PPT
3.2 Mock presentation
3.3 Reviewon presentation skills and content delivered both
3.4 Incorporating the review comments in the slides

Course Articulation Matrix:

CO Statement (RIC-400)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
RIC-400.1	3	2		1	2		3			2	2
RIC-400.2	3		1		3		3	1		2	2
RIC-400.3	2		1	1		2	3			2	1
RIC-400.4	2	2	1	1	2	2	3		1	2	
RIC-400.5	2	2	2			2	3			2	2
RIC-400.6		3	3	2	3		3			2	1

'3' (Tick) or 'More' Substantial/High Correlation, '2' Moderate/Medium Correlation, '1' Slightly/Low Correlation,'Blank' No Correlation

Evaluation Criteria: The following evaluation parameters shall be considered for internal assessment by both research coordinators and faculty coordinator or research mentors:-

S. No.	Parameters	Description	(Marks)	
1.	**Attendance**	• Percentage of classes attended by the students	5	**5**
2.	**Continuous Performance**	Group participation and response of the students to a given task: • Judge individual student in the group • Meeting timelines as per lesson plan	5 10	**15**
3.	**Literature Survey**	• Usage of Scientific Literature Databases. e.g., Scopus/ Web of Science/ etc. • Number of relevant papers referred for the given topic • Summarizing the referred paper • Plagiarism/Authenticity • Reference listing	2 4 4 3 2	**15**
4.	**Structuring and presentation**	• Paper structuring and presentation • Group presentation with individual contribution • Target journal, Impact factor/ Topic centered Journal • Students response towards comments by research/faculty mentors	7 2 1 5	**15**

References:

1. http://www.sciencedirect.com/
2. https://www.ncbi.nlm.nih.gov/pubmed
3. https://www.elsevier.com/books-and-journals
4. https://www.plos.org/
5. https://www.deepdyve.com/
6. http://ieeexplore.ieee.org/Xplore/home.jsp

7. https://www.researchgate.net/
8. https://www.science.gov/
9. https://scholar.google.co.in/
10. http://www.popsci.com/

BOOKS

11. E. Harman and I. Montagnes Ed., 1997, The thesis and the book. Now Delhi: Vistaar.
12. L.F. Locke and others, 1987, Proposals that work: A guide for planning dissertations
13. C.J. Mullins, 1997, A guide to writing and publishing in social and behavioral
14. R.J. Stemberg, 1991, The psychologist's companion: A guide to scientific writing forsciences, New York : John Wiley & Sons students & researchers, Cambridge: CUP.

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-404 Scientific Writing in Agricultural Sciences (Theory)

Periods/week	Credits	Max. Marks : 200
L: 2 T:0 P:0	2	Internal / Continuous Evaluation: 100
Duration of Examination: 3 Hours		End semester examination :100

Course Type: Discipline Specific

Course Outcomes:
BND-DS-406.1 To understand techniques and terms of scientific writing.
BND-DS-406.2 To enable students to develop competence in writing and abstracting skills.
BND-DS-406.3 To apply various forms of scientific methods in research papers writing.
BND-DS-406.3To critically evaluate the research papers for knowledge gaps in health topics

PART A

Unit 1 Introduction to Scientific Writing
1.1 scientific writing, objectives and importance
1.2 Types of scientific writing
1.3 Research Misconduct and Plagiarism

Unit 2 Characteristics and steps of writing for the following
2.1 Review articles, Systematic and meta analysis, Monographs.
2.2 Book chapters and book review.
2.3 Journals and Magazines

Unit 3 Outlines and titles in Research
3.1. Kinds of outline: Topic outlines, Conceptual outlines, Sentence outlines.
3.2. Drafting titles, sub titles, tables, illustrations.

PART B

Unit 4: Critical Appraise a research article
4.1. Selection and critical appraisal of research literature
4.2. CONSORT for trials
4.3. QUORUM for Meta-analysis
4.4 STROBE STATEMENT for observational studies

Unit 5: Development of Research Manuscript
5.1 Summary and abstract
5.2 Introduction and Objectives
5.3 Review of literature
5.4 Methods
5.5 Results and discussion
5.6 References and Annexure.

Unit 6: Process of publishing a scientific

6.1 Steps of peer-reviewing Research Manuscript

6.2 Selection of Journal and submission

Reference Readings:

1. E. Harman and I. Montagnes, 1997, The thesis and the book, 2nd Edition, New Delhi: Vistaar.

2. L.F. Locke, 1987, Proposals that work: A guide for planning dissertations & Grant proposals, 2nd Edition, Beverly Hills : Sage.

3. C.J. Mullins, 2009, A guide to writing and publishing in social and behavioral sciences, 7th Edition, New York : John Wiley & Sons.

4. R.J. Stemberg, 1991, The psychologist's companion: A guide to scientific writing for students & researchers, 4th Edition, Cambridge: CUP.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous Evaluation table

Sessional- I	**30%**
Sessional- II	**30%**
Assignment	**20%**
Class Performance	**10%**
Attendance	**10%**

Course Articulation Matrix

CO Statement (BND-DS-406)	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
BND-DS-406.1	3	3	3	3	2	3	3	2	3	2	3
BND-DS-406.2	3	2	3	3	2	3	3	2	3	2	3
BND-DS-406.3	3	3	3	3	2	3	3	2	3	2	3
BND-DS-406.4	3	2	3	3	2	3	3	2	3	2	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-405: Food Beverages (Theory)

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0 P: 0	2	Continuous Evaluation/ Continuous Evaluation: 50
Duration of Examination: 3 Hours		End Semester Examination: 50

Course Outcomes: The students will be able
BFST-DS-405.1: To identify the different kinds of beverages available in the food industry.
BFST-DS-405.2: To understand the technology required for processing of different beverages.
BFST-DS-405.3: To analyse the standards and guidelines for manufacturing of beverages.
BFST-DS-405.4: To apply the technology in manufacturing of food beverages.

