Jamia Hamdard

Deemed to be University

Accredited in 'A' Grade by NAAC

Declared to be designated as Institute of Eminence (IoE) by MHRD, GOI

DEPARTMENT OF FOOD TECHNOLOGY

School of Interdisciplinary Sciences and Technology

Jamia Hamdard, New Delhi-110062

www.jamiahamdard.edu

CURRICULUM STRUCTURE AND SYLLABUS

Choice Based Credit System (CBCS)

B. Tech. Food Technology

Department of Food Technology
School of Interdisciplinary Sciences and Technology (SIST)
Jamia Hamdard, New Delhi

Approved by:

BOS on 09.01.2023

Academic Council on 12.01.2023

1. Course Details: B. Tech. (Food Technology) Total Seats: 30 (General + NRI)
2. Eligibility: A candidate seeking admission to this program must have passed Senior Secondary (12th/ Intermediate) examination with Mathematics/ Biology from CBSE or any other Board recognized by Jamia Hamdard as equivalent thereto, securing at least 50% marks or equivalent CGPA in aggregate.
3. Total Semesters: 8

DEPARTMENT OF FOOD TECHNOLOGY

http://jamiahamdard.edu/Department/Department_FacultyList.aspx?nDeptID=mc

1. About the Department

The Department of Food Technology promotes education and research in Food Science, Food Safety, Packaging, Food Product Development, Food Engineering, Bakery, Meat, Dairy sciences and many more. The department provides opportunities to researchers and academicians having specific expertise to cross the boundaries of their respective subject areas and think across them. It encourages researchers to pool their approaches and modify them so that they are better suited to the problems at hand. The department is currently offering B. Tech., M. Tech. in Food Technology & PhD. in Food Technology and Interdisciplinary Sciences. The Department of Food Technology received a substantial grant of Rs. 75 lakhs in 2010 from Ministry of Food Processing Industries to strengthen the laboratories and infrastructure of the Department. As the demand of professionals and trained personnel in the food industry as well as in research and development in government and industrial set-up is immense. The department has funding for research projects from UGC, AICTE, SERB etc. The Department of Food Technology has also been awarded with DST-FIST Grant of Rs 155 lakh in 2022.

Objectives of the Department

As the demand of professionals and trained personnel in the food industry as well as in research and development in government and industrial set-up is immense, the Department of Food Technology has the following objectives:

- To produce professionally competent, proficient and highly skilled personnel in the field of food technology, with a knowledge of various aspects of food science and technology including the quality of raw material, packaging standards and methodology, health and hygiene parameters, processing techniques, storage and food value
- To enhance institutional capability to develop linkages with Industries and Community based regular and continuing education programs in the relevant areas.
- To impart technical and techno-managerial skill to the unemployed youth and the agrarian society.
- To promote R&D in the field and assist in the implementation of the food processing, safety and quality management of the food regulating bodies like FSSAI, BIS, ISO, CODEX.
- To promote R&D in the field and assist in the implementation of the food safety and quality management process of the food regulating bodies.

2. Faculty and Area of Interest

Prof. Farhan Jalees Ahmad
Dean, School of Interdisciplinary Sciences and Technology (SIST)
Jamia Hamdard

Prof. Sayeed Ahmad
Head, Department of Food Technology
Jamia Hamdard

Dr. Vasudha Sharma
Assistant Professor

Dr. Kulsum Jan
Assistant Professor

Dr Sweta Joshi
Assistant Professor

Er. Jinku Bora
Assistant Professor

Dr Khalid Bashir
Assistant Professor

Dr. Aastha Bhardwaj
Lecturer

Er. Suhaib Hasan
Guest Faculty

Prof. M. Muthukumarappan
Adjunct Faculty

Dr. Dilip Ghosh
Adjunct Faculty

- **Areas of Interest**

Faculties	Areas of Interest
Prof. Farhan J Ahmad Dean, SIST	Nanotechnology, Formulation development, Drug delivery, Nanomedicine, Pharmacology
Prof. Sayeed Ahmad Head	Pharmacognosy, Quality Control of Herbal drugs and Botanicals: Chromatography, Metabolomics.
Dr. Vasudha Sharma Assistant Professor	Probiotics, Fermented Functional Foods, Nutraceuticals, By-product utilization, food safety
Dr. Khalid Bashir Assistant Professor	Starch & Protein Modification, Food Rheology, Drying Technology, Food Fortification, Probiotics.
Dr. Sweta Joshi Assistant Professor	Food Chemistry, Functional foods, Nutraceutical, phytochemicals & extraction techniques.
Dr. Kulsum Jan Assistant Professor	Cereal processing, agricultural waste, biodegradable and edible Packaging, utilization, by-product utilization.
Er. Jinku Bora Assistant Professor	Food Engineering, Food Biotechnology, Food Chemistry, Starch modification, Nanotechnology
Dr. Aastha Bhardwaj Lecturer	Biodegradable Food Packaging, Waste Utilization, Functional Foods, Dairy Technology

3. Facilities

The Department is well equipped with processing and analytical equipments and is in the process of procuring many more equipments to make the state of the art facilities. Great emphasis is laid on practical for processing of foods and for analyzing their quality. List of some major equipments available with department and University are as follows: HPLC, Texture Analyser, Rheometer, Hunter Lab Color Spectrophotometer, UV-Vis Spectrophotometer, Motic Inverted Microscope, Deep Freezer, Moisture analyser, Freeze dryer, Rheometer, BOD Incubator, Rotary Vacuum Evaporator, Biohazard Safety Cabinet, Lab. Scale Spray Drier, Tray Drier, Fluidized Bed Drier, Oven, Meat Processing Unit, Bakery lab, Food Juice Processing Equipments, Packaging Equipments, Hammer Mill, Ball mill, Laboratory Pasteurizer, Shrink Packaging Machine, Vacuum Packaging Machine, Viscometer, Infra-red moisture meter, Fruit Crusher, etc.

4. Research Activities

No. of papers published in the year 2017-22: 200+

No. of current Ph.D. scholars: 20.

5. Publications

For the publication details kindly go through the below links, for the individual faculty members.

S. No.	Faculty Name	Profile details
1.	Dr Khalid Bashir	Google scholar: https://scholar.google.co.in/citations?user=vet13fEAAAAJ&hl=en JH website: http://jamiahamdard.edu/Department/Department_FacultyProfile.aspx?nID=iqm&nDeptID=mc
2.	Dr Sweta Joshi	Google scholar: https://scholar.google.com/citations?hl=en&authuser=2&user=N5PsbCkAAAAJ JH website: http://jamiahamdard.edu/Department/Department_FacultyProfile.aspx?nID=iqq&nDeptID=mc
3.	Dr. Vasudha Sharma	Google scholar: https://scholar.google.co.in/citations?user=fLe_AG4AAAAJ&hl=en JH website: http://jamiahamdard.edu/Department/Department_FacultyProfile.aspx?nID=iqs&nDeptID=mc\
4.	Dr Kulsum Jan	Google scholar: https://scholar.google.co.in/citations?user=iGNPXxAAAAAJ&hl=en JH website: http://jamiahamdard.edu/Department/Department_FacultyProfile.aspx?nID=iqo&nDeptID=mc
5.	Er. Jinku Bora	Google scholar: https://scholar.google.co.in/citations?user=IPqwYRQAAAAJ&hl=en JH website: http://jamiahamdard.edu/Department/Department_FacultyProfile.aspx?nID=isa&nDeptID=mc
6.	Dr. Aastha Bhardwaj	Google scholar: https://scholar.google.com/citations?user=auhdk0EAAAAJ&hl=en JH website: http://jamiahamdard.edu/Department/Department_FacultyProfile.aspx?nID=isg&nDeptID=mc

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.

2. The PROGRAMME

Highlights of the course are described in the following table:

a.	Name of the Programme	BACHELOR OF TECHNOLOGY (FOOD TECHNOLOGY)
b.	Nature	Regular and Full Time
c.	Duration	Four Years (8 Semesters)
d.	Total number of credits	162
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 50% marks or equivalent CGPA in aggregate.
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 will be announced separately, if situation arises.*
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 Sixth and seventh semester.
6. The students have to undergo educational tour during seventh semester. The students shall submit a report/status/review to the department and guide and give a presentation the topic at the end of Semester.
7. 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 140 marks and will comprise of submission of a project report after completion of the project. External will be assigned 210 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.
- A student shall have to score minimum pass marks (50%) 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

Range of Percentage of Marks	Grade	Grade Point	Description of Performance
90-100	O	10	Outstanding
80-89	A+	9	Excellent
70-79	A	8	Very Good
65-69	B+	7	Good
55-64	B	6	Above Average
50-54	C	5	Average/Pass
00-49	F	0	Fail
-	AB	0	Absent

A student obtaining Grade ‘F’ / ‘AB’ shall be considered as failed and will be required to reappear in the examination.

CALCULATIONS OF SGPA AND CGPA OF A STUDENT IN A SEMESTER

$$SGPA = \frac{\sum (\text{Earned Credits X Grade Point})}{\sum (\text{Course Credits Registered})}$$

M

$$CGPA = \frac{\sum (\text{Earned Credits X Grade Point})}{\sum (\text{Course Credits Registered})}$$

5. 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.

