



**DEPARTMENT OF TECHNOLOGY,
FINAL YEAR B.TECH**

**Scheme of Teaching and Examination: Semester- VII (Food Technology)
To be implemented from Academic Year 2023 - 24**

Subject Code	Subject	Teaching Scheme with Credits (Hours / Week)				Examination Scheme (Marks)					
		L	T	P	Total Credits	Theory			Practical		
						Scheme	Max. marks	Min. Passing	Scheme	Max. marks	Min. Passing
FT 411	Meat, Poultry and Fish Processing Technology	04	-	-	04	CIE	30	40	-	-	-
						SEE	70		-	-	-
FT 412	Legume and Oilseed Technology	04	-	-	04	CIE	30	40	-	-	-
						SEE	70		-	-	-
FT413	Food Biotechnology	04	-	-	04	CIE	30	40	-	-	-
						SEE	70		-	-	-
FT414	Food Packaging	04	-	-	04	CIE	30	40	-	-	-
						SEE	70		-	-	-
FT415	Elective –I	03	-	-	03	CIE	30	40	-	-	-
						SEE	70		-	-	-
FT411L	Meat, Poultry and Fish Processing Technology Laboratory	-	-	02	01	-	-	-	EOE	50	20
FT412L	Legume and Oilseed Technology Laboratory	-	-	02	01	-	-	-	EPE	50	20
FT413L	Food Biotechnology Laboratory	-	-	02	01	-	-	-	IOE	50	20
FT414L	Food Packaging Laboratory	-	-	02	01	-	-	-	IOE	50	20
FT415L	Major Project –Phase I	-	-	02	01	-	-	-	IOE	50	20
FT416	Internship II	-	-	-	01	-	-	-	EOE	50	20
	Total	19	-	10	25	-	500	-	-	300	-

Audit Course V

HS411	Introduction to Indian Constitution	02	-	-	-	Institute Level	--	---	---	----	----
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Total contact hours per week: **29+2=31** Total Credits=25

\$ In theory student should appear for the CIE (Mid Semester Exam), submit the assignment and must secure 40% marks in SEE.

Elective I	
1. Functional Foods & Nutraceuticals :	(FT 415.1)
2. Beverages Technology :	(FT 415.2)
3. Refrigeration Engineering :	(FT 415.3)
4. Database Management :	(FT 415.4)

Note: Tutorials and Practical to be conducted in batches with batch strength not exceeding 15 students

CIE: Continuous Internal Evaluation

SEE: Semester End Examination

IPE: Internal Practical Evaluation

EPE: External Practical Examination

IOE: Internal Oral Evaluation

EOE: External Oral Examination

MAJOR PROJECT (Phase I)

Teaching Scheme: P: 2hour/week

Credits: 01

The students are required to carry out one of the following projects related to field of Food Technology.

1. Process based Project: Manufacture of product.
2. Equipment based Project: Detailed design and fabrication of the equipment for a given capacity.
3. Experiment based Project: Experimental investigation of basic or applied research problem.
4. Industrial Problems: Any problem or project directly related to existing plants for modification of process or equipment or regarding pollution control and energy conservation under the guidance of one or more faculty members. The activity will be undertaken at the beginning of the seventh semester in consultation with concerned guide and it must be completed in eighth semester.

The project work is to be carried out by a group of students (not more than five students in a group).

The students will submit the report to the respective guide, present their work at the end of Semester.

They need to cover the following aspects related to their project topic:

- Introduction to the Project topic
- Detailed Literature Survey on the topic.
- Plan/outline of the Project work.
- Submitting requirements for execution the project work.

Based on the first phase work, it is desirable that the project group will publish a review article in a reputed and relevant Journal. The project group has to deliver Project Progress presentation.

The project progress will be evaluated by a research and review committee of internal teachers.

The committee includes concerned guide, the Program Coordinator, and other faculty members at the Department. This particular activity is assigned 50 marks as an IOE.

The committee will evaluate the performance of the project group. The students will follow one specific format recommended by the Program Advisory Board for submission of their Project Report.

Internship II

Credit: 1

Internship II which is part of Semester VII evaluation will be the activity after the SEE of semester VI.

It is mandatory for all the students to undergo the same and report to the institute for the semester VII along with the completion certificate by the concerned organization. The students have to submit a hard as well as soft copy of the activity report to the institute



DEPARTMENT OF TECHNOLOGY,
FINAL YEAR B.TECH
Scheme of Teaching and Examination: Semester- VIII (Food Technology)
To be implemented from Academic Year 2023 - 24

Subject Code	Subject	Teaching Scheme with Credits (Hours / Week)				Examination Scheme (Marks)					
		L	T	P	Total	Theory			Practical		
						Scheme	Max. marks	Min. Passing	Scheme	Max. marks	Min. Passing
FT421	Post-Harvest Technology of Plantation Crops	04	-	-	04	CIE	30	40	-	-	-
						SEE	70		-	-	-
FT422	Biochemical Engineering	04	-	-	04	CIE	30	40	-	-	-
						SEE	70		-	-	-
FT423	Waste Management of Food Industries	03	-	-	03	CIE	30	40	-	-	-
						SEE	70		-	-	-
FT424	Elective-II	03	-	-	03	CIE	30	40	-	-	-
						SEE	70		-	-	-
FT425	Food Plant Design and Layout	04	-	-	04	CIE	30	40	-	-	-
						SEE	70		-	-	-
FT426	Entrepreneurship Development for Food Technologists	02	-	-	02	-	-	-	IOE	50	20
FT421L	Post Harvest Technology of Plantation Crops Laboratory	-	-	02	01	-	-	-	IOE	50	20
FT422L	Biochemical Engineering Laboratory	-	-	02	01	-	-	-	EOE	50	20
FT423L	Major Project-Phase II	-	-	06	03	-	-	-	IPE	100	40
						-	-	-	EOE	50	20
Total		20	-	10	25	-	500	-	-	300	-

Audit Course VI

HS422	Professional Ethics	02	-	-	-	Institute Level	-	-	-	-	-
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Total contact hours per week: $30+2=32$ Total Credits=25

\$ In theory student should appear for the CIE (Mid Semester Exam), submit the assignment and must secure 40% marks in SEE.

Elective II	
1. Flavors Technology	: (FT 424.1)
2. Snack Foods Technology	: (FT 424.2)
3. Sugar Technology	: (FT 424.3)
4. Energy Systems and Technology	: (FT 424.4)

Note: Tutorials and Practical to be conducted in batches with batch strength not exceeding 15 students

CIE: Continuous Internal Evaluation
 IPE: Internal Practical Evaluation
 IOE: Internal Oral Evaluation

SEE: Semester End Examination
 EPE: External Practical Examination
 EOE: External Oral Examination

ELECTIVE-II (OPEN ELECTIVE)

Besides the departmental electives there is a concept of open elective listed under Teaching Scheme:

L: 3hours/week

Credits:3

The interested students have to choose the open elective from any of the specialized program available on the campus. The students have to contact the concerned course teacher and attend the classes in the respective course which will be taught by the concerned teacher.

MAJOR PROJECT (PHASE II)

Teaching Scheme: P: 06hours/week

Credits:3

In the second phase of the Project Work, all the project groups will carry out actual execution the work planned as stated as an outcome of the first phase in the seventh semester. They will submit the final project report in two hard bound copies along with soft copy to the guide. The guide will submit one copy to the Program office and the other copy will be owned by him/her. The report will be prepared in a standard format as provided by the Program Advisory Board.

Generally, the report will consist of Introduction, Review of Literature, Materials and Methods, Result & Discussion, Summary & Conclusion and References. There may be little variation in project report writing depending on the nature of the respective project problem under investigation.

The objective of the project is to make use of the knowledge gained by the students at various stages of the B.Tech Food Technology Program. This helps to judge the level of proficiency, originality and capacity for application of the knowledge attained by the students at the end of the studies.

This particular activity will be for 100 marks as an Internal Practical Evaluation (IPE). The same research and review committee will carry out the assessment of the project groups.

For External Practical Examination (EPE) carrying 50 marks, there will be external examiner to assess the project work. The research and review committee along with the external examiner will examine each of the project groups through VIVA VOCE and physical verification of the project models if any. The students group will demonstrate their work to all the examiners.

Equivalence of Final Year B.Tech (Food Technology) Semester VII and VIII

The above detailed syllabus is a revised version of the Final Year B.Tech (Food Technology) Program being conducted by Shivaji University at its Technology Department. This syllabus is to be implemented from June 2023, (Academic year 2022-23). Prime feature of this revision is the transformation of existing curriculum into the concept of Outcome Based Education as specified in NBA rules and regulations. The Equivalence for the subjects/courses of Food Technology at Final Year B Tech Semester VII and VIII pre-revised Program under the faculty of Engineering and Technology is as follows.

Final Year B.Tech (Food Technology) Semester VII

Sr.No	Final Year B.Tech (Food Technology) Semester VII Pre-revised syllabus	Final Year B.Tech (Food Technology) Semester VII Revised syllabus	Remark
1.	Meat, Poultry and Fish Processing Technology	Meat, Poultry and Fish Processing Technology	Slight modification in content
2.	Legume and Oilseed Technology	Legume and Oilseed Technology	Slight modification in content
3.	Food Biotechnology	Food Biotechnology	Slight modification in content
4.	Food Quality and Safety Management	Food Packaging	Interchange in subjects of Final Year and TY for better alignment due to introduction of new subject in Final Year, as per the suggestions of PAB committee
5.	Elective –I	Elective –I	Slight modification in content
6.	Meat, Poultry and Fish Processing Technology Laboratory	Meat, Poultry and Fish Processing Technology Laboratory	Slight modification in content
7.	Legume and Oilseed Technology Laboratory	Legume and Oilseed Technology Laboratory	Slight modification in content
8.	Food Biotechnology Laboratory	Food Biotechnology Laboratory	Slight modification in content
9.	-	Food Packaging Laboratory	Addition of laboratory course in Sem. VII
10.	Major Project-Phase I	Major Project-Phase I	Slight modification in content
11.	Internship II	Internship II	Slight modification in content
12.	Introduction to Indian Constitution	Introduction to Indian Constitution	Slight modification in content

Final Year B.Tech (Food Technology) Semester VIII

Sr.No	Final Year B.Tech (Food Technology) Semester VIII Pre-revised syllabus	Final Year B.Tech (Food Technology) Semester VIII Revised syllabus	Remark
1.	Post-Harvest Technology of Plantation Crops	Post-Harvest Technology of Plantation Crops	Slight modification in content
2.	Design and Development of New Products	Biochemical Engineering	Interchange in subjects of Final Year and TY for better alignment due to introduction of new subject in Final Year, as per the suggestions of PAB committee
3.	Waste Management of Food Industries	Waste Management of Food Industries	Slight modification in content
4.	Elective-II	Elective-II	Slight modification in content
5.	Food Plant Design and Layout	Food Plant Design and Layout	Slight modification in content
6.	Entrepreneurship Development for Food Technologists	Entrepreneurship Development for Food Technologists	Slight modification in content
7.	Post-Harvest Technology of Plantation Crops Laboratory	Post-Harvest Technology of Plantation Crops Laboratory	Slight modification in content
8.	Design and Development of New Products Laboratory	Biochemical Engineering Laboratory	Interchange in subjects of Final Year and TY for better alignment due to introduction of new subject in Final Year, as per the suggestions of PAB committee
9.	Major Project-Phase II	Major Project-Phase II	Slight modification in content
10.	Professional Ethics	Professional Ethics	Slight modification in content

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Glossary

B. Tech.: Bachelor of Technology, an Under Graduate Degree awarded from the Shivaji University, Kolhapur

Director: Director, Department of Technology, Shivaji University, Kolhapur

DC: Department Committee

DEC: Departmental Examination Coordinator

Semester: The academic year shall be divided into two regular semesters of approximately 20 weeks duration each. Typically the odd semester shall be from the first week of July to last week of November while the even semester shall be from the first week of January to the last week of May.

This shall include the period of academic delivery (14 to 15 weeks), Continuous Internal Evaluation (CIE) i.e. Mid Semester Examination and Assignments, Semester End Examination (SEE) assessment and declaration of results.

Course: Subject

Course Coordinator: Subject teacher

Course Credit: Weighted sum of the number of Lecture hours (L), Tutorial hours (T), and Practical hours (P) associated with the course.

Credits Earned: The sum of course credits for credit courses in which a student has passed.

Grade: Assessment of the student's performance in a course indicated by the letters, "AA", "AB", "BB", "BC", "CC", "CD", "DD", "FF", "XX", "ABSENT", "PP", "NP".

Grade Point: Number equivalent of the letter grades given by 10, 9, 8, 7, 6, 5, 4 corresponding to grades "AA", "AB", "BB", "BC", "CC", "CD", "DD" respectively. "FF" and "XX" carry zero grade points.

Instructor: Member of faculty who shall be assigned to teach a specific course.

Semester Grade Points: The sum of the products of credits and Grade Points for each course registered by a student in a semester.

SGPA: Semester Grade Point Average

CGPA: Cumulative Grade Point

Average ATKT: Allowed to Keep Terms.

Four year B. Tech. Course Academic Rules and Regulations

R.B.T. 1 Admission:

Candidates are admitted to this course according to norms and conditions prescribed as per AICTE, DTE, and Maharashtra.

R.B.T. 2 Award of Degree:

Following rules prevail for the award of degree:

1. B.Tech Degree shall be awarded to the student, who has registered and earned all the credits of prescribed courses under the general departmental requirements.
2. In addition to the credit requirement prescribed above for the Degree award, each student shall have to complete the requirements of Audit Course (AC) during the programme. All the students shall receive certification as PP (*for Passed*), and NP (*for not passed*) in AC, in the Grade Card. While obtaining certification as PP is a mandatory requirement for the Degree award of a student, this shall not be taken into account for computing the final Cumulative Grade Point Average.
3. A student has obtained CGPA ≥ 4.5 .
4. A student has paid all the institute dues and satisfied all the requirements prescribed.
5. A student has no case of indiscipline pending against him/her.
6. University authorities shall recommend the award of B. Tech. Degree to a student who is declared to be eligible and qualified for above norms.

R.B.T. 3 Attendance Rule:

All students must attend every lecture, tutorial and practical class. However, to account for late registration, sickness or other such contingencies, the attendance requirement will be a minimum of 75% of the classes actually held. A student with less than 75% attendance in a course during the semester, in lectures, tutorials and laboratories taken together (as applicable), will be awarded an 'XX' grade in that course irrespective of his/her performance in the tests.

The course coordinator will award 'XX' grade to the student who is deficient in attendance taking into account the consolidated attendance record for the whole semester. For the purpose of attendance calculation, every scheduled practical class will count as one unit irrespective of the number of contact hours.

Attendance record will be maintained based upon roll calls (or any equivalent operation) in every scheduled lecture, tutorial and practical class. The course coordinator will maintain and consolidate attendance record for the course (lectures, tutorials and laboratories together, as applicable).