PART A

Unit 1: Introduction to Food Beverage
1.1 Definition
1.2 Types of beverages
1.3 Current status of beverage industry in India

Unit 4: Packaged drinking water
4.1 Definition
4.2 Types of bottled water- spring water, mineral water, sparkling water
4.3 Manufacturing process
4.4 Methods of water treatment
4.5 FSSAI standards and guidelines for packaged drinking water

PART B

Unit 2: Alcoholic Beverages
2.1 Technology of brewing process
2.2 Technology of: Wine, Cider,Brandy, Beer, Whisky

Unit 3: Non Alcoholic Beverages
3.1 Manufacturing technology for carbonated beverages
3.2 Manufacturing technology for juice-based beverages, squashes, cordials and nectars
3.3 Technology of soft drinks
3.4 Manufacturing technology of Whey beverages

Reference books:

1. G.M. Marian, 2013, Open Innovation in the Food and Beverage Industry, Woodhead Publishing Series in Food Science, Technology and Nutrition, Woodhead Publishing, 1 edition.
2. I. Aguiló-Aguayo and L. Plaza, 2017, Innovative Technologies in Beverage Processing, John Wiley & Sons Ltd.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-405.1	2	3	2	1	2	3	3	2	1	3	3
BFST-DS-405.2	3	3	2	1	2	3	3	2	3	3	3
BFST-DS-405.3	2	2	3	3	2	2	2	1	2	2	3
BFST-DS-405.4	3	2	2	1	1	3	3	2	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-501 Instrumentation and Analytical Techniques (Theory)

Periods/week	Credits	Max. Marks: 200
L: 4 T: 0 P: 0	4	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Exam: 100

Course Type: Core Course theory
Course Outcomes: The student will be able to:
BFST-DS-501.1: To define key terms related to qualitative and quantitative food analysis.
BFST-DS-501.2: To understand the basic principles of analytical techniques.
BFST-DS-501.3: To describe the types of food analytical instruments.
BFST-DS-501.4: To analyze the role of different techniques in quantification of different food components.

PART – A

Unit 1: Introduction to Food Analysis
1.1 Sampling and sampling techniques
1.2 Sample preparation for analysis.
1.3 Buffers and pH

Unit 2: Proximate analysis
2.1 Proximate constituents- Methods of analysis: Total fat, crude fiber, protein, moisture, minerals analysis

Unit 3: Colorimetry and Spectro-photometry
3.1 Introduction, theory, Lambert-Beer's Law, limitations
3.2 Types of monochromator and detectors,
3.3 Instrumentation of single beam and double beam instrument, photometric errors.
3.4 Instrumentation of Flame photometer and atomic absorption spectrophotometer.

Part B

Unit 4: Spectroscopy
4.1 Infrared Spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), Infrared (IR) spectroscopy
4.2 Atomic Spectroscopy, Atomic emission spectroscopy (AES), Atomic fluorescence spectroscopy (AFS)

Unit 5: Chromatography
5.1 Basic principles and types of chromatography,
5.2 Paper, TLC, Gel permeation, ion exchange
5.3 HPLC, GLC
5.4 Super critical fluid extraction chromatography

Unit 6: Separation techniques and Sensing techniques
6.1 Dialysis, electrophoresis (paper and gel), iso-electric focusing
6.2 Sedimentation, ultra-filtration, ultracentrifugation
6.3 Sensing techniques: chemosensors, biosensors, immunosensors

Textbooks/ Reference Books:

1. S.S. Nielson, 2003, Food analysis. Kluwer Academic Press.
2. Y.J. Pomeranz, 2000, Food Analysis, Springer Publications.
3. Srivastava, 2000, Instrumental Approach to chemical analysis, S. Chand Publishers.
4. A.L. Winton, 1999, Techniques of food analysis, Allied Science, Official methods of analysis, Association of official analytical chemist USA.
5. H. Das, 2005, Food processing operations analysis, Asian Books private ltd.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BFST-DS-501)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-501.1	3	3	3	3	2	3	3	3	3	3	3
BFST-DS-501.2	3	3	3	2	3	3	3	3	2	3	3
BFST-DS-501.3	3	3	3	3	3	3	3	3	3	3	3
BFST-DS-501.4	3	3	3	3	3	2	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-551 Instrumentation and Analytical Techniques Practical)

Periods/week	Credits	Max. Marks: 100
L: 0 T: 0 P: 4	2	Continuous Evaluation: 50
Duration of Examination: 2 Hours		End Semester Exam: 50

Course Type: Core course practical

Course Outcomes: The students will be able:
BFST-DS-551.1: To understand the principles of food analysis instruments.
BFST-DS-551.2: To describe the different techniques of food analysis
BFST-DS-551.3: To analyze the nutritional quality of food.
BFST-DS-551.4: To handle the instruments proficiently in food laboratories.

Practical
1. Preparation of buffers and pH measurement
3. Estimation of moisture content of food sample
4. Estimation of crude protein of food sample
5. Estimation of crude fat of food sample
6. Estimation of total ash of food sample
7. Separation of proteins by paper chromatography.
8. Estimation of calcium and phosphorus in food sample using spectrophotometer

Text Books/ Reference Books:
1. S.S. Nielson, 2003, Food analysis. Kluwer Academic Press.
2. Y.J. Pomeranz, 2000, Food Analysis, Springer Publications.
3. Srivastava, 2000, Instrumental Approach to chemical analysis, S. Chand Publishers.
4. A.L. Winton, 1999, Techniques of food analysis, Allied Science, Official methods of analysis, Association of official analytical chemist USA.
5. H. Das, 2005, Food processing operations analysis, Asian Books private ltd.