6. 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 40 marks, for each theory paper shall be mandatory. Other modes of assessment shall account for remaining 5 marks.
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)	60 (Sixty only)
		(Lab papers)	60 (Sixty 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 50%.

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 SHALL BE DONE ON THE BASIS OF FOLLOWING CRITERIA:

The result of successful candidates who fulfill the criteria of the award of degree shall be classified at the end of last semester on the basis of his/her final CGPA.

a) He/she will be awarded “I Division with Distinction” if his/her final CGPA is 7.5 and above and up to 10.

b) He/she will be awarded “I Division” if his/her final CGPA is 6.00 and above and 7<.50.

c) He/she will be awarded “II Division” if his/her final CGPA is 5.00 and above and <6.00.

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

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

B.TECH. FIRST YEAR

FIRST SEMESTER (July-December)

S. No.	*Paper Code*	*Subject Category*	*Paper Title*	*Marks*	*L*	*T*	*P*	*Credits*
			Orientation Programme					
1	BFTC-101	Core	Applied Physics	100	2	1	0	3
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
			Total	**700**	**9**	**3**	**8**	**15**

SECOND SEMESTER (January-May)

S. No.	*Paper Code*	*Subject Category*	*Paper Title*	*Marks*	*L*	*T*	*P*	*Credits*
1	BFTC-201	Core	Mathematics-II	100	2	1	0	3
2	BFTC-202	Core	Programming for Problem Solving	100	2	1	0	3
3	BFTC-203	Core	Workshop/Manufacturing Practices	100	1	0	0	1
4	BFTC-204	Core	Basic Engineering Mechanics	100	2	1	0	3
5	BFTC-205	Core	Communication Skills	100	2	0	0	2
6	BFTC-206	Core	Programming for Problem Solving Lab	100	0	0	4	2
7	BFTC-207	Core	Workshop/Manufacturing Practices Lab	100	0	0	4	2
8	BFTC-208	Core	Communication Skills Lab	100	0	0	4	2
9	*ES-01	Compulsory	Environmental Studies	100	2	0	0	0
			Total	**900**	**11**	**3**	**12**	**18**

B.TECH. SECOND YEAR

THIRD SEMESTER (July-December)

S. No.	*Paper Code*	*Subject Category*	*Paper Title*	*Marks*	*L*	*T*	*P*	*Credits*
1	BFTC-301	Core	Food Chemistry	100	3	1	0	4
2	BFTC-302	Core	Food Microbiology	100	3	1	0	4
3	BFTC-303	Core	Thermodynamics	100	2	1	0	3
4	BFTC-304	Core	Transfer Process in Foods	100	3	1	0	4
5	BFTC-305	Core	Cereal, Pulses & Oilseed Technology	100	3	1	0	4
6	BFTC-306	Core	Food Chemistry Lab	100	0	0	4	2
7	BFTC-307	Core	Food Microbiology Lab	100	0	0	4	2
8	BFTC-308	Core	Cereal, Pulses & Oilseed Technology Lab	100	0	0	4	2
			Total	**800**	**14**	**5**	**12**	**25**

FOURTH SEMESTER (January-May)

S. No.	*Paper Code*	*Subject Category*	*Paper Title*	*Marks*	*L*	*T*	*P*	*Credits*
1	BFTC-401	Core	Fluid Mechanics I	100	3	1	0	4
2	BFTC-402	Core	Food Engineering	100	3	1	0	4
3	BFTC-403	Core	Technology of Fruits and Vegetables	100	3	1	0	4
4	BFTC-404	Core	Food Biotechnology and Functional Foods	100	3	1	0	4
5	BFTC-405	Core	Food Engineering Lab	100	0	0	4	2
6	BFTC-406	Core	Technology of Fruits and Vegetables Lab	100	0	0	4	2
7	BFTC-407	Core	Solid Mechanics	100	2	1	0	3
			Total	**700**	**14**	**5**	**8**	**23**

B.TECH. THIRD YEAR

FIFTH SEMESTER (July-December)

S. No.	*Paper Code*	*Subject Category*	*Paper Title*	*Marks*	*L*	*T*	*P*	*Credits*
1	BFTC-501	Core	Dairy Technology	100	3	1	0	4
2	BFTC-502	Core	Technology of Meat, Fish & Poultry	100	3	1	0	4
3	BFTC-503	Core	Fluid Mechanics II	100	3	1	0	4
4	BFTD-504	Discipline Specific Electives	Unit Operations in Food Processing	100	3	1	0	4
	BFTD-505		Beverage Technology	100	3	1	0	4
5	BFTG-506	Generic Electives	Techniques in Food Analysis	100	3	1	0	4
	BFTG-507		Food Storage & Plant Layout	100	3	1	0	4
6	BFTC-508	Core	Dairy Technology Lab	100	0	0	4	2
7	BFTC-509	Core	Technology of Meat, Fish & Poultry Lab	100	0	0	4	2
			Total	**700**	**15**	**5**	**8**	**24**

SIXTH SEMESTER (January-May)

S. No.	*Paper Code*	*Subject Category*	*Paper Title*	*Marks*	*L*	*T*	*P*	*Credits*
1	BFTC-601	Core	Food Packaging Technology	100	3	1	0	4
2	BFTC-602	Core	Bakery & Confectionery Technology	100	3	1	0	4
3	BFTD-603	Discipline Specific Electives	Food Product Development	100	3	1	0	4
	BFTD-604		Engineering, Textured and Fabricated Foods	100	3	1	0	4
4	BFTG-605	Generic Electives	Non-Thermal Food Processing	100	3	1	0	4
	BFTG-606		Food Business Management	100	3	1	0	4
5	BFTC-607	Core	Bakery & Confectionery Technology Lab	100	0	0	4	2
6	BFTC-608	Compulsory	Industrial /Research visit Report	100	0	0	4	2
			Total	**600**	**12**	**4**	**8**	**20**

B.TECH. FOURTH YEAR

SEVENTH SEMESTER (July to December)

S. No.	*Paper Code*	*Subject Category*	*Paper Title*	*Marks*	*L*	*T*	*P*	*Credits*
1	BFTC-701	Core	Research Methodology	100	3	1	0	4
2	BFTC-702	Core	Food Safety & Quality Management	100	3	1	0	4
3	BFTD-703	Discipline Specific Electives	IPR in Food Technology	100	3	1	0	4
	BFTD-704		Food Process Design	100	3	1	0	4
4	BFTG-705	Generic Electives	Food Additives	100	3	1	0	4
	BFTG-706		Technology of Waste Management	100	3	1	0	4
5	BFTC-707	Core	Food Safety & Quality Management Lab	100	0	0	4	2
6	BFTC-708	Compulsory	Educational tour Report	100	0	0	4	2
			Total	**600**	**12**	**4**	**8**	**20**

EIGTH SEMESTER (January to May)

S. No.	*Paper Code*	*Subject Category*	*Paper Title*	*Marks*	*L*	*T*	*P*	*Credits*
1	BFTC-801	Compulsory	Training & Research in Food Technology[#]	160* 240**	0	2	30	17
			Total	**400**	**0**	**2**	**30**	**17**

*Internal, **External, [#]450 hours training/ research work in industry/ institute.

Total Credits: 18+21+22+20+24+20+20+17 = **162**
Total Marks: 700+900+800+700+700+600+600+400 = **5400**

CORE PAPER **SEMESTER I**

Paper Title: Applied Physics
Paper Code: BFTC-101

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is '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

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER I**

Paper Title: Mathematics-I
Paper Code: BFTC-102

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

‘3’ is ‘High-level’ mapping, ‘2’ is ‘Medium-level’ mapping, ‘1’ is ‘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.

BOOKS RECOMMENDED:

- G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
- Erwin kreyszig, Advanced Engineering Mathematics, 9 th 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.

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER I**

Paper Title: Introductory Biology
Paper Code: BFTC-103

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

COURSE OUTCOMES (COs)

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

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

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

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

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is '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: Cell biology and energetics: Cell structure; Membranes; Function of cell organelles; Energetics; ATP and glycolysis; Respiration; Photosynthesis.

Unit-III: Reproduction, Heredity, Evolution; Cell division: mitosis, meiosis, 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:

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

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER I**

Paper Title: Engineering Graphics & Design
Paper Code: BFTC-104

Total Credits: 1, Total Lectures-15, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

‘3’ is ‘High-level’ mapping, ‘2’ is ‘Medium-level’ mapping, ‘1’ is ‘low-level’ mapping

UNIT-I: 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-II: 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-III: 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-IV: 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-V: 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.

BOOKS RECOMMENDED:

- 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

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER I**

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

Total Credits: 2, Contact hours-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is '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 acceleration due to gravity, The radius of gyration and the moment of inertia of the bar about an axis.
2. To determine the moment of inertia of a flywheel about its own axis of rotation.
3. To determine the value of acceleration due to gravity using koter‟s pendulum.