R.B.T. 4 Academic Progress Rules (ATKT Rules)

1. A student shall be allowed to register for the courses of the next year's odd semester only if he/she has earned all the credits of the previous year and has not failed in more than three passing heads (SEE, EPE/EOE) shall be considered for deciding the eligibility for ATKT.
2. For the promotion to the Third Year, students should not fail in more than three passing heads (SEE, EPE/EOE) of Second Year and all credits of First Year must be earned.
3. For the promotion to the Final Year, students should not fail in more than three passing heads (SEE, EPE/EOE) of Third Year and all credits of Second Year must be earned.
4. A student who has obtained 'FF' grade in SEE of a regular semester and has obtained 'FF' grade in 2nd attempt of SEE shall be eligible to choose one of the two options below to clear his/her backlog:
 - i. Re-registration for the next regular semester course whenever that course is offered.
 - ii. Application for Repeated Examination.
5. A student who has detained in a regular semester and obtained 'XX' grade can Re-register for the next regular semester whenever it is offered.
6. The maximum duration for getting B. Tech. degree for students admitted in the first semester of U.G. program shall be 12 semesters (six academic years) while for lateral entry students admitted in the third semester shall be 10 semesters (five academic years) from their date of admission. The maximum duration of the program includes the period of withdrawal, absence and different kinds of leaves permissible to a student but excludes the period of rustication of a student from the Department. If a student is unable to gain all credits of first year in three years from the date of his/her admission, then he/she shall be declared as "Not Fit for Engineering" leading to discontinuation of his/her registration with the Department.
7. If a student is unable to gain all credits of first year in three years from the date of his/her admission, then he/she shall be declared as "Not Fit for Engineering" leading to discontinuation of his/her registration with the Department.
8. Depending upon the academic progress of a student, Department may take a decision regarding continuation or discontinuation of his/her registration with the institute.

R.B.T. 5 Academic Flexibility

1. Flexibility in deciding Structure and Contents of Curriculum with reasonable frequency for changes in the same.
2. Continuous Assessment of Students performance with newly adopted - Credit System based on Award of Grade.
3. Credits are quite simply a means of attaching relative values to courses different components. They are a currency of learning, and in general regarded as a measure of the time typically required to achieve a given curricular outcome.
4. All subjects (year-wise) under each course/discipline are unitized

R.B.T. 6 Credit system:

Education at the Institute is organized around the semester-based credit system of study. The prominent features of the credit system are a process of continuous evaluation of a student's performance/progress and flexibility to allow a student to progress at an optimum pace suited to his/her ability or convenience, subject to fulfilling minimum requirements for continuation.

A student's performance/progress is measured by the number of credits that he/she has earned, i.e. completed satisfactorily. Based on the course credits and grades obtained by the student, grade point average is calculated. A minimum grade point average is required to be maintained for satisfactory progress and continuation in the program. Also a minimum number of earned credits and a minimum grade point average should be acquired in order to qualify for the degree. All programs are defined by the total credit requirement and a pattern of credit distribution over courses of different categories.

R.B.T. 7 Features of Credit System at Department of Technology, Shivaji University, Kolhapur:

Every subject is allotted credits based on its academic importance/weightage.

1. All subjects may not have same credits.
2. 25 Credits / Semester.
3. Absolute Grading System with 7 Passing Grades viz. AA, AB, BB, BC, CC, CD, DD and FF for failure.
4. Standardization of courses; each course is of 6 units.
5. Continuous Internal Evaluation (CIE) and Semester End Examination (SEE), both having (70:30) weightage in the student's performance in Course Work/Laboratory Work and other activities. A student's performance in a subject shall be judged by taking into account the results of CIE and SEE together. Students must score 40% marks in SEE irrespective of the CIE marks. (Note: The CIE shall be conducted as Mid Semester Exam and assignments throughout the semester on dates announced in advance by the department, and its results made known to the

students from time to time. However, the dates for the SEE shall be fixed at the University level.)

6. Continuous Internal Evaluation consists of Mid Semester Examination of 20 marks and assignment of 10 marks handled by Department of Technology and setting of question papers should be done by course coordinator. Assignments may be of varied nature for each course based on the need of the course coordinator.
7. Semester-End Examination (SEE), to be conducted by the Department of Technology, Setting of question papers should be done by course coordinator and jointly with an external examiner; this shall include a written examination for theory courses and practical/design/drawing examination with built-in oral part for laboratory/ design/drawing courses.
8. Request for Mid Semester Examination for the students representing in co-curricular, extracurricular activities or on medical grounds will be considered only. On receipt of application from the student the DC will take decision for the conduct of the Mid Semester Examination.
9. Care shall be taken to ensure that the total numbers of days for academic work are ≥ 180 per year.
10. Academic schedule prescribed shall be strictly adhered to all the Branches.

R.B.T. 8 Course credits assignment:

Each course, except a few special courses, has a certain number of credits assigned to it depending upon its lecture, tutorial and laboratory contact hours in a week. This weight-age is also indicative of the academic expectation that includes in-class contact and self-study outside of class hours.

Lectures and Tutorials: One lecture or tutorial hour per week per semester is assigned one credit.

Practical/Laboratory: One laboratory hour per week per semester is assigned half credit.

Example: Course: Concrete Technology: 4 credits (3-0-2)

The credits indicated for this course are computed as

follows: 3 hours/week lectures = 3 credits

0 hours/week tutorial = 0 credit

2 hours/week practical = $2 \times 0.5 = 1$ credit

Also, (3-0-2) 4 credit course = (3 h Lectures + 0 h Tutorial + 2 h Practical) per week
= 5 contact hours per week

R.B.T. 9 Detailed Evaluation Scheme:

1. Out of total 100% theory weightage, 30% weightage is allotted for Continuous Internal Evaluation (CIE). Appearing for CIE is must and student must submit the assignments to become eligible for Semester End Examination (SEE) of respective course.

CIE (30% weightage) includes:

- a. Mid Semester Exam of 20 Marks of one Hour
 - b. Assignment of 10 Marks during entire semester
2. For the Semester End Examination (SEE), 100 marks paper will be set and finally it will be converted to 70 marks, in which student must secure 40% (28 Marks out of 70) as university examination pass head and must appeared for CIE to become eligible for SEE of respective course.
 3. Final theory marks (out of 100) will be the addition of CIE (30 Marks) and SEE (70Marks).
 4. Final laboratory letter grade will be awarded (100%) will be the addition of CIE (50%) and SEE (50%).
 5. Semester End Examination (SEE) for laboratory consists of External Practical Evaluation (EPE)/External Oral Examination (EOE). Continuous Internal Evaluation (CIE) for laboratory consists of Internal Practical Evaluation (IPE) / internal oral Evaluation (IOE).
 6. There shall be no (SEE) for laboratory courses of First Year. The entire assessment of a student shall be based on CIE (IPE/IOE) 100% weightage and a minimum performance of 40% in CIE shall be required to get the passing grade. CIE of laboratory work consists of (IPE/IOE) shall be based on turn-by-turn supervision of the student's work and the quality of his/her work as prescribed through laboratory journals and his/her performance in oral or Practical/Oral examinations uniformly distributed throughout the semester. Student must submit and secure 40% marks in the IPE/IOE of the concerned course. Non submission of IPE/IOE will lead to term not grant (TNG).
 7. The assessment of laboratory course from the 3rd semester onwards shall be carried out in two parts.
 - i. CIE of laboratory consists of IPE/IOE shall be based on turn-by-turn supervision of the student's work and the quality of his/her work as prescribed through laboratory journals and his/her performance in oral or Practical/Oral examinations uniformly distributed throughout the semester. Student must submit and secure 40% marks in the IPE/IOE of the concerned course. Non submission of IPE/IOE will lead to term not grant (TNG).

- ii. SEE of laboratory shall be based on performing an experiment followed by an oral examination or a written examination.
 - iii. The relative weightage for CIE and SEE for assessment of laboratory courses shall be 50% and 50% respectively from second year onwards and a minimum performance of 40% in both CIE and SEE separately shall be required to get the passing grade.
 - iv. SEE for laboratory course shall normally be held one week before the SEE for theory courses and shall be conducted by a panel of examiners consisting of external and internal examiner. This activity shall be coordinated by Department Examination Coordinator (DEC) in consultation with Coordinator of the respective department.
7. A student failed in SEE of a laboratory course in a regular semester shall be eligible to appear for examination conducted along with SEE of laboratory courses of the subsequent semester. Such examination shall be fairly comprehensive (generally of 3 hours similar to EPE/EOE i.e. External Practical/Oral Examinations) to properly judge his/her practical skill and theoretical knowledge for that laboratory course. He/She shall suffer a grade penalty as per Table 3.
8. Assessment of Seminar, Mini-project, Major Project etc:
- i. The Seminar/Project report must be submitted by the prescribed date usually two weeks before the end of academic session of the semester.
 - ii. It is desirable that the topics for seminar/project be assigned by the end of previous semester.
 - iii. The seminar report and the presentation of seminar shall be evaluated by panel of three departmental faculty members (decided by Branch Coordinator).
 - iv. The mini-project shall be evaluated jointly by a panel of three Internal Examiners.
 - v. The report on field training shall be evaluated by a panel of three Internal Examiners.
 - vi. The assessment of B. Tech major project work shall be carried out in two phases as shown below:
 - I-phase CIE (50% weightage) consists of
 - a) Departmental Committee (Synopsis submission seminar)
 - b) Project work assessment by Guide
(Departmental Committee consists of following: Director- Chairman
Branch Coordinator from respective branch – member

Senior faculty from respective branch –
member Guide/Course Coordinator- member)

I-phase SEE (50% weightage) consists of Progress Seminar and presentation evaluated by Panel of Internal Examiners.

II-phase CIE (50% weightage) consists of

- a) Project work assessment by Guide
- b) Report submission seminar evaluated by Departmental Committee

II-phase SEE (50% weightage) (Final orals and presentations) evaluated by Panel of External and Internal Examiners.

9. *Semester End Examination duration will be 4 hrs.

10. In respect of CIE, and Laboratory work a target date shall be fixed for the completion of each sheet, job, Project, experiment or assignment and the same complete or incomplete shall be collected on the target date and assessed immediately at the respective departments by the concerned teachers and % marks (or grades) shall be submitted to the Co-coordinator. The Co-coordinator of the Department of Technology shall communicate this % of marks (or grades) to the University within a week after the end of each term.

R.B.T. 10 Earning credits:

At the end of every course, a letter grade is awarded in each course for which a student had registered. On obtaining a pass grade ($\geq 40\%$ minimum grade DD), the student accumulates the course credits as earned credits. A student's performance is measured by the number of credits that he/she has earned and by the weighted grade point average.

The credit system enables continuous evaluation of a student's performance, and allows the students to progress at an optimum pace suited to individual ability and convenience, subject to fulfilling minimum requirement for continuation.

R.B.T. 11 CGPA Improvement Policy for award of degree:

A student getting $CGPA \leq 4.50$ with grade 'DD' in any course or grade 'FF' in any course shall have the possibility to repeat one or more 'DD' graded courses along with the failed courses, /are being offered in a semester.

An opportunity shall be given to a student who has earned all the credits required by the respective program with CGPA greater than or equal to 4.00 but less than 4.50, to improve his/her grade by allowing him/her to appear for SEE of maximum two theory courses of seventh and eighth semester.

R.B.T. 12 Evaluation System:

1. **Semester Grade Point Average (SGPA)**

$$\frac{\sum(\text{Course credits in passed courses} \times \text{Earned Credits})}{\sum(\text{Course credits in registered courses})}$$

2. **Cumulative Grade Point Average (CGPA)**

$$= \frac{\sum(\text{Course credits in passed courses} \times \text{Earned Credits}) \text{ of all Semesters}}{\sum(\text{Course credits in registered courses})}$$

- i. Cumulative Grade Point Average (CGPA) will be calculated cumulatively for Sem. I to Sem. VIII for regular students.
- ii. Cumulative Grade Point Average (CGPA) will be calculated cumulatively for Sem. III to Sem. VIII for lateral entry students.

3. At the end of B. Tech Program, student will be placed in any one of the divisions as detailed below :

- Ist Division with distinction : CGPA ≥ 7.5 and
 above Ist Division : CGPA ≥ 6.0 and < 7.5
 IInd Division : CGPA ≥ 5.5 and < 6.0

New gradation suggested as follows.

Table 1

Grade Points	Equivalent Range
5.5	55%
6.0	60%
6.5	65%
7.0	70%
7.5	75%

Conversion of CGPA to percentage marks for CGPA ≥ 4.5 can be obtained using equation.

Percentage marks = (CGPA x 10)

An example of these calculations is given below:

Typical academic performance calculations - I semester

Table 2

Course no.	Course credits	Grade awarded	Earned credits	Grade points	Points secured
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6 (col4 *col5)
MALXXX	5	CC	5	6	30
CSLXXX	4	CD	4	5	20
PHLXXX	4	AA	4	10	40
PHPXXX	2	BB	2	8	16
MELXXX	4	FF	0	0	00
TTNXXX	2	AB	2	9	18
Total	21		17	38	124

1. Total Points earned for this semester = 124

$$\text{Semester Grade Point Average (SGPA)} = \frac{124}{21} = 5.90$$

2. Cumulative Grade Point Average (CGPA) =

$$\begin{aligned} \text{Cumulative points earned in all passed courses} &= 124 \text{ (past semesters)} + 124 \text{ (this semester)} \\ &= 248 \end{aligned}$$

$$\text{Cumulative earned credits} = 23 \text{ (past semesters)} + 21 \text{ (this sem.)} = 44$$

$$\text{Cumulative Grade Point Average (CGPA)} = \frac{\Sigma(124 + 124)}{\Sigma(23 + 21)} = 5.63$$

Table 3

System of Evaluation

Grade	Grade Points	Marks obtained (%)			Description of Performance
		Regular Semester	Re-examination	Repeated Examination	
AA	10	90-100	--	--	Outstanding
AB	09	80-89	90-100	--	Excellent
BB	08	70-79	80-89	90-100	Very Good
BC	07	60-69	70-79	80-89	Good
CC	06	50-59	60-69	70-79	Fair
CD	05	45-49	50-59	60-69	Average
DD	04	40-44	40-49	40-59	Poor
DD\$	04	Below 40	Below 40	Below 40	Poor (Subject to Application of

					Ordinance 96)
FF	00	Below 40	Below 40	Below 40	Fail
XX	--	--	--	--	Detained
ABSENT	--	--	--	--	Absent
PP	--	--	--	--	Passed (Audit Course)
NP	--	--	--	--	Not Passed (Audit Course)

Note: An equivalent certificate of CGPA to percentage of marks will be provided to student on his/her demand after remitting prescribed fees by Shivaji University.

