VISION AND MISSION STATEMENTS

Vision Statement: To create an atmosphere for quality education, research and entrepreneurship in the field of food processing.

Mission Statements:

MS1: To mainstream department of food technology into the Food Processing sector.

MS2: To produce professionally competent, proficient and highly skilled professionals in the field of food technology capable of working as food technologists, research scientists, quality controllers and entrepreneurs.

MS3: To create an environment capable of conducting internationally acclaimed research with a global reputation for excellence.

MS4: To emphasize upon a transformed partnership based on symbiosis between industry and academia is vital for both ends.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

After completion of the B. Tech (Food Technology), the undergraduates will be able to:

PEO1: Apply knowledge in solving industry-relevant programs.

PEO2: Carry out quality research in different facets of the program including higher education.

PEO3: Foster abilities to design and fabricate new products or techniques, benefiting the society at large.

PEO4: Combine practical knowledge and abilities with research ability for a better output.

PEO5: Inculcate entrepreneurial skills in aspiring Food Technology professionals

PEO6: Develop leadership skills to be applied in R&D, production and other facets of the profession.

Mapping Program Educational Objectives (PEOs) with Mission Statements (MS)

	MS-1	MS-2	MS-3	MS-4
PEO-1	3	3	3	3
PEO-2	3	3	3	3
PEO-3	3	3	3	3
PEO-4	3	3	3	3
PEO-5	3	3	3	3
PEO-6	3	3	3	3

Level of Mapping: '3' is for 'high-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low-level' mapping.

PROGRAMME SPECIFIC OUTCOME (PSO)

After completion of the B. Tech (Food Technology), the under graduates will be able to:

PSO1: The student will be able to apply knowledge of food technology with a sound comprehension of food sciences and allied disciplines which enable them to understand the emerging techniques and advanced food engineering concepts

PSO2: An ability to acquire proficiency in solving engineering problems related to modern food sector/industry, Food spoilage and adulteration along with focus on the importance of food safety and hygiene of nutritious processed food.

PSO3: An ability to work in the domain of Food processing, quality assurance and quality control in private or government organisations and research laboratories to design or process food products as per the needs and specifications, or can also emerge as an entrepreneur.

PROGRAM OUTCOMES (POs)

After going through the four years Bachelor Program in Food Technology, under graduates will exhibit the ability to:

PO1: Practical Knowledge: Use knowledge of the fundamental elements in sync with updated technologies, tailored food technological application and regulatory requirements pertaining to the development of innovative food products.

PO2: Research and development: Apply skills to generate novel food products and relevant products. Utilize software tools and computer bases programing for research oriented developments.

PO3: Problem investigation: Encourage the problem solving skills observed through practical developments along with meeting the set regulations by applying the concept of critical thinking and in-depth analysis.

PO4: Modern tool usage: Use latest product optimization tools along with statistical analysis during the novel product development.

PO5: Communication: Develop valued credentials, reports and effective presentation. Improve communication skills and the ability to successfully carry out responsibilities related to the development of knowledge in accordance with the demands of the academia and industry.

PO6: Professional identity: Create a profession that is dedicated to providing quality services that exceed the stakeholder's expectations like customers, industries, academia, regulatory bodies and to give direction and contribute to the improvement of services and technologies.

PO7: Leadership skills: Organize and execute the objectives related to research and development within a set timeline. Nurturing the skills from the beginning to manage and utilize the available resources judiciously.

PO8: Planning abilities: Implement the knowledge and **s**kills for proper planning and running different steps which are involved in the time bound deliverables like R&D, production, regulatory submissions and product life cycle management.

PO9: Ethics: Show a high level of morality, honesty and integrity. Implement ethical principles when drawing conclusions and accept responsibility for the consequences if any.

PO10: Environmental sustainability: Uutilise expertise to resolve environmental pollution, harmful industrial waste, along with wastage and also improve manufacturing processes while maintaining the sustainability practices.

PO11: Life-long learning: Engage in self-governing and ongoing learning in response to evolving needs and scientific advances. Using input from other professionals and identifying learning needs for life-long learning improvement. Recognize the importance of conferences, seminars, and workshops in the advancement of knowledge.

Mapping of Program Outcomes (POs) and Program Specific Outcomes (PSOs) with Program Educational Objectives (PEOs)

	PEO-1	**PEO-2**	**PEO-3**	**PEO-4**	**PEO-5**	**PEO-6**
PO-1	3	3	3	3	3	3
PO-2	3	3	3	3	3	3
PO-3	3	3	3	3	3	3
PO-4	3	3	3	3	3	3
PO-5	3	3	3	3	3	3
PO-6	3	3	3	3	3	3
PO-7	3	3	3	3	3	3
PO-8	3	3	3	3	3	3
PO-9	3	3	3	3	3	3
PO-10	3	3	3	3	3	3
PO-11	3	3	3	3	3	3
PSO-1	3	3	3	3	3	3
PSO-2	3	3	3	3	3	3
PSO-3	3	3	3	3	3	3

Level of Mapping: '3' is for 'high-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low-level' map

B. TECH. PROGRAMME IN FOOD TECHNOLOGY

BYE-LAWS

1. OBJECTIVE

To prepare highly skilled professionals with a strong conceptual and theoretical background in the field of Food Technology, especially in the emerging areas of packaged food.

a.	Name of the Programme	BACHELOR OF TECHNOLOGY (FOOD
b.	Nature	Regular and Full Time
c.	Duration	Four Years (8 Semesters)
d.	Total number of credits	180
e.	Medium of Instruction and English Examinations	English
f.	Eligibility criteria	A candidate seeking admission to this program must have passed Senior Secondary (12^{th}/ Intermediate) examination with Mathematics/ Biology from CBSE or any other Board recognized by Jamia Hamdard as equivalent thereto, securing at least
g.	Selection procedure	Selection will be based on merit of JEE/NEET score. *In case the seats remain unfilled, Jamia Hamdard may admit candidates on the basis of merit of qualifying examination or the merit of internal test and/ or interview conducted by Jamia Hamdard which*
h.	Total Seats	30; inclusive of seats reserved for NRI/ sponsored candidates; additional seats are available for Foreign Nationals.
i.	Period of Completion	Not more than 07 years (14 Semesters)
j.	Commencement of the Programme	July of the every academic session.

3. Course Structure:

1. A minimum of two credits and maximum of 4 credits (with one credit for Tutorial) shall be assigned for each theory paper and 2 credits for the lab work (practical). The lab work may also include a report or industrial visit.
2. One of the papers of at least 3 credits in semester V, VI and VII will be discipline centric elective course offered in the main subject of study, and a student shall have a choice of two papers each to choose from.
3. One of the papers of at least 3 credits in semester V, VI and VII will be Generic elective course which could be chosen from any discipline or subject.
4. One theory credit will be counted as 50-60 min of teaching per week, and two practical contact hours will be counted as 1 credit per week.
5. The students will be sent for Compulsory Industry visits in Fourth, Fifth Semester.
6. After Sixth Semester, the students shall undergo summer internship of 4-6 weeks. The students will submit their reports to the department forwarded by Supervisor and Head of the Department and shall give a presentation in 7^{th} Sem.
7. The students have to do a minor project/status paper during their Seventh Sem. The students shall select any topic of their interest and they shall submit a report/status/review to the department and guide and give a presentation the topic at the end of Sem.
8. There shall be a project/thesis work in the eighth semester instead of the theory papers. The credit to this course (thesis) should not exceed the maximum limits set for the number of credits in a semester. The thesis work shall include the experimental work on a specified topic and submission of the thesis towards the end of the Semester VIII. The project work/thesis shall be evaluated as per the guidelines proposed by the Board of Studies and specified into the syllabus. For the project work/thesis, the Head of the Department/Program Coordinator shall convene a meeting of all teachers of the Department and assign appropriate number of students to each teacher to act as supervisor for the project work. The student in consultation with the supervisor shall select a topic for the project work under the intimation to the Head of the Department/Program Coordinator in writing. The project/thesis work may be carried out in an institute/industry/university other than JH.

The evaluation of the dissertation, project presentation and viva voce will be conducted by external examiner. The project shall comprise of the two components namely **Internal** and **External**. Internal will be assigned 250 marks and will comprise of submission of a project report after completion of the project. External will be assigned 150 marks and will comprise of a presentation and viva voce on the topic of his/her project work carried out in department/industry/institute/research Centre.

The project report of the eighth semester shall comprise the following components:

- Each student will undertake a project work in the eighth semester under the supervision of either faculty member from Jamia Hamdard or an expert from industry/ institute research centre and under the overall supervision of Dean and Head of the faculty. After the completion of project each student has to submit a project report by the deadline fixed for the same purpose.
- Each student will deliver their research work in two phases; **Phase 1:** The presentation will be evaluated by the internal faculty members and in **Phase 2**: the same presentation will be evaluated by an external examiner on the date and time fixed for the purpose.
- The topic for the VIII Semester project dissertation will be finalized in the VII Semester in consultation with the faculty members of the department as well as experts from the industry / institute/ research centre. The students will be informed about the topics accordingly.

9. A student shall have to score minimum pass marks (40%) in aggregate in internal assessment and semester examination for each paper.

Mode of curriculum delivery includes classroom teaching, assignments, test, lab work, presentations, participation in relevant events and regularity.

4. THE GRADING SYSTEM

As per University Rule

5. CALCULATIONS OF SGPA AND CGPA OF A STUDENT IN A SEMESTER

As per University Rule

6. ADMISSION

A candidate, aspiring for admission to **B. Tech (FT) Programme**, shall have to apply in the prescribed application form that is complete in all respect, on or before the last date of submission.

NOTE:

a. Different procedure may be adapted for admission of Foreign/ NRI/ Industry sponsored candidates, who apply for admission in the prescribed form and fulfill the eligibility requirements.
b. The admission committee, duly constituted for purpose, would prepare a merit list on the basis of the selection criteria.
c. Admission committee shall display/ publish the list of candidates that are declared eligible for admission, after the due approval of the competent authority.
d. Eligible candidates shall have to complete the prescribed formalities, for completion of admission, within the stipulated period of time; otherwise they will forfeit the right to admission.

7. ATTENDANCE

a. All students are supposed to attend every lecture and practical classes. However, the attendance requirement for appearing in the examination shall be a minimum of 75% of the classes held.
b. Each one- period teaching shall account for one attendance unit.
c. The concerned teacher will take a roll call in every scheduled class, maintains and consolidate the attendance record, which would be submitted to the Head of the Department at the conclusion of the semester.
d. Attendance on account of participation (with prior submission from the head of the department) in the co-curricular/extra-curricular activities can be granted by the Dean on receipt of certificates or recommendations of the respective activity issued by the Head of the Department.
e. Attendance records displayed on notice board from time to time, in respect of short attendance, shall be deemed to be a proper notification and no individual notice shall be sent to the students/local guardian.
f. In case a student is found to be continuously absent from the classes without prior information for a period of 30 days, the concerned faculty shall report it to the Head of the department.
g. Head of the department may recommend for striking off the name of the student from rolls, after ensuring **"one month continuous absence"** from all the concerned teachers.
h. A student, whose name has been struck off on account of long absence, may apply to the Dean for readmission within 15 days of the notice of striking off the name. The readmission shall be effected on payments of prescribed readmission fees.
i. A student with less than 75 % attendance, in aggregate shall not be allowed to appear in the semester examination. The Head of the department shall recommend all such cases to the Dean of the faculty.

j. The Dean, on recommendation of the Head of the department, may consider the relaxation of attendance up to 10 % on account of sickness and/or any other valid reason. No application for relaxation of attendance (duly certified by a Registered medical practitioner/Public hospital or a concerned authority) will be entertained after 15 days from the recovery of illness etc.

k. A student detained on account of short attendance will start afresh in the same class in the next academic year on payment of current fees except enrollment fee, identity card fee and security deposits etc.

8. INTERNAL ASSESSMENT

a. Internal assessment, to be made by concerned teachers, will be based on minor test, quizzes, presentation, programming test, demonstrations and assignments.

b. Maximum of three minor tests, with a total of 25 marks, for each theory paper shall be mandatory. Other modes of assessment shall account for remaining 5 marks. Whereas, for lab course internal assessment will be of 50 marks each.

c. A minor test shall be scheduled after the completion of first and second term.

d. Dates of minor test will be announced at the beginning of the semester, by the examination coordinator.

e. The concerned teachers shall submit the compiled internal assessment marks to the Head of the department, on the conclusion of teaching of the current semester.

f. The Head shall display a copy of the compiled sheet, of internal assessment marks of all the papers, before forwarding it to the Controller of Examination, i.e. at the conclusion of the semester.

g. A promoted candidate, who has to reappear in the examination of the paper, will retain internal assessment marks.

h. In the case of re-admission, the candidates shall have to go through the internal assessment afresh and shall retain nothing of the previous year.

9. SEMESTER EXAMINATIONS

Prescriptions for conducting semester examinations of theory and lab papers, those shall be conducted after the inclusion of each of the semesters, are presented in the following table:

a.	Mode	(Theory papers)	Written only
		(Lab papers)	Written, Demo, Programming and viva-voce
b.	Duration	(Theory papers)	03 hours
c.	Total Marks	(Theory papers)	75 (Seventy five only)
		(Lab papers)	75 (Seventy five only)

10. MAJOR PROJECT

a. Each student of the final semester (VIII SEM) will have to carry out a project under the guidance of one or two faculty members.

b. There shall be a mid-term evaluation of the progress under the internal supervisors.

c. All the candidates shall submit Three (03) hard copies of the project report that are duly approved and signed by internal as well as external (if applicable) supervisors.

d. An external examiner, appointed for the purpose, shall evaluate the project report.

e. Head of the department shall forward the compiled total marks (awarded in internal assessment, project report and viva-voce examination), in the project-semester of each of the candidate, to the concerned Dean/Controller of Examination.

11. EXAMINATION

a. The performance of a student in a semester shall be evaluated through continuous class assessment and end-semester examination. The continuous assessment shall be based on class tests, assignments/tutorials, quizzes/viva-voce and attendance. The end-semester examination shall be comprised of written papers, practical and viva-voce, inspection of certified course work in classes and laboratories, project work, design reports or by means of any combination of these methods.
b. The marks obtained in a subject shall consist of marks allotted in end-semester theory paper, practical examination and Sessional work.
c. The minimum pass marks in each subject including sessional marks (Theory, practical or project etc.) shall be 40%.

12. PROMOTION SCHEME

In order to pass a paper, a student has to secure at least grade D in that paper.

a. A student will be promoted from first semester to second semester/second semester to third semester/third semester to fourth semester/ forth semester to fifth semester/ fifth semester to sixth semester/sixth semester to seventh semester/seventh semester to eight semester provided 40% of the subjects are cleared by the student. A student who fails to satisfy the criteria mentioned for the promotion shall be **detained** in the same year.
b. A **detained** student is not allowed to reappear in the minor tests. His/Her old internal assessment marks will remain same. However, he/she will be required to re-appear in the semester examination for those papers in which he/she had failed, when these papers are offered again (Examination for odd semester paper will be held in Odd semester, and for even semester papers will be held in even semester).
c. **Supplementary examination:** For the final year students, students can appear in supplementary examinations in their all backlog papers after the declaration of their final semester results only.

13. CLASSIFICATION OF SUCCESSFUL CANDIDATES

The result of successful candidates, who fulfill the criteria for the award of **B. Tech Food Technology**, shall be classified at the end of last semester, on the basis of his/her final CGPA (to be calculated as per university rules).

CURRICULUM OF B. TECH. PROGRAMME IN FOOD TECHNOLOGY DEPARTMENT OF FOOD TECHNOLOGY JAMIA HAMDARD

COURSE OF STUDY

L-T-P stands for number of contact hours as Lecture-Tutorial-Practical in a week.

B. TECH. FIRST SEMESTER (July- December)

S. No.	Paper Code	Subject Categor	Paper Title	Marks	L	T	P	Credits
			Orientation Programme					
1.	BFTC-101	Core	Applied Physics	100	3	1	0	4
2.	BFTC-102	Core	Mathematics – I	100	2	1	0	3
3.	BFTC-103	Core	Introductory Biology	100	2	1	0	3
4.	BFTC-104	Core	Engineering Graphics & Design	100	1	0	0	1
5.	BFTC-105	Core	Applied Physics Lab	100	0	0	4	2
6.	BFTC-106	Core	Engineering Graphics & Design Lab	100	0	0	4	2
7.	BFTC-107	Compulsory	Essence of Indian Traditional knowledge	100	2	0	0	1
8.	Total			700	10	3	8	16

B. TECH. SECOND SEMESTER (Jan- May)

S. No.	Paper Code	Subject Catego	Paper Title	Marks	L	T	P	Credits
1.	BFTC-201	Core	Mathematics - II	100	2	1		3
2.	BFTC-202	Core	Introduction to Food	100	2	1		3
3.	BFTC-203	Core	Programming for Problem Solving	100	2	1		3
4.	BFTC-204	Core	Workshop /Manufacturing	100	1	0		1
5.	BFTC-205	Core	Communication skills	100	2			2
6.	BFTC-206	Core	Basic Engineering Mechanics	100	2	1	0	3
7.	BFTC-207	Core	Programming for Problem Solving Lab	100	0		4	2

8.	BFTC-208	Core	Workshop /Manufacturing	100	0	0	4	2
9.	BFTC-209	Core	Communication skills Lab	100			4	2
10.	BFTC-210	Core	Introduction to Food Technology Lab	100			4	2
11.	*ES-01	Compulsory	Environmental Studies	100	2			
12.	Total			1100	13	4	16	23

B. TECH. THIRD SEMESTER (July- December)

S. No.	Paper Code	Subject Categor	Paper Title	Marks	L	T	P	Credits
1.	BFTC-301	Core	Food Chemistry	100	3	1		4
2.	BFTC-302	Core	Food Microbiology	100	3	1		4
3.	BFTC-303	Core	Nutrition and Dietetics	100	2	1		3
4.	BFTC-304	Core	Thermodynamics	100	3	1		4
5.	BFTC-305	Core	Cereal, Pulses & Oilseed Technology	100	3	1		4
6.	BFTC-306	Core	Food Chemistry Lab	100			4	2
7.	BFTC-307	Core	Food Microbiology Lab	100			4	2
8.	BFTC-308	Core	Cereal, Pulses & Oilseed Technology	100			4	2
	Total			800	15	4	12	25