4. To determine the frequency of A.C. mains using sonometer and an electromagnet.
5. To determine the frequency of electrically maintained turning fork by Melde‟s method.
6. To determine the dispersive power of prism using spectrometer and mercury source.
7. To determine the wavelength of sodium light by Newton‟s Ring.
8. To determine the wavelength of sodium light using diffraction
9. To determine the refractive index of a prism using spectrometer.
10. To determine the specific rotation of cane sugar solution with the help of polarimeter.
11. To find the wavelength of He-Ne Laser using transmission diffraction grating.
12. To determine the numeral aperture (NA) of a Optical Fibre.
13. Compute simulation (simple application of Monte Carlo) e.g. Brownian motion, charging & discharging of capacitor.
14. Measurement of the diameter of a thin wire using the phenomenon of diffraction.
15. To measure the divergence of a laser beam
16. 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

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks)

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER I**

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

Total Credits: 2, Contact hours-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT – I: Polygons-Construction of Regular Polygons using given length of a side; Ellipse-General method and Oblong Methods for Construction of ellipse; Scales-Plain, Vernier and Diagonal Scales. Introduction to Orthographic Projections; Projections of Points; Projections of Straight Lines parallel to both planes; Projections of Straight Lines-Parallel to one and inclined to other plane.

UNIT – II: Projections of Straight Lines inclined to both planes, determination of true lengths, angle of inclinations and traces.

UNIT – III: Projections of Planes; Regular Planes Perpendicular / Parallel to one Reference Plane and inclined to other Reference Plane; inclined to both the Reference Planes.

UNIT – IV: Projections of Solids-Prisms, Pyramids, Cylinders and Cones with the axis inclined to one Plane. Conversion of Isometric Views to Orthographic Views. Conversion of Orthographic

Views to Isometric Projections and Views.

BOOKS RECOMMENDED:

- Engineering Drawing by N.D. Bhat, Chariot publications
- Engineering Drawing by M.B. Shah and B.C. Rana, Pearson publishers
- Engineering Drawing by Dhananjay A. Jolhe, Tata McGraw Hill Publishers
- Engineering Graphics for Degree by K.C. John, PHI Publishers

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER I**

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

Total Credits: 1, Total Lectures-15, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, and '1' is 'low-level' mapping

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

UNIT-V: 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

BOOKS RECOMMENDED:

- 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

Teaching-Learning Strategies
The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER II**

Paper Title: Mathematics-II
Paper Code: BFTC-201

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT-I: 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-II: Continuous Probability Distributions Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

UNIT-III: Bivariate Distributions Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

UNIT-IV: 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-V: 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 - Chisquare test for goodness of fit and independence of attributes.

BOOKS RECOMMENDED:

- Erwin Kreyszig, Advanced Engineering Mathematics, 9 th 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.

Teaching-Learning Strategies
The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER II**

Paper Title: Programming for Problem Solving
Paper Code: BFTC-202

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT-I: 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-II: Arithmetic expressions and precedence, Conditional Branching, Writing and evaluation of conditionals and consequent branching, Iteration and loops

UNIT-III: 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-IV: 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-V: 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)

BOOKS RECOMMENDED:

- 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

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER II**

Paper Title: Workshop/Manufacturing Practices
Paper Code: BFTC-203

Total Credits: 1, Total Lectures-15, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT-I: Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods

UNIT-II: CNC machining, Additive manufacturing

UNIT-III: Fitting operations & power tools, Electrical &Electronics

UNIT-IV: Carpentry, Plastic molding, glass cutting

UNIT-V: Metal casting , Welding (arc welding & gas welding), brazing

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of

Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.
- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER II**

Paper Title: Basic Engineering Mechanics
Paper Code: BFTC-204

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

Unit-I: Statics: Newtons Laws Gravitation, Force (External and Internal-transmissiblity); Couple, Moment, Coplanar-forces, Static Equilibrium, Free Body diagram, Equilibrium equations
Trusses: Assumptions, rigid and non-rigid trusses, simple truss (Plain and space)Analysis by method of joints, Analysis by method of sections, compound truss.
Friction: Coloumb dry friction laws, simple surface contact problems friction angles and problems.

Unit-II: Particle Dynamics: Rectilinear motion, Plane curvilinear motion,3D curvilinear motion, Relative and Constrained motion, Newtons Second law, Work Kinetic Energy, Power Potential energy, Impulse momentum, Impact
Kinematics of rigid bodies: Rotation, parametric motion, relative velocity, I-centre of rotation, Relative acceleration, rotating reference frames. Law of conservation of energy and momentum

Unit-III: Stress And Strain: Simple stress, Hooks law compound stresses, Elastic Constants, thermal stresses, Analysis of strain, Theories of failure.

Unit-IV: Beams And Bending: Shear force and bending moment, Shear force and bending moment diagrams, bending stresses in beams, Shearing stresses in beams, Thin and thick cylinder, spherical cylinders

BOOKS RECOMMENDED:

- 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
- Engineering Mechanics of Solids — EP Popov

Teaching-Learning Strategies
The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.
- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER II**

Paper Title: Communication Skills
Paper Code: BFTC-205

Total Credits: 2, Total Lectures-30, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT-I: 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-II: 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-III: Identifying Common Errors in Writing Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

UNIT-IV: Nature and Style of sensible Writing Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion

UNIT-V: 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

BOOKS RECOMMENDED:

- 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

Teaching-Learning Strategies
The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER II**

Paper Title: Programming for Problem Solving Lab
Paper Code: BFTC-206

Total Credits: 2, Contact hours-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

Lab based on Programming for Problem Solving

1. Write a C program to find sum and average of three numbers.
2. Write a C program to find the sum of individual digits of a given positive integer.
3. Write a C program to generate the first n terms of the Fibonaccisequence.
4. Write a C program to generate prime numbers from 1 to n.
5. Write a C program to check whether given number is Armstrong Number or not.
6. Write a C program to check whether given number is perfect number or not.
7. Write a C program to check whether given number is strong number or not.
8. Write a C program to find the roots of a quadratic equation.
9. Write a C program to perform arithmetic operations using switch statement.
10. Write a C program to find factorial of a given integer using non-recursive function.
11. Write a C program to find factorial of a given integer using recursive function.
12. Write C program to find GCD of two integers by using recursive function.
13. Write C program to find GCD of two integers using non-recursive function.
14. Write a C program to find both the largest and smallest number in a list of integers.
15. Write a C program to Sort the Array in an Ascending Order
16. Write a C program to find whether given matrix is symmetric or not.
17. Write a C program to perform addition of two matrices.
18. Write a C program that uses functions to perform multiplication of two Matrices.
19. Write a C program to use function to insert a sub-string in to given main string from a given position.
20. Write a C program that uses functions to delete n Characters from a given position in a given string.
21. Write a C program using user defined functions to determine whether the given string is palindrome or not.
22. Write a C program that displays the position or index in the main string S where the sub string T begins, or - 1 if S doesn't contain T.
23. Write C program to count the number of lines, words and characters in a given text.
24. Write a C program to find the sum of integer array elements using pointers.
25. Write a C program to Calculate Total and Percentage marks of a student using structure.

BOOKS RECOMMENDED:

- C Programming and Data Structures, P.Padmanabham, Third Edition, BS Publications
- Computer programming in C.V.RAjaraman, PHI Publishers.

- C Programming, E.Balagurusamy, 3rd edition, TMHPublishers.
- C Programming, M.V.S.S.N Venkateswarlu and E.V.Prasad,S.Chand Publishers
- Mastering C,K.R.Venugopal and S.R.Prasad, TMH Publishers.
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Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER II**

Paper Title: Workshop/Manufacturing Practices Lab
Paper Code: BFTC-207

Total Credits: 2, Contact hours-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

LIST OF PRACTICALS:

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.

BOOKS RECOMMENDED:

- Raghuwanshi B.S., Workshop Technology Vol. I & II, Dhanpath Rai & Sons. Kannaiah P. and Narayana K.L., Workshop Manual, 2nd Edn, Scitech publishers.
- John K.C., Mechanical Workshop Practice. 2nd Edn. PHI 2010.
- Jeyapoovan T.and Pranitha S., Engineering Practices Lab Manual, 3rd Edn. Vikas Pub.2008.

Teaching-Learning Strategies
The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),
- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.
- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER II**

Paper Title: Communications Skills Lab
Paper Code: BFTC-208

Total Credits: 2, Contact hours-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is '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

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.

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

Compulsory Paper **SEMESTER II**

Paper Title: Environmental Studies
Paper Code: *ES-01

Total Credits: 0, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT-I: 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-II: 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-III: 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 pollutionRural/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-IV: 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-V: 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:

Textbook of Environmental studies, Erach Bharucha, UGC

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

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),
- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.
- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER III**

Paper Title: Food Chemistry
Paper Code: BFTC-301

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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. (Cognitive Level: Understand)

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. (Cognitive Level: Understand & analyze)

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. (Cognitive Level: Understand & analyze)

CO5. Understanding of the chemical and physical factors that influence pigments, vitamin and mineral bioavailability in foods and their 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	2	2	2	2	3	2	2	3	2	1	2	3	2	2
CO2	2	2	2	2	3	2	2	3	2	1	2	3	2	2
CO3	2	2	2	2	3	2	2	3	2	1	2	3	2	2
CO4	2	2	2	2	3	2	2	3	2	1	2	3	2	2
CO5	2	2	2	2	3	2	2	3	2	1	2	3	2	2

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT-I: Water : Structure of water and ice, properties, bound water, water activity. Post-harvest and Post-mortem biochemical changes in foods and its implications on quality of foods.