Continuous Evaluation table

Viva- I	**30%**
Viva- II	**30%**
Practical Record	**20%**
Class Performance	**10%**
Attendance	**10%**

Assessment Tools:
Practical Record
Viva I & II
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-551.1	3	3	3	3	2	3	3	3	3	3	3
BFST-DS-551.2	3	2	3	2	3	3	3	3	2	3	3
BFST-DS-551.3	3	3	3	3	3	3	3	3	3	3	3
BFST-DS-551.4	3	3	3	3	3	2	3	3	3	3	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-502 Technology of Meat, Poultry, Seafoods and Honey (Theory)

Periods/week	Credits	Max. Marks: 200
L: 4 T: 0 P: 0	4	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Exam: 100

Course Type: Core Course Theory

Course Outcomes: The student will be able:
BFST-DS-502.1: To classify the various type of animal-based foods
BFST-DS-502.2: To describe the nutritive value of animal-based food products.
BFST-DS-502.3: To relate processing methods with shelf life of animal-based foods.
BFST-DS-502.4: To analyze the quality of animal foods through various techniques

PART – A

Unit1: Introduction to animal foods
1.1 Status of meat, poultry and seafood industry in India and its need in nation's economy
1.2 Definition and classification of various animal meats
1.3 Muscle: Structure and chemical composition
1.4 Nutritive value of meat muscle
1.5 Effects of feed breed and environment on production of meat animals and their quality

Unit2: Meat quality and slaughter process
2.1 Meat Quality-color, flavor, texture, Water-Holding Capacity (WHC), Emulsification capacity of meat
2.2 Abattoir/ Lairage, Antemortem examination
2.3 Slaughter process: Slaughter of sheep/goat, buffalo and pig poultry (Generic HACCP model), post-mortem examination of meat, grading, dressing of carcasses, Packaging and storage

Unit3: Processing and Preservation of meat
3.1 Mechanical deboning, Refrigeration and freezing, meat curing, Smoking, thermal processing (canning, retort processing), dehydration, irradiation
3.3 By-products: Importance, classification and uses, manufacture of natural casings
3.2 Sausages: Processing, types and defects, and RTE meat products

PART B

Unit 4: Technology of Egg
4.1 Structure, Nutritive value and grading of eggs
4.2 Quality inspection of eggs, Factors affecting quality
4.3 Preservation of eggs: Refrigeration and freezing, thermal processing, dehydration, coating
4.4 The egg industry, its techniques of working, common terminologies

Unit 5: Technology of Sea Foods
5.1 Type of fish, nutritive value and quality inspection
5.2 Preservation of fish: Chilling and freezing of fish, fish curing and smoking, canning of fish

5.3 Fishery by-products: Surimi, fish mince products, Fish protein concentrates (FPC), fish protein extracts (FPE), fish protein hydrolysis (FPH)
5.4 Other Sea foods Crabs, lobsters, prawns, shrimps, shellfish.

Unit 6: Technology of Honey processing
6.1 Nutritional composition of honey and its quality attributes
6.2 Properties of honey products
6.3 Value addition of honey

Textbooks/ Reference Books:

1. R.A. Lawrie, Lawrie's, 2002, Meat Science, 6th Ed, Woodhead Publisher, England.
2. Parkhurst & Mountney, 1997, Poultry Meat and Egg Production, CBS Publication, New Delhi.
3. Pearson & Gillet, 1997, Processed Meats. 3rd Ed, CBS Publication, New Delhi.
4. S. Barbut, 2005, Poultry Products Processing., Ist Edition, CRC Press.
5. W.J. Stadelman, J. Cotterill Owen, 2002, Egg Science and Technology, 4th Ed., CBS Publication New Delhi.
6. D.P. Sen, 2005, Advances in Fish Processing Technology, Allied Publishers Pvt. Limited.
7. F. Shahidi and J.R. Botta, 1994, Seafoods: Chemistry, Processing, Technology and Quality, Blackie Academic & Professional, London.
8. Ted Hooper, 2014, The Beginner's Bee Book, Stenlake Publishing, Ayrshire.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BFST-DS-502)	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-502.1	3	3	3	3	2	3	3	3	3	3	3
BFST-DS-502.2	3	3	3	2	3	3	3	3	2	3	3
BFST-DS-502.3	3	3	2	3	3	3	3	2	3	3	3
BFST-DS-502.4	3	3	2	3	3	2	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-552 Technology of Meat, Poultry, Seafoods and Honey (Practical)

Periods/week	Credits	Max. Marks: 100
L: 0 T: 0 P: 2	1	Continuous Evaluation: 50
Duration of Examination: 2 Hours		End Semester Exam: 50

Course Type: Core Course Practical
Course Outcomes: The students will be able:
BFST-DS-552.1: To test the quality of animal foods.
BFST-DS-552.2: To enhance the shelf life of products through various methods
BFST-DS-552.3: To formulate products based using different methods of processing
BFST-DS-552.4: To analyze the quality of animal foods through various techniques.

Practical

1) Estimation of moisture content of meat/ fish/ egg
2) Cut out analysis of canned/retort meat and fish
3) Quality evaluation of frozen meat/meat emulsion products
4) Evaluation of eggs for quality parameters
5) To study shelf-life of eggs by different methods of preservation.
6) Subjective quality evaluation of fish/prawn
7) Product formulation and sensory evaluation
8) Quality evaluation and adulteration test of honey

Textbooks/ Reference Books:

1. R.A. Lawrie, Lawrie's, 2002, Meat Science, 6th Ed., Woodhead Publisher, England.
2. Parkhurst & Mountney, 1997, Poultry Meat and Egg Production, CBS Publication, New Delhi.
3. Pearson & Gillet, 1997, Processed Meats, 3rd Ed., CBS Publication, New Delhi.
4. S. Barbut, 2005, Poultry Products Processing, Ist Edition, CRC Press.
5. W.J. Stadelman, J. Cotterill Owen, 2002, Egg Science and Technology, 4th Ed., CBS Publication New Delhi.
6. D.P. Sen, 2005, Advances in Fish Processing Technology, Allied Publishers Pvt. Limited.
7. F. Shahidi and J.R. Botta, 1994, Seafoods: Chemistry, Processing, Technology and Quality, Blackie Academic & Professional, London.
8. Ted Hooper, 2014, The Beginner's Bee Book, Stenlake Publishing, Ayrshire.