B. TECH. FOURTH SEMESTER (Jan-May)

S. No.	Paper Code	Subject Category	Paper Title	Marks	L	T	P	Credits
1	BFTC-401	Core	Unit Operations in Food Processing	100	3	1		4
2	BFTC-402	Core	Functional Foods and Nutraceuticals	100	3	1		4
3.	BFTC-403	Core	Post harvest Technology of Fruit and Vegetables	100	3	1		4
4.	BFTC-404	Core	Food Engineering I	100	3	1		4
5.	BFTC-405	Core	Unit Operations Lab	100			4	2
6.	BFTC-406	Core	Fruits and Vegetables Lab	100			4	2
8.	BFTC-407	Compulsory	Industrial Visit-1	50				1
	Total			650	12	4	8	21

B. TECH. FIFTH SEMESTER (July- December)

S. No.	Paper Code	Subject Category	Paper Title	Marks	L	T	P	Credit
1	BFTC-501	Core	Dairy Technology	100	3	1		4
2	BFTC-502	Core	Food Engineering II	100	3	1		4
3.	BFTC-503	Core	Food Fermentation & Biotechnology	100	3	1		4
4.	BFTC-504	Core	Dairy Technology Lab	100			4	2
5.	BFTC-505	Core	Food Engineering II Lab	100			4	2
6.	BFTD-506	Discipline Specific Elective	Bakery & Confectionery Technology	100	3	1		4
7.	BFTD-507		Beverage Technology					
8.	BFTG-508	Generic Elective	Techniques in Food Analysis	100	3	1		4
9.	BFTG-509		Food Storage & Plant Layout					
11	BFTC-510	Compulsory	Industrial Visit-2	50				1
12	BFTC-511	Compulsory	Research Institute Tour-1	50				1
	Total			800	15	5	8	26

B. TECH. SIXTH SEMESTER (Jan-May)

S. No.	Paper Code	Subject	Paper Title	Marks	L	T	P	Credits
1	BFTC-601	Core	Meat, Fish & Poultry Technology	100	3			4
2	BFTC-602	Core	Engineering Properties of Food Materials	100	3			4
3.	BFTC-603	Core	Food Engineering III	100	3			4
4.	BFTC-604	Core	Meat Technology Lab	100				2
5.	BFTC-605	Core	Engineering Properties of Food Materials Lab	100				2
6.	BFTC-606	Core	Food Engineering III Lab	100				2
7.	BFTD-607	Discipline Specific Elective	Food Product Development	100	3			4
8.	BFTD-608		Engineered, Textured and Fabricated Foods					
9.	BFTG-609	Generic Elective	Non-Thermal Food Processing	100	3			4
10	BFTG-610		Food Business Management					
11		Compulsory	Summer Training					
	Total			800	15	5	18	26

B. TECH. SEVENTH SEMESTER (July- December)

S. No.	Paper Code	Subject	Paper Title	Marks	L	T	P	Credits
1	BFTC-701	Core	Food Packaging Technology	100	3	1		4
2.	BFTC-702	Core	Research Methodology	100	3	1		4
3.	BFTC-703	Core	Food Safety & Quality Management	100	3	1		4
4.	BFTC-704	Core	Food Packaging Lab	100			4	2
5.	BFTC-705	Core	Food Safety Lab	100			4	2
6.	BFTD-706	Discipline Specific Elective	Food Process & Equipment Design	100	3	1		4
7.	BFTD-707		IPR in Food Technology					
8.	BFTG-708	Generic Elective	Technology of Effluent Treatment & Waste	100	3	1		4
9	BFTG-709		Food Additives					
10	BFTC-710		Minor Project/Status/Review	100				1
11	BFTC-711	Compulsory	Summer Training	100	-			1
	Total			900	15	3	8	26

B. TECH. EIGHTH SEMESTER (Jan-May)

S. No.	Paper Code	Paper Title	Marks	L	T	P	Credits
1	BFTC-801	Internal External	250 150		2	30	17
	Total		400		2	20	17

Total Credits: 16+23+25+21+26+26+26+17 = 180

Total Marks: 700+1100+800+650+800+800+900+400 = 6150

DETAILED SYLLABUS OF BTECH (FOOD TECHNOLOGY)

FIRST YEAR

CORE PAPER **SEMESTER I**

Paper Title: Applied Physics Paper Code: BFTC-101

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Able to understand the basic principles of Quantum mechanics and to apply these to the complex phenomenon of matter radiation interactions

CO2. Able to understand the principle behind the working of Lasers

CO3. Able to apply the knowledge of semiconductor fundamentals to study various electronic devices.

CO4. Able to understand the semiconducting materials by using the concepts of band theory of solids.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	3	1	1	1	1	1	1	2	3	2	2	2
CO2	1	2	3	1	1	1	1	1	1	2	3	2	2	2
CO3	3	2	3	1	1	2	1	1	1	2	3	2	2	2
CO4	3	2	3	1	1	2	1	1	1	2	3	2	2	2

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT - I

Energy bands in solids, Fermi level and Fermi distribution function, Intrinsic and extrinsic semiconductors, P-N junction, Forward and reverse bias, V-I characteristics, Mobility of electrons and holes, Drift velocity, Electrical conductivity, resistivity, Zener diode.

UNIT - II

Einstein's theory of matter radiation interaction and A and B coefficients, amplification of light by population inversion, different types of lasers: He-Ne, Ruby, Properties of laser beams: monochromaticity, coherence, directionality and brightness, applications of

lasers in science, engineering and medicine.

UNIT - III

Numerical aperture, step index and graded index fibers, attenuation and dispersion mechanism in optical fibers (Qualitative only), applications of optical fibers, optical communication (Block diagram only).

UNIT - IV

Huygens' Principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting, Young's double slit experiment, Newton's rings, Fraunhoffer diffraction from a single slit and N slit, Diffraction gratings, dispersive and resolving power of grating.

UNIT - V

Introduction, Variation of resistivity with temperature, Difference between a metal and a superconductor, Meissner effect, Type I and Type II superconductors, Examples of superconductors, BCS Theory (Qualitative only), London's equations, applications of superconductors.

BOOKS RECOMMENDED:

- B.G. Streetman, "Solid State Electronic Devices", Prentice Hall of India, 1995.
- D.A. Neamen, "Semiconductor Physics and Devices," Times Mirror High Education Group, Chicago, 1997.
- O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.
- Ghatak, "Optics", McGraw Hill Education, 2012.
- D. Neamen, D. Biswas, "Semiconductor Physics and Devices," McGraw Hill Education

CORE PAPER **SEMESTER I**

Paper Title: Mathematics - I

Paper Code: BFTC-102

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Apply the knowledge of matrices to solve the problems.

CO2. Know and to understand various types of numerical methods.

CO3. Ability to interpret the mathematical results in physical or practical terms for complex numbers

CO4. Inculcate the Habit of Mathematical Thinking through Indeterminate forms and Taylor series expansion

CO5. Solve and analyse the Partial derivatives and its application in related field of engineering

CO6. Evaluate the improper integral using beta and gamma functions.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	3	1	1	1	2	1	1	2	2	2	2	2
CO2	2	1	3	1	1	1	2	1	1	2	2	2	2	2
CO3	2	1	3	1	1	1	2	1	1	2	2	2	2	2
CO4	1	1	3	1	1	1	2	1	1	2	2	2	2	2
CO5	3	1	3	1	1	1	2	1	1	2	2	2	2	2
CO6	2	1	3	1	1	1	2	1	1	2	2	2	2	2

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT-I

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

UNIT-II

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima.

UNIT-III

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

UNIT-IV

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

UNIT V

Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Textbooks/References:

- G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
- Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
- Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
- Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint,

2010.
- D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
- N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
- B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

CORE PAPER **SEMESTER I**

Paper Title: Introductory Biology
Paper Code: BFTC-103

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

~~CO1. Solve and analyse the Partial derivatives and its application in related field of engineering.~~

CO1. Understand the basic structural and functional aspects of biological molecules namely proteins, carbohydrates, fats and nucleic acids (Cognitive level: Understand)

~~CO2. Describe how RNA, DNA and proteins are synthesized.~~

CO2. Comprehend and understand basics of molecular and cell biology and cell energetic s (Cognitive level: Understand and analyze)

~~CO3. Explain the structure and function of organ systems in the human body.~~

CO3. Understand key concepts of heredity and reproduction, mendelian genetics, and principles of inheritance and variation (cognitive level: understand)

~~CO4. Identify and describe the structural features of plants.~~

CO4. Understand functional aspects of physiological systems of human body (namely, endocrine, neural and immune systems) as well as ecology and conservation (Cognitive level: understand)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	1	2	1	2	1	1	1	3	3	3	3
CO2	1	1	1	1	2	1	2	1	1	1	3	3	3	3
CO3	1	1	1	1	2	1	2	1	1	1	3	3	3	3
CO4	1	1	1	1	2	1	2	1	1	1	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write ‘3’ in the box for ‘High-level’ mapping, ‘2’ for ‘Medium-level’ mapping, ‘1’ for ‘low-level’ mapping

Unit I Introduction to Macromolecules
Introduction to Biology; Macromolecules; Carbon chemistry; Proteins: Structure, folding, catalysis; Nucleic acids: storage and transfer of genetic information; Lipids: membranes, energy storage; Carbohydrates: energy storage, building blocks.

Unit II
Molecular genetics: Genes; Basics of DNA replication, transcription, translation, Mutations; Genetechnology.
Cell biology and energetic: Cell structure; Membranes; Function of cell organelles; Energetics; ATP and glycolysis; Respiration; Photosynthesis.

Unit III Reproduction, Heredity, Evolution
Reproduction and Heredity; Cell division: mitosis, meiosis, gamete formation, pollination; Mendelian genetics; Evolution; Gene variation (Hardy-Weinberg principle); Darwin's theory of evolution.

Unit IV Principles of Classification
Physiology aspects: Regulatory systems (nervous, endocrine, immune systems); Ecology; Populations and communities; Biosphere; Conservation

BOOKS RECOMMENDED:

1. W. K. Purves et al. Life, The Science of Biology, 7th Edition, W. H. Freeman and Co., 2003. http:// www.whfreeman.com/thelifewirebridge2/
2. Peter H. Raven et al., Biology, 6th Edition, McGraw Hill, 2007. http://www.ravenbiology.com
3. Basic Concepts in Biology by Starr 5th ed.
4. Essential Biology, 3rd edition, by Campbell, Reece, and Simon

CORE PAPER **SEMESTER I**

Paper Title: Engineering Graphics and Design
Paper Code: BFTC-104
Total Credits: 1, Total Lectures-45, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Sketch two-dimensional orthographic drawings and three-dimensional isometric views.

CO2. Create and modify two-dimensional orthographic drawings using AutoCAD software, complete with construction lines, dimensions, and layers, conforming to industry standards.

CO3. Create three-dimensional solid models using AutoCAD software, and generate paper space layouts from model space geometry.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	1	1	1	1	1	1	3	3	3	3
CO2	3	2	2	3	1	1	1	1	1	1	3	3	3	3
CO3	3	2	2	3	1	1	1	1	1	1	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT 1: Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

UNIT 2: Orthographic Projections covering, Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes; **Projections of Regular Solids** covering ,those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

UNIT 3 :Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT 4: Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions; **Overview of Computer Graphics** covering, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

UNIT 5: Customization& CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

Reference Books:

- Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar

Publishing House

- Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
- Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
- Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
- (Corresponding set of) CAD Software Theory and User Manuals

CORE PAPER **SEMESTER I**

Paper Title: Applied Physics Lab
Paper Code: BFTC-105

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Develop skills to impart practical knowledge in real time solution.

CO2. Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.

CO3. Design new instruments with practical knowledge.

CO4. Gain knowledge of new concept in the solution of practical oriented problems and to understand more deep knowledge about the solution to theoretical problems.

CO5. Understand measurement technology, usage of new instruments and real time applications in engineering studies.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	1	1	1	1	1	2	1	1	2
CO2	3	2	2	2	1	1	1	2	1	1	2	1	1	2
CO3	3	2	2	2	1	1	1	3	1	1	2	1	1	2
CO4	2	1	1	2	1	1	1	2	1	1	2	1	1	2
CO5	2	1	1	1	1	1	1	2	1	1	2	1	1	2

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

LIST OF PRACTICALS:

1. To plot a graph between the distance of the knife-edge from the center of the gravity and the time period of bar pendulum. From the graph, find

2. The acceleration due to gravity
3. The radius of gyration and the moment of inertia of the bar about an axis.
4. To determine the moment of inertia of a flywheel about its own axis of rotation.
5. To determine the value of acceleration due to gravity using koter‟s pendulum.
6. To determine the frequency of A.C. mains using sonometer and an electromagnet.
7. To determine the frequency of electrically maintained turning fork by Melde‟s method.
8. To determine the dispersive power of prism using spectrometer and mercury source.
9. To determine the wavelength of sodium light by Newton‟s Ring.
10. To determine the wavelength of sodium light using diffraction
11. To determine the refractive index of a prism using spectrometer.
12. To determine the specific rotation of cane sugar solution with the help of polarimeter.
13. To find the wavelength of He-Ne Laser using transmission diffraction grating.
14. To determine the numeral aperture (NA) of a Optical Fibre.
15. Compute simulation (simple application of Monte Carlo) e.g. Brownian motion, charging & discharging of capacitor.
16. Measurement of the diameter of a thin wire using the phenomenon of diffraction.
17. To measure the divergence of a laser beam
18. To measure the spring constant K of a spring by Static Method and Dynamic method

Note: Any 8-10 experiments out of the list may be chosen. Proper error – analysis must be carried out with all the experiments.

CORE PAPER **SEMESTER I**

Paper Title: Engineering Graphics & Design Lab Paper Code: BFTC-106

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

Laboratory based upon Engineering Graphics & Design **BFTC-104**

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Use the drawing instruments effectively and able to dimension the given figures.

CO2. Appreciate the usage of engineering curves in tracing the paths of simple machine components.

CO3. Understand the concept of projection and acquire visualization skills, projection of points.

CO4. Able to draw the basic views related to projections of Lines, Planes

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	2	1	1	1	1	1	1	3	1	1	2
CO2	2	1	3	2	1	1	1	1	1	1	3	1	1	2
CO3	2	1	3	2	1	1	1	1	1	1	3	1	1	2
CO4	2	1	3	2	1	1	1	1	1	1	3	1	1	2

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

COMPULSORY PAPER

SEMESTE R I

Paper Title: Essence of Indian Traditional Knowledge Paper Code: BFTC-107

Total Credits: 1, Total Contact Hours 45, Maximum Marks: 100 (Internal Assesment-25, Final Exam 75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Ability to understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.

CO2. Identify the issues and concern of modern India

CO3. Correlate social change to history of India

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	2	1	2	1	2	1	1	1	2	1	1	1
CO2	2	2	2	1	1	1	2	1	1	1	2	1	1	1
CO3	1	2	2	1	2	1	2	1	1	1	2	1	1	1

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT 1 Introduction to Elements of Indian History: What is history? ; History Sources-Archaeology, Numismatics, Epigraphy & Archival research; Methods used in History; History & historiography; Introduction to sociological concepts-structure, system, organization, social institutions, Culture social stratification (caste, class, gender,

power).State & civil society.

UNIT 2: Indian history & periodization; evolution of urbanization process: first, second &third phase of urbanization; Evolution of polity; early states to empires; Understanding social structures- feudalism debate; Understanding social structure and social processes: Perspectives of Marx, Weber & Durkheim;

UNIT 3 : From Feudalism to colonialism-the coming of British; Modernity & struggle for independence; Political economy of Indian society. Industrial, Urban, Agrarian and Tribal society; Caste, Class, Ethnicity and Gender; Ecology and Environment;

UNIT 4: Issues & concerns in post-colonial India (up to 1991); Issues & concerns in postcolonial India 2nd phase (LPG decade post 1991),

UNIT 5: Social change in contemporary India: Modernization and globalization, Secularism and communalism, Nature of development, Processes of social exclusion and inclusion, Changing nature of work and organization

Reference Books:

- Desai, A.R. (2005), Social Background of Indian Nationalism, Popular Prakashan
- Guha, Ramachandra (2007), India After Gandhi, Pan Macmillan
- Deshpande, Satish (2002), Contemporary India: A Sociological View, Viking
- Gadgil, Madhav & Ramachandra Guha(1993), This Fissured Land: An Ecological History of India, OU Press
- Giddens, A (2009), Sociology, Polity, 6th edn.
- Xaxa, V (2008), State, Society and Tribes Pearson
- Chandoke, Neera & Praveen Priyadarshi (2009), Contemporary India: Economy, Society and Politics, Pearson

CORE PAPER **SEMESTER II**

Paper Title: Mathematics II

Paper Code: BFTC-201

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Apply the knowledge of basic probabilities to solve the problems.

CO2. Know and to understand various types of probability distribution.

CO3. Ability to understand the basic statistics

CO4. Solve and analyse the statistical problems and its application in related field of engineering

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	1	1	2	1	1	3	1	1	2
CO2	2	1	2	1	1	1	1	1	1	1	3	1	1	2
CO3	2	1	2	1	1	1	1	1	1	1	3	1	1	2
CO4	3	2	3	2	1	1	2	2	1	1	3	2	2	2

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT 1: Basic Probability:

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

UNIT 2: Continuous Probability Distributions

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

UNIT 3: Bivariate Distributions

Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

UNIT 4: Basic Statistics

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation

UNIT 5: Applied Statistics

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Reference books:

- Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
- P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).

- S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
- W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
- N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
- B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

CORE PAPER **SEMESTER II**

Paper Title: Introduction to Food Technology

Paper Code: BFTC-202

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Understand the history and course of evolution of food processing (Cognitive level: understand)

CO2. Acquire knowledge of the structure, composition, nutritional quality and post-harvest changes in various plant and animal foods (cognitive level: understand).

~~CO3. Understand the structure and composition of various animal foods~~

CO3. Understand the concepts and mechanisms of various food processing technologies namely drying/dehydration, freezing, thermal and non-thermal techniques etc. (cognitive level: understand)

CO4. Know about the types of equipments used in food industry (freezers, driers, blanchers, pasteurizers) along with their advantages, limitations and applications (cognitive level: understand)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	1	2	1	2	1	1	1	3	3	3	3
CO2	1	1	1	1	2	1	2	1	1	1	3	3	3	3
CO3	1	1	1	1	2	1	2	1	1	1	3	3	3	3
CO4	1	1	1	1	2	1	2	1	1	1	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT I

Introduction - Historical development of food science and technology, Evolution of Food Processing from prehistoric times till date, Introduction to various branches of Food Science and Technology

UNIT II

Introduction to various food processing and preservation technologies

Freezing- Introduction to refrigeration and freezing, definition, principle of freezing, freezing curve, changes occurring during freezing, types of freezing i.e. slow freezing, quick freezing, introduction to thawing, changes during thawing and its effect on food.