R.B.T. 13 Entry of Students from Regular Pattern to Credit Pattern

A student of Department of Technology, Shivaji University, Kolhapur admitted before academic year 2020-21, and such student shall clear back log subjects of regular pattern if any, by appearing for respective examination conducted by Department of Technology. Further they shall undergo additional academic requirements (bridge course) if required as suggested by Department committee, so as to have turning with credit pattern.

R.B.T. 14 Audit Courses:

Additional courses shall be included as audit courses from the third semester onwards. While the performance of the student in audited courses shall be included in the Grade Card. These grades are not contributed to SGPA or CGPA of the concerned student.

R.B.T. 15 Awards of Grades for Re-Examination:

- A student who has obtained grade 'FF' in regular semester shall be eligible to appear for re-examination conducted before the commencement of the next regular semester.
- In such cases Continuous Internal Evaluation performance of a student shall not be wiped out.
- A student shall apply for re-examination before the last date of such application and shall appear for re-examination.
- 70% weightage similar to SEE shall be given to re-examination.
- A student who is eligible for re-examination, but remains absent for reexamination shall be given grade 'Absent'.
- A student shall be awarded a grade between 'AB' to 'DD', or 'FF' or 'XX' as given in Table 3 depending upon the cumulative marks obtained by him/her in CIE and Re-examination of SEE.

Here student has to suffer a grade penalty by accepting one grade lower as compared with the regular grades.

R.B.T. 16 Showing Evaluated Semester End Examination Answer Paper, Re-Evaluation, and applying for revaluation:

The evaluated answer book will be shown to the student as per the timetable prepared by the exam cell of DOT after the declaration of result. The grievances regarding the incorrect total and assessment of the not assed questions will be done by the respective faculty on submission of grievance form. A student having doubt regarding the grade declared in a course can apply for the photocopy of the answer book by remitting the prescribed fee as specified; a student can also apply for rechecking of his/her SEE answer book as per Shivaji University norms. There is no provision for showing of evaluated answer book, photocopy and rechecking for revaluation of the reexamination.

R.B.T. 17 Change of Branch:

Students shall be eligible to apply for Change of Branch after completing the first two semesters. The change of branch shall be permitted strictly on merit basis subject to the rules and regulations prescribed by Directorate of Technical Education, Maharashtra State/Admission Regulatory authority, Maharashtra State time to time.

R.B.T. 18 Disciplines and Conduct:

- i. Every student shall be required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity, which shall tend to bring down the prestige of the Department.
- ii. Any act of indiscipline of a student reported to the Department, shall be referred as per Shivaji University norms.
- iii. If a student while studying in the institute is found indulging in anti-national activities contrary to the provisions of acts and laws enforced by Government he/she shall be liable to be expelled from the Department without any notice.
- iv. If a student is involved in any kind of ragging, the student shall be liable for strict action as per Maharashtra anti-ragging act 1999, which is in effect from 15th May 1999.
- v. If any statement/information supplied by the student in connection with his/her admission is found to be false/ incorrect at any time, his/ her admission shall be cancelled and he/she shall be expelled from the institute and fees paid shall be forfeited.
- vi. Student once admitted in the Department of Technology shall follow instructions issued from time to time.

- vii. If a student is found guilty of malpractice in examinations then he/she shall be punished as per the recommendations of the Shivaji University, Kolhapur.
- viii. Every admitted student shall be issued photo identification (ID) card which must be retained by the student while he/she is registered at Department of Technology. The student must have valid ID card with him/her while in the Department of Technology.
- ix. Any student who alters or intentionally mutilates an ID card or who uses the ID card of another student or allows his/her ID card to be used by another student shall be subjected to disciplinary action.
- x. The valid ID card must be presented for identification purpose as and when demanded by authorities. Any student refusing to provide an ID card shall be subjected to disciplinary action.

Note: All other rules and regulations will be applicable as per Shivaji University, Kolhapur.

Class, Part & Semester	:	Final Year B. Tech. (Food Technology), Part IV, Semester VII				
Course Title	:	Meat, Poultry and Fish Processing Technology		Course Code:	: FT 411	
Teaching Scheme (Hours)	:	Lecture :	4 hr/week		Total Credits	: 04
Evaluation Scheme (Marks)	:	CIE=30 (20+10)	SEE = 70	Grand Total=100	Duration of SEE	: 3 hr
Revision:	:	Fourth			Month	: June 2023
Pre-requisites (if any)	:	In order to complete the course studies successfully, it is important to have a good knowledge of FT211, FT214, FT223, FT224, FT311 and FT326				
Course Domain	:	Core				
Course Rationale: -						
This course deals with the various sources of animal foods such as meat, fish and poultry, technology involved in their preservation and storage. The objective of this course is to make students aware of various processing technologies, handling and quality standards of meat, fish and poultry products.						
Course Objectives: The Course teacher will help to			Course Outcomes: Students will be able to			
1	Understand the current status of livestock as well as the nutritional profile of meat, poultry (egg and chicken) and fish etc.	1	Learn about the current situation of livestock and the nutritional profile of meat, poultry(egg and chicken) and fish etc.			
2	Learn muscle structure, chemical composition and physico-chemical properties of meat muscle	2	Describe the muscle structure, chemical composition and physico-chemical properties of meat muscle			
3	Gain knowledge of slaughtering and dressing techniques of animals and poultry	3	Apply slaughtering and dressing techniques of animals and poultry in the practical.			
4	Learn different methods of processing and preservation of meat	4	Comprehend different methods of processing and preserving meat.			
5	Learn processing methods used to preserve egg	5	Review the processing methods used to preserve egg			
6	Understand fish types and fish products	6	Learn about the fish types and fish products.			
Curriculum Content					Hours	
Unit I Sources, Current Status of Meat, Fish, Poultry Processing Industries, Importance of Meat, Poultry and Fish Processing in National Economy, QSR					8	
Unit II Muscle Structure, chemical composition and physico-chemical properties of meat muscle Abattoir design and layout					8	
Unit III					8	

Pre-slaughter Care, Stunning, Slaughtering of Animals and Poultry, Pre-mortem Examination, Post-mortem Examination, Dressing, Grading	
Unit IV Processing and Preservation of Meat: Mechanical deboning, Chilling, Freezing, Pickling, Curing, Cooking and Smoking, Frozen Meat Products	9
Unit V Egg structure, Composition, Quality Characteristics, Processing, Preservation, Egg based products	9
Unit VI Fish Types, Examination, Care in Handling and Transportation, Processing, Freezing, Canning, Salting and Drying of fish, Frozen Fish Products	10
<i>Suggested Text Books:</i>	
1.	Aberle Elton D., Forrest John C., Gerrard David E. and Mills Edward W. (2012). Principles of Meat Science.
2.	Albert Levie. (1967). Meat Hand Book.3rd Revised Edition
3.	Ralston Andrew Lawrie. (1981). Developments in Meat Science Volume 2.
<i>Suggested Reference Books:</i>	
1.	Singh Ra. (2013). Poultry Production
2.	Frank Gerrad. (1951). Meat Technology: A Practical textbook for Students and butcher

Class, Part & Semester	: Final Year B. Tech (Food Technology), Part IV, Semester VII			
Course Title	: LEGUME AND OILSEED TECHNOLOGY		Course Code	: FT412
Teaching Scheme (Hours)	: Lecture	04 hr/Week		Total Credits : 04
	: Tutorial	00 hr/Week		
Evaluation Scheme (Marks)	: CIE=30 (20+10)	SEE = 70	Grand Total =100	Duration of SEE : 03 hr
Revision	: Fourth			Month : June 2023
Pre-requisites (If any)	: In order to complete the course successfully, it is important to have good knowledge of basic food science, nutrition and food processing.			
Course Domain	: Program core			
Course Rationale: This course deals with knowledge and understanding of different legumes present worldwide, principles and its processing methods .Also it makes students to learn about different fermented products that can be prepared from different legumes.				
Course Objectives: The Course Teacher will			Course Outcomes: Students will be able to	
1.	Explain to the students about legume present worldwide and their application in processing.		1.	Justify the role of basic food science, nutrition and knowledge of food processing for legume processing.
2.	Describe about various unit operations and machinery required for legume processing.		2.	Choose legumes for effective utilization to develop various processed products.
3.	Demonstrate the various legume based fermented products.		3.	Design the equipment required for legume processing.
4.	Introduce students to the traditional and modern way of milling.		4.	Understand the methods of milling.
5.	Illustrate students to the cooking quality of dhal and factors affecting cooking quality of dhal.		5.	Assess the processing scenario of legume based processed products.
6.	Elaborate different oil extraction methods.		6.	Know the various quality aspects of legumes and its processed products.
Curriculum Content				Hours
UNIT I Present Status and future prospects of legumes and oil Seeds Major and minor legumes, oilseeds and pulses grown in world and their application, present Status and future prospects of Pulse milling industry in India and world				6
UNIT II Morphology and classification of legumes, oilseeds and pulses Morphology and Classification of legumes, oilseeds and pulses. Chemical composition and nutritional value. Antinutritional factors, their chemistry, methods of removal of antinutritional factors				8
UNIT III Dehulling and Milling of oilseeds, legumes and pulses Methods of dehulling-. Home, cottage and commercial scale. Modern techniques of dehulling. Milling of oilseeds, legumes and pulses: Dal milling principles, methods,				10

equipment and effect on quality. Principle products, fermented products of legumes.	
UNIT IV Processing of oilseeds, legumes and pulses. Soaking principles, methods of soaking, sprouting, puffing, and roasting. Physical and bio-chemical changes during these processes Texturized vegetable protein, hydrolyzed vegetable protein, formulation and processing, Types of processed products	10
UNIT V Cooking quality of dhal Cooking quality of dhal, methods, factors affecting quality of dhal, cooking of dhal, quick cooking of dhal and instant dhal.	8
UNIT VI Oil extraction and Refining of oils Oil extraction methods: mechanical Pressing. Solvent extraction process: principle, pretreatment - breaking, cracking, flaking, extraction principle and Desolventization. Factors affecting the extraction process. Refining of oils: Refining, degumming, neutralization, bleaching, filtration, deodorization of oils and their principles and process controls.	10
Course Assessment Methods: 1. Continuous Internal Evaluation: Mid semester examination and home assignments 2. Semester End Examination.	
Suggested Text Books:	
1.	Chakraverty A, Majumdar A.S, VijayaRaghavan G.S and Ramaswamy H.S. Hand Book of PostHarvest Technology. Marcel Dekker Inc., New York. Basel, 1999.
2.	Chakraverty A. Post-Harvest Technology of Cereals, Pulses and Oil seeds. Oxford and IBH Publishing Co. Ltd., Calcutta
3.	Bailey's Industrial Oil and Fat Products: Processing Technologies Edible Oil and Fat Products: 5" by Fereidoon Shahidi
4.	Chemistry and Technology of Oils & Fats by M.M. Chakrabarty, Allied Publishers, 2003
Suggested Reference Books:	
1.	Achhayya K.T. Oil seeds and Oil Milling in India. Oxford and IBH Publishing Co., New Delhi, 1999
2.	Heldman, D.R. and Singh R.P. Ed. IV 2009. Introduction to Food Engineering. Elsevier Pub
3.	Desrosier, N.W, "The Technology of Food Preservation", CBS Publishers and Distributors, New Delhi 1996.
4.	Ruth H. Matthews: Pulses – Chemistry, Technology and Nutrition MerceL Dekker Inc. USA (1989)

Class, Part & Semester		Final Year B. Tech (Food Technology), Part IV, Semester VII			
Course Title	:	Food Biotechnology			Course Code: : FT413
Teaching Scheme (Hours)	:	Lecture : 04 hr/week			Total Credits : 4
	:	Tutorial : -- hr/week			
Evaluation Scheme (Marks)	:	CIE=30 (20+10)	SEE = 70	Grand Total=100	Duration of SEE : 3 hr
Revision:	:	Fourth			Month : June 2023
Pre-requisites (if any)	:	The students should have basic knowledge of Food chemistry, Food processing and food microbiology.			
Course Domain	:	Core			
Course Rationale: This course deals with knowledge and understanding of different principles, equipments and instruments involved during bio-processing. In addition students learn about different unit operations of upstream and downstream processing. Also student familiar with fermented products and their biochemical and microbial analysis.					
Course Objectives: The Course teacher will			Course Outcomes: Students will be able to		
1.	State conceptual knowledge of regulatory and social aspects of Biotechnology.	1.	Summarize basic concept of biotechnology and apply it in various fields.		
2.	Describe recombinant technology and molecular cloning.	2.	Gaining knowledge of biotechnology in food industry for development of different products.		
3.	Identify Genetically modified organism (GMO), crop, and foods (GMF).	3.	Demonstrate the importance of microbiology in strain development for industrially important microorganisms.		
4.	Analyze microbial cultures used in food industry.	4.	Reorganizes precise fermented food technology to prepare various healthy products.		
5.	Formulate upstream and downstream processes of various fermented food products.	5.	Explain upstream and downstream processing unit operations		
6.	Make use of new techniques for production of fermented foods.	6.	Evaluate biochemical and microbial parameters of food product.		
Curriculum Content					Hours
Unit I : Introduction to Food Biotechnology History and development of biotechnology. Regulatory, ethical and social aspects of biotechnology of foods. and importance of biotechnology in food safety					8
Unit II Strain Improvement of industrially important microorganisms Methods of molecular cloning, immobilization of microbial and cultured plant cells. Plant and animal tissue culture. Microbial cultures for food fermentation, strain improvement techniques.					8
Unit III Genetics and its application in food production Application of genetics such as Genetically modified organism (GMO), transgenic animals,					12

Genetically modified crop such as Golden rice, herbicide resistant crops, and pesticide resistant crops etc., Genetically modified foods (GMF) and related regulations by standard regulatory authorities.	
Unit IV: Introduction to Biotechnological aspects industrial production Biotechnological aspects of industrial production of alcohol(beer, wine), alcoholic beverages, antibiotics, organic acids(vinegar, lactic acid), polysaccharides, amino acids, single cell protein, glycerol, enzymes and vitamins, and distilled alcoholic beverages such as whiskey, rum, vodka)	6
Unit V: Upstream and downstream processing. Metabolic Engineering, scale up of fermentation, Extraction and recovery of product.	10
Unit VI: Fermented Food and their biochemical and microbial analysis Traditional fermented foods like idli, sauerkraut, dosa etc. Soy fermented foods and other foods like yoghurt, cheese, miso, tempeh, soya sauce etc.	8
Course Assessment Methods: 1. Continuous Internal Evaluation: Mid semester examination, Regular Tutorial, home assignments 2. Semester End Examination.	
Suggested Text Books:	
1.	Bains W. 1993, Biotechnology from A to Z, Oxford Univ. Press, Oxford.
2.	Crueger, W. and Crueger A. 1984. Biotechnology: A Textbook of Industrial Microbiology. Science Tech. Madison, USA
3.	Joshi, V.K. and Pandey, A. Ed. 1999. Biotechnology. Food Fermentation, (2 Vol. set). Education Publ. New Delhi.
Suggested Reference Books:	
1.	Knorr, D. 1982. Food Biotechnology. Marcel Dekker, New York.
2.	Stanburry P.P. and Whitaker, A. 1984. Principles of Fermentation Technology. Pergamon Press, Oxford UK.
3.	Steinkraus, K.H. 1983. Handbook of Indigenous Fermented Foods. Marcel Dekker, N. York.
4.	Comprehensive Biotechnology by Murray & Mooyoung, Academic press
5.	Fermentation Biotechnology, Principles, Processed Products by Ward OP, Open University Press.
6.	James D. Watson. 2013. Molecular Biology of the Gene, 7th Ed. Benjamin Cummings, San Francisco, USA.