Continuous Evaluation table

Viva- I	**30%**
Viva- II	**30%**
Practical Record	**20%**
Class Performance	**10%**
Attendance	**10%**

Assessment Tools:
Practical Record
Viva I & II
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BFST-DS-552)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-552.1	3	3	3	3	2	3	3	3	3	3	3
BFST-DS-552.2	3	3	3	2	3	2	3	3	2	3	3
BFST-DS-552.3	3	3	3	3	3	3	3	3	3	3	3
BFST-DS-552.4	3	3	3	3	3	2	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-553 Industrial Training

Periods/week	Credits	Max. Marks: 300
L:0 T:0 P: 20	10	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 200

Course Type: Core Course

Course Outcomes: The student will be able:
BFST-DS-553.1. To understand the principles of planning, organizing and managing food industry.
BFST-DS-553.2 To apply principles of hygiene and sanitation in food industry.
BFST-DS-553.3 To deal with daily challenges of industry
BFST-DS-553 .4 To develop skills to become entrepreneur.

Aspects to be covered: **Internship in Food Industries to enhance skills related to:**

1. Food product development
2. Product Quality analysis
3. Food regulatory issues (food laws)
4. Food packaging and Labelling
5. Food safety and quality systems
6. Food Science and Nutrition research and Development
7. Food Science and technology - related marketing and public relations
8. Food plant layout, working and analysis
9. Food plant sanitation and hygiene

10. Continuous Evaluation table

Viva- I	**30%**
Viva- II	**30%**
Practical Record	**20%**
Class Performance	**10%**
Attendance	**10%**

Assessment Tools:

Practical Record
Viva I & II
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-553.1	3	3	2	-	3	2	3	2	3	2	3
BFST-DS-553.2	3	2	2	-	3	2	3	2	3	2	3
BFST-DS-553.3	3	2	2	-	3	2	2	2	3	2	3
BFST-DS-553 .4	3	1	3	-	3	1	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956**)**

RIC-500: Research and Innovation Catalyst-III

Periods/week	Credits	Max. Marks	: 100
P: 1	1	Internal	: 100

Pre-requisites: Research and Innovation Catalyst-II
Course Type: Research & Training
Course Coordinator: Research Mentor of Department

Course outcomes: The students will be able
RIC-500.1. To compare the various research methodologies and choosing the appropriate one
RIC-500.2. To apply the contextual knowledge in designing and conducting the experiments
RIC-500.3. To analyze and interpret the research outcomes and adapt a process to yield the quality output
RIC-500.4. To gain hands on experience in techniques/technologies
RIC-500.5. To analyze the further scope of research
RIC-500.6. To adapt working with group members

Unit 1: Setting up the simulation/experiment environment

1.1. Deciding the hypothesis or direction to carry out simulation/experiments
1.2. Identifying the set of experiments/simulations for designing the model or analysing the data
1.3. Finding the resources for performing experiments/simulations
1.4. Choosing the appropriate research methodology

Unit 2: Planning of experiments

2.1 Formulate experimental procedures
2.2 Procurement of materials
2.3 Modification of the experimental set-up, if required

Unit 3: Execution of experiments/simulations

3.1. Conduct experiments/ build prototype
3.2. Tabulating and recording data
3.3. Analysis and interpretation of the data
3.4. Interpreting convolution between experimental data and hypothesis/simulation
3.5. Comparison of the results for discrepancies
3.6. Listing and analysing the observations to get the further research direction

Unit 4: Standardizing the results

4.1 Blocking, randomization and replication of experiments to ensure repeatability and reproducibility
4.2 Interpreting convolution between experimental data and hypothesis/simulation
4.3 Comparison of the results for discrepancies
4.4 Listing of observations
4.5 Analysing the observations to get the further research direction
4.6 Exploring opportunities for future work

Unit 5: Documentation and presentation

5.1 Integration of relevant theory, findings in a structured way and draw appropriate conclusions
5.2 Review and modification of the draft
5.3 Mock presentation
5.4 Identification of journal/conference

Course Articulation Matrix:

CO Statement (XX-500)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
RIC-500.1	3	2	2		2	2	3			2	2
RIC-500.2	3	1		1	2	3	3	1		2	2
RIC-500.3	3	3	1			2	3			2	1
RIC-500.4					2	2	3		1	2	
RIC-500.5	3	2	1	1	1	2	3			2	2
RIC-500.6		3	3	2	3		3			2	1

'3' (Tick) or 'More' Substantial/High Correlation, '2' Moderate/Medium Correlation, '1' Slightly/Low Correlation, 'Blank' No Correlation

Evaluation Criteria: The following evaluation parameters shall be considered for internal assessment by both research coordinators and faculty coordinator or research mentors:-

S. No.	Parameters	Description	(Marks)	
1.	**Attendance**	• Percentage of classes attended by the students	10	**10**
2.	**Continuous Performance**	• Judge individual student's participation in the experiments • Proper experimental planning • Collecting evidences substantiating to the experiments • Time bound completion of experiments	10 4 6 10	**30**
3.	**Execution of experiments**	• Finding available resources • Usage of Scientific Literature Databases. e.g., Scopus/ Web of Science/ etc. for theoretical guidance • Understanding the technique/technology used • Analysis and interpretation of results • Percentage of reproducibility • Knowledge gained over the topic	4 4 6 4 6	**24**
4.	**Report and Presentation And Finalization of experimental paper**	• Presentation of slides • Experimental findings and content (Graph, Tables, Diagrams, Real time videos etc.) • Report • Compilation and structuring of experimental paper with the obtained results • Relevance of technique/technology/methodology used • Conclusion and scope of future research • Finding the target journal/conference	 12 12 12	**36**

References:

1. www.originlab.com
2. http://www.cambridgesoft.com/software
3. http://www.synergy.com/
4. www.mathworks.com/products/matlab.html

BOOKS

1. E. Harman and I. Montagnes, 1997, The thesis and the book, 2nd Edition, New Delhi: Vistaar.
2. L.F. Locke, 1987, Proposals that work: A guide for planning dissertations & Grant proposals, 2nd Edition, Beverly Hills : Sage.
3. C.J. Mullins, 2009, A guide to writing and publishing in social and behavioral sciences, 7th Edition, New York : John Wiley & Sons.
4. R.J. Stemberg, 1991, The psychologist's companion: A guide to scientific writing for students & researchers, 4th Edition, Cambridge: CUP.