UNIT II: Enzymes: Functions, classification, nomenclature, enzymes in food industries;
Carbohydrates: monosaccharides, disaccharides, polysaccharides, Reactions and properties of simple and complex carbohydrates, starch gelatinization and retrogradation; Enzymatic and Non enzymatic browning, formation of acrylamide in food

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

UNIT-IV: Vitamins: Fat soluble and water soluble, food sources, dietary requirements, deficiency disorders; Minerals: Macronutrients and micronutrients, food sources, dietary requirements, bioavailability and physiological function of minerals**,** Pigments: carotenoids, chlorophylls, anthocyanins, tannins and myoglobin.

BOOKS RECOMMENDED:

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

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER III**

Paper Title: Food Microbiology
Paper Code: BFTC-302

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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 terms 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 with Awareness 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 and egg 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

‘3’ is ‘High-level’ mapping, ‘2’ is ‘Medium-level’ mapping, ‘1’ is ‘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:

- Microbiology, J. Willey, L. M. Sherwood, C. Woolverton, McGraw Hill International, 8th Edition, 2010.
- Food Microbiology, W. C. Frazier & D.C. Westhoffs, TMH, 4 th Edition, 1993.
- Essentials of food Microbiology, J. Garbutt, Arnold Publication, 2nd Edition, 1997.
- Microbiology, M. J. Pelczar Jr., E.C.S. Chan and N.R. Krieg, TMH Book Company, 5th Edition, 1993.
- Modern Food Microbiology, James M. Jay, CBS Publishers Delhi, 4th Edition, 1993.
- Essentials of Microbiology; K. S. Bilgrami; CBS Publishers, Delhi

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER III**

Paper Title: Thermodynamics
Paper Code: BFTC-303

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

‘3’ is ‘High-level’ mapping, ‘2’ is ‘Medium-level’ mapping, ‘1’ is ‘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, First Law of Thermodynamics: Applications of First. closed and open systems, non-flow and flow processes; steady state, steady flow and transient flow processes

UNIT-II: Second Law of Thermodynamics, Heat Engine and Heat Pumps. Kelvin Planck and Clausius statement, Refrigeration. Irreversibility and availability, energy analysis; Entropy; thermodynamic relations; Properties of mixtures and ideal gases.

UNIT-III: Thermodynamic Cycles: Otto, Diesel, Dual and Joule Cycle, Air-standard Brayton cycle,Carnot vapour cycle,Ideal Rankine cycle,Rankine Reheat cycle

UNIT-IV: Air Refrigeration cycles, performance of refrigeration system, Open air refrigeration cycle,Air refrigerator working on Dense air refrigeration cycle, Reversed carnot cycle, Vapour compression refrigeration system, balance and multiple evaporation systems. Numericals. Food chilling and freezing, Properties of frozen foods; freezing point depression; general introduction to enthalpy change during freezing, Psycrometry.

BOOKS RECOMMENDED:

- Engineering Thermodynamics By P.K Nag, TMH Publishers
- Applied Thermodynamics By R.K Rajput,Laxmi Publications
- Applied Thermodynamics By B.K Venkanna, PHI Publishers
- Applied Thermodynamics By Onkar Singh, New Age International

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER III**

Paper Title: Transfer Process in Foods
Paper Code: BFTC-304

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT-I: Introduction to Mass Transfer, mass balance calculations, Calculations involved in dilution, concentration dehydration, evaporation and other unit operations.

UNIT-II: Introduction to heat transfer, modes of heat transfer. Calculation for heat transfer. Design of single & multi effect evaporators.

UNIT-III: Theory, process and equipment for humidification and dehumidification, Osmosis, reverse osmosis, adsorption and absorption. Numericals

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

BOOKS RECOMMENDED:

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

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER III**

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

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

COURSE OUTCOMES (COs)

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

CO1. Understand basic composition & structure of food grains. (Cognitive level: Understand)
CO2. Understand the basics of milling operations of different cereal grains. (Cognitive level: Understand)
CO3. Learn processing of food grains into value added products. (Cognitive level: Understand and analyze)
CO4 Understand the basics of milling operations of pulses, millets and antinutritional factors affecting health (Cognitive level: Understand)
CO5 Learn to manage the by-products produced during milling and their utilization. (Cognitive level: Understand, analyze and develop)

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	2	1	2	3	3	3	3
CO2	3	3	3	2	1	1	1	2	1	2	3	3	3	3
CO3	3	3	3	2	1	1	1	2	1	2	3	3	3	3
CO4	3	3	3	2	1	1	1	2	1	3	2	3	3	3
CO5	3	3	3	2	1	1	1	2	1	2	3	2	3	3

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT-I: Wheat: Chemical composition, structure, Milling: general principle, cleaning, conditioning and milling systems; Wheat protein and its function; Types of wheat flour.

UNIT-II: Rice: Chemical composition, structure, Milling: - types of rice mill (huller mill, shellercum-huller mill, sheller-cum-cone polisher mill, small capacity rice mill). Modern rice milling unit operations – dehusking, paddy separation, polishing and grading; parboiling, By-products of rice milling, Technology of breakfast cereals: Puffed Rice, flaked rice
Corn: Wet and dry milling; Quality aspects of different flours. Corn products: Corn flakes, corn starch, puffed product.

UNIT–III: Legumes: Composition, Milling of pulses. Legume-based products; anti- nutritional factors.
Millets: Composition; milling and malting; Traditional and nutritional products.

UNIT-IV: Oilseed: Significance of oil seeds processing in India; processing: traditional and

modern methods of oil extraction, refining, bleaching, deodorizing, hydrogenation.

BOOKS RECOMMENDED:

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

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks)

CORE PAPER **SEMESTER III**

Paper Title: Food Chemistry Lab
Paper Code: BFTC-306

Total Credits: 2, Contact hours-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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. To Learn the preparation of different standard solutions.

CO3. Learn to differentiate between sugars by calorimetric method

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	3	3	2	2	3	2	1	3	2	3
CO2	3	2	2	3	3	3	2	2	3	2	1	3	2	3
CO3	3	2	2	3	3	3	2	2	3	2	1	3	2	3

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

LIST OF PRACTICALS:

1. Preparation of standard solutions i.e. HCl, H2SO4
2. Determination of moisture content.
3. Determination of fat content
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.
10. Determination of pH of different food samples
11. Determination of reducing and non-reducing sugar

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER III**

Paper Title: Food Microbiology Lab
Paper Code: BFTC-307

Total Credits: 2, Contact hours -60, Maximum Marks: 100 (Internal Assesment-40 Final Exam-60)

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. 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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

LIST OF 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. Isolation and characterization from normal and decayed food items ; Standard plate count and serial dilution methods
6. Effect of environmental factor on growth and development of microbes.
7. Study on food fermentation processes.
8. Swab and rinse method for enumeration of microbial colonies
9. Streaking and plating methods

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER III**

Paper Title: Cereal, Pulses and Oilseed Technology Lab
Paper Code: BFTC-308

Total Credits: 2, Contact hours -60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

COURSE OUTCOMES (COs)

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

CO1. Identify and explain milling terms, ingredients, equipment and tools. (Cognitive level: Understand and analyze)

CO2. Learn different types of Physicochemical properties of cereal grains. (Cognitive level: Understand and analyze)

CO3. Impart training on processes like Malting and Germination. (Cognitive level: Understand and analyze)

CO4 Understand techniques used for extraction of oil like solvent extraction methods (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	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
CO4	3	3	3	3	1	2	1	3	2	2	3	3	3	3

‘3’ is ‘High-level’ mapping, ‘2’ is ‘Medium-level’ mapping, ‘1’ is ‘low-level’ mapping

LIST OF PRACTICALS:

1. Estimation of different physicochemical characteristics of cereals grains;
2. Physical-tests on wheat and rice;
3. Physicochemical analysis of different cereal flours;
4. Determination of gluten content in wheat flour;
5. Milling of wheat and rice by laboratory mill;
6. Malting of Barley;

7. Extraction of oil using solvent extraction methods;
8. Detection if extraneous matter in grains and flours;
9. Germination of different cereals;
10. Particle size distribution;

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),
- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.
- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER IV**

Paper Title: Fluid Mechanics-I
Paper Code: BFTC-401

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

COURSE OUTCOMES (COs)

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

CO1: Understand all underlying concepts of fluid mechanics at higher level.

CO2: Understanding concepts of floating bodies and buoyancy

CO3: Derive the kinematic equations of fluids (Lagrangian and Eulerian Approach)

CO4: Understand fluid dynamics and corresponding applications with problem/numerical solving.