Class, Part & Semester	: Final Year B. Tech (Food Technology), Part IV, Semester VII			
Course Title	: Food Packaging		Course Code	: FT414
Teaching Scheme (Hours)	: Lecture	04 hr/Week		Total Credits : 04
	: Tutorial	00 hr/Week		
Evaluation Scheme (Marks)	: CIE=30 (20+10)	SEE = 70	Grand Total =100	Duration of SEE : 3 hr
Revision	: Fourth			Month : June 2023
Pre-requisites (If any)	: In order to complete the course successfully, it is important to have good knowledge of FT211, FT213, FT214, FT221 and FT311			
Course Domain	: Core Program			
Course Rationale: Food Packaging is a professional course targeted to cater the food packaging industry needs trained food professionals. The main objective of this subject is to impart knowledge and skills related to designing packaging system in food products and developing skills in handling of packaging equipment in the students. This course explain the different types of packaging materials, its characteristics and wide application in food industry. This course included many newer packaging techniques.				
Course Objectives: The Course Teacher will			Course Outcomes: Students will be able to	
1.	Explain the role of different packaging materials		1.	Justify the role of packaging materials for food preservation
2.	Describe the properties of different packaging materials		2.	Choose suitable packaging materials for different food products
3.	Demonstrate different packaging materials for different food products		3.	Design food grade packaging materials
4.	Introduce different quality characteristics for different packaging materials		4.	Understand the properties of different packaging materials
5.	Illustrate the designing of different packaging materials		5.	Assess quality characteristics for different packaging materials
6.	Elaborate newer food packaging technologies		6.	Know newer food packaging technologies
Curriculum Content				Hours
UNIT I Introduction to Food Packaging Need for Packaging and Functions of packaging. Levels of packaging. Factors affecting quality of good materials– product environment and spoilage factors, labeling laws, Package Environment, Classification of packaging materials and its Application				08

<p>UNIT II Paper and Plastic Packaging Paper: Manufacturing method, types, characteristics and advantages. Plastic: Manufacturing method, types, characteristics and advantages. Lamination, need of lamination, types, properties, advantages and disadvantages of each type. Types of coatings. Need of coating, methods of coatings.</p>	12
<p>UNIT III Glass and Metal Packaging Glass: Manufacturing method, types, characteristics and advantages. Metal: Manufacturing method, types, characteristics and advantages.</p>	08
<p>UNIT IV Packaging of Specific Foods Packaging Machineries, Packaging of specific foods with its properties like bread, biscuits, coffee, milk powder, egg powder, carbonated beverages, Snack foods etc. Packages type i.e. FFS, Standable pouches</p>	08
<p>UNIT V Food Packaging Techniques Food and Packaging material interactions including migration, scalping of flavor; Aseptic processing and packaging, Biodegradable packaging</p>	08
<p>UNIT VI Novel Food Packaging CAP/MAP packaging, Irradiated packaging, Retort pouch, Microwaveable packaging, packaging for high pressure processing, active packaging; smart/ intelligent packaging</p>	08
<p><i>Suggested Text Books:</i></p>	
1.	Coles, R., McDowell, D., & Kirwan, M. J. (Eds.). (2003). Food packaging technology (Vol. 5). CRC press.
2.	Robertson, G. L. (2005). Food packaging: principles and practice. CRC press.
3.	Lee, D. S., Yam, K. L., & Piergiovanni, L. (2008). Food packaging science and technology. CRC press.
<p><i>Suggested Reference Books:</i></p>	
1.	Paine, F. A., & Paine, H. Y. (2012). A handbook of food packaging. Springer Science & Business Media.
2.	Grumezescu, A. M. (Ed.). (2016). Food packaging. Academic Press.
3.	Kadoya, T. (Ed.). (2012). Food packaging. Academic Press.
4.	Ahvenainen, R. (Ed.). (2003). Novel food packaging techniques. Elsevier.

Class, Part & Semester		Final Year B. Tech. (Food Technology), Part IV, Semester VII			
Course Title	:	Elective - I ELECTIVE I : BEVERAGES TECHNOLOGY		Course Code:	: FT 415 (FT 415.2)
Teaching Scheme (Hours)	:	<i>Lecture :</i>	3 hr/week	Total Credits	: 03+0=03
		<i>Tutorial :</i>	0 hr/week		
Evaluation Scheme (Marks)	:	<i>CIE=30 (20+10)</i>	<i>SEE = 70</i>	<i>Grand Total=100</i>	Duration of SEE : 3 hr
Revision:	:	Fourth			Month : June 2023
Pre-requisites (if any)	:	In order to complete the course studies successfully, it is important to have a good knowledge of FT211, FT214, FT222, FT311 and FT326			
Course Domain	:	Core			
Course Rationale: - Beverage Technology will help students to develop their skills in the areas of beverage. The course will focus on making students understand the basics of beverages, get familiar with different types of beverages, the importance of beverages for Indian population. The course is completely Industry oriented which includes all the knowledge of processing and packaging technologies that is required in industries.					
Course Objectives: The Course teacher will			Course Outcomes: Students will be able to		
1.	Support students in understanding the present status plus future prospects of beverages in India and Globally	1.	Describe the present status and future prospects of their importance.		
2.	Guide the students on principles involved in the Beverage processing	2.	Understand the role of various ingredients used in beverages		
3.	Help to get acquainted with equipment required for beverage manufacturing	3.	Know the working principle of various types of equipment required for beverage manufacturing		
4.	Help the students to apply basic food science knowledge and get to know beverage technology	4.	Formulate the different alcoholic and Non-alcoholic beverages		
5.	Inform students the role of various ingredients used in beverages	5.	Analyze various quality parameters for different beverages		
6.	Help to understand quality and regulatory aspects of Beverages	6.	Select the suitable packaging materials for different types of beverages		
Curriculum Content					Hours
Unit I Types of beverages, Present status of beverage industry in India and Globally, Scope and importance of Beverage Industry, Market					7
Unit II Types of Bottled Water: Mineral Water, Spring Water, Flavored Water, Carbonated Water, Manufacturing process of packaged drinking water, Water Treatments, Quality Standards of Bottled and Packaged Water					7
Unit III Beverage Additives, FSSAI specification for beverages, Equipment's used for Beverages					6

manufacturing, Plant Layout		
Unit IV	Non Alcoholic Beverages: Tea, Coffee, Low-calorie beverages, Sports Drinks (Isotonic, Hypertonic, Hypotonic Drinks), Quality Control aspects of Non Alcoholic beverages	6
Unit V	Soft Drinks: History, Types, Role of various ingredients, manufacturing process; Quality Control in the Beverage, Packaging of Beverages	6
Unit VI	Alcoholic Beverages: Classification; Fermented alcoholic beverage : Beer, types of beer, the role of yeast in beer, technology of brewing process, Wine; Distilled spirits: Whisky, Brandy, Vodka, Rum; Equipment used for brewing and distillation	7
Suggested Text Books:		
1.	Hardwick WA. 1995. Handbook of Brewing. Marcel Dekker.	
2.	Hui, Y. H., Meunier-Goddik, L., Josephsen, J., Nip, W. K., & Stanfield, P. S. (Eds.). (2004). <i>Handbook of food and beverage fermentation technology</i> (Vol. 134). CRC Press.	
3.	Graham G. Stewart, Fergus G. Priest (2006). Handbook of Brewing, 2nd Edition, CRC Press	
4.	Vine, R. P. (2012). <i>Commercial winemaking: Processing and controls</i> . Springer Science & Business Media.	
Suggested Reference Books:		
1.	Varnam, A., & Sutherland, J. M. (1994). <i>Beverages: technology, chemistry and microbiology</i> (Vol. 2). Springer Science & Business Media.	
2.	Woodroof, J. G., & Phillips, G. F. (1981). <i>Beverages: carbonated and noncarbonated</i> . AVI Pub. Co..	

Class, Part & Semester	:	Final Year B. Tech. (Food Technology), Part IV, Semester VII					
Course Title	:	Elective – I Functional foods and Nutraceuticals		Course Code:	:	FT 415 (FT 415.1)	
Teaching Scheme (Hours)	:	Lecture :	3 hr/week	Total Credits	:	03+0=03	
		Tutorial :	0 hr/week				
Evaluation Scheme (Marks)	:	CIE=30 (20+10)	SEE = 70	Grand Total=100	Duration of SEE	:	3 hr
Revision:	:	Fourth			Month	:	June 2023
Pre-requisites (if any)	:	In order to complete the course successfully, it is important to have good knowledge of FT214 and FT224					
Course Domain	:	Core					

Course Rationale: -

This course is to provide students with an overview of the field of functional foods, nutraceuticals and natural health products. The course enables students to understand the functional food concept as related to ingredient efficacy and safety. In addition, it familiarizes students with: examples of bioactive ingredient-disease relationships and the importance of clinical study support; regulatory aspects of functional foods; and requirements for standards of evidence of efficacy for health claims; and market determinants of the functional food industry.

Course Objectives: The Course teacher will

Course Outcomes: Students will be able to

1.	Explain and introduce the all types of functional food, nutraceutical food, specialty foods and health foods, etc.	1.	Understand the concept of functional and nutraceutical foods.
2.	Describe emphasis on to the principles of specific consumer oriented foods. Introduce students the requirement of specific consumer oriented foods.	2.	Design specific consumer oriented food
3.	Illustrate the action of probiotic and prebiotic and also inform students about necessity of GM Foods, Proprietary foods and Supplementary foods	3.	Identify the purpose and functions of probiotics, prebiotics and supplementary foods for development of functional and nutraceutical foods.
4.	Explain the principle and concepts of bioactive components extraction methods	4.	Explore the regulatory aspects for different functional and nutraceutical foods.
5.	Demonstrate the beneficial effects of functional foods and nutraceuticals	5.	Understand and apply the role of different ingredients for development of functional and nutraceutical foods
6.	Categorize food for the specific physiological disorders	6.	Know the various bioactive compounds and its application for physiological disorders

Curriculum Content		Hours
Unit I : Introduction	Scope, importance and renewed emphasis on specialty foods, health foods, functional foods, Nutraceutical, infant and baby foods, adolescent/ teen age foods, foods for pregnant ladies and nursing mothers, geriatric foods, Concept of supplementation	8
Unit II : Specific consumer oriented foods	Defense persons, Space / astronaut, High altitude mountain climbers, Disaster situation – crises, care, and maintenance.	6
Unit III : Transgenic plant foods with health claims	Prebiotics and Probiotics, Quality Assurance of Probiotics and Safety, Genetically modified foods, Proprietary foods, Supplementary foods.	6
Unit IV : Beneficial Effects Functional Foods and Nutraceuticals	Beneficial Effects of Spices, gamma-linolenic acid, Spirulina, antioxidants and other food Constituents.	6
Unit V : Bioactive components	Sources, extraction methods, uses and health benefits	5
Unit VI : Development of Functional Foods	Low sugar, low calorie foods, foods to address specific physiological disorders	8
Suggested Text Books:		
1.	Functional food and nutraceuticals, Aluko, Rotimi E., 2012	
2.	Functional Foods, Maria Saarela, 2nd Edition, 2011, Woodhead Publishing	
3.	Handbook of Nutraceuticals and Functional Foods, Robert E. C. Wildman, 2nd Edition, 2006, CRC Press	
4.	Handbook of Nutraceuticals and Functional Foods. Yashwant Pathak, Vol. 1. (Ingredients, formulations, and applications)” CRC Press 2005	
5.	Handbook of Nutraceuticals and Functional Foods”. Robert Wildman, 2nd Edition. CRC Press 2001	
Suggested Reference Books:		
1.	“Introduction to functional food science”, Dr. Danik Martirosyan, Third edition, vol. I, Dallas TX, USA.	
2.	“Phytochemicals in Health and Disease”, Bao and Fenwick, Marcel Decker, Inc. NY 2004.	

Class, Part & Semester		Final Year B. Tech. (Food Technology), Part IV, Semester VII			
Course Title	:	Elective - I REFRIGERATION ENGINEERING			Course Code: : FT 415 (FT 415.3)
Teaching Scheme (Hours)	:	Lecture : 3 hr/week Tutorial : 0 hr/week			Total Credits : 03+0=03
Evaluation Scheme (Marks)	:	CIE=30 (20+10)	SEE = 70	Grand Total=100	Duration of SEE : 3 hr
Revision:	:	Fourth			Month : June 2023
Pre-requisites (if any)	:	In order to complete the course studies successfully, it is important to have a good knowledge of FT211, FT215, FT221, FT314			
Course Domain	:	Core			
Course Rationale: - The objective of the course is to provide an introduction to the principles of air conditioning and refrigeration. The course will provide a basic understanding of the types of air conditioning and refrigeration systems, applications and operating principles.					
Course Objectives: The Course teacher will help to			Course Outcomes: Students will be able to		
1.	Understand fundamentals, need and importance of HVAC systems	1.	Explain the fundamentals, need and importance of HVAC systems		
2.	Familiarize various applications of refrigeration, air conditioning and cryogenics	2.	Apply knowledge for various applications of refrigeration, air conditioning and cryogenics		
3.	Get acquainted with psychrometric terms, its application in HVAC, comfort conditions and Design of refrigeration and air conditioning system	3.	Analyze psychrometric terms, its application in HVAC, comfort conditions and Design of refrigeration and air conditioning system		
4.	Demonstrate the use of psychrometry and calculate cooling load for air conditioning systems used for various applications	4.	Solve problems of heat transfer in buildings and its application to heating and cooling load estimation		
5.	Understand psychrometric properties	5.	Explain psychrometric properties		
6.	Familiarize Refrigeration and air conditioning system.	6.	Analyze Refrigeration and air conditioning system.		
Curriculum Content					Hours
Unit I BASIC REFRIGERATION CYCLES Carnot cycle, Reversed Carnot cycle, Simple Vapor compression cycle, sub superheating, Liquid to suction vapor heat exchanger, Calculations and performance of above cycles, Actual vapor compression cycle, Bell Coleman cycle, Air cycles for air craft's (Only theory)					7
Unit II REFRIGERATION EQUIPMENTS AND REFRIGERANTS A. Refrigeration Equipments: Compressor, Condenser, Evaporator, Expansion devices, Types, selection, use of insulation, methods of charging and testing, Non -conventional methods of					7