UNIT III

Drying and Dehydration- Definition, drying as a means of preservation, differences between sun drying and dehydration (i.e. mechanical drying), factors affecting rate of drying, normal drying curve, names of types of driers used in the food industry.

UNIT IV

Food processing and preservation technologies - Food Irradiation- Introduction, kinds of ionizing radiations used in food irradiation, uses of radiation processing in food industry, concept of cold sterilization.

Thermal Processing- Concept of pasteurization, sterilization, commercial sterilization, blanching, and canning.

BOOKS RECOMMENDED:

1. Food Science and Technology, Geoffrey Campbell – Platt, Wiley-Blackwell, 1st Edition, 2009
2. Food Science, Norman N Potter, Joseph H Hotchkiss, Springer, 5th Edition, 1995
3. Introduction to Food Science and Technology, George F. Stewart, Maynard A. Amerine, Bernard S. Schweigert and John Hawthorn, Academic Press, 2nd Edition, 1982
4. Food Technology: An Introduction, Anita Tull, Oxford University Press, 1st Edition, 2002.
5. Koronye A. I. and Ngoddy P.O. (1985). Intergrated Food Science for the Tropics.Macmillan Education LTD., London and Oxford UK

CORE PAPER **SEMESTER II**

Paper Title: Programming for Problem Solving

Paper Code: BFTC-203

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Demonstrate the basic knowledge of computer hardware and software.

CO2. To formulate simple algorithms for arithmetic and logical problems.

CO3. To translate the algorithms to programs (in C language).

CO4. To test and execute the programs and correct syntax and logical errors.

CO5. Ability to apply solving and logical skills to programming in C language and also in other languages.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	3	1	1	2
CO2	3	2	3	2	1	1	1	2	1	1	3	1	1	2
CO3	2	2	2	2	1	1	1	2	1	1	3	1	1	2
CO4	3	2	3	2	1	1	1	2	1	1	3	1	1	2
CO5	3	2	3	2	1	1	1	2	1	1	3	1	1	2

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

Unit 1:

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.): Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/ Pseudo-code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

Unit 2:

Arithmetic expressions and precedence, Conditional Branching, Writing and evaluation of conditionals and consequent branching**,** Iteration and loops

Unit 3

Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required), Arrays: Arrays (1-D, 2-D), Character arrays and Strings

UNIT 4

Function: Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference, Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT 5

Structure: Structures, Defining structures and Array of Structures, Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation), File handling (only if time is available, otherwise should be done as part of the Laboratory)

Suggested Text Books

- Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

- E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
- Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

CORE PAPER **SEMESTER II**

Paper Title: Workshop/ Manufacturing Practices

Paper Code: BFTC-204

Total Credits: 1, Total Lectures-40, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Study and practice on machine tools and their operations

CO2. Practice on manufacturing of components using workshop trades including pluming, fitting, carpentry, foundry, house wiring and welding.

CO3. Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.

CO4. Apply basic electrical engineering knowledge for house wiring practice.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	1	1	1	1	3	1	1	2
CO2	2	2	2	2	1	1	1	1	1	1	3	1	1	2
CO3	2	2	2	2	1	1	1	1	1	1	3	1	1	2
CO4	3	2	3	2	1	1	1	3	1	1	3	1	1	2

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

Unit l

Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods

Unit 2

CNC machining, Additive manufacturing

Unit 3

Fitting operations & power tools , Electrical &Electronics

Unit 4

Carpentry, Plastic molding, glass cutting

Unit 5

Metal casting , Welding (arc welding & gas welding), brazing

CORE PAPER **SEMESTER II**

Paper Title: Communication Skills

Paper Code: BFTC-205

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Demonstrate critical and innovative thinking.

CO2. Display competence in oral, written, and visual communication.

CO3. Apply communication theories.

CO4. Show an understanding of opportunities in the field of communication.

CO5. Use current technology related to the communication field.

CO6. Respond effectively to cultural communication differences.

CO7. Communicate ethically.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1	3	2	2	1	1	1	3	1	1	2
CO2	1	1	1	1	3	2	3	1	1	1	3	1	1	2
CO3	2	1	2	1	3	2	2	1	1	1	3	1	1	2
CO4	1	1	2	1	3	2	2	1	1	1	3	1	1	2
CO5	2	1	2	2	3	2	2	1	1	1	3	1	1	2
CO6	2	1	2	1	3	2	3	1	1	1	3	1	1	2
CO7	1	1	2	1	3	2	3	1	3	1	3	1	1	2

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write ‘3’ in the box for ‘High-level’ mapping, ‘2’ for ‘Medium-level’ mapping, ‘1’ for ‘low-level’ mapping

UNIT 1: Vocabulary Building

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations.

UNIT 2 : Basic Writing Skills

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing

precisely

UNIT 3: Identifying Common Errors in Writing

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

UNIT 4: Nature and Style of sensible Writing

Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion

UNIT 5: Writing Practices and Oral Communication

Comprehension, Précis Writing, Essay Writing,

Oral Communication

(This UNIT involves interactive practice sessions in Language Laboratory), Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Everyday Situations: Conversations and Dialogues Communication at Workplace, Interviews, Formal Presentations

Reference Books:

- Practical English Usage. Michael Swan. OUP. 1995.
- Remedial English Grammar. F.T. Wood. Macmillan.2007
- On Writing Well. William Zinsser. Harper Resource Book. 2001
- Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
- Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

CORE PAPER **SEMESTER II**

Paper Title: Basic Engineering Mechanics

Paper Code: BFTC-206

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Determine resultant of forces acting on a body and analyse equilibrium of a body subjected to a system of forces.

CO2. Solve problem of bodies subjected to friction.

CO3. Find the location of centroid and calculate moment of inertia of a given section.

CO4. Understand the kinetics and kinematics of a body undergoing rectilinear, curvilinear, rotator motion and rigid body motion.

CO5. Solve problems using work energy equations for translation, fixed axis rotation and plane motion and solve problems of vibration.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	1	1	1	1	1	1	1	3	2	1	2
CO2	3	2	3	1	1	1	1	1	1	1	3	2	1	2
CO3	2	2	3	1	1	1	1	1	1	1	3	2	1	2
CO4	2	2	2	1	1	1	1	2	1	1	3	2	1	2
CO5	3	2	3	1	1	1	1	3	1	1	3	2	1	2

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT 1:
Statics: Free body diagrams with examples on modeling of typical supports and joints; Condition for equilibrium in three- and two- dimensions; Friction: limiting and non-limiting cases; Force displacement relationship; Geometric compatibility for small deformations; Illustrations through simple problems on axially loaded members like trusses.

UNIT 2:
Introduction to Mechanics of solids: Concept of stress at a point; Planet stress: transformation of stresses at a point, principal stresses and Mohr's circle; Displacement field;

UNIT 3:
Concept of strain at a point; Plane strain: transformation of strain at a point, principal strains and Mohr's circle; Strain Rose; Discussion of experimental results on one- dimensional material behavior; Concepts of elasticity, plasticity, strain hardening, failure (fracture / yielding); Idealization of one-dimensional stress-strain curve; Generalized Hooke's law with and without thermal strains for isotropic materials; Complete equations of elasticity;

UNIT 4:
Force analysis — axial force, shear force, bending moment and twisting moment diagrams of slender members (without using singularity functions); Torsion of circular shafts and thin-walled tubes (plastic analysis and rectangular shafts not to be discussed); Moment curvature relationship for pure bending of beams with symmetric cross-section; Bending stress; Shear stress; Cases of combined stresses; Concept of strain energy; Yield criteria;

UNIT 5: Deflection due to bending; Integration of the moment-curvature relationship for simple boundary conditions; Method of superposition (without using singularity functions); Strain energy and complementary strain energy for simple structural elements (i.e. those under axial load, shear force, bending moment and torsion); Castigliano's theorems for deflection analysis and indeterminate problems.

Reference books:

- An Introduction to the Mechanics of Solids, 2nd ed. with SI Units — SH Crandall, NC
- Dahl & TJ Lardner
- Engineering Mechanics: Statics, 7th ed. — JL Meriam
- (iii)Engineering Mechanics of Solids — EP Popov

CORE PAPER **SEMESTER II**

Paper Title: Programming for Problem Solving Lab Paper Code: BFTC-207

Total Credits: 2, Total Contact Hours-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

Lab based on Programming for Problem Solving

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Formulate the algorithms for simple problems

CO2. Translate given algorithms to a working and correct program

CO3. Correct syntax errors as reported by the compilers

CO4. Identify and correct logical errors encountered during execution

CO5. Represent and manipulate data with arrays, strings and structures

CO6. Use pointers of different types

CO7. Create, read and write to and from simple text and binary files CO8: Modularize the code with functions so that they can be reused

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	2	1	2	1	1	2	1	1	2
CO2	3	2	3	2	1	2	1	1	1	1	2	1	1	2
CO3	3	2	3	2	1	2	1	1	1	1	2	1	1	2
CO4	3	2	3	2	1	2	1	1	1	1	2	1	1	2
CO5	3	2	3	2	1	2	1	2	1	1	2	1	1	2
CO6	3	2	3	2	1	2	1	1	1	1	2	1	1	2
CO7	3	2	3	2	1	2	1	2	1	1	2	1	1	2

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write ‘3’ in

the box for ‘High-level’ mapping, ‘2’ for ‘Medium-level’ mapping, ‘1’ for ‘low-level’ mapping

CORE PAPER **SEMESTER II**

Paper Title: Workshop /Manufacturing Practices Lab Paper Code: BFTC-208

Total Credits: 2, Total Contact Hours-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Study and practice on machine tools and their operations.

CO2. Practice on manufacturing of components using workshop trades including pluming, fitting, carpentry, foundry, house wiring and welding.

CO3. Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiselling.

CO4. Apply basic electrical engineering knowledge for house wiring practice.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	2	1	1	1	1	3	2	2	2
CO2	3	1	1	1	1	2	1	1	1	1	3	2	2	2
CO3	2	1	2	1	1	2	1	2	1	1	3	2	2	2
CO4	3	3	3	1	1	2	1	3	1	1	2	2	2	2

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write ‘3’ in the box for ‘High-level’ mapping, ‘2’ for ‘Medium-level’ mapping, ‘1’ for ‘low-level’ mapping

1. Machine shop
2. Fitting shop
3. Carpentry
4. Electrical &Electronics
5. Welding shop **(Arc welding + Gas welding)**
6. Casting
7. Smithy
8. Plastic molding& Glass Cutting

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

CORE PAPER **SEMESTER II**

Paper Title: Communication Skills Lab Paper Code: BFTC-209

Total Credits: 2, Total Contact Hours-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Better understanding of nuances of English language through audio- visual experience and group activities.

CO2. Neutralization of accent for intelligibility

CO3. Speaking skills with clarity and confidence which in turn enhances their employability skills.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	3	3	2	3	1	1	1	3	2	1	2
CO2	3	1	1	2	3	2	2	1	1	1	3	1	2	2
CO3	3	1	1	2	3	2	3	1	1	1	3	1	2	2

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

Laboratory 1: Familiarization with the lab & purpose Laboratory 2: Writing Practices-Comprehension Laboratory 3: Writing Practices-Précis Writing Laboratory 4: Writing Practices-Essay Writing
Laboratory 5: Oral Communication-Listening Comprehension
Laboratory 6: Oral Communication-Pronunciation, Intonation, Stress and Rhythm
Laboratory 7: Oral Communication-Common Everyday Situations: Conversations and Laboratory 8: Oral Communication-Dialogues Communication at Workplace
Laboratory 9: Oral Communication-Interviews
Laboratory 10: Oral Communication-Formal Presentations If time permits, group discussions may be added.

CORE PAPER **SEMESTER II**

Paper Title: Introduction to Food Technology

Lab Paper Code: BFTC-210

Total Credits: 2, Total Contact Hours-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Know about the various aspects of assessing the quality of the food.

CO2. Understand and know the different methods of food analysis

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	2	2	2	2	1	1	3	3	3	3
CO2	3	3	1	1	2	2	2	2	1	1	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

PRACTICALS

1. To determine the efficacy of blanching treatment.
2. To perform pasteurization and sterilization of foods.
3. To carry out tray drying of different fruits.
4. To carry out osmotic dehydration of onion slices.
5. To perform canning of pineapple slices.
6. To perform vacuum drying of spices.
7. Setting up of sensory evaluation lab and introducing the concept of organoleptic testing.
8. Estimation of pH of different foods
9. Adulteration tests for different foods:
    - Milk and milk products
    - Tea and coffee
    - Spices
10. To give the concept of shelf life of different foods.(processed and unprocessed)
11. Standards of identity, standards of minimum quality and standards of fill of container.
12. Identification of different types of packaging materials used in the food industry.

COMPULSORY **SEMESTER II**

Paper Title: Environmental Studies
Paper Code: ES-01
Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Based on this course, Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development.

CO2. Students can use their knowledge of the natural sciences to protect the environment and human health.

CO3. At the end of the program engineering graduates will be able to apply concepts and methodologies to analyse and understand interactions between social and environmental processes of ecosystem for maintaining ecological balance.

CO4. Take up the awareness programme for environment protection of water resources, mineral resources and forest conservation

CO5. Plan the conservation of biodiversity and analyse the possible effects on the biodiversity.

CO6. Develop an understanding of environmental pollutions and hazards due to engineering / technological activities and general measures to control them. Follow the environmental policies and regulation and implement the sustainable development.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	1	1	2	1	3	2	2	2	2
CO2	3	2	2	1	1	1	1	2	1	3	2	2	2	2
CO3	3	2	2	1	1	1	1	2	1	3	2	2	2	2
CO4	3	2	2	1	1	1	1	2	1	3	2	2	2	2
CO5	3	2	2	1	1	1	1	3	1	3	2	2	2	2
CO6	2	2	2	1	1	1	1	2	1	3	2	2	2	2

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write ‘3’ in the box for ‘High-level’ mapping, ‘2’ for ‘Medium-level’ mapping, ‘1’ for ‘low-level’ mapping

UNIT 1

Concepts of Environmental Sciences covering, Environment, Levels of organizations in

environment, Structure and functions in an ecosystem; Biosphere, its Origin and distribution on land, in water and in air, Broad nature of chemical composition of plants and animals;

UNIT 2

Natural Resources covering Renewable and Non-renewable Resources, Forests, water, minerals, Food and land (with example of one case study); Energy, Growing energy needs, energy sources (conventional and alternative);

UNIT 3

Biodiversity and its conservation covering, Biodiversity at global, national and local levels; India as a mega-diversity nation; Threats to biodiversity (biotic, abiotic stresses), and strategies for conservation; Environmental Pollution covering, Types of pollution- Air, water (including urban, rural, marine), soil, noise, thermal, nuclear; Pollution prevention; Management of pollution- Rural/Urban/Industrial waste management [with case study of any one type, e.g., power (thermal/nuclear), fertilizer, tannin, leather, chemical, sugar], Solid/Liquid waste management, disaster management;

UNIT 4

Environmental Biotechnology covering, Biotechnology for environmental protection- Biological indicators, bio-sensors; Remedial measures- Bio-remediation, phyto remediation, bio-pesticides, bio-fertilizers; Bio-reactors- Design and application. Social Issues and Environment covering, Problems relating to urban environment- Population pressure, water scarcity, industrialization; remedial measures; Climate change- Reasons, effects (global warming, ozone layer depletion, acid rain) with one case study; Legal issues- Environmental legislation (Acts and issues involved),Environmental ethics;

UNIT 5

Environmental Monitoring covering, Monitoring- Identification of environmental problem, tools for monitoring (remote sensing, GIS); Sampling strategies- Air, water, soil sampling techniques, Laboratory Work including Practical and Field Work covering, Plotting of bio-geographical zones and expanse of territorial waters on the map of India; Identification of biological resources (plants, animals, birds) at a specific location; Determination of (i) pH value, (ii) water holding capacity and (iii) electrical conductivity of different types of soils; Determination of energy content of plants by bomb calorimeter; Measurement and classification of noise pollution; Determination of particulate matter from an industrial area by high volume sampler;

Determination of ico-chemical parameters (pH, alkalinity, acidity, salinity, COD, BOD) of tap water, well water, rural water supply industrial effluent and seawater & potability issues; Demonstration of Remote Sensing and GIS methods; Industrial visit for environmental biotechnology processes (e.g., any one of the fermentation, tissue culture, pharmaceutical industries)

BOOKS RECOMMENDED:

1. Textbook of Environmental studies, Erach Bharucha, UGC

2. Fundamental concepts in Environmental Studies, D D Mishra, S Chand & Co

SECOND YEAR

CORE PAPER **SEMESTER III**

Paper Title: Food Chemistry
Paper Code: BFTC-301
Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Students are expected to understand water's influence on food stability in a broader context.

CO2. To understand the properties of different carbohydrate components and interactions among these components to regulate the specific quality attributes of food systems.

CO3. Students are expected to understand the role of proteins /enzymes in foods and be able to control the major chemical and biochemical (enzymatic) reactions that influence food quality with emphasis on food industry applications.

CO4. To understand the chemical composition of lipids, their physical properties, methods to modify the fatty acid and triacylglycerol composition, tendency of lipids to undergo oxidative deterioration, and the role of lipids in health and disease.

CO5. Understanding of the chemical and physical factors that influence vitamin, mineral and pigment retention and bioavailability in foods.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	1	3	2	2	3	3	1	2	3	3	2
CO2	2	1	2	1	3	2	2	3	3	1	2	3	3	2
CO3	2	1	2	1	3	2	2	3	3	1	2	3	3	2
CO4	2	2	2	1	3	2	2	3	3	1	2	3	3	2
CO5	3	1	2	1	3	2	2	3	3	1	2	3	3	2

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT-I

Water : Structure of water and ice, properties, bound water, water activity. Post-harvest and Postmortem biochemical changes in foods and its implications on quality of foods.
Carbohydrates: monosaccharides, diasacharides, polysaccharides, Reactions and properties of simple and complex carbohydrates, starch gelatinization and retrogradation; Enzymatic and Non enzymatic browning, formation of acrylamide in food

UNIT-II
Lipids: Types and properties: function of lipids in foods; Lipolysis, Auto-oxidation, Rancidity, Reversion, lipid Refining: degumming, neutralization, bleaching, deodorization; hydrogenation; food lipids and health.
Proteins: classification of amino acids; primary, secondary, tertiary structure of proteins; properties of proteins, Important protein sources, Nutritive value of food protein; Denaturation and its implications.