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-504: Emerging Food Processing Technologies (Theory)

Periods/week	Credits	Max. Marks: 200
L: 2 T: 0 P: 0	2	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Discipline specific elective

Course Outcomes: After completion of the course, students will be able:
BFST-DS-504.1: To outline concepts of novel food processing technologies.
BFST-DS-504.2: To describe the principles of novel technologies used in food processing and preservation
BFST-DS-504.3: To interpret the effect of the technologies on micro-organisms and food constituents
BFST-DS-504.4: To apply these technologies in further research.

Part-A

Unit 1: High Pressure Processing
1.1 Principles of high-pressure processing
1.2 Effects of high pressure on food quality: Pressure effects on microorganisms, texture and nutrients of food.
1.3 Hurdle Technology Concept, effect on preservation of food

Unit 2: Pulsed electric field and Ultrasound processing
2.1 PEF treatment systems, main processing parameters, Mechanisms of action: mechanisms of microbial inactivation.
2.2 Ultrasound processing: fundamentals of ultrasound, mechanism of ultrasound in food preservation, effects of ultrasound on food properties.

Part-B

Unit 3: Osmotic dehydration and Membrane separation
3.1 Osmotic dehydration: mechanism of osmotic dehydration, application of osmotic dehydration.
3.2 Membrane separation: Principle, different types of Membrane processing. Application in Food industry

Unit 4: Alternate processing techniques
4.1 Microwave and Ohmic heating
4.2 Radio-frequency processing and dielectric heating
4.3 Freeze drying, freeze concentration
4.4 UV and infra-red radiation

Reference Books:

1. A.S. Bawa, P.S. Raju and O.P. Chauhan, 2013, Food Science, New India Publishing Agency.
2. P.J. Fellows, 2009, (revised) Food Processing Technology: Principles and Practice, Third edition, Wood Head Publishing in Food Science, Technology and Nutrition.
3. Q. Howard, Zhang, V. Gustavo, V.M. Barbosa-Cánovas, C. Bala Balasubramaniam, Patrick Dunne, F. Daniel, Farkas, T.C. James, 2011, Nonthermal Processing Technologies for Food, Wiley-Blackwell.
4. Ortega-Rivas, Enrique, 2012, Non-thermal Food Engineering Operations, Springer.
5. N.S. Isaacs, 1998, High pressure food science, bioscience and chemistry, Wood Head Publishing limted.
6. H.L.M. Lelieveld, S. Notermans and S.W.H. De Haan, 2007, Food preservation by pulsed electric fields: From research to application, Wood Head Publishing limited.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination
Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-504.1	2	3	2	1	1	-	1	2	-	2	-
BFST-DS-504.2	3	3	2	1	2	2	2	2	1	3	-
BFST-DS-504.3	3	2	1	1	2	2	2	3	3	3	2
BFST-DS-504.4	3	2	3	2	3	3	3	2	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-505: Food Plant Equipment & Process Design (Theory)

Periods/week	Credits	Max. Marks: 200
L: 2 T: 0 P: 0	2	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Discipline specific elective

Course Outcomes: After completion of the course, students will be able:
BFST-DS-505.1: To summarize concepts of plant design and layout.
BFST-DS-505.2: To outline basic designing of equipment used in food processing
BFST-DS-505.3: To interpret the concepts of product and process design
BFST-DS-505.4: To analyse the cost of plant set up.

Part-A

Unit 1: Equipment design
1.1 Design operation in food equipment- definition
1.2 Design of machinery for sorting and grading, drying, freezing, size reduction, dry and wet separation, mixing, evaporation, condensation, membrane separation.

Unit 2: **Plant Design**
2.1 Plant Layout, Plant design concepts
2.1.1. General design considerations
2.2 Plant location, selection of materials of construction and standard components,
2.3 Design standards and testing standards.
2.4 Human factors in design- Ergonomics, safety- OSHAS

Part-B

Unit 3: Process Design
3.1 Product and process design
3.2 Process selection
3.3 Process flow charts (bakery and dairy industry).

Unit 4: Plant Set-Up and management
4.1 Setting up a plant, estimation of capital investment,
4.2 analysis of plant cost and profitability
4.3 General management techniques in plant operation.

Text Books/Reference Books:

1. P.G. Smith, 2011, Introduction to Food Process Engineering Food Science Text Series, Springer Publisher
2. M.M. Cramer, 2013, Food Plant Sanitation: Design, Maintenance, and Good Manufacturing Practices, CRC Press Taylor and Francis Group.
3. T. Ahmed, 1997, Dairy plant engineering and management, 4th Ed., Kitab Mahal.
4. A. Chakraverty and D.S. De, 1988, Post-harvest technology of cereals, pulses and oilseeds. Oxford and IBH.
5. R.T. Toledo, 1999, Fundamentals of Food Processing Engineering, 3rd edition, CBS publishers
6. W. McCabe, J. Smith, P. Harriott, 2004, Unit operation of Chemical engineering, 7th Edition, Mc Graw Hill.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination
Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-505.1	2	3	2	1	1	-	1	2	-	2	-
BFST-DS-505.2	3	3	2	1	2	2	2	2	1	3	-
BFST-DS-505.3	3	2	1	1	2	2	2	3	3	3	2
BFST-DS-505.4	3	2	3	2	3	3	3	2	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-601: Fundamentals of Food Engineering (Theory)

Periods/week	Credits	Max. Marks: 200
L: 4 T: 0 P: 0	4	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Core Course theory

Course Outcomes: The Students will be able:

BFST-DS-601.1: To comprehend the principle of unit operations

BFST-DS-601.2: To understand basics of designing of food plant and storage system

BFST-DS-601.3: To outline the basic principles of refrigeration, freezing, fluid flow, heat and mass transfer, steam, psychrometrics etc. used food industry

BFST-DS-601.4: To apply these principles for solving numerical problems encountered in food industry.