<p>refrigeration like vortex tube, Pulse Tube, safety controls.</p> <p>B. Refrigerants: Classification, Desirable Properties like Thermodynamic, physical, Comparison among commonly used refrigerants, Selection of Refrigerants, Effect on Ozone depletion and global warming, Alternative Refrigerant.</p>	
<p>Unit III MULTI PRESSURE AND VAPOUR ABSORPTION SYSTEM</p> <p>A. Removal of flash gas, Flash inter - cooling, water cooling, Multistage , multi evaporator and Cascade System, Introduction to cryogenic engineering system, Claude Cycle, Linde Cycle.</p> <p>B. Vapor Absorption System, Practical Vapor absorption system, Aqua Ammonia system, Lithium Bromide water vapor system, Coefficient of Performance, Comparison with vapor compression system (Descriptive treatment only)</p>	6
<p>Unit IV PSYCHROMETRY</p> <p>Moist air as a working substance, Psychrometric properties of air, Use of Psychrometric tables and charts, Basic Processes in conditioning of air, Combinations and Calculations, Apparatus Dew Point, Sensible heat factor, Bypass factor, Air washer and it's applications.</p> <p>COMFORT</p> <p>Thermal exchange between human body and environment, factors affecting comfort, effective temperature comfort chart, ventilation requirements</p>	6
<p>Unit V HEATING AND COOLING LOAD CALCULATION</p> <p>Air Conditioning system, Different heat sources, Load analysis RSHP, GSHP, ESHF, Factors forming the load on air conditioning systems, Different Air Conditioning System: Central Station Air Conditioning System, Unitary Air Conditioning System, District Air Conditioning System and Self Contained Air Conditioner, Components related to Air Conditioning System, Transport Air Conditioning: Air Conditioning System for Automobiles, Railway, Marine</p>	6
<p>Unit VI DUCT DESIGN,AIR - DISTRIBUTION AND APPLICATIONS</p> <p>Losses in duct system, , Types of supply air outlets, methods used for duct design, duct arrangement systems, Air-Distribution system, Ventilation System Energy Conservations and Green Buildings, freeze drying, Air – conditioning system for house and offices, hotels and restaurants, stores, Theatres and auditoriums, hospitals , textile industry</p>	7
<p>Suggested Text Books:</p>	
1.	Reddy, T., Kreider, J. F., Curtiss, P. S., & Rabl, A. (2016). <i>Heating and cooling of buildings: principles and practice of energy efficient design</i> . CRC press.
2.	Arora, C. P. (2000). <i>Refrigeration and air conditioning</i> . Tata McGraw-Hill Education.
3.	Rj, D. (1961). Principles of refrigeration. <i>Tokyo: Jhon Wiley</i> .
4.	Stoecker, W. F. (1998). <i>Industrial refrigeration handbook</i> . McGraw-Hill Education.
5.	Arora, C. P. (2000). <i>Refrigeration and air conditioning</i> . Tata McGraw-Hill Education.
<p>Suggested Reference Books:</p>	
1.	Althouse, A. D., & Turnquist, C. H. (1956). Modern refrigeration and air conditioning

2.	Ananthanarayanan, P. N. (2013). <i>Basic refrigeration and air conditioning</i> . Tata McGraw-Hill Education.
3.	Wang, S. K., & Wang, S. K. (1993). <i>Handbook of air conditioning and refrigeration</i> (Vol. 2). New York: McGraw-Hill.

Class, Part & Semester		Final Year B. Tech. (Food Technology), Part IV, Semester VII			
Course Title	:	Elective - I DATABASE MANAGEMENT			Course Code: FT 415 (FT 415.4)
Teaching Scheme (Hours)	:	Lecture : Tutorial :	3 hr/week 0 hrs/week	Total Credits	: 03+0=03
Evaluation Scheme (Marks)	:	CIE=30 (20+10)	SEE = 70	Grand Total=100	Duration of SEE : 3 hr
Revision:	:	Fourth			Month : June 2023
Pre-requisites (if any)	:	In order to complete the course studies successfully, it is important to have a good knowledge of FT215L			
Course Domain	:	Core			
Course Rationale: -					
The objective of the course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively.					
Course Objectives: The Course teacher will			Course Outcomes: Students will be able to		
1.	Understand the basic concepts and the applications of database systems.	1.	Understand the basic concepts and the applications of database systems.		
2.	Learn the basics of SQL and construct queries using SQL.	2.	Become master in the basics of SQL and construct queries using SQL.		
3.	Inform students the Integrity Constraints and Design	3.	Apply the integrity constraints and design		
4.	Inform students the file and system structure	4.	Categorize the file and system structure		
5.	Evaluate crash recovery	5.	Examine the crash recovery		
6.	create case study report	6.	Prepare case study report		
Curriculum Content					
					Hours
Unit I Introduction: Purpose of Database Systems, Data abstraction, Data Models, Entities and Entity sets, Mapping Constraints, E-R Diagram, Reducing E-R Diagrams to Tables					7
Unit II Relational Model: Structure of Relational Databases, The Relational Algebra, Structured Query Language (SQL)					7
Unit III Integrity Constraints and Design: Domain Constraints, Referential Integrity, Functional Dependencies					6
Unit IV File and System Structure: Overall System Architecture, File Organization, Organization of Records into Blocks, Sequential Files, Mapping Relational Data to Files, Data Dictionary					6

Storage	
Unit V Crash Recovery: Failure Classification, The storage Hierarchy, Transactions Model, Log-Based Recovery, Shadow Paging, Failure with Loss of Non-Volatile Storage	6
Unit VI CASE STUDIES: Distributing data storage and processing with frameworks - Case study: e.g, Assessing risk when lending money	7
Suggested Text Books:	
1.	Silberschatz, A., Korth, H. F., & Sudarshan, S. (2002). <i>Database system concepts</i> (Vol. 5). New York: McGraw-Hill.
2.	Cielen, D., & Meysman, A. (2016). <i>Introducing data science: big data, machine learning, and more, using Python tools</i> . Simon and Schuster
Suggested Reference Books:	
1.	Ullman, J. D. (1983). <i>Principles of database systems</i> . Galgotia publications.
2.	Wiederhold, G. (1983). <i>Database design</i> (Vol. 1077). New York: McGraw-Hill.
3.	Masri, E., & Navathe, S. (5). <i>Fundamentals of database systems</i> .
4.	Database design, application development & administration – Michael V. Mannino (MGH- International Edition)
5.	Ramakrishnan, R., Gehrke, J., & Gehrke, J. (2003). <i>Database management systems</i> (Vol. 3). New York: McGraw-Hill.
6.	Sumathi, S., & Esakkirajan, S. (2007). <i>Fundamentals of relational database management systems</i> (Vol. 47). Springer.

Class, Part & Semester		Final Year B. Tech. (Food Technology), Part IV, Semester VII			
Course Title	:	Meat, Poultry and Fish Processing Technology Laboratory		Course Code:	: FT 411L
Teaching Scheme (Hours)	:	Practical:	2 hr/week	Total Credits	: 1
Evaluation Scheme (Marks)	:		EOE = 50	Grand Total=50	Duration of SEE : Nil
Revision:	:	Fourth			Month : June 2023
Pre-requisites (if any)	:	In order to complete the course studies successfully, it is important to have a good command of English and knowledge of FT211, FT214, FT223, FT224, FT31, FT326 and FT 4111.			
Course Domain	:	Core			
Course Rationale: -					
This course deals with the various sources technology involved in their preservation and storage of meat, poultry and fish. The objective of this course is to make students aware of various processing technologies, handling and quality standards of meat, fish and poultry products.					
Course Objectives: The Course teacher will help to			Course Outcomes: Students will be able to		
1. Learn the skills required in pre-slaughtering			1. Remember the skills required in pre-slaughtering		
2. Gain the skills required for slaughtering and dressing of Livestock			2. Understand the skills required for slaughtering and dressing of Livestock		
3. Impart knowledge on preservation techniques in meat			3. Learn the preservation techniques used in meat/chicken/fish		
4. Categorize and inspect the eggs			4. Categorize and inspect the eggs		
5. Evaluate moisture content, fat content and protein content of food			5. Evaluate moisture content, fat content and protein content of food		
6. Formulate value added product from egg			6. Develop value added product from egg		
Practical List					
1	Preparation of chicken nugget				
2	Preparation of fish fingers				
3	Preparation of chicken burger				
4	Slaughtering of poultry bird				
5	Preservation of meat/chicken/fish by curing and pickling				
6	Sensory Evaluation of prepared pickle (meat/chicken/fish)				
7	Candling and grading of eggs				
8	Preparation of egg product				
9	Preservation of fish by freezing				
10	Preservation of fish by drying				
11	Quality Evaluation of chicken sausage				
12	Market Analysis				

13	Visit to any meat/poultry processing industry	
General Instructions: -		
1. Always reach the laboratory in time. Be punctual		
2. Always carry following for working in lab: a.) An auxiliary note book b.) Laboratory Coat		

Class, Part & Semester	:	Final Year B. Tech (Food Technology), Part IV, Semester VII					
Course Title	:	Legume and Oilseed Technology Laboratory		Course Code	:	FT412L	
Teaching Scheme (Hours)	:	Practical	2 hr /Week		Total Credits	:	01
Evaluation Scheme (Marks)	:	IOE = Nil	EPE=50	Grand Total = 50	Duration of EPE	:	NA
Revision	:	Fourth			Month	:	June 2023
Pre-requisites (If any)	:	In order to complete the course successfully, it is important to have a good knowledge of basic food science, nutrition and food processing.					
Course Domain	:	Program core					
Course Rationale: The purpose of this course is to provide the students hands-on experience in processing of various legumes.							
Course Objectives: The Course Teacher will				Course Outcomes: Students will be able to			
1.	Help students to analyze the physico chemical properties of legumes			1.	Analyse different physico-chemical properties of legumes and oil seeds		
2.	Introduce students to the various processed products of legume			2.	Know about tools and equipment used for post-harvest Technology of legumes and oilseeds		
3.	Illustrate to the students about methods of milling			3.	Design and develop various processed products of legume		
4.	Demonstrate about development of protein rich products from oil extracted waste			4.	Choose legume for the development of protein rich products from legumes		
5.	Elaborate about oil extraction processing and its methods			5.	Understand technology for milling of legume		
General Instructions: Any 8 experiments to be performed from the list.							
Sr. No.	List of Experiments						
1.	Physical properties of legumes and oil seeds						

2.	Methods and principles of dehulling
3.	Dal milling process.
4.	Cooking quality of dal
5.	Fermented product of legumes
6.	Production of protein rich product.
7.	Preparation of quick cooking dhal
8.	Puffing of legumes
9.	Soaking of legumes and changes in its biochemical nature after soaking.
10.	Determination of antinutritional factors in legumes
11.	Preparation of composite legume flour
12.	To study the oil extraction methods
13.	Visit to dal mill / oil industry

Lab Manual :

1.	Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.
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Suggested Text Books/ Reference Books/Manual

1.	Achhayya K.T. Oil seeds and Oil Milling in India. Oxford and IBH Publishing Co., New Delhi, 1999
2.	Guriqbal Singh, Harbhajan Singh Sekhon and Jaspinder Singh Kolar. Pulses. Agrotech
3.	Jaswanth Singh and Shukla B.D. Post Harvest Technology of Oil Seeds. Central Institute of Agricultural
4.	Chakraverty A, Majumdar A.S, VijayaRaghavan G.S and Ramaswamy H.S. Hand Book of PostHarvest Technology. Marcel Dekker Inc., New York. Basel, 1999.
5.	Chakraverty A. Post-Harvest Technology of Cereals, Pulses and Oil seeds. Oxford and IBH Publishing Co. Ltd., Calcutta.

Class, Part & Semester	:	Final Year B. Tech (Food Technology), Part IV, Semester VII				
Course Title	:	Food Biotechnology Laboratory		Course Code:	FT413L	
Teaching Scheme (Hours)	:	Practical :	2 hr /week		Total Credits	1
Evaluation Scheme (Marks)	:	IOE=50 marks	EPE/EOE= NA	Grand Total= 50	Duration of EPE	--
Revision:	:	Fourth			Month	June 2023
Pre-requisites (if any)	:	The students should have basic knowledge of Food chemistry, Food processing and food microbiology.				
Course Domain	:	core				
Course Rationale: The purpose of this course is to provide the students hands-on experience in biotechnology experiment.						
Course Objectives: The Course teacher will				Course Outcomes: Students will be able to		
1.	Performs various techniques used in biotechnology for practical experience.			1.	Executes basic biotechnology experiment.	
2.	Isolates of industrially important strains.			2.	Recognizes important strains used in production of fermented foods.	
3.	Studies different separation techniques.			3.	Analysis of DNA and proteins by isolation and separation technique.	
4.	Develops fermented food products in laboratory.			4.	Evaluate developed fermented food products	
5.	Explain scale up of different fermentation processes in laboratory.			5.	Identifies and deal with the issues generated during actual fermentation processes.	
6.	Describes upstream and downstream processing unit operations			6.	Practices how to handle tools and equipment used for various biotechnology experiments.	
List of Experiments						
Sr. No.	Name of experiment					
1.	Isolation and Preservation of industrially important Microorganisms.					
2.	Stabilization of strains of microorganisms useful in fermentation.					
3.	Scale up kinetic studies in different fermentation processes.					
4.	Isolation of DNA from bacterial cell.					
5.	Isolation of DNA from plant cell.					

6.	Organic acid production and purification
7.	Agarose and SDS-PAGE gel electrophoresis
8.	Column chromatography
9.	High performance liquid chromatography (HPLC)
10.	Organic acid production
11.	Alcohol production
12.	Development of Enzyme
13.	Industrial Visit

Course Assessment Methods:

Practical Journal Assessment, Internal Oral Examination

Suggested Text Books/ Reference Books/Manual

1.	Biotechnology procedures and experiments handbook by S.Harisha
2.	Guide to food biotechnology (1996) IFST
3.	Mosier, N S and Ladisch, M.R(2009)Modern biotechnology. John Wiley and sons
4.	Meenakshi Paul. 2007. Biotechnology and Food Processing Mechanics. Gene-Tech Books, New Delhi.