UNIT-III
Vitamins: Fat soluble and water soluble, food sources, dietary requirements, deficiency disorders; Minerals: Macronutrients and micronutrients, food sources, dietary requirements and physiological function of minerals.

BOOKS RECOMMENDED:

1. O.R. Fennema Food Chemistry
2. Food chemistry, Lillian Hoagland Meyer, CBS publication, New Delhi, 2nd Edition, 2006.
3. Food Science Chemistry & Experimental Foods, Dr. M. Swaminathan, Bappco Ltd 2nd Edition, 2001.
4. Food Chemistry by L. H. Muyer
5. Food chemistry, S. Yadav, Anmol Publications 1st Edition, 1997
6. Essentials of Food & Nutrition by Swaminathan, Vol. 1 & 2

CORE PAPER **SEMESTER III**

Paper Title: Food Microbiology
Paper Code: BFTC-302
Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. The learner will gain basic knowledge of food and its microbiological aspects in term of quality and spoilage activity along with structural composition, nutrient value and biological value and their mechanisms.

CO2. Learners also will gain the fundamental aspects of bacterial growth by using different media and its role in the sustainable growth of bacteria along withAwareness about media preparation and culture characteristic of bacteria which grow on that media as food by utilizing food nutrient as substrates.

CO3. Learners would have acquired basic knowledge of food properties like intrinsic and extrinsic parameter and its significance of spoilage mechanism in food.

CO4. Understand the application of fermentation and their importance in the development of fermented food along with the biological and nutritive value of fermented food developed as yoghurt, cheese, fruits and vegetable, meat and meat product, egg and fish in daily life.

CO5. Know about the symptoms as well as detection of food borne diseases along with fundamental knowledge of toxins produced by *Staphylococcus, Clostridium, Aspergillus.*

CO6. Understand the contamination, spoilage and preservation aspects of various food groups namely dairy, meat and poultry, fruits and vegetables, fish and seafoods etc.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	2	2	3	2	1	3	3	3	3
CO2	2	2	2	1	2	2	2	3	2	1	3	3	3	3
CO3	2	2	2	1	2	2	2	3	2	1	3	3	3	3
CO4	2	2	2	1	2	2	2	3	2	1	3	3	3	3
CO5	2	2	2	1	2	2	2	3	2	1	3	3	3	3
CO6	2	2	2	1	2	2	2	3	2	1	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT I

Importance of microorganisms in foods; Classification, morphology, growth, nutrition and reproduction: bacteria, moulds, yeasts, viruses; Methods of isolation, pure culture techniques and maintenance of cultures; enumeration methods for micro-organisms.

UNIT II

Incidence of microorganisms in foods, sources of contamination. Factors affecting microbial growth; Principles underlying spoilage and preservation of foods. Contamination, spoilage and preservation of fruit and vegetables, meat, fish and sea foods, egg and poultry and dairy.

UNIT III

Probiotics and prebiotics. Beneficial microorganisms and their utilization in food fermentation of bread, malt beverages, fermented vegetables, fermented dairy products.

UNIT IV

Control of microorganisms by physical, chemical, antibiotic and other chemotherapeutic agents. Food borne diseases: types, common foodborne diseases and their causal agents (food borne infection and intoxication), factors responsible for FBDs; Mycotoxins

BOOKS RECOMMENDED:

1. Microbiology, J. Willey, L. M. Sherwood, C. Woolverton, McGraw Hill International, 8th Edition, 2010.

2. Food Microbiology, W. C. Frazier & D.C. Westhoffs, TMH, 4 th Edition, 1993.
3. Essentials of food Microbiology, J. Garbutt, Arnold Publication, 2nd Edition, 1997.
4. Microbiology, M. J. Pelczar Jr., E.C.S. Chan and N.R. Krieg, TMH Book Company, 5th Edition, 1993.
5. Modern Food Microbiology, James M. Jay, CBS Publishers Delhi, 4th Edition, 1993.
6. Essentials of Microbiology; K. S. Bilgrami; CBS Publishers, Delhi

CORE PAPER **SEMESTER III**

Paper Title: Nutrition and Dietetics
Paper Code: BFTC-303
Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Understand the energy vales of importance food components carbohydrate, proteins, fat, minerals, vitamins and water in food

CO2. Understand the immunity, infection and nutrition.

CO3. Explain Understand the nutritional quality of diet and its requirements.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	3	2	1	2	1	1	1	2	3	3	3	3
CO2	3	3	3	2	1	2	1	1	1	2	3	3	3	3
CO3	3	3	3	2	1	2	1	1	1	2	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT-I
Introduction to the study of nutrition, characteristics, functions, digestion and assimilation of food, metabolism, food sources of different nutrients.

UNIT-II
Recommended allowances-RDA for Indians, basis for requirement, computation of allowance based on energy expenditure, components of energy expenditure. General concepts about growth and development through different stages of life, BMR, BMI, Calorific value and Thermic effect of food.

UNIT-III
Energy metabolism, special nutrition needs during pregnancy, nutrition during lactation, infancy:

premature infant and their feeding, weaning foods, for children, adolescents and aged; nutrition and public health. Dietary modification, planning a menu.

UNIT-IV

Introduction to therapeutic nutrition, diet in disease conditions: jaundice, coronary heart disease, obesity, anaemia, renal problems, GI tract problems; inborn errors of metabolism, diabetes: neutraceuticals, Fortification, Enrichment.

BOOKS RECOMMENDED:

1. Robert‟s Nutrition Work with Children, Martin S.R., 1963, The University of -Chicago Press, Chicago.
2. Assessment of Nutrition Status of the Community, Jellife D.B. 1966, WHO, Geneva.
3. Nutrition in the Sub Tropics and Tropics, Jellife D.B.
4. Essentials of Food and Nutrition, Swaminathan, Vol 1 & 2
5. Fundamentals of Food and Nutrition by Sumati. R. Muldambi
6. Nutrition and dietetics by Rose 9. Nutrition and dietetics by Joshi

CORE PAPER **SEMESTER III**

Paper Title: Thermodynamics

Paper Code: BFTC-304

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Use thermodynamic terminology correctly.

CO2. Explain fundamental thermodynamic properties.

CO3. Derive and discuss the first and second laws of thermodynamics.

CO4. Solve problems using the properties and relationships of thermodynamic fluids.

CO5. Analyse basic thermodynamic cycles.

CO6. Students must have understanding of thermodynamic fundamentals before studying their application in applied thermodynamics.

CO7. The understanding of thermodynamic properties and processes will assist students in other related coursework

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3

CO1	1	1	2	1	1	1	1	1	1	2	3	3	3	3
CO2	2	1	1	1	1	1	1	1	1	2	3	3	3	3
CO3	2	2	3	1	1	1	1	1	1	2	3	3	3	3
CO4	3	2	3	1	1	1	1	1	1	2	3	3	3	3
CO5	3	2	3	1	1	1	1	1	1	2	3	3	3	3
CO6	3	2	3	1	1	1	1	1	1	2	3	3	3	3
CO7	3	2	2	1	1	1	1	1	1	2	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT I

Definitions and concepts: SI Units, Thermodynamic systems, states, properties, processes, heat, work and energy, Thermodynamic Equilibrium: Zeroth Law, Temperature Scale.

UNIT II

First Law of Thermodynamics; Properties of pure substances and steam, Mollier Chart.

Second Law of Thermodynamics; Carnot Cycle, Entropy; Corollaries of Second Law; Applications of First and Second Law to closed and open systems, non-flow and flow processes; steady state, steady flow and transient flow processes.

UNIT III

Heat Engine and Heat Pumps. Refrigeration. Irreversibility and availability, energy analysis; thermodynamic relations; Properties of mixtures and ideal gases; Thermodynamic Cycles: Otto, Diesel, Dual and Joule Cycle.

UNIT IV

Third Law of Thermodynamics. Introduction to IC Engines. Introduction to Power Cycle –Carnot, Rankine and Modified Rankine Cycle.

BOOKS RECOMMENDED:

1. Engineering thermodynamics. P. K. Nag, Tata McGraw-Hill, New Delhi, 3rd Edition, 2005.
2. Fundamentals of Thermodynamics. R. E. Sonntag, and C. Borgnakke, John Wiley & Sons, 7th Edition, 2008.
3. Thermodynamics, an Engineering Approach. Y. A. Cengel and M. A. Boles, McGraw Hill, 7th Edition, 2010.
4. Fundamentals of Engineering Thermodynamics. J. P. Howell and P. O. Buckius, McGraw Hill, 2nd Edition, 1992.
5. Richardson, J.F., Peacock, D.G.Coulson & Richardson‟s Chemical Engineering- Volume 3ed., First Indian ed. Asian Books Pvt. Ltd. 1998
6. Levenspiel.O., Chemical Reaction Engineering, Wiley Eastern Ltd

CORE SUBJECT **SEMESTER III**

Paper Title: Cereal, Pulses and Oilseed Technology
Paper Code: BFTC-305

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Understand basic composition & structure of food grain.

CO2. Understand the basics of milling operations.

CO3. Learn processing of food grains into value added products. CO4 Learn to manage by products utilization.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	1	1	1	1	2	3	3	3	3
CO2	3	3	3	2	1	1	1	1	1	2	3	3	3	3
CO3	3	3	3	2	1	1	1	1	1	2	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write ‘3’ in the box for ‘High-level’ mapping, ‘2’ for ‘Medium-level’ mapping, ‘1’ for ‘low-level’ mapping

UNIT-I

Wheat: Milling; types of wheat flour, Wheat protein and its function; Wheat-based baked products:

Bread, biscuit, chapattis and cakes; Extruded products: pasta, noodles; Rheology of flour- Falling number, Pasting properties.

UNIT- II

Rice: structure, milling, parboiling, By-products of rice milling, Technology of breakfast cereals: Puffed Rice, flaked rice

Corn: Wet and dry milling; Corn products: Corn flakes, corn syrup and corn starch. Quality aspects of different flours. Corn products: Corn flakes, corn starch, canned corn products, puffed product;

UNIT -III

Sorghum, pearl millet, finger millet, and kodo millet: structure, composition; milling and malting; barley: milling and malting; Oats: Milling and processing. Traditional and nutritional products based on,

UNIT- IV

Legumes: Structure, composition and processing, Milling of pulses. Legume-based products; anti-nutritional factors; utilization of pulses.

Oilseed: Structure; processing: traditional and modern methods of oil extraction, refining, bleaching, deodorizing, hydrogenation; Applications of different oils and fats in food processing and products.

Suggested Reading:

1. Chakrabarty MM. Chemistry and Technology of Oils and Fats. Prentice Hall.
2. Dendy DAV & Dobraszczyk BJ. Cereal and Cereal Products. Aspen.
3. Hamilton RJ & Bhati A. Fats and Oils - Chemistry and Technology.App. Sci. Publ.
4. Kent NL. Technology of Cereals. 4th Ed. Pergamon Press.
5. Kulp K & Ponte GJ. Handbook of Cereal Science and Technology. 2nd Ed. Marcel Dekker.
6. Lorenz KL. Handbook of Cereal Science and Technology. Marcel Dekker.
7. Mathews RH. Legumes Chemistry, Technology and Human Nutrition. Marcel Dekker.
8. Matz SA. Cereal Science. AVI Publ.

CORE PAPER **SEMESTER III**

Paper Title: Food Chemistry Lab

Paper Code: BFTC-306

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Understand the biochemical analysis in terms of estimation of proximate analysis of foods.

CO2. Understand the biochemical analysis in terms of estimation of nutritional value of foods.

CO3. Understand the biochemical analysis in terms of estimation of physiochemical characteristics of foods.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	3	3	2	2	2	3	2	1	1	2	1
CO2	2	2	3	3	3	2	2	2	3	2	1	1	2	1
CO3	2	2	3	3	3	2	2	2	3	2	1	1	2	1

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

Practical's:

1. Preparation of standard solutions for the chemical analysis i.e. HCl, H_2SO_4, $KMnO_4$ and Sodium Thiosulphate.
2. Determination of moisture content.
3. Determination of reducing and non-reducing sugar
4. Determination of fiber content of different food material.
5. Determination of protein by Kjeldal method.
6. Determination of Ash content.
7. Detection of presence of starch by Iodine test.
8. Determination of water activity of different food materials.
9. To distinguish between mono-saccharides and di-saccharides by barfoed test.
10. Determination of minerals: calcium, phosphorous and iron
11. Estimation of vitamins: ascorbic acid, carotene and thiamine.

CORE PAPER **SEMESTER III**

Paper Title: Food Microbiology Lab

Paper Code: BFTC-307

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Explore various microbiological organisms in food.

CO2. Discover the various physical and chemical agents used to control microorganism in food.

~~CO3. Learn about food related illness from microorganisms.~~

~~CO4. Determine microorganism that can cause food spoilage.~~

CO3. Understand and apply various enumeration techniques for micro-organisms along with serial dilution,

plating and streaking techniques through hands on practice.

CO4. To know about types of media and broth and various sterilization and disinfection methods to maintain aseptic conditions.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	2	2	3	2	1	3	3	3	3
CO2	2	2	3	2	1	2	2	3	2	1	3	3	3	3
CO3	2	2	3	2	1	2	2	3	2	1	3	3	3	3
CO4	2	2	3	2	1	2	2	3	2	1	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

PRACTICALS

1. Culture media preparation, sterilization and activities of microorganism
2. Determination of microbial growth curves based on absorbance.
3. Isolation, plating and characterization of microbes, population, colony count.
4. Gram staining.
5. Antibiotic sensitivity and determination of minimum inhibitory concentration.
6. Isolation and characterization from normal and decayed food items
7. Effect of environmental factor on growth and development of microbes.
8. Study on food fermentation processes.
9. Isolation and identification of coli forms and *vibrio* species.

CORE SUBJECT **SEMESTER III**

Paper Title: Cereal, Pulses and Oilseed Technology

Lab Paper Code: BFTC-308

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Identify and explain baking terms, ingredients, equipment and tools.

CO2. Learn different types of bakery products and their quality.

CO3. Impart training on baking and confectionery methods.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific

Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	2	1	3	2	2	3	3	3	3
CO2	3	3	3	3	1	2	1	3	2	2	3	3	3	3
CO3	3	3	3	3	1	2	1	3	2	2	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

List of Experiments:

1. Physical-tests on wheat and rice;
2. Determination of gluten content in wheat flour;
3. Milling of wheat and rice by laboratory mill;
4. Assessment of degree of polishing;
5. Quality tests of rice; Amylose content determination in rice;
6. Malting of Barley,
7. Extraction of oil using expeller and solvent extraction methods.
8. Detection of ergot in food grains.
9. Detection if extraneous matter in grains and flours.
10. Detection of dhatura in grains.
11. Detection of khesari dal in dal.
12. Study of milling characteristics of Food by Ball mill.
13. Study of milling characteristics of Food by Hammer mill
14. Visit to FCI Godown, Silo

SECOND YEAR

CORE SUBJECT **SEMESTER IV**

Paper Title: Unit Operations in Food Processing

Paper Code: BFTC-401

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Be well versed with food process engineering calculations. Cognitive level: Understand and analyze.

CO2. Explain the principles of different types of material handling equipment and their application. Cognitive level: Understand and Analyze

CO3. Acquire knowledge on importance of size reduction and energy requirement Cognitive level: Understand

CO4. Explain mechanism of crystallization, distillation and leaching process. Cognitive level: Understand

CO5. Explain the principles of mixing and homogenization. Cognitive level: Understand

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	2	2	1	1	1	1	2	3	2	1	3
CO2	2	2	2	3	1	1	1	1	2	2	3	2	2	3
CO3	3	3	2	3	2	1	1	2	2	3	3	3	2	3
CO4	2	3	2	3	2	2	1	2	2	3	3	3	2	3
CO5	3	1	1	2	2	1	1	1	1	2	3	2	1	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT-I

Material handling and storage - Theory, classification of various material handling equipment – conveyors: belt, bucket, screw and pneumatic conveyors. Characteristics of bulk material and flow through orifices; Traditional, improved and modern grain storage structures.

UNIT-II

Cleaning- aim of cleaning, aspiration, magnetic cleaning and abrasive cleaning. Screening, types of screens: Grizzly, Rotary, Vibratory, Revolving, Wiremesh, Perforated metal screens; Dry and wet cleaning methods.

UNIT III

Milling –Size Reduction: principles and laws of size reduction: Kick's law, Bonds law and Rittinger's law, equipment selection, Particle size analysis, size reduction procedures: crushing, impact shearing and cutting; size reduction machinery: crushers, grinders and cutting machines.

UNIT V

Engineering properties of agricultural material, physical, mechanical, thermal, rheological properties,

Recommended Books:

1. Geankoplis J Christie. (1999). Transport Process and Unit Operations. Allyn & Bacon.
2. Earle R. L. and Earle M.D.. Unit Operations in Food Processing
3. McCabe WL & Smith JC. (1999). Unit Operations of Chemical Engineering. McGraw Hill.

4. Sahay KM & Singh KK. (1994). Unit Operation of Agricultural Processing. Vikas Publ. House.
5. Singh RP and Heldman DR. (1993).Introduction to Food Engineering. Academic Press

CORE SUBJECT **SEMESTER IV**

Paper Title: Functional Foods and Nutraceuticals
Paper Code: BFTC-402

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. To understand the concept of nutraceutical science and its relation with other sciences.

CO2. Acquire knowledge on various bio molecules showing health benefits.

CO3. Understand various physiological and biochemical aspects of life threatening and chronic diseases and nutraceutical as their remedies.

CO4. Apply their knowledge regarding extraction, isolation, characterization and application of nutraceuticals in food industries.

CO5. To understand about various inhibitors present in food and their prevention, role of prebiotics and probiotics as nutraceuticals.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	3	2	3	2	2	3	3	3	3
CO2	2	2	2	1	2	3	2	3	2	2	3	3	3	3
CO3	2	2	2	1	2	3	2	3	2	2	3	3	3	3
CO4	2	2	2	1	2	3	2	3	2	2	3	3	3	3
CO5	2	2	2	1	2	3	2	3	2	2	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write ‘3’ in the box for ‘High-level’ mapping, ‘2’ for ‘Medium-level’ mapping, ‘1’ for ‘low-level’ mapping

UNIT I

Scope, importance and renewed emphasis on specialty foods, health foods, functional foods. Nutraceuticals, infant and baby foods, adolescent/ teen age foods, foods for pregnant ladies and nursing mothers, geriatric foods.