Part A

UNIT 1: Introduction to basic concepts

1.1 Concept of Unit operation
1.2 Units and dimensions, Unit conversions, dimensional analysis
1.3 Mass & Energy balance (with numerical)

UNIT 2: Design and layout of food plant

2.1 Important considerations for designing of food plants (location, land, building)
2.2 Types of layout for plant
2.3 Process layout, product layout for food industry

UNIT 3: Fluid Flow in food Processing

3.1 Liquid Transport systems
3.2 Newton's Law of Viscosity, Properties of Newtonion and Non-Newtonian fluids
3.3 Principle of Capillary tube and rotational viscometer
3.4 Flow characteristics, Reynolds Number, Bernoulli's Equation
3.5 Concept of Flow Measurement devices

Part B

UNIT 4: Refrigeration and Freezing

4.1 Description of a Refrigeration cycle, properties of a refrigerant
4.2 Pressure Enthalpy charts and Tables
4.3 Mathematical expressions useful in analysis of vapor compression refrigeration cycle
4.4 Numerical on VCR system using R -134 a, R-717 including super heating and sub cooling
4.5 Freezing time calculation using Plank equation, related basic numerical

UNIT 5: Heat and Mass Transfer

5.1 Systems for heating and cooling food products
5.2 Thermal Properties of Food, Modes of heat transfer
5.3 Application of steady state heat transfer- estimation of conductive heat transfer coefficient, convective heat transfer coefficient, overall heat transfer coefficient and, design of tubular heat exchanger, related basic numerical

5.4 Fick's Law of Diffusion

UNIT 6: Evaporation and Dehydration

6.1Boiling point elevation, Types of evaporators, Design of single effect evaporators
6.2Basic Drying Process, Moisture content on wet basis and dry basis
6.3Dehydration systems and Design

Reference Books:

1. P. Fellows, 2009, Food processing technology, Woodhead publication, 3rd edition
2. D.G. Rao, 2010, Fundamentals of food engineering, PHI learning private ltd.
3. R.P. Singh and D.R. Heldman, 1993, Introduction to food engineering, 2nd edition, Academic press.
4. T. Romeo Toledo, 1999, Fundamentals of Food Process Engineering, Aspen Publishers.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-601.1	2	1	1	-	1	2	2	3	1	3	-
BFST-DS-601.2	3	3	3	3	3	3	3	2	-	3	2
BFST-DS-601.3	3	3	2	2	1	2	2	2	2	3	1
BFST-DS-601.4	3	2	1	1	-	1	1	2	1	3	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-651: Fundamentals of Food Engineering (Practical)

Periods/week	Credits	Max. Marks: 100
L: 0 T: 0 P: 4	2	Continuous Evaluation: 50
Duration of Examination: 3 Hours		End Semester Examination: 50

Course Type: Core Course Practical

Course Outcomes: The Students will be able:
BFST-DS-651.1: To outline unit operations in food processing.
BFST-DS-651.2: To design food plant layouts
BFST-DS-651.3: To predict rate and time for freezing, drying and evaporation process.
BFST-DS-651.4: To describe different types of fluids based on their flow properties

Practical

1. To study unit operations in food processing.
2. To study and prepare plant layout and design of food industry.
3. To perform Screen analysis of flour sample.
4. Determination of drying characteristics of food.
5. Determination of viscosity of Newtonian and Non-Newtonian fluids
6. Study of effect of temperature on viscosity of Newtonian and Non-Newtonian fluids
7. To Study evaporation process and calculate the evaporation rate
8. To estimate Freezing time of water and juice.

Reference Books:

1. P. Fellows, 2009, Food processing technology, Woodhead publication, 3rd edition
2. D.G. Rao, 2010, Fundamentals of food engineering, PHI learning private ltd.
3. R.P. Singh and D.R. Heldman, 1993, Introduction to food engineering, 2nd edition, Academic press.
4. T. Romeo Toledo, 1999, Fundamentals of Food Process Engineering, Aspen Publishers.

Continuous Evaluation table

Viva- I	**30%**
Viva- II	**30%**
Practical Record	**20%**
Class Performance	**10%**
Attendance	**10%**

Assessment Tools:
Practical Record
Viva I & II
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-651.1	1	1	-	-	1	2	2	3	-	2	-
BFST-DS-651.2	3	3	2	2	2	3	3	3	-	3	2
BFST-DS-651.3	2	2	1	-	-	1	2	3	2	3	1
BFST-DS-651.4	3	2	1	-	-	1	1	3	2	3	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BND-DS-652 Research Project

Periods/week	Credits	Max. Marks: 400
P: 12	6	Continuous Evaluation: 200
Duration of Examination: 3 Hours		End Semester Examination: 200

Course type: Compulsory Course
Course Objectives: The students will be able:
BND-DS-652.1: To describe current issues, problems and challenging concepts in the field of Food Science and Technology.
BND-DS-652.2: To study, analyze and condense the current literature.
BND-DS-652.3: To present the research project.
BND-DS-652.4 To create new concepts/techniques for food industries.

Contents:
1. The project will be carried out by students in groups.
2. Any topic of interest may be chosen by the student in consultation with teaching faculty to include current issues, pertinent problems, and changing trends in the areas of food science.
3. Collection of Review of Literature and planning of Methodology.
4. Collection of Data and result analysis
5. Report Writing
6. Internal presentations for Continuous Evaluation
7. The project will be evaluated by an external examiner.