CO5: Solve analytically and numerically dimensional and non-dimensional parameters

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	2	1	2	3	3	3	3
CO2	3	3	3	2	1	1	1	2	1	2	3	3	3	3
CO3	3	3	3	2	1	1	1	2	1	2	3	3	3	3
CO4	3	3	3	2	1	1	1	2	1	3	2	3	3	3
CO5	3	3	3	2	1	1	1	2	1	2	3	2	3	3

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

Unit-I: Introduction: Classification of Fluids, Continuum Concept; Properties of Fluids- Density Specific Gravity, Viscosity, Surface Tension and Capillary Effect, Vapor Pressure and Cavitation, Newtonian and Non Newtonian Fluids, Pascal's Law, Hydraulic Pressure, Pressure Measurement, Manometer and Micro-Manometer, Pressure Gauges, Slip / No Slip condition.

Unit-II: Fluid Statics: Hydrostatic Forces on Submerged Plane and Curved Surfaces, Centre of Pressure, Equilibrium of Submerged and Floating Bodies, Buoyancy, Meta-Centric Height, Fluid Subjected to Constant Linear Acceleration and Constant Rotation.

Unit-III: Kinematics of Fluid: Classification of Fluid Flows, Lagrangian and Eulerian Approach, Velocity and Acceleration of Fluids, Path Line, Streak Line and Stream Line, Stream Tube, Stream Function and Potential Function, Flow net, Deformation of Fluid Elements; Vorticity and Circulation; Reynolds Transport Theorem.

Unit-IV: Fluid Dynamics and its Applications: Conservation Equations of Mass, Momentum and Energy, Euler and Bernoulli's equation, Forces due to Fluid Flow in the Bends, Pitot Tube, Venturimeter and Orifice Meters, Orifice and Mouthpieces; Notches and Weirs; Rotameter and Other Devices.

Unit-V: Dimensional Analysis and Similitude: Basic and Derived Quantities; Similitude and Dimensional Analysis; Rayleigh's Method; Buckingham Method; Non-Dimensional Parameters and Model Testing.

BOOKS RECOMMENDED:

- Computational Fluid Dynamics in Food Processing by Da-Wen Sun
- A Textbook of Fluid Mechanics and Hydraulic Machines by R K Bansal

- A Textbook of Fluid Mechanics by R K Rajput
- Fluid Mechanics: Fundamentals and Applications. Yunus A Cengel
- Fluid Mechanics by Hibbeler R C
- Fluid Mechanics in Food Process Engineering by D. Ricardo , P. Andrade , E. Carmen , C. Pérez , J. German , G. Narvaez

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER IV**

Paper Title: Food Engineering
Paper Code: BFTC-402

Total Credits:4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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.
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	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
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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT-I: Introduction to Engineering Properties of foods. Physico-chemical characteristics: shape, sphericity, size, volume, density, porosity, surface area, terminal velocity, drag coefficient, coefficients of friction and angle of repose. Specific heat, thermal conductivity, thermal diffusivity, electrical resistance and conductance, dielectric constant, energy absorption, Numerical calculations.

UNIT-II: Rheology of food materials, Newtonian and Non-Newtonian fluids, rheological models and equations, Linear Visco-elasticity, Creep stress relaxation, Texture profile analysis. Application of engineering properties in process development as well as design.

UNIT III: Drying-Theory of drying, Types of drying. Moisture sorption curves, Drying rate periods, bound moisture, free moisture, equilibrium moisture content, critical moisture content, engineering aspects of different types of driers Water activity, moisture content; wet basis and dry basis; calculations.

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

BOOKS RECOMMENDED:

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

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),
- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.
- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER IV**

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

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

COURSE OUTCOMES (COs)

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

CO1. Understand the developments, nutritive value, physiological and biochemical changes and post-harvest losses and handling of fruits and vegetables.

CO2. Understand the different preservation methods like freezing, drying, canning, concentration and emerging technologies for fruits & vegetables.

CO3. Learn the processing and development of value-added products.

CO4. Gain Knowledge about the different aspects of food storage methods in context to fruits & vegetables. (cognitive level: understand)

CO5: Understand the effect of different preservation, processing and storage methods on the shelf-life and stability of 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	1	1	1	1	3	2	2	1	3	1	2	2	2	2
CO2	1	2	2	1	3	2	2	2	3	1	2	2	2	2
CO3	2	3	3	3	3	2	2	2	3	3	2	3	3	3
CO4	1	1	1	3	3	2	2	2	3	1	2	1	1	2
CO5	1	1	2	1	3	2	2	2	3	1	2	1	1	3

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is '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, pasteurization, minimal processing, 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, Intermediate moisture foods, Food concentration: methods of concentration

BOOKS RECOMMENDED:

- Lal G, Siddappa GS & Tandon GL. Preservation of Fruits and Vegetables. ICAR.
- Salunkhe DK & Kadam SS.,Handbook of Vegetables Science & Technology: Production, Composition, Storage and Processing.Marcel Dekker.
- Srivastava RP & Kumar S. Fruit and Vegetable Preservation - Principles and Practices.

International Book Distributors

- Verma LR & Joshi VK. 2000. Post Harvest Technology of Fruits and Vegetables. Indus Publ.

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER IV**

Paper Title: Food Biotechnology and Functional Foods
Paper Code: BFTC-404

Total Credits:4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

COURSE OUTCOMES (COs)

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

CO1. To gain the fundamental aspects of central dogma of life, recombinant DNA technology and application of Applications of GMO/GMC in food, agriculture, and industrial sector. (Cognitive level: Understand)

CO2. To learn about the design of fermenter, Aerobic and anaerobic fermentation, types of bioreactors and waste utilization. (Cognitive level: Understand)

CO3. Role of microorganism in food biotechnology and their various applications in food sector. To learn the production of various products: alcoholic beverages, amino acids, citric acid, gums, PUFA, Baker's yeast, SCP. (Cognitive level: Understand)

CO4. To understand the concept of functional foods and nutraceuticals, speciality foods, medical foods and the relevance of functional foods for pregnant, lactating women, old age people and infants.

CO5. To understand the implications of functional foods in human health: in gastrointestinal disorders; liver, gall, bladder, and pancreatic disturbances; cardiac diseases; urinary and musculoskeletal diseases; To analyze the status of Transgenic plant foods with health claims in 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	1	1	2	3	2	2	1	2	1	2	1	1	2
CO2	1	1	2	2	3	2	2	3	2	1	2	2	2	3
CO3	1	2	2	2	3	2	2	3	2	3	2	2	2	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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

Unit-I: Central dogma of life-replication, transcription, translation, Recombinant DNA Technology; Genetically modified foods, Bioreactors, Fermenter design and various types of fermentation systems (submerged, surface and solid state). waste utilization

Unit-II: Production of alcoholic beverages, 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, Single Cell protein

Unit III: Scope & Importance of functional foods, nutraceuticals, speciality foods, health foods, Functional foods: infant and baby foods, foods for pregnant ladies and nursing mothers, geriatric foods.

Unit IV: Food recommended and restricted in gastrointestinal disorders; liver, gall, bladder and pancreatic disturbances; cardiac diseases; urinary and musculoskeletal diseases. Nutritional

deficiencies and its correction through fortification and supplementation; Transgenic plant foods with health claims.

BOOKS RECOMMENDED:

- Human nutrition: A textbook of nutrition in health and disease. B. T. Burton, Mc Graw Hill, 3rd Edition, 2002.
- Nutrition and Dietetics. S. A. Joshi, Tata Mc Graw Hill Co. Ltd., 2nd Edition, 2003.
- Dietetics. B. Shrilakshmi, New Age International (P) Ltd., New Delhi, 5th Edition, 2005.
- Nutrition and Dietetic Foods, A. E. Bender, Chem. Pub. Co. New York, 2nd Edition, 2004.
- Basic Nutrition in Health and Disease. P. S. Howe, W. B. Saunders Company, London, 2nd
- Edition, 2003.
- Joshi VK & Pandey A. Biotechnology: Food Fermentation. Vols. I, II.Education Publ.
- Knorr D. Food Biotechnology. Marcel Dekker.
- Lee BH. Fundamentals of Food Biotechnology. VCH.
- Prescott SC & Dunn CG. Industrial Microbiology. McGraw Hill.
- Ward OP. Fermentation Biotechnology. Prentice Hall.

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER IV**

Paper Title: Food Engineering Lab
Paper Code: BFTC-405

Total Credits: 2, Contact hours-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

LIST OF PRACTICALS:

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.

11. Comparison of tray dryer and vacuum tray drying of food and vegetable.
12. Freeze drying characteristic of food material
13. To study the drying characteristics of different food materials.
14. To plot drying curve for onion, potato, tomato slices.
15. Moisture Sorption Isotherm of different foods.
16. Calculation of moisture content on dry weight basis and wet weight basis.
17. Model fitting to drying curves.
18. To check the rheology of different materials.
19. To check the pasting properties of flours.

Note: Any 8-10 experiments out of the list may be chosen.