UNIT II

Food recommended and restricted in metabolic disorders and disturbances, gastrointestinal disorders;

fever and infection; liver, gall, bladder and pancreatic disturbances; blood, circulatory and cardiac diseases; urinary and musculoskeletal diseases; allergies. Nutritional deficiencies and its correction through fortification and supplementation of foods.

UNIT III

Beneficial effect of spices, honey, spirulina etc. Health benefits/ mode of action of PUFA/ gamma linolenic acids, antioxidants, dietary fiber, oligosaccharides, sugar alcohols, peptides and proteins, glycosides, alcohols, iso-prenoides and vitamins, choline, LAB, phenolics, flavonols, minerals and other miner food constitutes as reported in literature.

UNIT IV

Transgenic plant foods with health claims. Prebiotics and Probiotics, regulatory issues for nutraceuticals, Clinical testing of nutraceuticals

BOOKS RECOMMENDED:

1. Human nutrition: A textbook of nutrition in health and disease. B. T. Burton, Mc Graw Hill, 3rd Edition, 2002.
2. Nutrition and Dietetics. S. A. Joshi, Tata Mc Graw Hill Co. Ltd., 2nd Edition, 2003.
3. Dietetics. B. Shrilakshmi, New Age International (P) Ltd., New Delhi, 5th Edition, 2005.
4. Nutrition and Dietetic Foods, A. E. Bender, Chem. Pub. Co. New York, 2nd Edition, 2004.
5. Basic Nutrition in Health and Disease. P. S. Howe, W. B. Saunders Company, London, 2nd Edition, 2003.
6. Fundamentals of Food and Nutrition by Sumati. R. Muldamb

CORE SUBJECT **SEMESTER IV**

Paper Title: Postharvest Technology of Fruits and Vegetables Paper Code: BFTC-403

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Developments and current status of fruits and vegetables storage and processing.

CO2. Role of fruits and vegetables in human nutrition and diet.

CO3. Physicochemical composition of fruits and vegetables and the effect of processing on nutrients and pigments.

CO4. Value addition to fruits and vegetables, processing and preservation

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3

CO1	3	3	2	3	3	2	3	2	3	1	3	3	3	3
CO2	1	1	2	2	3	2	2	2	3	1	3	1	1	1
CO3	1	1	2	2	3	2	3	2	3	1	3	2	2	1
CO4	3	2	2	3	3	2	3	2	3	3	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

Unit –I

Composition and nutritive value of fruits and vegetables; Importance and scope of post-harvest management of fruits and vegetables. Maturity indices and standards for selected fruits and vegetables; Methods of maturity determinations; Harvesting and handling of important fruits and vegetables; Post harvest losses; Post-harvest physiological and biochemical changes in fruits and vegetables.

Unit- II

Preservation: Processing for pulp, puree and concentrates, from different fruits using aseptic packaging, RTS fruit beverages, individual quick freezing. Technology for processing of pickles, chutneys, sauces. Canning, Blanching, Thermal death time, D value, Z value, F value calculations Spoilage of canned foods, Emerging technologies for fruits and vegetables processing technologies.

Unit-III

Controlled and modified atmosphere Storage, Hypobaric storage; Field heat of fruits and vegetables and primary processing; Pre-cooling and cold storage.

Unit-IV

Drying, Dehydration and concentration of fruits and vegetables, sun drying, solar drying, osmotic, tunnel drying, fluidized bed drying, freeze drying and spray drying. Food concentration: methods of concentration.

References:

1. Lal G, Siddappa GS & Tandon GL. Preservation of Fruits and Vegetables. ICAR.
2. Salunkhe DK & Kadam SS.,Handbook of Vegetables Science & Technology: Production, Composition, Storage and Processing.Marcel Dekker.
3. Srivastava RP & Kumar S. Fruit and Vegetable Preservation - Principles and Practices. International Book Distributors
4. Verma LR & Joshi VK. 2000. Post Harvest Technology of Fruits and Vegetables. Indus Publ.

CORE SUBJECT **SEMESTER IV**

Paper Title: Food Engineering I

Paper Code: BFTC-404

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Understand the basic modes of heat transfer in foods. Cognitive level: Understand

CO2. Interpret and analyse forced and free convection heat transfer. Cognitive level: Understand and Analyze

CO3. Formulate and solve convective heat transfer problems. Cognitive level: Understand

CO4. Able to calculate freezing time and freezing rate. Cognitive level: Understand and Analyze

CO5. Understand mechanisms of moisture removal in foods. Cognitive level: Understand

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	1	2	2	1	1	1	2	2	2
CO2	3	1	2	2	2	2	2	2	2	2	2	2	1	1
CO3	3	2	2	1	1	1	2	2	1	1	2	2	2	1
CO4	3	2	2	3	3	3	3	2	2	2	2	2	1	1
CO5	3	1	1	1	2	2	2	2	1	2	1	1	2	1

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT-I

Introduction to food engineering & processes: principles of thermodynamics, enthalpy, entropy, fundamentals of heat transfer. Kinetics of reactions occurring in processed foods, reaction velocity constant, order of reaction; quality changes during storage of foods.

UNIT-II

Methods for thermal process evaluation - Commercial sterility, pasteurization and sterilization, thermal death time, d, z and f values. General introduction to aseptic canning process.

UNIT-III

Food chilling and freezing, Properties of frozen foods; freezing point depression; general introduction to enthalpy change during freezing, IQF; design of food freezing equipment such as air blast freezers, plate freezers and immersion freezers.

UNIT IV

Flow rate, friction losses and pressure drop relationships for Newtonian fluids through pipe.

Recommended Books:

1. Heldman DR & Singh RP. Food Process Engineering. AVI Publ
2. R.C. Sachdeva. Fundamentals of Engineering Heat and mass transfer.
3. Fellows P. Food Processing Technology. VCH Ellis Horwood.
4. Brennan JG, Butter JR, Corell ND & Lilly AVE. Food Engineering Operations. Elsevier.
5. Charm SE, McCabe WL, Smith JC & Harriott P. Unit Operations of Chem Engineering. McGraw Hills.
6. Sahay KM & Singh KK. Unit Operation of Agricultural Processing. Vikas Publ. House.

7. Geankoplis J Christie. (1999). Transport Process and Unit Operations. Allyn & Bacon

CORE SUBJECT **SEMESTER IV**

Paper Title: Unit Operations Lab
Paper Code: BFTC-405
Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Study the various unit operations in food processing. Cognitive level: Understand
CO2. Compute the moisture content and drying characteristics of food materials. Cognitive level: Understand
CO3. Describe and demonstrate the milling equipment. Cognitive level: Understand and Analyze

CO4. Estimate the energy requirement for the grain milling operations. Cognitive level: Understand
CO5. Estimate the mixing properties of flours and grains. 6. Evaluate the performance of grain separators and rice mill. Cognitive level: Understand and Analyze

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	2	1	2	3	1	3	2	2	3
CO2	3	1	1	2	2	3	2	2	2	2	2	2	2	1
CO3	3	1	2	2	1	2	3	2	2	3	2	2	2	2
CO4	3	2	2	1	1	1	2	2	1	2	2	2	2	1
CO5	3	2	2	2	1	2	1	2	1	2	2	2	2	1

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

List of Experiments:

1. Determination of physical properties such as bulk density, porosity, sphericity, angle of repose.
2. Particle size distribution using sieve shaker.
3. Size reduction using Ball Mill and calculation of critical speed of mill.
4. Size reduction using Jaw crusher and calculation of equivalent diameter of solid particle.
5. Study of mechanical expression of edible oil.
6. Mixing experimentation and determination of uniformity coefficient.
7. Determination of power consumption in mixing/agitation.
8. Filters and filter resistance.
9. Determine the terminal velocity of Cyclone separator.

10. Studies on membranes separation processes.

CORE SUBJECT **SEMESTER IV**

Paper Title: Fruits and Vegetables Lab

Paper Code: BFTC-406

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Understand the role of processing in terms of shelf life, safety, nutritional and economic value of fruit and vegetables.

CO2. Assess the role in pre- and post-harvest changes in fruits and vegetables on product quality.

CO3. Gain knowledge on production, preservation and packaging of jam, jelly, marmalade, pickles, candies.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	1	1	2	3	1	1	1	1	1
CO2	2	2	2	2	3	1	1	2	3	1	3	3	3	2
CO3	3	2	2	3	3	1	3	3	3	2	3	3	3	3

Each Course2 Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

List of Experiments:

1. Comparison of tray dryer and vacuum tray drying of food and vegetable
2. Freeze drying characteristic of food material
3. Determination of TSS of different fruits
4. Processing of tomato products;
5. Study on Zero Energy Cooling Chamber for Shelf-life study of Fruits and Vegetable
6. Preparation of pickle/mixed pickle
7. Design of Cold storage
8. Preparation of banana and potato wafers;
9. Preparation of dehydrated vegetables

Paper Title: Industrial Visit 1

Paper Code: BFTC- 407

Maximum Marks: 50 (Attendance: 20, Report-30)

The students will visit the different food processing industries, to acquaint them with different

handling, processing and preservation techniques. Different hazards and risks associated with the processing will also be explained. The students have to make a report, which shall include; the layout of the industry, different machineries and their uses, limitations in the processing line and suggestions. The internal assessment will be carried out by the internal faculties.

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Gather, form and critique knowledge from industry

CO2. Identify and investigate the working or processing in the food industry

CO3. Ability to analyze and present the learning from the visit

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	2	3	1	2	2	3	3	3
CO2	3	3	2	2	2	2	3	3	1	2	2	3	3	3
CO3	3	3	2	2	3	2	3	3	1	2	2	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

THIRD YEAR

CORE SUBJECT **SEMESTER V**

Paper Title: Dairy Technology

Paper Code: BFTC-501

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Gain knowledge on milk source and composition

CO2. Understand the various milk processing methods.

CO3. Learn the processing aspects of various value added dairy products and related milk processing equipments.

CO4. Develop an understanding on milk packaging machines

CO5. Demonstrate hands-on skills in manufacturing selected dairy products in a pilot plant setting

CO6. Evaluate the safety and quality factors that determine the acceptability of the dairy products by consumers.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	2	3	2	3	1	1	2	3	3	3	3	3
CO2	2	1	1	1	2	3	2	3	2	3	2	3	3	3
CO3	2	3	2	3	2	3	1	1	2	3	3	3	3	3
CO4	2	1	1	1	2	3	2	3	2	3	2	3	3	3
CO5	2	3	2	3	2	3	1	1	2	3	3	3	3	3
CO6	2	1	1	1	2	3	2	3	2	3	2	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT I

Introduction: Milk: Factors affecting composition and quality; Types of milk; Dairy Chemistry & Microbiology: Processing aspects in brief: Reception, Homogenization, Pasteurization, Sterilization, Cleaning and sanitization of dairy equipments.

UNIT-II

Milk products; Condensed milk: definition, methods of manufacture; Evaluation of condensed and evaporated milk; Dried milk: definition, methods of manufacture of skim and whole milk powder; Properties in defects in dried milk powder. Cream: definition, classification, composition; Cream processing; Evaluation and defects in cream

UNIT-III

Milk products: Cheese: Definition, composition, classification, methods of manufacture, cheddar, cottage and processed cheese; defects in cheese. Ice cream: definition; Composition, Classification; Methods of manufacture; over run, Defects in ice cream; Butter: definition, composition, classification, methods of manufacture, theories of churning, and defects in butter.

UNIT-IV

Indigenous milk products: present status; Methods of manufacture of yoghurt, khoa, burfi, kalakand, gulabjamun, rosogolla, chhana, paneer, shrikhand.

References:

1. Aneja RP, Mathur BN, Chandan RC & Banerjee AK. Technology of Indian Milk Products. Dairy India Publ.
2. De S. Outlines of Dairy Technology. Oxford Univ. Press.
3. Henderson JL. Fluid Milk Industry. AVI Publ.
4. Walstra P., Geuits T.J., Noomen A., Jellema A. and Van Boekel M.A.J.S.,Dairy technology- Principles of milk properties and processes; Marcel Dekker Inc.

5. Web BH, Johnson AH & Lford JA. 1987. Fundamental of Dairy Chemistry. 3rd Ed. AVI Publ.
6. Walstra P., Geuits T.J., Noomen A., Jellema A. and Van Boekel M.A.J.S.,Dairy technology-Principles of milk properties and processes; Marcel Dekker Inc.

CORE SUBJECT **SEMESTER V**

Paper Title: Food Engineering II
Paper Code: BFTC-502
Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. To understand the principle of Unit operation. Cognitive level: Understand

CO2. To acquaint with fundamentals of food engineering and its process. Cognitive level: Understand and Analyze

CO3. To impart basic knowledge of: Radiation, Plasma, Bio preservation and hurdle technology. Cognitive level: Understand

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	3	2	2	2	3	2	1	1	1
CO2	3	2	2	3	2	3	2	2	3	2	2	2	2	2
CO3	3	3	1	2	2	2	2	1	1	1	1	2	1	1

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT I

Principles of mass transfer, mass balance calculations, Calculations involved in dilution, concentration dehydration, evaporation and other unit operations. Modes of heat transfer, steady state heat conduction equation, Heat conduction in slabs, cylinders & spheres heat generation inside solids, unsteady state heat conduction.

UNIT-II

Design of single & multi effect evaporators, mechanics of movements of air through stationary bed, then layer and thick layer bed drying. Natural convection and its applications. Refrigeration cycles, performance of refrigeration compressors, refrigeration system balance and multiple evaporation

systems.

UNIT III

Theory, process and equipment for humidification and dehumidification, Theory, process and equipment for osmosis, reverse osmosis, adsorption and absorption.

UNIT IV

Drying of Foods: various mechanisms of moisture removal in solid and liquid foods during drying; properties of air-water vapour mixture; Pyschrometry. Types of Dryers and their performance.

Recommended Books:

1. Heldman DR & Singh RP. Food Process Engineering. AVI Publ
2. R.C. Sachdeva. Fundamentals of Engineering Heat and mass transfer.
3. Fellows P. Food Processing Technology. VCH Ellis Horwood.
4. Brennan JG, Butter JR, Corell ND & Lilly AVE. Food Engineering Operations. Elsevier.
5. Charm SE, McCabe WL, Smith JC & Harriott P. Unit Operations of Chem Engineering. McGraw Hills.
6. Sahay KM & Singh KK. Unit Operation of Agricultural Processing. Vikas Publ. House.
7. Geankoplis J Christie. (1999). Transport Process and Unit Operations. Allyn & Bacon

CORE SUBJECT **SEMESTER V**

Paper Title: Food Fermentation and Biotechnology
Paper Code: BFTC-503

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. The student will gain basic knowledge of GMOs/GMCs, Role of microorganism in food biotechnology and their various applications in food sector.

CO2. Students also will gain the fundamental aspects of r-DNA technology and aware about gene cloning methodology and their significance in different biotechnological research centre.

CO3. Student would have acquired basic knowledge of molecular level vectors used as genetic engineering tool for development of new plant variety

CO4. Understand the application of Applications of GMO/GMC in food, agriculture and industrial sector, Regulatory and Social aspects of Food Biotechnology

CO5. The students will learn about the basics fermentation and difference in primary and secondary metabolites.

CO6. The students will learn about the Design of fermenter, Aerobic and anaerobic fermentation and

kinetics in in Batch, Fed batch and continuous mode of reaction.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	1	3	1	1	1	3	1	2	3	3	1
CO2	1	1	1	1	3	1	1	1	3	3	2	2	2	1
CO3	1	1	1	1	3	1	1	1	3	1	2	2	2	1
CO4	1	1	1	1	3	1	1	1	3	1	2	2	1	2
CO5	1	1	1	1	3	1	1	2	3	3	2	1	2	1
CO6	1	2	3	1	3	1	2	2	3	3	2	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT-I

Nucleic acids: structure and types of DNA and RNA, Watson and Crick model; central dogma of life-replication, transcription, translation and their inhibition

Unit -II

Bioreactors, Fermenter design and various types of fermentation systems (submerged, surface and solid state). production of alcoholic beverages; waste utilization

UNIT-III

Fermented food products:; sauerkraut, pickles, fermented soy products, yoghurt, cheese, bread; application of fermentation for value-addition; Production of amino acids, , citric acid, lactic acid, Baker's yeast, vinegar. Principles and production of Poly Unsaturated Fatty Acids, Dextran, Xantham and gum – properties and applications.

UNIT-IV

Recombinant-DNA technology, Expression and production of foreign genes, enzymes; biomass utilization-SCP; genetically modified organism; Cell and tissue culture, Secondary metabolites synthesis.

Suggested reading

1. Bains W.. Biotechnology from A to Z. Oxford Univ. Press.
2. Joshi VK & Pandey A. Biotechnology: Food Fermentation. Vols. I, II.Education Publ.
3. Knorr D. Food Biotechnology. Marcel Dekker.
4. Lee BH. Fundamentals of Food Biotechnology. VCH.
5. Prescott SC & Dunn CG. Industrial Microbiology. McGraw Hill.
6. Ward OP. Fermentation Biotechnology. Prentice Hall.
7. Perman D. Annual Reports of Fermentation Processes. Vols. I-III.
8. Prescott SC & Dunn CG. Industrial Microbiology. Mc Graw Hill.
9. Robert EC. Handbook of Nutraceuticals and Functional Foods. 2nd Ed. Wildman.
10. Shi J. (Ed.). Functional Food Ingredients and Nutraceuticals: Processing Technologies. CRC Press.

CORE SUBJECT **SEMESTER V**

Paper Title: Dairy Technology Lab

Paper Code: BFTC-504

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Understand role of various ingredients in the manufacturing of various dairy products.

CO2. To determine Quality evaluation of various dairy products

CO3. Gain knowledge on production of dairy and dairy products such as ice creams, Paneer, khoa etc including their quality assurance

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	3	2	2	2	2	2	3	3	3	3	3
CO2	3	2	1	3	2	2	2	2	2	3	3	3	3	3
CO3	3	2	1	3	2	2	2	2	2	3	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

List of Experiments:

1. Determination of titrable acidity, pH and clot on boiling test in milk.
2. Detection of added starch and cane sugar in milk
3. Detection of water in milk.
4. Detection of presence of neutralizers in milk.
5. Preparation of chana and paneer from milk.
6. Preparation of flavored milk.
7. Estimation of salt in butter sample.
8. Design and layout of Dairy plant.
9. Preparation of whey-based beverages
10. To prepare a HACCP plan for a dairy processing unit.
11. Detection of preservatives: formalin, H_2O_2 in milk.
12. Detection of presence of urea in milk.
13. Preparation of cheese from milk.
14. Preparation of yoghurt.