Class, Part & Semester	: Final Year B. Tech (Food Technology), Part IV, Semester VII			
Course Title	: Food Packaging Laboratory	Course Code	:	FT414L
Teaching Scheme (Hours)	: Practical	02 hr/week	Total Credits	: 01
Evaluation Scheme (Marks)	: IOE = 50	EPE=Nil	Grand Total = 50	Duration of IOE : NA
Revision	: Fourth		Month	: June 2023
Pre-requisites (If any)	: In order to complete the course successfully, it is important to have good knowledge of FT211, FT213, FT214, FT221 and FT311			
Course Domain	: Core Program			
Course Rationale: This course will be able to provide the students hands-on experience of quality analysis of different packaging materials. Students acquire knowledge of experimental data analysis, technical report writing and work in teams.				
Course Objectives: The Course Teacher will			Course Outcomes: Students will be able to	
1.	Impart practical knowledge and skills		1.	Understand different packaging materials
2.	Introduce students to food packaging		2.	Use different analytical equipment's for quality analysis of packaging material
3.	Discuss different equipment's used to assess the quality of packaging material		3.	Asses suitable packaging material for different food products
4.	Explain the relation between shelf life and packaging material		4.	Extend the shelf life of different food products
5.	Implant the practical proficiency in Food Packaging		5.	Acquire problem solving skills in Food industries
General Instructions: Any 8 experiments to be performed from the list, any 2 experiments to be studied as demonstration.				
Sr. No.	List of Experiments			
1.	Classification of various packages based on material and rigidity			
2.	Measurement of thickness of given packaging material			
3.	Qualitative tests for Plastics			
4.	Determination of water absorption of given packaging material			
5.	Determination of bursting strength of given packaging material			

6.	Measurement of tear resistance of given packaging material
7.	Determination of puncture resistance of given packaging material
8.	Measurement of tensile strength of given packaging material
9.	Determination of water-vapour transmission rate
10.	Determination of drop test of food package
11.	Visit to packaging industry
<i>Suggested Text Books/ Reference Books/Manual</i>	
1.	Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow etc.

Class, Part & Semester	:	Final Year B. Tech (Food Technology), Part IV, Semester VII					
Course Title	:	Major Project –Phase I		Course Code	:	FT415L	
Teaching Scheme (Hours)	:	Practical	02 Hour/Week		Total Credits	:	01
Evaluation Scheme (Marks)	:	IOE = 50	EOE=Nil	Grand Total = 50	Duration of EOE	:	NA
Revision	:	Fourth			Month	:	June 2023
Pre-requisites (If any)	:	Pre-requisites include basic knowledge of soft skills, presentation and familiarity of Food Technology field overview.					
Course Domain	:	Research Skills					
Course Rationale: Students' evaluation is by continuous internal examination and based on External Oral Evaluation at the end of the semester, based on attendance during the entire semester, project report submission at the end of semester.							
Course Objectives: The Course Teacher will				Course Outcomes: Students will be able to			
1.	Plan for various activities of the project and distribute the work amongst team members;			1.	Apply fundamental and disciplinary concepts and methods to solve problems		
2.	Promote self-study, critical thinking and independent research ability;			2.	Identify, analyze, and solve problems		
3.	Make the students initiate their own small conceptual or practical based projects individually or as a team of no more than 4 members;			3.	Integrate information from multiple sources.		
4.	Make them use Research Methodology for the task undertaken;			4.	Analyze developed products		
5.	Trial exercise that may help them to satisfactorily complete their project			5.	Design, project manage and evaluate a concept/model/product		
Curriculum content							
The students either individually or in a group of maximum 4 members will undertake a Major project on a particular topic under the guidance of an internal course teacher. Prior to the topic selection, the course in charge will guide them about searching topic related to requirements of industry, farmers and other societal issues. Student should submit their synopsis copy. The work progress will be monitored from time to time in batch wise review conducted during							

the semester. During phase I student will complete half objectives of their proposed work. A report is to be written upon completion of the activity. The report should include academic contents such as the background, market survey, objectives, product/process description, the work done and conclusion. The Department will provide a specific format for report writing. The assessment of the major project work will be based on: 1. Attendance 2. Physical Demonstration of their work 3. Presentation based on the work carried out.

Class, Part & Semester	:	Final Year B. Tech (Food Technology), Part IV, Semester VII					
Course Title	:	Internship II		Course Code	:	FT416	
Teaching Scheme (Hours)	:	Practical	Nil	Total Credits	:	01	
Evaluation Scheme (Marks)	:	IOE = Nil	EOE= 50	Grand Total = 50	Duration of EOE	:	NA
Revision	:	Fourth		Month	:	June 2023	
Pre-requisites (If any)	:	The pre-requisite for this course is to have the idea of the overview of the fundamental courses of Food Technology					
Course Domain	:	Core					

Course Rationale: The course helps students to develop their skills in the application of theory to practical knowledge. It helps to develop the skills and techniques which are directly relevant to their desired goals.

Course Objectives: The Course Teacher will

Course Outcomes: Students will be able to

1.	Create a learning platform for the students where they can enhance their skills and prepare themselves for the future.	1.	Capable to acquire and apply fundamental principles of engineering.
2.	Enhance their skills-set in the area of their expertise and also convert their theoretical learning into practical experience.	2.	Ability to identify, formulate and model problems and find engineering solution in practical work environment
3.	Promote cooperation and to develop synergetic collaboration between industry and the university in promoting a knowledgeable society;	3.	Adapt good technical knowledge, management, leadership and entrepreneurship skills.
4.	Equip Student with qualities like integrity and leadership and build their self-confidence	4.	Write technical documents and give oral presentations related to the work completed
5.	Provide learners hands on practice within a real job situation.	5.	Develop attitude of a team player and aptitude for lifelong learning

Curriculum content

Students of Food Technology must undergo internship in reputed Private / Public Sector / Government organization related to food for minimum Four weeks after the Semester End Examination. Internal faculty members help and issue internship letter to students and place students at reputed industries/organizations for training program. A report is to be written upon completion of their internship. The report should include information about the industry, organization structure, different products, quality control and quality assurance department, waste disposal department and packaging and dispatch. The final assessment of internship will be based on 1. Industrial Report, 2. Presentation 3. Training certificate.

<i>Class & Semester</i>		Final Year B.Tech Food Technology, Part IV, Semester VII									
<i>Course Title</i>	:	Introduction to Indian Constitution				<i>Course Code:</i>	:	HS411			
<i>Teaching Scheme (Hours)</i>	:	Lectures= 2 hr /Week				<i>Credits</i>	:	Nil			
<i>Evaluation Scheme (Marks)</i>	:	Assignments	:	50	Written Test	:	25	<i>Duration of Exam</i>	:	Not Applicable	
		Viva voce	:	25	Grand Total	:	100				
<i>Revision</i>	:	Third				<i>Month</i>	:	June 2023			
<i>Pre-requisites</i>	:	It has no any pre-requisites. Every citizen of the country ought to study the course content.									
<i>Course Domain</i>	:	Audit Course at institute level , Humanities & Social Science									
<i>Course Rationale:</i> As a citizen of India, every student should have basic knowledge about Indian constitution. Every student should know the importance of Fundamental rights, Fundamental duties as well as Directive Principles. This course fulfills all these requirements. This course also includes knowledge about state as well as union legislature, judiciary and executive. It helps to understand emergency provisions, electoral process and amendment procedures. This course is helpful for the students to be legally updated.											
<i>Course Objectives:</i> The Course Teacher will						<i>Course Outcomes:</i> Students will be able to					
1.	Familiarize students with the preamble					1.	Get associated with Indian Constitution				
2.	Describe fundamental rights & duties of citizens					2.	Understand their fundamental duties and rights.				
3.	Explain union and state executives.					3.	Recognize union and state executives.				
4.	Discuss constitutional provisions.					4.	Interpret about constitutional provisions.				
5.	Illustrate electoral process.					5.	Understand and follow the electoral process				
6.	Summarize role of democracy in social welfare.					6.	Realize importance of democracy in social welfare.				

Curriculum Content		Hours
Unit I: Introduction to Preamble and Fundamental Rights Preamble to the constitution of India. Fundamental rights under Part – III – details of Exercise of rights, Limitations & Important cases.		04
Unit II: Fundamental Duties and Directive Principles. Relevance of Directive principles of State Policy under Part – IV. Fundamental duties & their significance.		05
Unit III: Union Legislature, Judiciary & Executive. President, Prime Minister, Parliament & the Supreme Court of India.		04
Unit IV: State Legislature, Judiciary & Executive. Governors, Chief Minister, State Legislator and High Courts.		05
Unit V: Constitutional Provisions. Provisions for Scheduled Castes & Tribes, Women & Children & Backward classes. Emergency Provisions.		05
Unit VI: Electoral process & Amendment procedures: Constitution of election commission, system of adult suffrage, procedure for amendment. 42nd, 44th, 74th, 76th, 86th and 91st		05

Constitutional amendments.	
<i>Text Books:</i>	
<ol style="list-style-type: none"> 1. Durga Das Basu: “Introduction to the Constitution of India” (Students Edn.) Prentice – Hall EEE, 19th/20th Edn. 2001. 2. R.C.Agarwal, “Indian Political System”, (1997) S.Chand and Company, New Delhi. Maciver and Page, “Society: An Introduction Analysis”, Mac Milan India Ltd., New Delhi. 3. K.L.Sharma, “Social Stratification in India: Issues and Themes”, (1997), Jawaharlal Nehru University, New Delhi. 	
<i>Reference Books:</i>	
<ol style="list-style-type: none"> 1. An Introduction to Constitution of India” by M.V.Pylee, Vikas Publishing, 2002. Sharma, Brij Kishore, “Introduction to the Constitution of India: Prentice Hall of India, New Delhi. 2. U.R.Gahai, “(1998) Indian Political System “, New Academic Publishing House, Jalandhar. 3. R.N. Sharma, “Indian Social Problems “, Media Promoters and Publishers Pvt. Ltd. 4. Yogendra Singh, “(1997) Social Stratification and Charge in India “, Manohar, New Delhi. 	

Class, Part & Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VIII			
Course Title	Post-Harvest Technology of Plantation Crops			Course Code: FT421
Teaching Scheme (Hours)	Lecture :	4 hr/week		Total Credits : 04
	Tutorial :	Nil		
Evaluation Scheme (Marks)	CIE=30 (20+10)	SEE = 70	Grand Total=100	Duration of SEE : 3 hr
Revision:	Fourth			Month : June 2023
Pre-requisites (if any)	In order to complete the course studies successfully, it is important to have a good command of English and knowledge of FT211, FT214, FT223, FT224, FT31, FT326			
Course Domain	Core			
Course Rationale: This course will help you to understand the business opportunities and trends in Spices processing. This course includes different processing methods and quality assessments of spices and plantation crops.				
Course Objectives: The Course teacher will			Course Outcomes: Students will be able to	
1.	Introduce basic food science knowledge in spices and plantation crops.		1.	Know the scope and importance of Spice processing.
2.	Introduce students to major and minor spice processing aspects		2.	Describe the Classification of the spices.
3.	Describe the Post-harvest technology of and processing of tea		3.	Understand the different Techniques used for extraction of functional ingredients from Spices
4.	Explain the Post-harvest technology of and processing of coffee		4.	Identify the major and minor constituents of food and the chemical reactions in which they participate.
5.	Illustrate the quality assessment of spices and herbs		5.	Describe the principals involved in the processing of the major types of food products.
6.	Demonstrate the different spices and herbs		6.	Extraction of functional ingredients from Spices
Curriculum Content				Hours
Unit I Introduction Production and processing scenario of spice & plantation crops and its future scope, Importance and role of spices in food processing Classification and properties of spices and herbs – their products, including medicinal properties, Condiments				10
Unit II Major spices Ginger, chili, turmeric, onion and garlic, pepper and cardamom its Postharvest technology, composition, processed products				8
Unit III Minor spices Cinnamon, clove, coriander, cumin, all spice, sweet basil; caraway seed, cassia, nutmeg, mace, mint, saffron, ajowan & asafetida				8
Unit IV Post-harvest technology of and processing of Plantation				8

Post-harvest technology and processing aspects of cocoa, vanilla, annatto, herbs, seasoning and curry leaves	
<p>Unit V Post-harvest technology of and processing of tea and coffee</p> <p>Types of tea Post-harvest technology of types of tea Green, oolong and CTC, Technology of tea manufacturing process for green tea and black and instant tea. Grading, Packaging, Labeling, specification, Physiochemical and Microbial Quality evaluation of Tea as per food laws and regulations. Types of coffee Post-harvest technology of Coffee, Technology of coffee and instant coffee manufacturing process, Fermentation of coffee beans. Grading, Packaging, Labeling, specification, Physiochemical and Microbial Quality evaluation of coffee as per food laws and regulations.</p>	10
<p>Unit VI Extraction of functional ingredients from Spices</p> <p>Techniques used to extraction of functional ingredients from minor and major spices. Spice oil, oleoresins and Coloring pigment. Packaging, Labeling and specification as per food laws and regulations.</p>	8
Suggested Text Books:	
1.	K.G. Shanmugavelu. Spices and Plantation Crops. Oxford & IBH Publishing Co., New Delhi
2.	J.W. Pursegrove, E.G. Brown, C.L. Green and Robins. Spices, Vol. I and II. SRJ Academic Press, New Delhi.
3.	Kenji Hirasa and Mitsuo Takemasa. 1998. Spice Science and Technology. Marcel Dekker, NY, USA.
4.	H.Panda. Handbook on Spices and Condiments (Cultivation, Processing and Extraction). Asia Pacific Business Press Inc., New Delhi.
Suggested Reference Books:	
1.	J.S. Pruthi. 2001. Spices and Condiments – Major Spices of India. National Book Trust, New Delhi.
2.	S.Gupta. Handbook of Spices and Packaging with Formulae. Engineers India Research Institute, New Delhi
3.	Handbook of Herbs and Spices (2012), 2nd edn, edited by K.V.Peter, Woodhead Publishing Ltd., 80 High Street, Sawston, Cambridge CB22 3HJ, UK. Volume 1

Class, Part & Semester		Final Year B. Tech (Food Technology), Part IV, Semester VIII			
Course Title	:	Biochemical Engineering			Course Code: : FT422
Teaching Scheme (Hours)	:	Lecture :	04 hr /week	Total Credits :	4
		Tutorial :	-- hr /week		
Evaluation Scheme (Marks)	:	CIE=30 (20+10)	SEE = 70	Grand Total=100	Duration of SEE : 3 hr
Revision:	:	Fourth			Month : June 2023
Pre-requisites (if any)	:	The students should have basic knowledge of Food engineering I and II, Food microbiology, Food chemistry, physics and mathematics.			
Course Domain	:	Core			
Course Rationale: This course deals with knowledge and understanding of different principles, equipments and instruments involved during bio-processing. In addition students learn about different unit operations of product recovery and purification. Also student familiar with fermented products and their biochemical and microbial analysis.					
Course Objectives: The Course teacher will			Course Outcomes: Students will be able to		
1.	Studies of basic concept of Biochemical Engineering.	1.	Investigate applications of biochemical Engineering in various fields.		
2.	Explain the mechanism and application of the bioreactor.	2.	Discusses importance of bioreactor in food industry for development of different products.		
3.	Defines thoroughly the food processing unit operations.	3.	Enumerate product recovery and purification technique.		
4.	Apply the principles of heat transfer and mass transfer phenomena	4.	Describes the microbial kinetics and Enzyme kinetics.		
5.	States importance of the fermentation technology.	5.	Designs protocols for different fermentation product		
Curriculum Content					Hours
Unit I : Kinetics of microbial growth and death Definition, Types of kinetics, Batch and continuous type, control measures, fermentation kinetics of biomass production, product formation and effect of environment.					8
Unit II: Enzyme kinetics Simple kinetics model for enzyme substrate interaction. Derive the equation of Michelin Menton for reaction rate, product formation, and calculation of Km and Vmax values. Complex enzyme kinetics: Oxidation – reduction form of enzymes, observed apparent rate constant, factors affecting inhibition, competitive and non-competitive inhibition					10