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER IV**

Paper Title: Technology of fruits and vegetables lab
Paper Code: BFTC-406

Total Credits: 2, Contact hours-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

COURSE OUTCOMES (COs)

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

CO1: To determine the total soluble solids, pH, and acidity of samples. (Cognitive level: Understand and apply)

CO2. Understand the role of processing and storage techniques in terms of shelf life, safety, nutritional and economic value of fruit and vegetables. (Cognitive level: Understand and apply)

CO3. To learn the processing of tomato processed products ketchup, puree, paste (Cognitive level: Understand, Analyze & Develop)

CO4. Gain knowledge on processing of jam, jelly, marmalade, pickles and beverage (Cognitive level: (Understand, Analyze & Develop)

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

‘3’ is ‘High-level’ mapping, ‘2’ is ‘Medium-level’ mapping, ‘1’ is ‘low-level’ mapping

LIST OF PRACTICALS:

1. Determination of TSS, acidity and pH
2. Assessment of Post-harvest losses and demonstration of value addition by post-harvest handling and packaging.
3. Study on Zero Energy Cooling Chamber for Shelf-life study of Fruits and Vegetable
4. Processing of tomato products: puree, paste, ketchup
5. Preparation of Saurkraut
6. Preparation of pickle/mixed pickle
7. Preparation of Jam
8. Preparation of Jelly
9. To Prepare Potato Chips

10. To Prepare chutney

11. To Prepare Marmalade

12. To Prepare Cordial/sherbet

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER IV**

Paper Title: Solid Mechanics
Paper Code: BFTC-407

Total Credits: 3, Total Lectures-30, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

COURSE OUTCOMES (COs)

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

CO1: Understand advanced stress-strain correlations.

CO2: Critical thinking and critical judgment of assumptions adopted.

CO3: Establish links between theoretical and practical applications.

CO4: Identify, formulate, model, and analyze the complex engineering structural problem.

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

3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT-I: Equivalent force systems; free-body diagrams; equilibrium equations; analysis of determinate trusses and frames; friction; principle of minimum potential energy; particle kinematics and dynamics; dynamics of rigid bodies under planar motion; law of conservation of energy; law of conservation of momentum.

UNIT-II: Stresses and strains; transformation of stresses and strains, principal stresses and strains; Mohr's circle for plane stress and plane strain; generalized Hooke's Law; elastic constants; thermal stresses; theories of failure.

UNIT-III: Axial force, shear force and bending moment diagrams; axial, shear and bending stresses; combined stresses; deflection (for symmetric bending); torsion in circular shafts; thin walled pressure vessels; energy methods (Castigliano's Theorems); Euler buckling.

UNIT-IV: Free vibration of undamped single degree of freedom systems.

BOOKS RECOMMENDED:

- Mechaics of Solids By E.R Popov
- Strength Of Material By Dr Sadhu Singh,Khanna Publications
- Strength Of Material,By R.S Khurmi,s.Chand Publicatios
- Dr B.C Punamia, Laxmi Publications

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER V**

Paper Title: Dairy Technology
Paper Code: BFTC-501

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is '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

BOOKS RECOMMENDED:

- Aneja RP, Mathur BN, Chandan RC & Banerjee AK. Technology of Indian Milk Products. Dairy India Publ.
- De S. Outlines of Dairy Technology. Oxford Univ. Press.
- Henderson JL. Fluid Milk Industry. AVI Publ.
- 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.
- Web BH, Johnson AH & L.ford JA. 1987. Fundamental of Dairy Chemistry. 3rd Ed. AVI Publ.

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER V**

Paper Title: Technology of Meat, Fish & Poultry
Paper Code: BFTC-502

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

COURSE OUTCOMES (COs)

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

CO1. To understand need and importance of livestock, egg and poultry industry (Cognitive Level: Understand)

CO2. To understand and analyze the compositional and technological aspects of meat, fish and poultry processing & products. (Cognitive Level: Understand & Analyze)

CO3. To understand and apply different processing and preservation technologies to preserve meat, fish and poultry products (Cognitive Level: Understand & Apply)

CO4. To understand and apply various food safety management systems to ensure quality of products. (Cognitive Level: Understand & Apply)

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	3	2	2	1	3	1	2	1	2	3	3	3	3
CO3	3	3	2	2	1	3	1	2	1	3	3	3	3	3
CO4	3	2	3	3	2	3	2	3	1	2	3	3	3	3

‘3’ is ‘High-level’ mapping, ‘2’ is ‘Medium-level’ mapping, ‘1’ is ‘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;, 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.

BOOKS RECOMMENDED:

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

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks)

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER V**

Paper Title: Fluid Mechanics-II
Paper Code: BFTC-503

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

COURSE OUTCOMES (COs)

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

CO1: Obtain the finite difference approximations of flow parameters and velocity distributions

CO2: Discretize the governing energy losses in pipes and solve related numericals

CO3: Understand the concepts of thickness, momentum, layer flow in systems

CO4: Analyze and understand the concepts of Incompressible Flow, Stagnation Properties, Couette Flow; Hagen-Poiseuille Flow.

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	3	2	2	1	3	1	2	1	2	3	3	3	3
CO3	3	3	2	2	1	3	1	2	1	3	3	3	3	3
CO4	3	2	3	3	2	3	2	3	1	2	3	3	3	3

‘3’ is ‘High-level’ mapping, ‘2’ is ‘Medium-level’ mapping, ‘1’ is ‘low-level’ mapping

Unit-I: Viscous Flow : Flow of Viscous Fluid Through Circular Pipes, Flow of Viscous Fluid Between Two parallel Plates, Power Absorbed in Viscous Flow, Loss of Head Due to Friction in Viscous Flow and Problems.Turbulent Flow: Reynolds Experiment, Frictional Loss in Pipe Flow, Shear Stress in Turbulent Flow, Velocity Distribution in Turbulent Flow.

Unit-II: Flow Through Pipes: Loss Of Energy in Pipes, Loss of Energy Due to Friction, Minor Energy Losses, HGL and TEL, Pipes in Series, Parallel Pipes, Branched Pipes, Problems.

Unit-III: Boundary Layer Flow: Definitions: Laminar boundary layer, Turbulent Boundary Layer, Laminar Sublayer, Boundary layer thickness, Displacement thickness, Momentum thickness, Energy thickness, Drag Force on a Flat Plate. Problems.

Unit-IV: Incompressible Flow: Mach Number, Stagnation Properties, Couette Flow; Hagen-Poiseuille Flow; Moody's Diagram, Aerofoil, Lift and Drag, Flow Separation.

BOOKS RECOMMENDED:

- Fluid Mechanics in Food Process Engineering by D. Ricardo , P. Andrade , E. Carmen , C. Pérez , J. German , G. Narvaez
- Fluid mechanics in food process engineering by AliEsin
- Computational Fluid Dynamics in Food Processing by Da-Wen Sun
- Engineering Principles of Unit Operations in Food Processing by Seid Mahdi Jafari
- Heldman DR & Singh RP. Food Process Engineering. AVI Publ

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER V**

Paper Title: Dairy Technology Lab

Paper Code: BFTC-508

Total Credits: 2, Contact hours-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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, chhana 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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

LIST OF PRACTICALS:

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, H2O2 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

Note: Any 8-10 experiments of the list may be conducted.

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER V**

Paper Title: Technology of Meat, Fish & Poultry Lab
Paper Code: BFTC-509

Total Credits: 2, Contact hours-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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 pH and water holding capacity of meat.

CO4. Able to prepare meat products: patties, kebabs, tandoori, shami.

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

LIST OF PRACTICALS:

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. Video demonstrations
7. To carry out candling and grading of shell eggs.
8. Visit to a meat processing plant.
9. Preparation of different meat products: nuggets, patties, kebabs, tandoori, shami etc.
10. Preparation of sausages.
11. Preparation of egg pickle
12. Estimation of pH and water holding capacity of meat.

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode

(10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.
- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

DISCIPLINE SPECIFIC ELECTIVE PAPER **SEMESTER V**

Paper Title: Unit Operations in Food processing
Paper Code: BFTD-504

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT-I: Material handling - Theory, classification of various material handling equipment - conveyors, elevators, trucks, cranes and hoists, Conveyance of food grain and powder in screw and vibratory conveyors. Selection of material handling equipments.

UNIT-II: Cleaning - Types, aims of cleaning, methods of cleaning, Dry cleaning methods: screening, aspiration, magnetic cleaning and abrasive cleaning. Wet cleaning methods: soaking, spray washing, flotation washing and ultrasonic washing. Sorting and Grading - Advantages of sorting and grading, grading factors, methods of sorting and grading.

UNIT-III: Size Reduction: principles and laws of size reduction, energy calculations, equipment selection, Particle size analysis.

UNIT-IV: Mixing - Terminology (agitating, kneading, blending, and homogenizing), equipments - mixers for liquids of low or moderate viscosity (Paddle agitators, turbine agitators and propeller agitators), mixers for high viscosity pastes (Pan mixer, horizontal mixer and dough mixer), mixers for dry solids (tumbler mixer and vertical screw mixer), effect of mixing on foods. Power consumption and efficiencies.