15. Preparation of Ice cream.
16. Calculation of over run in ice cream.
17. Design and layout of Dairy plant.
18. Detection of presence of detergent in milk.
19. To prepare a HACCP plan for a dairy processing unit.
20. Visit to Dairy Plant

CORE SUBJECT **SEMESTER V**

Paper Title: Food Engineering II Lab
Paper Code: BFTC-505

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. To know the method of estimation of carbohydrates, protein, reducing and non-reducing sugars, starch in food samples. Cognitive level: Understand

CO2. To know the method of determination of pH, acidity, Moisture Content, Ash content in different food sample Cognitive level: Understand

CO3. To know the principle & working of pulping, paste making, frying, toasting processes. Cognitive level: Understand

CO4. To know the method for detection of emulsifiers, stabilizers, thickeners, natural colors, benzoic acid, saccharin from different food samples. Cognitive level: Understand

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	2	1	1	1	2	2	2	1	2
CO2	2	2	2	1	2	2	2	2	2	3	3	2	3	3
CO3	3	2	3	2	3	2	3	3	3	3	3	2	2	2
CO4	2	2	3	2	1	1	1	1	1	2	1	1	1	1

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

List of Experiments:

1. Material balance in food processes.
2. Particle size analysis for determination of mean particle diameter.

3. Performance evaluation of different mills.
4. Efficiency of separation for a grain mixture using indented cylinder separator
5. Efficiency of separation for a grain mixture using spiral separator.
6. Mixing index of food material by ribbon blender and cone blender.
7. Efficiency of cyclone separator.
8. Compression of tray dryer and vacuum tray drying of food and vegetable
9. Freeze drying characteristic of food material.
10. Effect of processing parameter on Spray drying of milk.

DISCIPLINE SPECIFIC ELECTIVE I **SEMESTER V**

Paper Title: Bakery and Confectionery Technology

Paper Code: BFTD-506

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Gain knowledge on the ingredients, process and machinery involved in bakery and confectionery and beverage technology. Cognitive level: Understand and Analyze

CO2. Understand the importance and effect of quality of raw materials on the final products

CO3. Apply the knowledge gained in formulating new types of products. Cognitive level: Understand and Analyze

CO4. Analyze the process for maintaining and improving the quality of the final product. Cognitive level: Understand and Analyze

CO5. Evaluate the steps involved in the process and improve existing technologies or develop newer technologies. Cognitive level: Understand

CO6. Design and create newer process and products that are better economically, nutritionally or technologically. Cognitive level: Understand

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	2	2	2	2	2	2	2	2
CO2	3	1	2	1	1	1	2	2	1	1	1	1	1	1
CO3	3	2	2	2	2	2	2	2	2	1	1	1	1	1

CO4	3	2	2	2	2	2	2	2	1	1	1	1	1	1
CO5	3	1	1	1	1	1	1	1	1	1	1	1	1	1
CO6	3	2	2	2	2	2	2	2	2	2	1	1	1	1

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT I

Bakery industry status in India and World. Raw materials and quality parameters; Product types; Functions of Gluten, rheological testing of dough-Farinograph, Mixograph, Rapid Visco Analyzer, Falling number.

UNIT-II

Technology for the manufacture of bakery products-bread, biscuits, crackers, buns, pizza base Equipments used, product quality characteristics, faults and corrective measures; Staling and losses in baking.

UNIT III

Technology for the manufacture of cakes, types of cakes-pound cake, fruit cake, sponge cake; Equipments used for the manufacture of cakes, product quality characteristics, faults and corrective measures. Different types of icings.

UNIT IV

General technical aspects of Industrial sugar confectionery, Quality characteristics of confectionery ingredients; technology for manufacture of chocolate, boiled sweets, caramel, toffee and fudge. Processing of liquorice paste, cream paste, marshmallow and fondents

References:

1. Matz, (1989). Bakery Engineering and Technology, Vol I and II, CBS Publishers, New Delhi.
2. Dubey SC. Basic Baking. The Society of Indian Bakers, New Delhi.
3. Manley D. 2000. Technology of Biscuits, Crackers & Cookies. 2nd Ed. CRC Press.
4. Pomeranz Y. Modern Cereal Science and Technology. MVCH Publication
1. Levie A. Meat Hand Book. 4th Ed. AVI Publ.
2. Mead M. Poultry Meat Processing and Quality. Woodhead Publ.
3. Mead GC. Processing of Poultry. Elsevier.
4. Pearson AM & Gillett TA. Processed Meat. 3rd Ed. Chapman & Hall.
5. Stadelman WJ & Cotterill OJ. Egg Science and Technology. 4th Ed. CBS.

DISCIPLINE SPECIFIC ELECTIVE II **SEMESTER V**

Paper Title: Beverage Technology

Paper Code: BFTD-507

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Gain knowledge on the ingredients, process and machinery involved in beverage technology.

CO2. Understand the importance and effect of quality of raw materials on the final products\

CO3. Apply the knowledge gained in formulating new types of products

CO4. Analyze the process for maintaining and improving the quality of the final product

CO5. Evaluate the steps involved in the process and improve existing technologies or develop newer technologies

CO6. Design and create newer process and products that are better economically, nutritionally or technologically.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	2	1	1	1	2	3	3	3	3
CO2	2	3	1	1	1	2	1	1	1	1	3	3	3	3
CO3	3	3	2	2	1	2	1	3	1	1	3	3	3	3
CO4	3	3	2	2	1	2	1	3	1	1	3	3	3	3
CO5	3	2	2	2	1	2	1	3	1	1	3	3	3	3
CO6	3	3	2	2	1	2	1	3	1	2	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT-I

Introduction and ingredients: Scope and status of beverages in North East region and in India. Definition of beverage, study of ingredient like sweeteners, emulsifier, colouring agent, flavoring agent, stabilizer.

UNIT II

Technology for non-alcoholic beverages: Raw materials quality and handling. Equipment and machinery for carbonated beverages, water treatment, syrup preparation, containers and closures, handling of empty containers and cleaning, carbonation, filling, inspection and quality control.

UNIT III

Technology for non-carbonated beverages: Raw materials quality and handling. Technology, specification, equipment and machinery for instant tea and coffee, fruit juice based beverages, milk and whey based beverages.

UNIT IV

Technology for alcoholic beverages: Raw materials quality and handling. Technology, equipment and machinery for Wine, Beer, Whiskey, Brandy, and Rum. Cereal Fermentation.

Packaging and storage of different beverages. Sanitation in beverage industry. Waste utilization of

beverage industries.

BOOKS RECOMMENDED:

1. Prescott, S. C and Dunn, C. G. Industrial microbiology, (Agrobios, 2007).
2. Boulton, C. and Quain, D. Brewing, Yeast and Fermentation, (Blackwell Science Ltd, 2001)
3. Fix, G. J. Principles of Brewing Science, (Brewers Publications, 1999)
4. Stanbury, P. F., Hall, S. and Whitaker, A. Principles of Fermentation Technology, (Aditya Books Pvt. Ltd., 1997)
5. Global Advances in Tea Science. N.K.Jain, Aravali Books International, 1st Edition, 1999.
6. Coffee: Botany, Biochemistry and Production of Beans and Beverage. M.N. Clifford and K.C.Willson, AVI publishing Co., 1st Edition, 1985

GENERIC SPECIFIC ELECTIVE I **SEMESTER V**

Paper Title: Techniques in Food Analysis
Paper Code: BFTG-508

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Gain knowledge in the sampling techniques in used in food analysis

CO2. Learn chromatographic and spectroscopic techniques in food analysis

CO3. Understand how microscopic techniques are used in food analysis.

CO4. Familiar with specialized and rapid techniques in food analysis.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	2	3	2	3	2	1	2	2	2	2	2
CO2	3	3	3	3	1	3	3	3	3	1	3	1	3	3
CO3	2	2	2	2	2	2	2	2	1	2	2	2	1	2
CO4	3	2	3	1	2	3	1	3	2	3	3	1	3	1

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT-I

Sampling techniques, Importance of sampling in food analysis, Food Safety and toxicity, calibration and standardisation of instruments, Accuracy and Precision.

Unit- II

Chromatographic Techniques, Thin layer, Paper chromatography, column chromatography, normal phase and reverse phase chromatography, HPLC, GC, detectors (flame ionization, conductivity, photoionization, MS, electron capture, MALDI), FTIR, Spectroscopy.

Unit-III

Microscopic techniques in food analysis: Light microscopy, Compound microscopy, Scanning electron microscopy, Transmission electron microscopy.

Unit-IV

Biosensors, Artificial tongue, electronic nose, PCR, ELISA, NMR, Differential scanning calorimetry.

Unit- V

Basic principles of centrifugation, relation between g and RCF, gel electrophoresis techniques,

References:

1. Skoog, D. A., Holler, F. J., & Crouch, S. R. (2017). Principles of instrumental analysis. Cengage learning.
2. Nielsen S. (Eds.). 1994. Introduction to Chemical Analysis of Foods. Jones & Bartlett
3. Ranganna S. 2001. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd Ed. Tata-McGraw-Hill
4. AOAC International. 2003. Official methods of analysis of AOAC International. 17th Ed.

GENERIC SPECIFIC ELECTIVE II **SEMESTER V**

Paper Title: Food storage and Plant Layout Paper Code: BFTG-509

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. To understand the basics of designing of food plant and systems

CO2. Basic knowledge of Food plant layout introduction, planning and experimentation

CO3. The student will gain knowledge to design and setting up of new food processing plant as Entrepreneur and/or consultant.

CO4. The student can prepare cost estimate and economic analysis of food industry.

CO5. The student can implement the food safety standards in food industries.

CO6. Identify the specific storage needs of a variety of foods and crops.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific

Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	2	1	1	1	2	3	3	3	3
CO2	2	2	1	1	1	2	1	2	1	2	3	3	3	3
CO3	3	3	2	2	1	2	1	3	2	2	3	3	3	3
CO4	3	3	2	2	1	2	1	3	2	2	3	3	3	3
CO5	2	2	2	2	1	2	1	3	2	2	3	3	3	3
CO6	3	3	2	2	1	2	1	3	2	2	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT I

Grain storage: Levels of storage, properties of grain affecting storability, factors of spoilage, changes occurring during storage; bulk storage structures: traditional storage structures bukhari, kothar,morai, mud kothi; improved storage structures pusa bin, RCC bin,-, air distribution system and aeration fans; Bag storage: general Design consideration for warehouse

UNIT II

Modified atmospheric storage and controlled atmosphere storage; Biological spoilage of grains: common insects of stored grains, insecticides: principle, toxicity; fumigants-principle, properties and application; Rodenticides: anticoagulants. Cold storage and cold chain management: Introduction, scope of Cold Chain for enhancing marketing potentials of perishables in domestic and international markets, importance, cold chain transportation, different types of freezing methods, temperature- time management along the cold chain Food, temperature abuse in cold chain.

UNIT III

Plant layout: plant design concepts - situations giving rise to plant design problems - differences in design of food processing and non-food processing plants, general design considerations. Waste disposal and sanitation

Recommended Readings:

1. Norman G. Marriott and Robert B. Gravani. (2006). Principles of Food Sanitation,5th edition
2. Rao, D. G. (2010). Fundamentals of Food Engineering, PHI learning Private Ltd.
3. Fellows P. (2000). Food Processing Technology, 2nd Edition. Woodhead Publishing Limited and CRC Press LLC
4. James A (2013). The supply chain handbook, distribution group.
5. FAO, US (1984) Design and operations of cold store in developing

Paper Title: Industrial Visit 2

Paper Code: BFTC- 510

Maximum Marks: 50 (Attendance: 20, Report-30); Credit 1

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Gather, form and critique knowledge from industry

CO2. Identify and investigate the working or processing in the food industry

CO3. Ability to analyze and present the learning from the visit

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	2	3	1	2	2	3	3	3
CO2	3	3	2	2	2	2	3	3	1	2	2	3	3	3
CO3	3	3	2	2	3	2	3	3	1	2	2	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

The students will visit the different food processing industries, to acquaint them with different handling, processing and preservation techniques. Different hazards and risks associated with the processing will also be explained. The students have to make a report, which shall include; the layout of the industry, different machineries and their uses, limitations in the processing line and suggestions. The internal assessment will be carried out by the internal faculties.

Paper Title: Research Institute Tour 1

Paper Code: BFTC- 511

Maximum Marks: 50 (Attendance: 20, Report-30); Credit 1

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Gather, form and critique knowledge from industry

CO2. Identify and investigate the working or processing in the food industry

CO3. Ability to analyze and present the learning from the visit

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	2	3	1	2	2	3	3	3
CO2	3	3	2	2	2	2	3	3	1	2	2	3	3	3
CO3	3	3	2	2	3	2	3	3	1	2	2	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

The students will visit any Food Research Institute, to acquaint them with different handling, processing and preservation techniques. Different hazards and risks associated with the processing will also be explained. The students have to make a report, which shall include; the layout of the industry, different machineries and their uses, limitations in the processing line and suggestions. The internal assessment will be carried out by the internal faculties.

THIRD YEAR

CORE SUBJECT **SEMESTER VI**

Paper Title: Meat, Fish and Poultry Technology

Paper Code: BFTC-601

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. To know the compositional and technological aspects of meat, egg, milk and fish.

CO2. To understand need and importance of livestock, egg and poultry industry

CO3. To study structure, composition and nutritional quality of animal products.

CO4. To study processing and preservation of animal foods.

CO5. To understand technology behind preparation of various animal food products and byproduct utilization.

CO6. To enumerate the composition and role of microorganisms in meat.

CO7. To understand the slaughtering, carcass processing methods and equipments used for processing meat.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	2	1	1	1	1	3	3	3	3

CO2	3	2	2	2	1	2	1	1	1	2	3	3	3	3
CO3	2	2	2	2	1	2	1	1	1	2	3	3	3	3
CO4	2	2	2	2	1	2	1	1	1	2	3	3	3	3
CO5	3	2	2	2	1	2	1	1	1	2	3	3	3	3
CO6	3	3	2	2	1	2	1	1	1	2	3	3	3	3
CO7	3	3	2	2	1	2	1	1	1	2	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT I

Introduction to meat and poultry industries, Meat: composition from different sources; Muscle structure and composition; Modern abattoirs, Scientific methods of Stunning and Slaughtering: Halal, jhatka and kosher meat processing, Steps in slaughtering and dressing.

Unit- II

Postmortem muscle chemistry: Exsanguination, Loss of Homeostasis, Postmortem pH Decline, Rigor Mortis, Resolution of Rigor, Color, water holding capacity (WHC) and juiciness, texture and tenderness, odour and taste, meat tenderization;. Chilling and freezing of carcass and meat; Cold storage, Canning, cooking, drying, pickling, curing and smoking; Prepared meat products salami, kebabs, sausages, sliced, minced, corned, Meat microbiology and safety

Unit-III

Poultry industry in India; Microbiology of poultry meat; Spoilage factors; Layout, sanitation and processing operations of poultry processing. Byproducts: eggs, egg products; Whole egg powder and egg yolk products: manufacture, packaging and storage.

Unit-IV

Fish: structure and composition, post mortem changes, rigor mortis, autolytic changes, bacteriological changes, rancidity, physical changes.
Meat plant hygiene: GAP and HACCP; Packaging of meat products, Packaging of poultry products, refrigerated storage of poultry meat.

References:

1. Forrest JC. Principles of Meat Science. Freeman.
2. Govindan TK. Fish Processing Technology. Oxford & IBH.
3. Hui YH. Meat Science and Applications. Marcel Dekker.
4. Kerry J. et al. Meat Processing. Woodhead Publ. CRC Press.

CORE SUBJECT **SEMESTER VI**

Paper Title: Engineering Properties of Food Materials Paper Code: BFTC-602

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. To understand Engineering properties of food materials.

CO2. To identify the structure and chemical composition of foods.

CO3. To determine the physical properties of food materials.

CO4. To calculate the water activity, food stability sorption and desorption isotherm of food materials.

CO5. To study the difference between Newtonian and non-Newtonian fluids.

CO6. To examine the thermal properties, electrical and magnetic properties of food.

CO7. To measure the aero- and hydrodynamic characteristics and the application of frictional properties in grain handling, processing and conveying.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	2	1	1	1	2	3	3	3	3
CO2	2	2	3	3	1	2	1	1	1	2	3	3	3	3
CO3	3	2	3	3	1	2	1	1	1	2	3	3	3	3
CO4	3	3	3	3	1	2	1	2	1	2	3	3	3	3
CO5	2	3	3	3	1	2	1	2	1	2	3	3	3	3
CO6	3	3	3	3	1	2	1	2	1	2	3	3	3	3
CO7	3	3	3	3	1	2	1	2	1	2	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT-I

Physico-chemical characteristics: shape, sphericity, size, volume, density, porosity, surface area, terminal velocity, drag coefficient, coefficients of friction and angle of repose.

UNIT-II

Specific heat, thermal conductivity, thermal diffusivity, electrical resistance and conductance, dielectric constant, energy absorption, Numerical calculations.

UNIT-III

Physical states of Matter, Rheology of food materials, Newtonian and Non-Newtonian fluids, rheological models and equations, Linear Visco-elasticity, Creep stress relaxation, Plastic behaviour. Texture profile analysis.

UNIT-IV

Application of engineering properties in process development as well as design and operation of equipment and structures associated with handling, processing and storage of raw as well as processed food products.

Recommended Books:

1. M.A. Rao & S.S. H. Rizvi. Engineering Properties of Foods. CRC Press.
2. J. M. Aguilera & D. W. Stanley. Micro-structural principles of food processing

and Engineering.
3. N. N. Mohsenin. Physical properties of plant and animal materials.
4. Zeki Berk. Food Process Engineering and Technology. Academic Press.

CORE SUBJECT **SEMESTER VI**

Paper Title: Food Engineering III
Paper Code: BFTC-603
Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. To understand the various drying operations and drying methods

CO2. To understand the principle of blanching, pasteurization and sterilization

CO3. To understand the properties of dry-air, water-vapour & air-vapor mixtures

CO4. To understand the textural properties of food materials.

CO5. To understand the rheological properties of food materials.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	3	2	1	2	1	1	1	2	3	3	3	3
CO2	2	3	3	2	1	2	1	1	1	2	3	3	3	3
CO3	3	3	3	3	1	2	1	1	1	2	3	3	3	3
CO4	3	3	3	3	1	2	1	1	1	2	3	3	3	3
CO5	3	3	3	3	1	2	1	1	1	2	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT-I

Drying-Theory of drying, Spray drying, Freeze drying, Vacuum drying, Sun drying, Foam mat drying, Evaporators, Continuous, Multiple effect, Falling and Rising film evaporators, fluidized bed drying. Psycrometry, Moisture sorption curves, Drying rate periods, Water activity, moisture content; wet basis and dry basis; calculations.