Unit III Fermenter Design, operation and problems during Scale up, management of cellular process	8
Unit IV: Kinetics pattern of various fermentations Classification of kinetics pattern, as per different scientists, simple, simultaneous, consecutive, stepwise, complex reactions and their examples	8
Unit V Air sterilization, aeration and agitation Definition, thermal death time, media heat sterilization, advantages of continuous sterilization. Aeration and agitation :Oxygen requirement of industrial fermentations, determination of K La Value, factors affecting K La Value	8
Unit VI: Recovery and purification of fermented product Introduction, removal of microbial cell, Separation techniques like adsorption, chromatography, precipitation, ultra-filtration etc., purification techniques: spray drying, fluidized bed drying etc. Effluent treatment (ETP)	10
Course Assessment Methods: 1. Continuous Internal Evaluation: Mid semester examination, Regular Tutorial, home assignments 2. Semester End Examination.	
Suggested Text Books:	
1. Shuler, M.L. and Kargi, F. "Bioprocess Engineering: Basic Concepts", 2nd Edition, PHI, 2002.	
2. Palmer, Trevor "Enzymes: Biochemistry, Biotechnology, Clinical Chemistry", Affiliated East-West Press Pvt. Ltd., 2004.	
3. Stanbury, P.F., A. Whitaker and S.J. Hall "Principles of Fermentation" Technology", 2nd	
4. Edition, Butterworth – Heinemann (an imprint of Elsevier), 1995	
Suggested Reference Books:	
1. Doran, P.M. "Bioprocess Engineering Principles", Academic Press, 1995.	
2. Najafpour, D. Ghasem. "Biochemical Engineering & Biotechnology". Elsevier, 2007.	
3. Bryce, C.F.A and EL. Mansi. "Fermentation Microbiology & Biotechnology, 1999.	
4. Blanch, H.W. and Clark, D.S. "Biochemical Engineering", Marcel Decker Inc., 1997 .	
5. Introduction to Biochemical Engineering Rao DG Tata McGraw Hill, 2010	
6. Textbook for Engineers, Chemists and Biologist Kotah, Horiuchi and Yoshida Jown Wiley and Sons, 2015	

Class, Part & Semester	:	Final Year B. Tech. (Food Technology), Part IV, Semester VIII			
Course Title	:	Waste Management of Food Industries		Course Code:	: FT 423
Teaching Scheme (Hours)	:	Lecture :	3 hr/week		Total Credits
		Tutorial :	Nil		
Evaluation Scheme (Marks)	:	CIE=30 (20+10)	SEE = 70	Grand Total=100	Duration of SEE : 3 hr
Revision:	:	Fourth			Month : June 2023
Pre-requisites (if any)	:	In order to complete the course studies successfully, it is important to have a good knowledge of FT211, FT213, FT214, HS211, FT223, FT311, FT312, FT313, FT322, FT323 and FT326.			
Course Domain	:	Core			

Course Rationale: -

The aim of the course is to provide students with advanced knowledge in the field of agri-food waste management, particularly on waste treatment ways. The focal point of the course is based on the importance and role of waste management in the environment within the frame of the sustainable concept aspects, description and classification of by-products in agriculture and food industry sectors and possibilities of their reduction and eventually possible re-use.

Course Objectives: The Course teacher will help to		Course Outcomes: Students will be able to	
1.	Study various waste from agricultural and food industries and evaluate its possible impact on the environment	1.	Identify various waste from agricultural and food industries and evaluate its possible impact on the environment
2.	Recognize and communicate common methods of waste treatment and disposal	2.	Recommend a variety of ways to treat and dispose of waste.
3.	Learn the working principles of treatment methods used for effluent and solid waste generated in food industries	3.	Identify various by products from agricultural and food industry and ways to utilize them.
4.	Understand different waste water treatment and solid waste disposal methods	4.	Suggest different waste water treatment and solid waste disposal methods

5.	Learn different techniques used to prepare by products	5.	Judge the importance of development of byproducts
6.	Understand legal aspects related to waste management	6.	Analyze and apply legal aspects related to waste management

<i>Curriculum Content</i>		Hours
Unit I	Types of waste, magnitude of waste generation in different food processing industries, concept, scope and importance of waste management and effluent treatment, Environmental Protection Act	7
Unit II	Waste Water Characterization: Physical characteristics, Chemical characteristics and Biological characteristics	7
Unit III	Wastewater treatment; Preliminary treatments, Primary treatments, Secondary treatments and Tertiary treatments	6
Unit IV	Solid Waste Management, Biological composting, Drying, Incineration, Landfill Digester, Vermicomposting	6
Unit V	Characterization and utilization of by-products from cereals (breweries), pulses, oilseeds, fruits and vegetables (wineries) and plantation crops (sugar industries)	6
Unit VI	Characterization and utilization of by-products from dairy, eggs, meat, fish and poultry processing industries	7

Suggested Text Books:

1.	Marriott PhD Norman G. and Gravani Robert B. (2006). Principles of Food Sanitation, 5th Edition.
2.	Verma L.R. Joshi and V.K. (2000). Postharvest Technology of Fruits and Vegetables: Handling, Processing, Fermentation and Waste Management. Indus Publishing Co. New Delhi
3.	Bhide A. D. and Sundaresan B. B. (2010). Solid Waste Management in Developing Countries.
4.	Tchobanoglous George and Kreith Frank. (2002). Handbook of Solid Waste Management.

Suggested Reference Books:

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|----|--|
| 1. | Joshi V. K. and Sharma S. K. (2011). Food Processing Waste Management: Treatment and Utilization Technology |
| 2. | AFST (I) and CFTRI. Proceedings of the Symposium on Byproducts From food Industries: Utilization and Disposal. |

Class, Part & Semester	:	Final Year B. Tech. (Food Technology), Part IV, Semester VIII			
Course Title	:	Elective - II SUGAR TECHNOLOGY			Course Code: : FT 424 (424.3)
Teaching Scheme (Hours)	:	Lecture :	3 hr/week		Total Credits : 03+0=03
		Tutorial :	0 hr/week		
Evaluation Scheme (Marks)	:	CIE=30 (20+10)	SEE = 70	Grand Total=100	Duration of SEE : 3 hr
Revision:	:	Fourth			Month : June 2023
Pre-requisites (if any)	:	-			
Course Domain	:	Core			

Course Rationale: This course explore the information about sugar processing

Course Objectives: The Course teacher will

Course Outcomes: Students will be able to

1.	Explain basic food science knowledge and get to know sugar processing	1.	Apply the basic food science of Sugar in sugar industries
2.	Inform students the role of various unit operations and machinery required for sugar processing	2.	Understand the processing of sugar production
3.	Introduce students to roles of various chemicals for sugar processing	3.	Know equipment required for sugar processing
4.	Explain students to the different quality aspects of produced sugar	4.	Understand the quality assessment of sugar and its by products
5.	Describe the basic unit operations used in sugar processing	5.	Design machinery required for sugar processing
6.	Explore the different grades of sugars	6.	Learn basic unit operations used in sugar processing

Curriculum Content		Hours
<p>Unit I</p> <p>Introduction: Brief account of Sugar Industry and Sugar Manufacturing Process Composition of Sugarcane and Juice, Importance of juice clarification, Weighing and metering of juice (Maxwell Boulogne Scale & Magnetic Flow Meters)</p> <p>Juice Heating: Types of juice heater, construction & working of tubular heater, removal of condensate and non-condensable gases, vacuum equalization, scaling of tubes, cleaning & testing of heater, concept of vapor line & dynamic juice heater. Effect of heat on juice, Purpose of primary and secondary heating. Construction and working of Direct Contact Heater (DCH), Plate Heater (PHE), advantages & disadvantages.</p>		8
<p>Unit II</p> <p>Clarification: Techniques of clarification; Defecation, Sulphitation & Carbonation, clarificants used in Sugar manufacture. Lime; specification, storage - Preparation of milk of lime; rotary</p>		6

lime slacker, classifier, MOL tanks, lime pumps, use of hydrated lime powder. Sulphur; specification & storage, production of sulphur dioxide gas - combustion of sulphur, construction & working of sulphur burner, film type sulphur burner. Liming & Sulphitation; Effect of liming & sulphitation on cane juice, simultaneous liming & sulphitation.	
Unit III Subsidiation and Filtration: construction & working of Dorr clarifier, operation of Dorr, velocity of juice in clarifier, flash tank cleaning & maintenance of clarifier, Vacuum filter; construction and working, effect of washing on pol in cake, filtrate receivers, baby condenser, vacuum pump, filtrate clarification system.	6
Unit IV Evaporation: Introduction, Construction & Working of Robert type evaporator, Rellieux's principles, working of multiple effect evaporator, factors affecting heat transfer and performance of evaporators. Pan Boiling: Vacuum Pan, Continuous Pan: Boiling Technique	6
Unit V Refining of Sugar : Crystallization: Crystallization while cooling, air cooled & water cooled crystallizer, vertical crystallizer, cooling and reheating of massecuite, transient heater, molasses exhaustion, Centrifugals: Continuous Centrifugals – construction & working, importance of rpm & screen size, factors affecting	6
Unit VI Manufacturing of Khandasari Sugar: Specification of Khandasari Sugar, Extraction & Clarification of Cane Juice Open Pan Boiling System, Centrifugation Drying & Packing, Manufacturing of Jaggry/ Gur : Extraction of Juice, Clarification of Gur, Concentration of Juice, Drying & grading of Gur, Storage of Gur	7
Suggested Text Books:	
1.	Principles of Sugar Technology Vol. 2 - Peter Honig
2.	Cane Sugar Handbook - D P Kulkarni
3.	Handbook of Cane Sugar Technology – R B L Mathur.
4.	Introduction to Cane Sugar Technology – G H Jenkins.
Suggested Reference Books:	
1.	Hand Book of Cane Sugar Engineering – E Hugot
2.	Introduction to Sugar Technology – Chen & Chou
3.	Sakhar Nirmity – By S.V. Karmarkar
4.	Handbook of Cane Sugar Technology- By Jenkins G.H.
5.	Cane Sugar Manufacture in India - By D.P. Kulkarni

Class, Part & Semester	:	Final Year B. Tech. (Food Technology), Part IV, Semester VIII			
Course Title	:	FLAVOURS TECHNOLOGY		Course Code:	: FT 424 (FT 424.1)
Teaching Scheme (Hours)	:	Lecture :	3 hr/week	Total Credits	: 03
		Tutorial :	0 hr/week		
Evaluation Scheme (Marks)	:	CIE=30 (20+10)	SEE = 70	Grand Total=100	Duration of SEE : 3 hr
Revision:	:	Fourth			Month : June 2023
Pre-requisites (if any)	:	-			
Course Domain	:	Core			

Course Rationale: -

Course Objectives: The Course teacher will		Course Outcomes: Students will be able to		
1.	impart compressive overview production and processing scenario flavour.	1.	Identify the type and sources of flavour	
2.	Explain the principles of natural and synthetic food flavor.	2.	Understand the principles of natural and processed food flavor.	
3.	Conduct the various sensory evaluation techniques.	3.	Understand the various sensory evaluation techniques.	
4.	Help to formulate the food products by utilization of flavours	4.	Utilize the formulation of flavour and standardization of flavour in food product.	
5.	Demonstrate the flavor rules and regulations.	5.	Classify and explain flavor rules and regulations.	
6.	Describe the methods for adulteration in flavour emulsion	6.	Understand adulteration in flavour emulsion	
Curriculum Content				Hours
Unit I Introduction: Production and processing scenario of flavour.				5
Unit II Types and sources of flavours: Types of flavours, Sources of flavours (natural, processed and added), Flavour composites (natural, semi-synthetic and synthetic), Flavours production in fermented foods.				8
Unit III Biogenesis of flavors: Biogenesis of flavours in food – natural and processed foods (Maillard Reaction and Lipid Oxidation)., Powder flavor- Spray drying technology				6
Unit IV				6

<p>Extraction and analysis of Flavour components: Extraction of flavours from various sources, conditions and extracting agents. Analysis of flavours components (Subjective and objective)</p>	
<p>Unit V Sensory Evaluation: Sensory evaluation of flavours, selection of flavours, flavours and legal standards for flavours and legal regulatory bodies -FSSAI, Codex Alimentarius</p>	6
<p>Unit VI Flavours in industries: Formulations of flavours, Flavours of soft drinks, Baking and confectionery industries, Standards specification of flavours, Adulterations in Flavour emulsions.</p>	8
<p><i>Suggested Text Books:</i></p>	
1.	Food Flavourings. Ashurst PR. 1994. 2nd Ed. Blackie.
2.	Handbook of Flavour, Characterization: Sensory Analysis, Chemistry and Physiology. Marcel Dekker. Deibler D & Delwiche J. 2004.
3.	Food Flavour Technology. Taylor A. 2002. Sheffield Academic Press.
<p><i>Suggested Reference Books:</i></p>	
1.	Flavour Chemistry and Technology. Heath HB & Reineccius G. 1986. AVI Publ.
2.	Fenaroli's Handbook of Flavour Ingredients. Burdock GA. 2004. 5th Ed. CRC Press.

Class, Part & Semester	:	Final Year B. Tech. (Food Technology), Part IV, Semester VIII			
Course Title	:	SNACK FOODS TECHNOLOGY		Course Code:	: FT 424 (FT 424.2)
Teaching Scheme (Hours)	:	Lecture :	3 hr /week	Total Credits	: 03
		Tutorial :	0 hr /week		
Evaluation Scheme (Marks)	:	CIE=30 (20+10)	SEE = 70	Grand Total=100	Duration of SEE : 3 hr
Revision:	:	Fourth			Month : June 2023
Pre-requisites (if any)	:	-			
Course Domain	:	Core			

Course Rationale: -

The course is all about a science and engineering field that deals with the study of snack food processing and its products. It is part of processing industry that involves processing, packaging, distribution and transportation of various snack products such as extruded products, fruit and vegetable based snacks, salted, spiced and sweetened coated nuts, grain-based snacks, flour based– batter and dough based snack products, savoury, farsans and instant premixes of traditional Indian snack foods, etc. It also involves science of biochemistry, food microbiology and nutrition. The aim of the course is to provide the students with deep understanding of how nutrients contributes to maintain healthy life and technology contributes to maintain quality, extend shelf life and improve functions of packaging.