UNIT-V: Theory and equipment for filtration, Expression, Concentration and Evaporation, Distillation, Sedimentation fluidization and centrifugation

BOOKS RECOMMENDED:

- Geankoplis J Christie. (1999). Transport Process and Unit Operations. Allyn & Bacon.
- Earle R. L. and Earle M.D.. Unit Operations in Food Processing
- McCabe WL & Smith JC. (1999). Unit Operations of Chemical Engineering. McGraw Hill.
- Sahay KM & Singh KK. (1994). Unit Operation of Agricultural Processing. Vikas Publ. House
- Singh RP and Heldman DR. (1993).Introduction to Food Engineering. Academic Press

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks)

DISCIPLINE SPECIFIC ELECTIVE PAPER **SEMESTER V**

Paper Title: Beverage Technology
Paper Code: BFTD-505

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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. (Cognitive level: Understand)

CO2. Understand the importance and effect of quality of raw materials on the final products. (Cognitive level: Understand and analyze)

CO3. Apply the knowledge gained in formulating new types of products. (Cognitive level: Understand analyze and develop)

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, evaluate and analyze)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT-I: Introduction and ingredients: Scope and status of beverages in India and World. Definition of beverage, study of ingredient like sweeteners, emulsifier, colouring agent, flavoring agent, stabilizer etc.

UNIT-II: Technology for non-alcoholic beverages: Raw materials, Manufacturing technology for fruit juice-based beverages, technology for manufacture of carbonated soft drinks.

UNIT-III: Technology for alcoholic beverages: Raw materials, Manufacturing Technology for Wine, Beer, Whiskey, Brandy, and Rum.

UNIT-IV: Packaged drinking water: definition types, manufacturing technology, quality evaluation.
Specialty beverages: Raw materials, manufacturing Technology for instant tea and coffee, Imitation dairy-based beverages, probiotic beverages.

BOOKS RECOMMENDED:

- Prescott, S. C and Dunn, C. G. Industrial microbiology, (Agrobios, 2007).
- Boulton, C. and Quain, D. Brewing, Yeast and Fermentation, (Blackwell Science Ltd, 2001)
- Fix, G. J. Principles of Brewing Science, (Brewers Publications, 1999)
- Stanbury, P. F., Hall, S. and Whitaker, A. Principles of Fermentation Technology, (Aditya Books Pvt. Ltd., 1997)

- Coffee: Botany, Biochemistry and Production of Beans and Beverage. M.N. Clifford and K.C.Willson, AVI publishing Co., 1st Edition, 198

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

GENERIC ELECTIVE PAPER **SEMESTER V**

Paper Title: Techniques in Food Analysis
Paper Code: BFTG-506

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

COURSE OUTCOMES (COs)

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

CO1. Understand the sampling techniques used in food analysis (*Cognitive Level: Understand*)

CO2. Understand and analyze various chromatographic and spectroscopic techniques used in food analysis (*Cognitive Level: Understand & Analyze*)

CO3. Understand application of microscopic techniques are used in food analysis. (*Cognitive Level: Understand & Apply*)

CO4. Familiarize with specialized and rapid techniques in food analysis and their applications. (*Cognitive Level: Understand & Apply*)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is '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 tech

BOOKS RECOMMENDED:

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

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),
- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.
- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks)

GENERIC ELECTIVE PAPER **SEMESTER V**

Paper Title: Food Storage & Plant layout

Paper Code: BFTG-507

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is '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

BOOKS RECOMMENDED:

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

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),
- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.
- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER VI**

Paper Title: Food Packaging Technology
Paper Code: BFTC-601

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is '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.

BOOKS RECOMMENDED:

- Ahvenainen, R. Novel Food Packaging Techniques. Woodhead Publishing Series
- Robertson, (2005), Principles of Food Packaging. CRC Press, USA.

- Scharow, S., and Griffin, R.C. (1980). Principles of Food Packaging, 2nd Edition, AVI Publications Co. Westport, Connecticut, USA.
- Yam, KL, Lee, DS and Piergiovanni, L. Food Packaging Science and Technology. CRC Press

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER VI**

Paper Title: Bakery & Confectionary Technology
Paper Code: BFTC-602

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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. (Cognitive level: Understand and Analyze)

CO3. Apply the knowledge gained in formulating new types of products. (Cognitive level: Understand, design 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 and evaluate)

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

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT-I: Bakery industry status in India and World. Raw materials and quality parameters; Product types; Functions of Gluten; standards & regulations of bakery and Confectionery products.

UNIT-II: Technology for the manufacture of bakery products-bread, biscuits, Equipments used, product quality characteristics, faults and corrective measures; 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.

BOOKS RECOMMENDED:

- Matz, (1989). Bakery Engineering and Technology, Vol I and II, CBS Publishers, New Delhi.
- Dubey SC. Basic Baking. The Society of Indian Bakers, New Delhi.
- Manley D. 2000. Technology of Biscuits, Crackers & Cookies. 2nd Ed. CRC Press.
- Pomeranz Y. Modern Cereal Science and Technology. MVCH Publication

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

DISCIPLINE SPECIFIC ELECTIVE PAPER **SEMESTER VI**

Paper Title: Food Product Development
Paper Code: BFTD-603

Total Credits: 4, Total Lectures-120, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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 (*Cognitive Level: Understand*)
CO2. Understand market and consumer surveys in food product development (*Cognitive Level: Understand*)
CO3. Understand the relevance of market research, and application of costing, and advertising in food product development (*Cognitive Level: Understand and apply*)
CO4. Apply the basic strategies of shelf-life testing and sensory evaluation in creation and development of new products (*Cognitive Level: Apply and create*)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is '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-II: 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-III: 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-IV: 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).

BOOKS RECOMMENDED:

- Amerine, M.A.; Pangborn, R.M.; Roessler, E.B.,Principles of Sensory Evaluation,

Academic Press, NY
- Kapsalis, J.G,Objective, Methods in Food Quality Assessment, CRC Press, Florida.
- Martens, M.; Dalen, G.A.; Russwurm, H. (eds), Flavour Science and Technology, John Wiley and Sons, Chichester.
- Moskowitz, H.R.(eds), Food Texture: Instrumental and Sensory Measurement, Marcel Dekker Inc. , New York.
- Earle R, Earle R & Anderson A. 2001. Food Product Development. Woodhead Publ.
- Fuller 2004. New Food Product Development - from Concept to Market Place. CRC.
- Moskowitz, Howard R. 2009. An Integrated Approach to New Food Product Development. CRC Press.

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER VI**

Paper Title: Bakery & Confectionary Technology Lab
Paper Code: BFTC-607

Total Credits: 4, Contact hours-120, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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. (Cognitive level: Understand and Analyze)

CO2. Develop different bakery products and understand the role of ingredients. (Cognitive level: Understand and Analyze)

CO3 Learn different types of bakery products and their quality. (Cognitive level: Understand and Analyze)

CO4. Impart training on baking and confectionery methods. (Cognitive level: Understand and Analyze)

CO5 Understand the role of confectionery ingredients in developing the final products. (Cognitive level: Understand and Analyze).

CO6 Develop and evaluate the new products of confectionery. (Cognitive level: Understand develop, Analyze and evaluate)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

LIST OF PRACTICALS:

1. Preparation of Biscuits.
2. Preparation of cookies.
3. Fortification of biscuits.
4. Preparation of cakes (Sponge Cake, Rock Cake, Fruit Cake)
5. Preparation of pizza.
6. Preparation of Bread.
7. Preparation of jellies.
8. Preparation of caramel
9. Preparation of chocolates.

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),
- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.
- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER VI**

Paper Title: Industrial/Research Visit Report
Paper Code: BFTC-608

Total Credits: 2, Total Lectures/ hours of visit-60, Maximum Marks: 100 (Internal Assesment-40, Visit Report-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is '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 assessment will be made by the internal faculties for their sincerity during visit followed by visit report on assigned topic by tour incharge.

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and Visit presentation (60 marks). Internal assessment consists of attendance and report (20 marks)

DISCIPLINE SPECIFIC ELECTIVE PAPER **SEMESTER VI**

Paper Title: Engineered, Textured and Fabricated Foods
Paper Code: BFTD-604

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

Unit-I: Introduction and need of the engineered foods. Techniques adopted for engineering the foods special emphasis on Extrusion and 3D printing, Weaning Foods/ Baby Foods. Therapeutic Foods. Geriatric Foods. Space Foods. Probiotics and Synbiotics

Unit-II: Textured plant protein products. Soy protein fibres, isolate and concentrate, Puffing Gun, Puffed Products. Meat Analogues. Imitation Paneer. Structural modification of macromolecules.

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: 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.

BOOKS RECOMMENDED:

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

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

GENERIC ELECTIVE PAPER **SEMESTER VI**

Paper Title: Non-thermal Food Processing
Paper Code: BFTG-605

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is '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.

BOOKS RECOMMENDED:

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

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightage

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of

10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.
- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

GENERIC ELECTIVE PAPER **SEMESTER VI**

Paper Title: Food Business Management
Paper Code: BFTG-606

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is '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.

BOOKS RECOMMENDED:

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

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),
- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.
- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER VII**

Paper Title: Research Methodology
Paper Code: BFTC-701

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is '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, FTest, 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.