Unit- II

Drying rate curves, bound moisture, free moisture, equilibrium moisture content, critical moisture content, engineering aspects of different types of driers including bin drier, tray drier, drum drier, tunnel drier, spray drier, fluidized bed drier, freeze drier. Principle of humidification & dehumidification, humidity chart, wet and dry bulb temperature.

UNIT-II

Rheological classification of Fluid Foods: Newtonian and Non-Newtonian fluids; Mechanisms and relevant models for non-Newtonian flow; Effect of temperature; Compositional factors affecting flow behaviour. Pasting properties and Linear Viscoelastic Range, Creep recovery.

UNIT III

Rheological and textural properties of selected food products. Texture profile analysis, Effect of processing and additives (stabilizers and emulsifiers) on food product rheology; Relationship between instrumental and sensory data. Comparative assessment of different types of Viscometers. Modifying microstructure, glass transition (starch, proteins and fats), effects of processing on rheology and texture.

References:

1. Singh RP. 1991. Fundamentals of Food Process Engineering. AVI Publ.
2. Singh RP and Heldman DR. 1993.Introduction to Food Engineering. Academic Press.
3. Fellows P. 1988.Food Processing Technology: Principle and Practice. VCH Publ.
4. Geankoplis J Christie. 1999. Transport Process and Unit Operations. Allyn & Bacon.
5. Henderson S & Perry SM. 1976.Agricultural Process Engineering.5th Ed. AVI Publ.
6. McCabe WL & Smith JC. 1999. Unit Operations of Chemical Engineering. McGraw Hill.
7. Sahay KM & Singh KK. 1994. Unit Operation of Agricultural Processing. Vikas Publ. House.
8. Bourne, M. Food Viscosity and Texture, 2nd Edition, Academic Press, New York, 2002.
9. José Miguel Aguilera. Microstructural Principles of Food Processing Engineering.
10. Macosko, Ch.W. Rheology: Principles, Measurements, and Applications (Advances in Interfacial Engineering), Wiley-VCH, 1994.
11. Morrison, Faith. Understanding Rheology, Oxford University Press, 2001.
12. Donald B. Bechtel. New Frontiers in Food Microstructure.
13. Moskowitz. Food Texture.

CORE SUBJECT **SEMESTER VI**

Paper Title: Meat Technology Lab

Paper Code: BFTC-604

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Able to perform the proximate analysis of meat and meat products

CO2. Able to perform the quality tests of egg.

CO3. Able to perform the microbial analysis of meat and meat products.

CO4. Able to prepare meat products.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	2	1	1	1	2	3	3	3	3
CO2	3	3	3	2	1	2	1	2	1	2	3	3	3	3
CO3	3	3	3	2	1	2	1	2	1	2	3	3	3	3
CO4	3	3	2	2	1	2	1	2	1	2	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

List of Experiments:

1. Determination of moisture content in meat samples.
2. Determination of fat content in meat samples
3. Determination of protein content.
4. Determination of crude fibre content.
5. Study of Animal Carcass and Meat grading and cutting practices.
6. Study of Smoking on different physico-chemical and sensory characteristics on Meat and meat products.
7. To carry out candling and grading of shell eggs.
8. Visit to a meat processing plant.
9. Preparation of different meat products.

CORE SUBJECT **SEMESTER VI**

Paper Title: Engineering Properties of Food Material
Lab Paper Code: BFTC-605

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Understand Engineering properties of food materials. Cognitive level: Understand

CO2. Identify the structure and chemical composition of foods. Cognitive level: Understand and Analyze

CO3. Determine the physical properties of food materials. Cognitive level: Understand

CO4. Calculate the sorption and desorption isotherm of food materials.

CO5. Study the rheological behavior of Newtonian and non-Newtonian fluids. Cognitive level: Understand

CO6. Evaluate the properties and quality of food materials. Cognitive level: Understand and Analyze

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	1	2	1	2	1	2	2	1
CO2	3	2	2	1	2	1	2	1	2	1	2	1	2	2
CO3	2	2	2	2	2	2	2	1	2	2	2	2	2	2
CO4	3	2	1	2	1	2	1	2	2	1	2	1	2	1
CO5	2	2	2	1	2	1	2	1	2	1	2	1	2	1
CO6	3	2	2	2	2	2	2	2	1	1	1	2	2	1

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

List of Experiments:

1. Determination of viscosity of different foods.
2. To study the engineering properties of different food materials.
3. To calculate the angle of repose of different grains.
4. To calculate the heat penetration in foods.
5. To evaluate texture of raw and processed foods using texture analyser.
6. To analyse the flour quality by Falling Number.
7. Design of Cold storage.
8. Design of Grain storage and Silo.
9. Performance evaluation of different mills.
10. Material balance in food processes.
11. Comparison of tray dryer and vacuum tray drying of food and vegetable.
12. Freeze drying characteristic of food material
13. Particle size analysis of different flours.

CORE SUBJECT **SEMESTER VI**

Paper Title: Food Engineering III
Lab Paper Code: BFTC-606

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. To know the principle & working of instruments such as incubator, oven, autoclave, water bath

colorimeter, weighing balances, muffle furnace and centrifuge etc.

CO2. To know the method of weighing, adjusting the pH of media and sterilize the media by autoclaving.

CO3. To pasteurize the fluids using different methods.

CO4. To determine the drying rate curve of food materials and effect of various drying methods on food materials.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	3	2	1	2	1	2	1	1	3	3	3	3
CO2	3	3	3	2	1	2	1	2	1	2	3	3	3	3
CO3	3	3	3	3	1	2	1	2	1	2	3	3	3	3
CO4	3	3	3	3	1	2	1	2	1	2	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

List of Experiments:

1. Comparison of tray dryer and vacuum tray drying of food and vegetable.
2. Freeze drying characteristic of food material
3. To study the drying characteristics of different food materials.
4. To plot drying curve for onion, potato, tomato slices.
5. Moisture Sorption Isotherm of different foods.
6. Calculation of moisture content on dry weight basis and wet weight basis.
7. Model fitting to drying curves.
8. To check the rheology of different materials.
9. To check the pasting properties of flours.

DISCIPLINE SPECIFIC ELECTIVE I **SEMESTER VI**

Paper Title: Food Product Development Paper Code: BFTD-607

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Define the basic concepts and recent trends in new product development of processed foods

CO2. Understand market and consumer surveys in food product development.

CO3. Understand the relevance of market research, costing, and advertising in food product development.

CO4. Apply the basic strategies of shelf life testing and sensory evaluation in new product development .

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	3	1	1	1	3	3	1	2	1	2	2	3
CO2	2	2	3	3	1	1	1	3	1	1	1	1	1	3
CO3	3	3	1	1	3	1	1	3	1	2	1	2	1	3
CO4	2	3	1	3	1	1	1	3	1	1	1	1	1	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

Unit I

New Proprietary Food Products: Sources for R&D initiative, Definition, Classification, Characterization, Factors shaping new product development- Social concerns, health concerns, impact of technology. Product integrity and conformance to standard.

UNIT-2

Market and market place influence on new product development, Market Survey, Consumer survey to identify new products in terms of Line Extension, Repositioning Existing Products, New form/Reformulation. New packaging of existing products, Innovative products, Creative Products. Tapping traditional foods and unconventional sources of foods.

UNIT-3

Identification of concept and product for development, Market research for the concept and selected product, Identification of products, selection of one product and its standardization improving success. Costing the product and determining the sales price, Advertising and test marketing the product, Report preparation.

UNIT-4

Shelf life testing of new product (testing for appropriate quality parameters-chemical, microbiological and nutrient content, acceptability studies), Overview of sensory principles and practices: General consideration in sensory testing, Selection and screening of panel: Types of panel (Trained panel, discriminative and communicative panel).

Recommended Books

1. Amerine, M.A.; Pangborn, R.M.; Roessler, E.B.,Principles of Sensory Evaluation, Academic Press, NY
2. Kapsalis, J.G,Objective, Methods in Food Quality Assessment, CRC Press, Florida.
3. Martens, M.; Dalen, G.A.; Russwurm, H. (eds), Flavour Science and Technology, John Wiley and Sons, Chichester.
4. Moskowitz, H.R.(eds), Food Texture: Instrumental and Sensory Measurement,

Marcel Dekker Inc. , New York.
5. Earle R, Earle R & Anderson A. 2001. Food Product Development. Woodhead Publ.
6. Fuller 2004. New Food Product Development - from Concept to Market Place. CRC.
7. Moskowitz, Howard R. 2009. An Integrated Approach to New Food Product Development. CRC Press.
8. Earle R, Earle R & Anderson A. 2001. Food Product Development. Woodhead Publ.
1. Lyon, D.H.; Francombe, M.A.; Hasdell, T.A.; Lawson, K. (eds) ,Guidelines for Sensory Analysis in Food Product Development and Quality Control, Chapman and Hall, London.

DISCIPLINE SPECIFIC ELECTIVE II **SEMESTER VI**

Paper Title: Engineered, Textured and Fabricated Foods Paper Code: BFTD-608

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. To understand the extrusion processing of foods and various types of extruders. Cognitive level: Understand and Analyze

CO2. To understand the textured vegetable products. Cognitive level: Understand

CO3. Understanding of the fabricated RTE beverages, bakery products, etc. Cognitive level: Understand

CO4. To know the Speciality of food products. Cognitive level: Understand

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	2	2	3	2	2	1	1	1
CO2	3	2	2	2	2	2	1	2	1	2	1	2	1	2
CO3	3	2	2	2	2	2	2	2	1	1	1	1	1	1
CO4	3	2	2	2	2	2	2	2	2	2	2	1	2	2

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

Unit I

Introduction, need of the engineered foods, Extruders. Single Screw and Multiple Screw Extruders, Design and geometry of different parts. Extrusion process. Extrusion cooking. Compression during extrusion, effects of food components, Physical and Chemical Changes during Extrusion Process. Glass transition.

Unit II

Textured vegetable protein products. Soy protein fibres, isolate and concentrate, Puffing Gun, Puffed Products. Meat Analogues. Imitation Paneer.

Unit III

Fabricated Ready to serve Beverages, stimulating and nourishing beverages, Bakery Products, Margarine, Peanut Butter, Imitation Milks Designer Lipids, Technology and manufacture of Macaroni, Pasta, Noodles, Vermicilli.

Unit IV

Weaning Foods/ Baby Foods. Therapeutic Foods. Geriatric Foods.

References:

1. M.A. Rao & S.S. H. Rizvi. Engineering Properties of Foods. CRC Press.
2. J. M. Aguilera & D. W. Stanley. Micro-structural principles of food processing and Engineering.
3. N. N. Mohsenin. Physical properties of plant and animal materials.
4. Zeki Berk. Food Process Engineering and Technology. Academic Press.

GENERIC SPECIFIC ELECTIVE I **SEMESTER VI**

Paper Title: Non-Thermal Food Processing
Paper Code: BFTG-609

Total Credits: 4, Total Lectures 50, Maximum Marks 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. To impart basic knowledge of: Principles of non-thermal processing, Plasma, Bio preservation and hurdle technology

CO2. To know the emerging technologies applied to food processing

CO3. To understand the relative advantages and disadvantages of emerging technologies over existing technologies

CO4. To visualize the equipment used and process stages of emerging technologies

CO5. To apply the non thermal technologies as alternative food processing methods

CO6. To identify the potential of newer technologies for commercialization

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	3	1	2	1	1	1	2	3	3	3	3
CO2	2	3	2	3	1	2	1	1	1	2	3	3	3	3
CO3	2	3	2	2	1	2	1	1	1	2	3	3	3	3
CO4	2	3	2	3	1	2	1	1	1	2	3	3	3	3
CO5	3	3	2	3	1	2	1	2	1	2	3	3	3	3
CO6	2	3	2	3	1	2	1	2	1	2	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT I

Traditional preservation technologies; Emerging techniques - principles of minimal processing and non-thermal processing, use of natural food preservatives and hurdle technology concept; Irradiation processing - equipment, effect on microorganisms and foods.

UNIT II

Non-thermal processing using high hydrostatic pressure, pulsed light, ultrasound, pulsed electric field, reverse osmosis and ultrafiltration, microfiltration, osmotic distillation, membrane distillation; Oscillating magnetic field processing - equipment, effect on micro-organisms, enzymes and food components. Applications in Food Processing.

UNIT III

Freeze drying, freeze concentration, UV radiation, electron beam, ozone, antimicrobial proteins, non-thermal plasma tech., radio frequency, electrolysed water, steam condensation and pasteurization, bacteriocins and lactoferrin, etc.

References:

1. P J Fellows (2009). Food Processing Technology: Principles and Practice. Third edition. Wood Head Publishing in Food Science, Technology and Nutrition.
2. Ortega-Rivas, Enrique (2012). Non-thermal Food Engineering Operations. Springer
3. P J Cullen, Brijesh K. Tiwari, VasilisValdramidis (2011). Novel Thermal and Non-Thermal Technologies for Fluid Foods. Academic Press.
4. Gustavo V. Barbosa Canovas (1998). Nonthermal Preservation of Foods. Marcel Dekker.

GENERIC SPECIFIC ELECTIVE II **SEMESTER VI**

Paper Title: Food Business Management
Paper Code: BFTG-610
Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25 Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Understand the forms and practices adopted at business organizations

CO2. Gain knowledge on the various sources of finance and marketing procedures

CO3. Develop competencies in accounting procedures practiced at the organizations

CO4. Compile the financing and entrepreneurial tasks at the food based business

CO5. Encourage Entrepreneurship ventures in food product development and processing sector

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	3	2	1	2	3	3	3	3
CO2	2	3	2	2	3	2	3	2	1	2	3	3	3	3
CO3	2	2	3	2	2	2	3	2	1	2	3	3	3	3
CO4	3	3	3	2	2	2	3	2	1	2	3	3	3	3
CO5	3	3	2	2	2	2	3	3	1	2	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT-I
Concept and functions of marketing, Advertising; how advertising works? Deciding advertising objectives, advertising budget and advertising message, Media Planning, Personal Selling, Publicity; Sales Promotion, Food and Dairy Products Marketing.

UNIT-II
Production Cost and Pricing Strategies, Introduction to the theories of production and cost; Law of variable proportions; Returns to scale; Producer's Equilibrium; Producer's surplus; revenue curves of a firm .Different pricing strategies: Average pricing and Marginal pricing.

UNIT III
Market measurement- present and future demand; Market forecasting; market segmentation, micro and macro environments; Consumer behaviour, Marketing Planning Process, Product policy and planning: Product-mix; product line; product life cycle, New product development process. Product brand, packaging, services decisions, Brain Storming.

UNIT IV

Entrepreneurship: Definition of Entrepreneur, Internal and External Factors, Functions of an Entrepreneur, Entrepreneurial motivation and Barriers, Classification of Entrepreneurship, Theory of Entrepreneurship, Concept of Entrepreneurship, Development of entrepreneurship; Culture, stages in entrepreneurial process.

References:

1. Damodaran Suma, Managerial Economics; OUP, New Delhi.
2. C. H. Peterson, Managerial Economics; Pearson Education Inc. Indian Reprint
3. L J Truett and D B Truett, Managerial Economics: Analysis, Problems, Cases; John Wiley and Sons.
4. Bridge S et al (2003). Understanding Enterprise: Entrepreneurship and Small Business, Palgrave.
5. Holt (1990) Entrepreneurship,New Venture Creation,Prentice-Hall
6. 3 Dollinger M J (1999) Entrepreneurship,Prentice-Hall

SUMMER TRAINING

Maximum Marks: 100; Credit 1

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Gather, form and critique knowledge from industry

CO2. Identify and investigate the working or processing in the food industry

CO3. Ability to analyze and present the learning from the training

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	2	3	1	2	2	3	3	3
CO2	3	3	2	2	2	2	3	3	1	2	2	3	3	3
CO3	3	3	2	2	3	2	3	3	1	2	2	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

Industrial training: Training will be of 4-6 weeks duration carried out during the summer break after the 6th Semester. The students will submit their reports, and make a presentation in the 7th Semester against the Subject code BFTC-711. The internal assessment will be carried out by the internal

faculties.

FOUTH YEAR

CORE SUBJECT **SEMESTER VII**

Paper Title: Food Packaging Technology
Paper Code: BFTC-701
Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. To impart comprehensive overview of the scientific and technical aspects of food packaging.

CO2. To instil knowledge on packaging machinery, systems, testing and regulations of packaging.

CO3. To know the Objectives and functions of food packaging.

CO4. Understand the concepts of packaging in terms of history, principle and functions

CO5. Identify the various packaging materials available in the market

CO6. Gain knowledge on the packaging methods and systems

CO7. Enumerate the packaging of different food products

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	1	1	2	1	2	1	2	3	3	3	3
CO2	3	2	2	3	1	2	1	2	1	2	3	3	3	3
CO3	2	2	2	2	1	2	1	2	1	2	3	3	3	3
CO4	2	2	2	2	1	2	1	1	1	2	3	3	3	3
CO5	3	3	3	3	1	2	1	2	1	3	3	3	3	3
CO6	3	3	3	3	1	2	1	2	1	3	3	3	3	3
CO7	3	3	3	3	1	2	1	2	1	3	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT-I

Definitions, Functions of packaging and packaging materials; Types of packaging materials: Rigid, Semi-rigid and flexible: Paper and types of papers; Glass: composition, properties, types of closures, Metals: Tinplate containers, tinning process, components of tinplate, tin free steel (TFS), types of cans, aluminum containers, lacquers; Plastics: types of plastic films, laminated plastic materials (Retort pouches).

UNIT-II

Properties of materials such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, Barrier properties of packaging materials: Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement, prediction of shelf life of foods,.

UNIT-III

Active packaging and techniques: oxygen, ethylene, carbon dioxide and other scavengers, intelligent packaging and techniques: Time temperature indicators (TTIs): Definition and classification, Introduction to antimicrobial food packaging and Non-migratory bioactive polymers used in food packaging.

UNIT-IV

Modified atmosphere packaging (MAP), Controlled atmosphere packaging (CAP), combination of MAP and other preservative techniques. Vacuum packaging of food products, Aseptic packaging: Sterilization of packaging material, biodegradable, edible films and recyclable packaging material, Labelling.