Format to be used for preparation of bachelor's research project report

ARRANGEMENT OFCONTENTS:
The sequence in which the thesis material should be arranged and bound should be as follows:

a. Cover page
   Inner cover page
b. Certificate of the supervisor
c. Acknowledgement
d. Abstract
e. Table of contents
f. List of tables
g. List of figures/graphs
h. List of photographs
i. List of abbreviations
j. Body of the thesis (Introduction, Review of Literature, Material and Methods, Results and Discussions, Summary and Conclusion)
k. References
l. Appendices

PAGE DIMENSION, TYPING AND BINDINGSPECIFICATIONS

a. A4 size paper should be used.
b. The Thesis should be soft bound with cover page printed on it in the specified format.
c. Photographs, if necessary, should be suitably mounted on the same quality paper as the thesis.
d. References should be given in a style in the text consistent with a Harvard style.
e. The typing of cover page, title page, declaration of candidate, certificate of supervisor and names of chapters should be only on one side of the paper whereas the other printing should be on both sides of the paper.
f. The chapter numbers should be indicated in Roman.
g. Three copies of the thesis in binding must be submitted. In case of candidate being supervised by more than one supervisor, appropriate number of additional copies must be submitted.
h. The cover should have the material indicated in the item 'b' above printed on it and should be written with black ink.
i. The general text shall be typed in the font style 'Times New Roman' and Font size 12. Use 1.5 spacing between the regular text and quotations.
j. FONT

REGULAR TEXT – Times Roman 12 pts. Normal print
CHAPTER HEADING- Times Roman 15 pts., bold print and all capitals
SECTION HEADINGS- Times Roman 12 pts., bold print and all capitals
SUBSECTION HEADINGS – Times Roman 12 pts., bold print and leading capitals i.e. only first letter in each word should be in capital. 1.5 line spacing should be used for typing the general text.

Continuous Evaluation table

Research proposal development	20%
Internal seminar/PPT	30%
Evaluation by supervisor	30%
Attendance	20%

Assessment Tools:
Oral presentation
Project submission

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BND-DS-652.1	3	3	2	-	3	-	3	2	3	2	3
BND-DS-652.2	3	2	2	-	3	-	3	2	3	2	3
BND-DS-652.3	3	2	2	-	3	-	2	2	3	2	3
BND-DS-652.4	3	1	1	-	3	-	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-603 Nutraceuticals & Functional Foods (Theory)

Periods/week	Credits	Max. Marks: 200
L: 2 T: 0 P: 0	2	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Skill Enhancement Course Theory

Course Outcomes
After completion of the course, students will be able:

BFST-DS-603.1: To describe the importance of nutraceutical and functional food components.
BFST-DS-603.2: To state the mechanism of action of nutraceutical components
BFST-DS-603.3: To differentiate between probiotics and prebiotics
BFST-DS-603.4: To relate the nutraceutical properties of food with various degenerative diseases.

Part-A

Unit 1 Basics of nutraceuticals and functional foods
1.1 Definition, importance and difference
1.2 Functional foods in traditional health science
1.3 Nutraceutical compounds and their classification based on chemical and biochemical nature
1.4 Recent developments in the areas of nutraceuticals and functional foods and their role in health care and Ayuceuticals

Unit 2 Nutraceuticals: Prebiotics, probiotics and synbiotic
2.1 Probiotic: Health Effects of Probiotic Microorganisms, Probiotics in Various Foods
2.2 Prebiotics and Synbiotics: Non Digestible Carbohydrates/ Oligosaccharides, Dietary Fiber, Resistant Starch
2.3 Safety issues of probiotics/prebiotics
2.4 Nutraceuticals for specific situations: Cancer, heart disease, stress, osteoarthritis, hypertension

PART B

Unit 3 Functional Foods: Types and health benefits
3.1 Cereal and cereal products, Milk and milk products, egg, sea foods, nuts and oilseeds, herbs and spices, beverages, honey (split them)

Unit 4 Functional foods: Stability and safety issues
4.1 Stability and bio-availability of functional foods
4.2 Effects of processing and shelf stability of Functional foods
4.3 Safety, regulatory issues and labelling requirements of functional foods and nutraceuticals.

Reference Books:
1. G. Mazza, 1998, Functional foods - Biochemical and processing aspects, Technomic Publ. Lancaster, USA.

2. R.E.C. Wildman, 2019, Handbook of Nutraceutical and Functional Foods, 3rd Ed. CRC Press.
3. D. Ghosh, S. Bagchi, D.R.B. Smarta, 2012, Innovations in Healthy and Functional Foods Ed. CRC Press.
4. Y.V. Pathak, 2017, Handbook of Nutraceuticals, 1st Edition, Volume 2, CRC Press.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-603.1	3	2	3	3	2	3	3	3	2	3	3
BFST-DS-603.2	3	3	3	2	3	3	3	3	2	3	3
BFST-DS-603.3	3	3	2	3	3	3	3	3	3	3	3
BFST-DS-603.4	3	3	3	3	2	2	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

BFST-DS-604 Food Biotechnology (Theory)

Periods/week	Credits	Max. Marks: 200
L: 2 T: 0 P: 0	2	Continuous Evaluation: 100
Duration of Examination: 3 Hours		End Semester Examination: 100

Course Type: Elective Course (Theory)

Course Outcomes: The Students will be able:
BFST-DS-604.1 To define different uses of food biotechnological processes
BFST-DS-604.2 To describe the applications and implications of genomics and genetic modification on foods
BFST-DS-604.3 To associate ways and means of natural control of micro-organisms
BFST-DS-604.4 To illustrate the importance, uses and ways of production of biotechnology based products

PART – A

Unit 1: Introduction to Food Biotechnology

1.1 Biotechnology application to food stuffs, Landmarks in biotechnology, Advantages of using microorganisms
1.2 Genetic engineering and recombinant DNA technology, Structure of DNA and RNA, Control of gene expression and gene complexity in prokaryotes and eukaryotes

Unit 2: Molecular Methods & Production

2.1 Methods and application of molecular cloning in foods, Tools in genetic engineering, Enzymes,
2.2 Cloning vectors, gene cloning and strategies, Recombinant DNA techniques, Developmental technique for new plant varieties
2.3 Transgenic plants- current status, methods, prospects, risks and regulation. Transgenic Animals- methods and applications, ethical issues

PART – B

Unit 3: Natural Control of Microorganisms

3.1 Bacteriocins of lactic acid bacteria, applications of bacteriocins in food systems. Aflatoxins– production, control and reduction using molecular strategies.
3.2 Protein engineering in food technology– methods, objectives, limitations and applications of protein engineering (gluco-isomerase, lactobacillus β-galactosidase and peptide antibiotic nisin)