BOOKS RECOMMENDED:

- Kothari, C.K., Research Methodology- Methods and Techniques, (New Age International, New Delhi).
- Trochim, William M.K., Research Methods, (Biztantra, Dreamtech Press, New Delhi).
- Gupta, C.B., An Introduction to Statistical Methods, 23rd Edition, Vikash Publications.
- Gupta, SC & Kapoor, VK. Fundamentals of mathematical Statistics: A modern approach, (2000), Sultan Chand & Sons.
- Aggarwal, BL. 2003. Basic Statistics. New Age Publishers, New Delhi

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),
- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.
- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER VII**

Paper Title: Food Safety & Quality Management
Paper Code: BFTC-702

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

COURSE OUTCOMES (COs)

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

CO1. To understand food safety, different types of hazards in food production chain. (Cognitive Level: Understand)

CO2. To understand and identify physical, chemical, biological contaminants and adulterants in foods and their impact on human health (Cognitive Level: Understand and apply)

CO3. To understand and analyze the various practices for processing of safe and quality foods. (Cognitive Level: Understand)

CO4. Understand the national and international regulations and laws on food safety and standards (Cognitive Level: Understand)

CO5. Apply the standards and regulations to implement food safety (Cognitive Level: Apply)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT-I: 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-II: 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-III: 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-IV: 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:

- Lawley, R., Curtis L. and Davis,J. The Food Safety Hazard Guidebook , RSC publishing, 2004
- De Vries. Food Safety and Toxicity, CRC, New York, 1997
- Forsythe,S.J.The Microbiology of Safe Food ,Willey-Blackwell,U.K.,2010
- Mortimore S.and Wallace C. HACCP-A Practical Approach,Chapman and Hill, London,1995

- Blackburn CDW and Mc Clure P.J. Food Borne Pathogens- Hazards,Risk Analysis and Control.CRC Press, 2005
- Hester, R E and Harrison R M -Food Safety and Food Quality :Issues in Environmental Science and Techonology ,Cambridge, 2001
- Paster T - The HACCP Food Safety Training Manual, John Wiley and Sons Inc., 2007

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER VII**

Paper Title: Food Safety & Quality Management Lab
Paper Code: BFTC-707

Total Credits: 2, Contact hours-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

LIST OF PRACTICALS:

- Development of GHP and GMP plan for a food factory.
- Development of HACCP plan.
- Identification of hazards associated to various processed food products.
- Development of FSMS.
- Visit to a food industry/outlet and identifying the gaps for HACCP plan.
- To check the various adulterants in spices and processed foods.

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

Compulsory paper **SEMESTER VII**

Paper Title: Educational tour report
Paper Code: BFTC-708

Total Credits: 2, Total Lectures/ Visit hours-60, Maximum Marks: 100 (Internal Assesment-40, Visit Report-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

The students will visit Food Research Institutes/organizations/factories/plants, to acquaint themselves with different handling, processing and preservation techniques. 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 assessment will be made by the internal faculties for their sincerity during visit and on the basis of tour report submitted by candidate on assigned topics by tour Incharge.

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and Visit presentation (60 marks). Internal assessment consists of attendance and report (20 marks).

DISCIPLINE SPECIFIC ELECTIVE PAPER **SEMESTER VII**

Paper Title: IPR in Food Technology
Paper Code: BFTD-703

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT-I: Introduction of intellectual property right and the need for IPR, IPR in India and abroad. Macroeconomic impact of the patent system. WIPO and its role.

UNIT-II: 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. Emerging sectors in Food Processing for IPR.

UNIT-IV: Reverse Engineering, patent pool, cross-licensing, patent map, voluntary and Compulsory licensing, patent thicket, TRIPS, Fair Use of IPR,

BOOKS RECOMMENDED:

- P.N. Cheremisinoff, R.P. Ouellette and R.M.Bartholomew,Biotechnology Applications and
- Research, Technomic Publishing Co., Inc. USA, 1985.
- D.Balasubramaniam, C.F.A.Bryce,K. Dharmalingam, J. Green and K. Jayaraman, Concepts in Biotechnology, University Press (Orient Longman Ltd.), 2002
- Bourgagaize, Jewell and Buiser,Biotechnology: Demystifying the Concepts, Wesley Longman, USA, 2000.
- Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
- B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
- P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi , 2010

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

DISCIPLINE SPECIFIC ELECTIVE PAPER **SEMESTER VII**

Paper Title: Food Process Design
Paper Code: BFTD-704

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT-I: 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-III: 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

BOOKS RECOMMENDED:

- M. V. Joshi. Process equipment design
- R.T. Toledo. Fundamentals of food process Engg.
- Brennan, J.G. and J.R. Cowell. Food Engineering. Operations
- Heldman, D.R. and R.P.Singh. Food Process Engineering.

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

GENERIC ELECTIVE PAPER **SEMESTER VII**

Paper Title: Food Additives
Paper Code: BFTG-705

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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. To know the chemistry, types and functions of direct and indirect food additives in maintaining or improving food quality. (Cognitive Level: Understand)

CO3. To understand methods for detection of Food Additives. (Cognitive Level: Understand)

CO4. To understand the safety and toxicological quality evaluation of food additives. (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	2	1	1	1	3	1	1	1	2	1	2	1	1	3
CO3	2	2	2	1	3	1	2	2	2	1	2	1	2	3
CO4	1	1	2	1	3	1	1	1	2	1	2	1	1	3
CO7	1	1	2	1	3	1	1	3	2	1	2	1	1	3

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

UNIT-I: Introduction, classification, and functions of Preservatives, curing agents, sequestrants, humectants, hydrocolloids, non nutritive sweeteners (Acesulfame K, Aspartame, Saccharin, sucralose, stevia, neotame) anticaking agents, leavening agents,

UNIT-II: Flavour technology: Types of flavours, Food flavour 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, antioxidants emulsifiers, flour improvers, stabilizers, and thickeners, 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; methods for detection of Food Additives

BOOKS RECOMMENDED:

- Branen AL, Davidson PM & Salminen S. Food Additives. 2nd Ed. Marcel Dekker.
- Gerorge AB. Encyclopedia of Food and Color Additives. Vol. III. CRC Press.
- Gerorge AB. Fenaroli's Handbook of Flavor Ingredients. 5th Ed. CRC Press.
- Madhavi DL, Deshpande SS & Salunkhe DK. Food Antioxidants: Technological, Toxicological and Health Perspective. Marcel Dekker.

- Morton ID & Macleod A J Food Flavours. Part A, BC. Elsevier.

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

GENERIC ELECTIVE PAPER **SEMESTER VII**

Paper Title: Technology of Waste Management
Paper Code: BFTG-706

Total Credits: 4, Total Lectures-60, Maximum Marks: 100 (Internal Assesment-40, Final Exam-60)

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. Cognitive level: Understand and Analyze

CO2. Fundamental knowledge of effect of waste management on environment. Cognitive level: Understand

CO3. To Learn effective waste treatment and disposal management 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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is '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.

BOOKS RECOMMENDED:

- Food Processing Work Management by Green and Krammer; CBS Publication
- Principles of Food Sanitation by Mariett NG; CBS Publication
- Waste Treatment in the Food Processing Industry by Lawrence K.Wang, Yung-Tse Hung Howard H.Lo, constanitine Yapijakis.

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning.

Assessment methods and weightage

- *There are two components of assessment:* Internal assessment (40 marks) and End semester examination (60 marks). Internal assessment consists of continuous mode (10 marks) and sessional examinations (30 marks). Continuous mode evaluation is of 10 marks comprising of Attendance -5 marks (calculated as: Percentage of Attendance: Allotment of

marks- Less than 75: 0 marks; 75-80: 2 mark; 81-85: 3 marks; 86-90: 4 marks and >90: 5 marks),

- Assignments contain 3 marks and Student teacher interaction-2 marks. There are two Sessional exams (each conducted for 15 marks) and one improvement exam (15 marks). The average marks of two best sessional exams are computed out of 30 marks.

- Total Marks are 100 for the subject (Internal Assessment: 40 marks and End Semester Examination: 60 Marks).

CORE PAPER **SEMESTER VIII**

Paper Title: Training & Research in Food Technology
Paper Code: BFTC-801

Total Credits: 17, Maximum Marks: 400 (Internal Assesment-160, Final Assessment External-240)

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

'3' is 'High-level' mapping, '2' is 'Medium-level' mapping, '1' is 'low-level' mapping

The students will carry out project work/ research training for more than 450 hours individually under the guidance of a faculty member or in collaboration with any industry. The project shall consist of research/design/development/ implementation work.. 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 on the basis of quality of work done, dissertation submitted and presentation made in front of examiners. All the faculties will be

member of examination panel including external examiner. However, evaluation marks will be given by external examiner.

Teaching-Learning Strategies

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, quiz, presentations, Q & A session and reflective learning. For project work, emphasis shall be given on laboratory/industry hands-on work carried out by the student.

Assessment methods and weightages

- *There are two components of assessment:* Internal assessment (160 marks) and External examination (240 marks). Internal and external assessment consists of presentation and viva-voice. The project shall consist of research/design/development/ implementation work. 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 on the basis of quality of work done, dissertation submitted and presentation made in front of examiners.