Recommended Books:

1. Ahvenainen, R. Novel Food Packaging Techniques. Woodhead Publishing Series.
2. Robertson, (2005), Principles of Food Packaging. CRC Press, USA.
3. Scharow, S., and Griffin, R.C. (1980). Principles of Food Packaging, 2nd Edition, AVI Publications Co. Westport, Connecticut, USA.
4. Yam, KL, Lee, DS and Piergiovanni, L. Food Packaging Science and Technology. CRC Press.

CORE SUBJECT **SEMESTER VII**

Paper Title: Research Methodology

Paper Code: BFTC-702

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Understand research problem formulation

CO2. Analyze research related information

CO3. Comprehend the different types of research and various tools of data collection.

CO4. Translate the knowledge gained on types of data and tools of data collection in compiling editing and coding of data and hypothesis

CO5. Perform Statistical analysis

CO6. Interpret and justify the research findings

CO7. Design, execute and document a research

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	2	3	3	3	2	3	3	3	3
CO2	3	3	3	3	3	2	3	3	3	2	3	3	3	3
CO3	3	3	3	3	3	2	2	3	2	2	3	3	3	3
CO4	3	3	3	3	3	2	2	3	3	2	3	3	3	3
CO5	3	3	3	3	2	2	2	2	2	2	3	3	3	3
CO6	3	3	3	3	3	2	3	2	3	2	3	3	3	3
CO7	3	3	3	3	3	2	3	3	3	2	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT I

Research – Meaning, Objectives and types, criteria of good research, Significance of research, Research and scientific methods. Research ethics, research integrity, standards and problems in research ethics, research safety in laboratories, welfare of animals used in research. Selection of research problem, Justification, theory, hypothesis, basic assumptions, limitations and delimitations of the problem.

UNIT-II

Sampling techniques, Population and sample, collection and classification of data, Frequency distribution, Diagrammatic Representation of data, Measures of central tendencies–Mean, Median and Mode, Measures of dispersion – Range, Quartile deviation, standard deviation, Skewness and Kurtosis.

UNIT-III

Introduction to Regression, Significance Level, ANOVA, Co-Relations, Chi square test, T-Test, F-Test, RSM. Introduction to different statistical software's.

UNIT-IV

Introduction to Funding Agencies: DST, DBT, MoFPI, CSIR, ICMR, SERB, UGC.

UNIT-V

Report writing, Research proposal, Bibliography, Impact factor.

Recommended Books:

1. Kothari, C.K., Research Methodology- Methods and Techniques, (New Age International, New Delhi).
2. Trochim, William M.K., Research Methods, (Biztantra, Dreamtech Press, New Delhi).
3. Gupta, C.B., An Introduction to Statistical Methods, 23rd Edition, Vikash Publications.
4. Gupta, SC & Kapoor, VK. Fundamentals of mathematical Statistics: A modern approach,

(2000), Sultan Chand & Sons.
5. Aggarwal, BL. 2003. Basic Statistics. New Age Publishers, New Delhi.

CORE SUBJECT **SEMESTER VII**

Paper Title: Food Safety and Quality Management

Paper Code: BFTC-703

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. To learn about food safety, different types of hazards in food production chain.

CO2. To learn about physical, chemical contaminants and adulterants in foods and their impact on human health

CO3. To understand the various practices for processing of safe and quality foods.

CO4. Understand the national and international regulations and laws on food safety and standards

CO5. Apply the standards and regulations to implement food safety

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	2	2	2	2	2	3	2	1	3
CO2	1	2	2	1	1	2	2	2	2	2	3	2	1	3
CO3	1	2	3	2	2	3	2	2	2	2	2	2	1	3
CO4	1	2	2	3	3	3	3	3	3	3	3	2	2	3
CO5	1	2	3	3	3	3	3	3	3	3	3	2	2	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT 1

Need for Food Safety, Definition of Food Safety, Types of hazards, biological, chemical, physical hazards, Factors affecting Food Safety, Emergence of Street foods and Convenience foods and the related safety concerns, Food borne diseases- types, impact and control

UNIT 2

Definition, Environmental contaminants (indirect additives, residues and contaminants), Residues of insecticides/pesticides/weedicides, veterinary drug residues, metal contaminants, radio-nuclides, contamination from packaging material, Food Adulteration, types of adulterants in common foods, impact on human health, tests to check common adulterants and admixtures

UNIT 3

GMP, GHP, Good Veterinary Practices, Good Animal Feeding Practices, Good Transport Practices, Good Storage Practices, Good Retail Practices, Design & Facilities for food processing facilities, HACCP, ISO 22000 series, TQM, Auditing and accreditation, Traceability and Recall, Crisis Management

UNIT 4

FSSAI – (transition from PFA, FPO, MMPO, MFPO), composition and role, FSS Act, Rules and Regulations, Export Promotion Bodies and Export Inspection Council and their role, Accreditation and Certifications (BIS, QCI, AGMARK, etc.), Codex Alimentarius, International organizations in area of food standardization, International Organization for Standardization (ISO)

BOOKS RECOMMENDED:

1. Lawley, R., Curtis L. and Davis,J. The Food Safety Hazard Guidebook , RSC publishing, 2004
2. De Vries. Food Safety and Toxicity, CRC, New York, 1997
3. Forsythe,S.J.The Microbiology of Safe Food ,Willey-Blackwell,U.K.,2010
4. Mortimore S.and Wallace C. HACCP-A Practical Approach,Chapman and Hill, London,1995
5. Blackburn CDW and Mc Clure P.J. Food Borne Pathogens- Hazards,Risk Analysis and Control.CRC Press, 2005
6. Hester, R E and Harrison R M -Food Safety and Food Quality :Issues in Environmental Science and Techonology ,Cambridge, 2001
7. Paster T - The HACCP Food Safety Training Manual, John Wiley and Sons Inc., 2007
8. Roday, S - Food Hygiene and Sanitation, Tata McGraw Hill,1999

CORE SUBJECT **SEMESTER VII**

Paper Title: Food Packaging Lab
Paper Code: BFTC-704
Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Evaluate the acceptability of food products.

CO2. Formulate cereal and pulse based products.

CO3. Develop vegetable and fruit preserves.

CO4. Design and create novel instant and value added products.

CO5. Choose appropriate packaging materials and interpret labelling information.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	2	1	2	1	2	3	3	3	3
CO2	3	3	3	2	1	2	1	2	1	2	3	3	3	3
CO3	3	3	3	2	1	2	1	2	1	2	3	3	3	3
CO4	3	3	3	2	1	2	1	3	1	2	3	3	3	3
CO5	3	3	3	2	1	2	1	2	1	2	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

List of Experiments:

1. Identification of different types of packaging and packaging materials
2. Determination of tensile strength of given material
3. Destructive and non-destructive test on glass container, drop test
4. Determination of wax weights, tensile strength of papers, bursting strength
5. WVTR of packaging materials
6. Measurement of thickness of packaging materials
7. Testing of chemical resistance of packaging materials
8. Determination of shelf life of packaged foods; determination of ERH of foods.
9. Introduction of students with the latest trends in packaging from websites and magazines.
10. Shelf life and sensory study of Vacuum packed food products.
11. Shelf life and sensory study of Shrinked packed food products.

CORE SUBJECT **SEMESTER VII**

Paper Title: Food Safety Lab
Paper Code: BFTC-705
Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final Exam-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. To know the principle & working of baking, frying, roasting, grilling and blanching processes.

CO2. To understand the method of determination of adulteration in milk, cereals, oils and fats, spices etc.

CO3. To know the application of additives in bakery, fruits, vegetables, milk and meat products.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	2	1	2	1	2	3	2	3	3
CO2	3	2	3	2	1	2	1	2	1	2	3	3	3	3
CO3	3	2	2	2	1	2	1	2	1	2	3	2	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

List of Experiments:

1. Development of GHP and GMP plan for a food factory.
2. Development of HACCP plan.
3. Identification of hazards associated to various processed food products.
4. Development of FSMS.
5. Visit to a food industry/outlet and identifying the gaps for HACCP plan.
6. To check the various adulterants in spices and processed foods.

DISCIPLINE SPECIFIC ELECTIVE I **SEMESTER VII**

Paper Title: Food Process and Equipment Design
Paper Code: BFTD-706
Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Ability to design, fabricate and operate processing equipments. Cognitive level: Understand

CO2. Understand the use of computer aided design principles and practice. Cognitive level:

Understand and Analyze

CO3. Learn effective approaches to building up knowledge about a process through simulation. Cognitive level: Understand

CO4. Acquire the skills needed to design a food plant. Cognitive level: Understand

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	1	2	1	2	1	2	1	2	1
CO2	3	2	2	2	2	2	2	2	2	2	2	2	2	2
CO3	3	1	2	1	2	1	2	2	2	2	1	1	1	2
CO4	3	1	2	1	2	2	2	2	1	1	1	1	1	1

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT 1

Introduction to equipment or machine design, Basic requirements for machine elements and machines, classification of engineering materials, selection of materials for engineering purposes, mechanical properties of metals, Manufacturing considerations in machine design; introduction to load, stress, strain, Young Modulus of Elasticity or Stress modulus or Modulus of rigidity, Stress strain diagram, Factor of safety, Theories of failure under static load, Corrosion mechanism and its control.

UNIT II

Concept of heat transfer, efficiency of parallel and counter current flow heat exchanger, design of heat exchanger, Different types of pipes, fabrication method of different types of pipes, testing of piping material, colour codes, different types of piping pints, different types of flow regulators. Dryers, design of dryers

UNIT II

Loss mechanism in storage tanks, optimum proportions of a storage tank, spherical storage tanks, design of rectangular storage tanks, different types of roofs of tanks, nozzles and mountings in storage tanks, estimation of nozzle diameter for drain and vent in a storage tank

References:

1. M. V. Joshi. Process equipment design
2. R.T. Toledo. Fundamentals of food process Engg
3. Brennan, J.G. and J.R. Cowell. Food Engineering. Operations
4. Heldman, D.R. and R.P.Singh. Food Process Engineering.

DISCIPLINE SPECIFIC ELECTIVE II **SEMESTER VII**

Paper Title: IPR in Food Technology

Paper Code: BFTD-707

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. The student will gain basic knowledge of IPR (patent, design, copyright and Geographical indication). Cognitive level: Understand

CO2. Understand the significance of IPR and how to obtain patent or filing process of patent. Cognitive level: Understand

CO3. Understand IPR in Food Technology Cognitive level: Understand

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	2	2	2	2	2	2	2	2
CO2	3	3	3	3	2	3	2	3	3	2	3	3	3	3
CO3	3	2	2	2	2	2	2	2	2	2	2	2	2	2

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT I

Introduction of intellectual property right and the need for IPR, IPR in India and abroad.

UNIT II

Macroeconomic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions? Granting of patent, Rights of a patent, How extensive is patent protection? Why protect inventions by patents? Searching a patent, Drafting of a patent, Filing of a patent.

UNIT III

What is covered by: Trademarks, Copyrights, Industrial Designs and Geographical Indication. Rights of the Patentee, Obligations of a Patentee, Working of a patent, Compulsory Licensing, Revocation of Patents, IPR in Food Technology.

References:

1. P.N. Cheremisinoff, R.P. Ouellette and R.M.Bartholomew,Biotechnology Applications and

Research, Technomic Publishing Co., Inc. USA, 1985.
2. D.Balasubramaniam, C.F.A.Bryce,K. Dharmalingam, J. Green and K. Jayaraman, Concepts in Biotechnology, University Press (Orient Longman Ltd.), 2002
3. Bourgagaize, Jewell and Buiser,Biotechnology: Demystifying the Concepts, Wesley Longman, USA, 2000.
4. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
5. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
6. P. Narayanan; Law of Copyright and Industrial Designs;Eastern law House, Delhi , 2010

GENERIC SPECIFIC ELECTIVE I **SEMESTER VII**

Paper Title: Technology of Effluent Treatment and Waste Management

Paper Code: BFTG-708

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Gain the knowledge regarding various types of waste generated from various food processing industries and their effective treatment and disposal management. Cognitive level: Understand and Analyze

CO2. Fundamental knowledge of food processing operations. Cognitive level: Understand

CO3. The student will be able to explain and apply the technical knowledge of waste management in food industry. Cognitive level: Understand

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	2	2	2	2	2	2	2	2
CO2	3	1	2	2	2	1	2	2	2	2	2	1	2	2
CO3	3	2	2	1	1	1	1	1	1	1	1	1	1	1

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT-I

Types of waste and waste generation in different food processing industries; Concept, scope and importance of waste management and effluent treatment Temperature, pH, Oxygen Demands

(BOD, COD), fat, oil and grease content, metal content, forms of phosphorus and sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues

UNIT II

Environmental protection act and specifications for effluent of different food industries, Population forecast; Water demand for various purposes; Estimation of wastewater quantity; Variation in quantity of water and wastewater

UNIT III

Waste Utilization, Effluent treatment, Pre-treatment of waste : sedimentation, coagulation, flocculation and floatation, Secondary treatments: Biological oxidation-trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons, Tertiary treatments : Advanced waste water treatment processs and, coal and activated carbon filters, phosphorus, sulphur, nitrogen and heavy metals removal.

Recommended Readings:

1. Food Processing Work Management by Green and Krammer; CBS Publication
2. Principles of Food Sanitation by Mariett NG; CBS Publication
3. Waste Treatment in the Food Processing Industry by Lawrence K.Wang, Yung-Tse Hung Howard H.Lo, constanitine Yapijakis.

GENERIC SPECIFIC ELECTIVE II **SEMESTER VII**

Paper Title: Food Additives

Paper Code: BFTG-709

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-25, Final-75)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Know the classification and functions of additives in food processing and preservation.

CO2. Understand the safety and quality evaluation of food additives and contaminants.

CO3. To know the chemistry, types and functions of direct and indirect food additives.

CO4. To understand methods for detection of Food Additives

CO5. To know about importance of additives in maintaining or improving food quality, permissible limits and toxicity.

CO6. To learn about the development of various instant premixes by addition of preservatives within the permissible limits.

CO7. To understand the applications of food additives and how to study the toxicity of food additives.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific

Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1	3	1	1	1	3	1	1	1	1	1
CO2	1	1	2	1	3	1	1	1	3	1	1	1	2	1
CO3	2	1	2	1	3	1	1	1	3	1	1	1	1	1
CO4	1	1	2	1	3	1	1	1	3	1	1	1	1	1
CO5	1	1	2	1	3	1	1	3	3	1	2	1	3	2
CO6	3	2	2	3	3	2	3	3	3	1	2	1	3	2
CO7	1	1	2	1	3	1	1	3	3	1	2	1	3	2

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

UNIT I

Introduction, classification and functions of Preservatives, curing agents, sequesterants, humectants, hydrocolloids, non nutritive sweeteners (Acesulfame K, Aspartame, Saccharin , sucralose, stevia, neotame) anticaking agents, leavening agents,

UNIT II

Flavour technology: Types of flavours, Food flavor and its importance to consumers, flavours generated during manufacturing of cheese, chocolate, garlic, onion, tea, coffee, beer, bread, meat products, spices; extraction of essential oils and oleoresins: distillation, maceration, supercritical fluid extraction, ultrasound assisted extraction, microwave assisted extraction; flavour enhancer

UNIT III

Food colours: natural colours and synthetic colours, colour retention agents, antioxidants emulsifiers, flour impovers, stabilizers and thickners, glazing agents- their types and applications in food

UNIT IV

Microencapsulation of food additives and flavours, encapsulating materials, importance of microencapsulation, toxicological evaluation of food additives

References:

1. Branen AL, Davidson PM & Salminen S. Food Additives. 2nd Ed. Marcel Dekker.
2. Gerorge AB. Encyclopedia of Food and Color Additives. Vol. III. CRC Press.
3. Gerorge AB. Fenaroli's Handbook of Flavor Ingredients. 5th Ed. CRC Press.
4. Madhavi DL, Deshpande SS & Salunkhe DK. Food Antioxidants: Technological, Toxicological and Health Perspective. Marcel Dekker.
5. Morton ID & Macleod A J Food Flavours. Part A, BC. Elsevier.

COMPULSORY

Paper Title: Minor Project/Status paper/Review

BFTC-710

Total credits: 1 Maximum Marks: 100 (Internal)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Ability to read, understand and analyze a research paper

CO2. Ability to write a review paper

CO3. Ability to present a research or review paper

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	2	2	2	1	1	3	3	3	3
CO2	2	2	2	2	1	2	2	3	2	1	3	3	3	3
CO3	2	2	2	2	3	2	3	3	1	1	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

The student will carry out minor project work, individually or in groups under the guidance of a faculty member. The project shall consist of review paper/status report/product development/ assignments/ online courses. The internal assessment will be carried out by the internal faculties.

COMPULSORY
SUMMER TRAINING
BFTC-711

Maximum Marks: 100; Credit 1

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Gather, form and critique knowledge from industry

CO2. Identify and investigate the working or processing in the food industry

CO3. Ability to analyze and present the learning from the training

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	2	3	1	2	2	3	3	3
CO2	3	3	2	2	2	2	3	3	1	2	2	3	3	3
CO3	3	3	2	2	3	2	3	3	1	2	2	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

Industrial training: Training will be of 4-6 weeks duration carried out during the summer break after the 6th Semester. The students will submit their reports, and make a presentation in the 7th Semester. The internal assessment will be carried out by the internal faculties.

CORE PAPER **SEMESTER VIII**

Paper Title: Major Project/Dissertation

Paper Code: BFTC-801

Total Credits: 17, Maximum Marks: 400 (Internal-250, External: 150)

COURSE OUTCOMES (COs)

On the successful completion of the course, students will be able to

CO1. Gather, form and critique knowledge from research studies

CO2. Identify and investigate a research problem

CO3. Apply an appropriate research design and associated methods rigorously

CO4. Conduct the research project in an ethical fashion

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	2	2	3	2	2	3	3	3	3
CO2	3	3	3	3	2	2	3	3	2	2	3	3	3	3
CO3	3	3	3	3	2	2	3	3	2	2	3	3	3	3
CO4	3	3	3	3	2	2	3	3	2	2	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more program Outcomes (POs). Write '3' in the box for 'High-level' mapping, '2' for 'Medium-level' mapping, '1' for 'low-level' mapping

The students will carry out project works in groups of 4 or 5 students each under the guidance of a faculty member. The project shall consist of research/design/development/ implementation work. It may also be a continuation of the project/industrial work carried out after the summer break of 6th or 7th SEM, but to be evaluated separately based on similar criteria. The internal assessment will be carried out by the internal faculties and the external assessment will be evaluated by an external

examiner, as approved in the BoS of the department.