Unit 4: Food Fermentation

4.1 Definition, types of fermentation
4.2 Bioreactors: design & utilization of by-products produced (bio-ethanol/lactic acid/acetic acid, etc)
4.3 Upstream & downstream processing

Text Books/Reference Books:

1. I. Goldberg. & R. Williams, 1991, Biotechnology and Food Ingredients: Van Nostrand Reinhold, New York.
2. V.K. Joshi & A. Pandey, 1999, Biotechnology- Food fermentation (Vol 1&2): Educational publishers and Distributors.
3. B.H. Lee, 1996, Fundamentals of Food Biotechnology: VCH Publishers.
4. A. Schwartzberg & Rao, 1990, Biotechnology & Food Process Engineering: Marcel Dekker, INC, New York.
5. M.P. Tombs, 1991, Biotechnology in Food Industry: Open University Press, Milton Keynes.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Continuous evaluation table

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
BFST-DS-604.1	2	1	1	1	2	2	2	2	3	3	2
BFST-DS-604.2	2	1	1	2	2	2	2	2	3	3	3
BFST-DS-604.3	3	1	3	2	2	3	2	2	2	2	3
BFST-DS-604.4	3	2	3	2	3	3	2	2	3	3	3

Appendix A

Courses focusing on Global, National and Regional Development

Course Code	Course Name	Global	National	Regional
BFST-101	Communication Skills	✔	✔	✔
BFST-DS-101	Mathematics	✔	✔	✔
BFST-DS-102	Life Sciences	✔	✔	✔
BFST-DS-103	Principles of Food Science & Technology		✔	✔
BFST-DS-153	Principles of Food Science & Technology (Practical)		✔	✔
BFST-DS-104	Principles of Food processing & Preservation		✔	✔
BFST-DS-154	Principles of Food processing & Preservation (Practical)		✔	✔
BFST-201	ManavRachna Life Skills-I			✔
CH-202B	Environmental Science	✔	✔	✔
BFST-DS-201	Technology of Cereals, Pulses and Oilseeds		✔	✔
BFST-DS-251	Technology of Cereals, Pulses and Oilseeds (Practical)		✔	✔
BFST-DS-202	Technology of Milk and milk products		✔	✔
BFST-DS-252	Technology of Milk and milk products (Practical)		✔	✔
BFST-DS-203	Food and Nutrition	✔	✔	✔
BFST-DS-253	Food and Nutrition (Practical)	✔	✔	✔
BFST-DS-204	Food Laws & Regulations		✔	✔
BFST-DS-205	Enzymes in Food Processing		✔	✔
BFST-DS-301	Technology of Fruits & Vegetables	✔	✔	
BFST-DS-351	Technology of Fruits & Vegetables (Practical)	✔	✔	
BFST-DS-302	Food Microbiology and Food Safety		✔	✔
BFST-DS-352	Food Microbiology and Food Safety (Practical)		✔	✔

BFST-DS-303	Food Chemistry-I		✔	✔
BFST-DS-353	Food Chemistry-I (Practical)		✔	✔
RIC -300	Research and Innovation Catalyst-I	✔	✔	✔
BFST-DS-354	Bakery & Confectionary Technology (Practical)	✔	✔	✔
BFST-DS-355	Food Product Development (Practical)	✔	✔	✔
BFST-DS-501	Instrumentation & Analytical Techniques		✔	✔
BFST-DS-551	Instrumentation & Analytical Techniques (Practical)		✔	✔
BFST-DS-502	Technology of Meat, Seafood, Poultry and Honey	✔	✔	✔
BFST-DS-552	Technology of Meat, Seafood, Poultry and Honey (Practical)	✔	✔	✔
BFST-DS-553	Industrial Training	✔	✔	✔
RIC -500	Research and Innovation Catalyst-III	✔	✔	✔
BFST-DS-504	Emerging Food Processing Technologies	✔	✔	
BFST-DS-505	Food Plant Equipment & Process Design	✔	✔	
BFST-601	Manav Rachna Life Skills-III	✔	✔	✔
BFST-DS-601	Fundamentals of Food Engineering		✔	✔
BFST-DS-651	Fundamentals of Food Engineering (Practical)		✔	✔
BFST-DS-652	Research Project	✔	✔	✔

Appendix B

Courses focusing on Professional ethics, Environment and sustainability, Gender Equality and Human values

Course Code	Course	Professional Ethics	Environment & Sustainability	Gender Equality	Human Values
CH-202B	Environmental Studies		✔		
BFST-DS-204	Food laws & regulation	✔			
BFST-DS-351	Technology of fruits and vegetables (Practical)		✔		
BFST-201/401/601	Manav Rachna Lifeskills-I/II/III		✔		

Appendix C

Courses focusing on Entrepreneurship, Employability and Skill development

Course Code	Courses	Entrepreneurship	Employability	Skill Development
BFST-101	Communication skills			✔
BFST-DS-153	Principles of Food Science and Technology (Practical)			✔
BFST-DS-154	Principles of Food Processing & Preservation (Practical)			✔
BFST-DS-201	Technology of cereals, pulses & oilseeds			✔
BFST-DS-202	Technology of milk & milk products			✔
BFST-DS-204	Food laws & regulation		✔	
BFST-DS-351	Technology of fruits and vegetables (Practical)			✔
RIC-300	Research & Innovation Catalyst-I	✔	✔	
BFST-DS-354	Bakery & Confectionary technology (Practical)	✔		✔
BFST-DS-355	Food Product Development (Practical)	✔	✔	✔

BFST-402	Biostatistics & Research Methodology	✔	✔	
BFST-DS-401	Food Chemistry-II (Practical)			✔
BFST-DS-452	Food Packaging Technology (Practical)		✔	✔
BFST-DS-453	Food Quality Evaluation & Management (Practical)			✔
BFST-DS-551	Instrumentation & Analytical Techniques (Practical)			✔
BFST-DS-553	Industrial training		✔	✔
BFST-DS-504	Emerging Food Processing Technologies		✔	
BFST-DS-651	Fundamentals of Food Engineering (Practical)			✔
BFST-DS-652	Research Project			✔