Course Objectives: The Course teacher will

Course Outcomes: Students will be able to

1.	Introduce students to snack foods technology	1.	Understand the concept of snack foods Knowledge about the nutritional profile and consumer demand for snack foods.
2.	Describe emphasis on to the principles and processing of different snack foods	2.	Identify the purpose and functions of snack foods
3.	Illustrate the processing of various snack foods	3.	Classify and explain the different types of snack products
4.	Describe the technology for coated nuts preparation	4.	Apply knowledge for selecting suitable techniques for the snack food processing operations
5.	Explain Engineering principles and concepts to handle, store and process of extruded snack foods	5.	Analyze flow chart for the production processes of various extruded snack products
6.	Categorize the equipment, about the operations and importance of quality control in the snack industry	6.	Evaluate the hygiene and sanitation condition in snack food processing plant, equipment, storage and handling

Curriculum Content

Hours

Unit I : Introduction

5

Importance and scope of snack food technology. Present status of snack foods industries.	
Unit II : Various types of snack food Technology for grain-based snacks: whole grains – roasted, toasted, puffed, popped and flakes, coated grains-salted, spiced and sweetened; flour based– batter and dough based products; savoury and farsans; formulated chips and wafers, papads, instant premixes of traditional Indian snack foods.	8
Unit III: Technology for fruit and vegetable based snacks Technology for fruit and vegetable based snacks: Chips, wafers.	6
Unit IV : Technology for coated nuts Technology for coated nuts – salted, spiced and sweetened; <i>chikkis</i> .	6
Unit V : Extruded snack foods Formulation and processing technology, coloring, flavoring and packaging, Raw materials & their role.	6
Unit VI: Equipments Equipments for frying, Baking, drying, flaking, popping and blending, Coating and chipping	8
Suggested list of Tutorials and Assignments: Regular Tutorial and home assignments	
<i>Suggested Text Books:</i>	
1.	Snack foods processing. Edmund WL. AVI Publ
2.	The Technology of Extrusion Cooking. Frame ND .1994. Blackie Academic.
3.	Snack Food. Gordon BR. AVI Publ.
4.	Snack Food Technology. Samuel AM.1976. AVI Publ.
5.	Extruded foods. Matz.
6.	The Complete Technology Book on Snack Foods Dr. Himadri. Panda (2nd Revised Edition)
<i>Suggested Reference Books:</i>	
1.	Extrusion of Food, Vol 2; Harper JM; 1981, CRC Press.
2.	New protein foods, vol.I,II, A.L. Altschul.

Class, Part & Semester	:	Final Year B. Tech. (Food Technology), Part IV, Semester VIII			
Course Title	:	ENERGY SYSTEMS AND TECHNOLOGY		Course Code:	: FT 424 (424.4)
Teaching Scheme (Hours)	:	Lecture :	3 hr/week	Total Credits	: 03
		Tutorial :	0 hr/week		
Evaluation Scheme (Marks)	:	CIE=30 (20+10)	SEE = 70	Grand Total=100	Duration of SEE : 3 hrs
Revision:	:	Fourth			Month : June 2023
Pre-requisites (if any)	:	-			
Course Domain	:	Core			

Course Rationale: -

Course Objectives: The Course teacher will		Course Outcomes: Students will be able to	
1.	Explain basic concepts of renewable energy systems	1.	Understanding of renewable energy systems, its components and interaction between components
2.	Explore the utilization methods, merits & demerits of various renewable energy systems	2.	Utilize knowledge in special field such as solar energy, wind energy
3.	Develop the ability of student to analyse issues related various energy systems	3.	Analyse issues related various energy systems
4.	Describe the identify issues and communicate issues within the subject area	4.	Familiar with innovation and innovation process compared to traditional processes
5.	Introduce renewable energy systems	5.	Conduct research and development in the renewable energy systems
6.	Explain the importance of energy system and technology	6.	Identify issues and communicate issues within the subject area

Curriculum Content		Hours
Unit I Introduction: Energy chains, Energy demand, Energy crises, Worlds production & consumption of energy resources, Impact of energy on sustainable development Energy Management & planning: Energy management principles, Energy & pollution trade off, objectives of energy management, energy strategy & energy planning.		6
Unit II Solar Energy: Introduction, utilization methods, merits & demerits of solar energy utilization, potential of solar energy, solar radiation, data for India, solar thermal collectors, concentrators & reflectors, collector efficiency, application of solar energy, solar cooker, solar water heating, solar dryer, solar distillation, solar photovoltaic systems, solar pond.		6
Unit III		8

<p>Wind Energy and Geothermal Energy : Wind Energy: Introduction, potential & scope, classification & types of wind machines, application of wind energy, merits & limitations of wind energy. Site selection for wind farm, wind map of India, wind energy station in India.</p> <p>Geothermal Energy: Introduction, types of geothermal resources, potential of geothermal resources in India & world. Environmental problems in utilization of geothermal resources.</p>	
<p>Unit IV</p> <p>Tidal Energy: Tides, tidal range, tidal power, suitably sites & prospects. Types of tidal power plants, single basin, modulated single basin & double basin schemes, main equipment, energy storage.</p>	7
<p>Unit V</p> <p>Biomass Energy Resources : Biomass energy, biomass energy from cultivated crops & from waste organic matter, biomass conversion processes, incineration & thermo chemical, biochemical conversion of biomass, urban solid waste to energy by incineration & from landfill biogas projects, pyrolysis plants, biogas plants.</p>	8
<p>Unit VI</p> <p>Hydro Energy: Introduction, India's Hydro reserves, merits & limitations, low head , medium head, high head schemes, hydro turbines, economics.</p>	4
<p><i>Suggested Text Books:</i></p>	
1.	Environmental studies by Benny Joseph,
2.	Environmental Biology by K. C. Agarwal
3.	Environmental Encyclopedia by Cunningham, W. P. Cooper, T. H. Hepworth, Jaico Pub.
<p><i>Suggested Reference Books:</i></p>	
1.	Energy & Ecology by David M. Gates, Sinaur Associates
2.	Non-conventional Energy Sources by G. D. Rai,
3.	Power Technologies by Stephenson,
4.	Energy Technology by S. Rao & B. B. Parulekar

Class, Part & Semester	: Final Year B. Tech (Food Technology), Part IV, Semester VIII			
Course Title	: FOOD PLANT DESIGN AND LAYOUT		Course Code	: FT425
Teaching Scheme (Hours)	: Lecture	04 hr /Week		Total Credits : 04
	: Tutorial	00 hr /Week		
Evaluation Scheme (Marks)	: CIE=30 (20+10)	SEE = 70	Grand Total =100	Duration of SEE : 3 hr
Revision	: Fourth			Month : June 2023
Pre-requisites (If any)	: In order to complete the course successfully, it is important to have a good knowledge of basic food science and food engineering.			
Course Domain	: Program core			
Course Rationale: This course deals with the knowledge of science, processing and engineering for the implementation of layout designing. It covers all the areas of food processing. In this course different models are also there for study to understand the subject more thoroughly. Apart from designing it will also help students to learn about cost estimation of any unit.				
Course Objectives: The Course Teacher will			Course Outcomes: Students will be able to	
1.	Help students to gain knowledge of basic concepts of plant layout and design with special reference to food process industries		1.	Understand about advanced unit operations specific to the food industry and of the criteria for the design of complex food plants
2.	Introduce students to the various factors affecting for plant location selection		2.	Choose processing site, transportation mode, fuel, energy and their integration with the skills of food technology in the design of complex food plants
3.	Develop the ability of student to learn about different plant layout and equipment layout		3.	Apply the knowledge of food manufacturing processes and their representation in a flow-sheet preparation of the plant.
4.	Describe the economics and cost analysis method for plant designing.		4.	Evaluate the critical control points where product or process can be compromised, draw, using standard symbols, and factory layouts.
5.	Illustrate to the students about factors consideration in new plant building		5.	Design the plant layout and initiate processing related to foods in a safe and creative manner.
6.	Elaborate to the students about how to initiate processing related to foods in a safe and creative manner.		6.	Create layout of waste treatment plant and management of food plant.

<i>Curriculum Content</i>		Hours
UNIT I Introduction Basic concepts of plant layout and design with special reference to food process industries. Application of HACCP concept, ISO, FPO & MPO requirements in food plant layout and design.		8
UNIT II Plant Location Influence of location on plant layout, location factors, location theory and models, Economic plant size, types of manufacturing processes like continuous, repetitive and intermittent processes.		8
UNIT III Plant Layout Preparation of a Plant Layout, Plant Layout problem, importance, objectives, classical types of layouts. Evaluation of layout. Advantages of good layout		8
UNIT IV Plant Building Considerations in building design, type of factory buildings, choice of building construction, material for floors, foundation, walls, doors, windows, drains etc, ventilation, fly control, mold prevention and illumination in food processing industries.		8
UNIT V Plant layout & Equipment Layout Plant layout and design of bakery and biscuit industries; fruits and vegetables processing industries including beverages; milk and milk products; meat, poultry and fish processing industries. Equipment layout in Food Industries : Basic understanding of equipment layout and. Preparation of flow sheets for material movement and utility consumption in food plants.		12
UNIT VI Cost Analysis Fixed cost, variable cost, depreciation, method of economic analysis, profitability analysis of a plant		8
<i>Suggested Text Books:</i>		
1.	Plant Layout and Design by James M.Moore (1962), Mac Millan, New York	
2.	Plant Design for Chemical Engg. By Peterse & Timmerhaus, McGraw Hill	
3.	Textbook of Dairy Plant Layout and Design by Prof. Lalat Chander by ICAR, Pusa, Delhi Publication,2004	
4.	Food Process Design by Zacharias B. Maroulis published by Marcel Dekker, Inc , Cimarron Road, Monticello, New York 12701, U S A	
5.	Food plant engineering systems by Theunis C. Robberts, CRC Press, Washington	
<i>Suggested Reference Books:</i>		
1.	Facility Planning And Layout Design by Chandrasekhar Hiregoudar, Technical Publications, 2017	
2.	Applied guide to process and plant design by Sean Moran Elsevier, 2015	
3.	Project Engg. of process plants by Rase & Brrow t John Willey & Sons	
4.	Chemical Engineering Plant Design by Vilbrant & Dryden, Tata McGraw Hill	
5.	Plant Design & Economics for Chemical Engineering, by Peters & Timmerhaus, McGraw Hill	

Class, Part & Semester	:	Final Year B. Tech (Food Technology), Part IV, Semester VIII				
Course Title	:	Entrepreneurship development for food Technologists	Course Code	:	FT426	
Teaching Scheme (Hours)	:	Lecture	02 hr /Week	Total Credits	:	02
Evaluation Scheme (Marks)	:	IOE= 50		Duration of SEE	:	-
Revision	:	Fourth		Month	:	June 2023
Pre-requisites (If any)	:	Pre-requisites include basic knowledge of soft skills, presentation and familiarity of Food Technology field overview.				
Course Domain	:	Entrepreneurship				
Course Rationale: This course is important to develop entrepreneurial abilities among the students.						
Course Objectives: The Course Teacher will			Course Outcomes: Students will be able to			
1.	Explain about entrepreneurship development		1.	Understand the concept of Entrepreneurship		
2.	Develop ability to prepare project plan		2.	Design project reports for setting food processing industry		
3.	Introduce various funding schemes to start business		3.	Know different schemes for setting food processing industry		
4.	Describe Entrepreneurship Development Programs		4.	Asses the feasibility of project		
Curriculum Content					Hours	
UNIT I Entrepreneurship Importance and growth, characteristics and qualities of entrepreneur, role of entrepreneurship, ethics and social responsibilities; Entrepreneurship development					04	
UNIT II Entrepreneurship Development Concept of entrepreneurship, Entrepreneurial and managerial characteristics, managing an enterprise, Entrepreneurship Development Programs – Need, Objectives. incubation and commercialization of ideas and innovations, SWOT analysis					04	
UNIT III Project Meaning, Features, Classification, Stages in project identification, Planning and evaluation of projects: Growth of firm, project identification and selection, factors inducing growth, Project feasibility study: Post planning of project, project planning and control; New venture management; Creativity					08	
UNIT IV Setting up of micro small and medium enterprises					04	

Setting up of micro, small and medium enterprises, location significance, Green channel, Bridge capital, Seed capital assistance, Margin money scheme, Sickness, Causes-Remedies, Incubation centers	
UNIT V Role of schemes in entrepreneurial development Ministry of Food Processing Industries, National Bank for Agriculture and Rural Development (NABARD), Khadi Village and Industries Commission (KVIC), District Industry Centers (DICs), National Small Industries Corporation (NSIC) and many other relevant institutions/organizations/NGOs at State level	06
<i>Suggested Text Books:</i>	
1.	Gordon, E., Natarajan, K., & Arora, A. (2009). Entrepreneurship development. Mumbai, India: Himalaya publishing house.
2.	Casson, M., Yeung, B., & Basu, A. (Eds.). (2008). The Oxford handbook of entrepreneurship.
3.	Kumar, S. A. (2008). Entrepreneurship development. New Age International.
<i>Suggested Reference Books:</i>	
1.	Jindal, M. K., & Bhardwaj, A. (2016). Entrepreneurship development in India: A new paradigm. In Proceedings of the world congress on engineering (Vol. 2, pp. 724-726).
2.	Tiwari, A. (2007). Entrepreneurship development in India. Sarup & Sons.
3.	Singh, S. K., & Ram, P. (2017). Entrepreneurship development in India: Opportunities and challenges. Splint International Journal of Professionals, 4(3), 75-81.
4.	Gupta, C. B., & Khanka, S. S. (2003). Entrepreneurship and small business management. Sultan Chand & Sons, New Delhi.

Class, Part & Semester	:	Final Year B. Tech (Food Technology), Part IV, Semester VIII					
Course Title	:	Post-Harvest Technology of Plantation Crops laboratory		Course Code	:	FT 421L	
Teaching Scheme (Hours)	:	Practical	2 hr /Week		Total Credits	:	01
Evaluation Scheme (Marks)	:	IOE = 50	EPE=00	Grand Total = 50	Duration of EPE	:	NA
Revision	:	Fourth			Month	:	June 2023
Pre-requisites (If any)	:	In order to complete the course successfully, it is important to have a good knowledge of basic food science, nutrition and food processing.					
Course Domain	:	Program core					
Course Rationale: The purpose of this course is to provide the students hands-on experience of quality assessment of spices and plantation crops							
Course Objectives: The Course Teacher will				Course Outcomes: Students will be able to			
1.	Explain basic varieties and morphological characteristics of spices and herbs			1.	Understand basic varieties and morphological characteristics of spices and herbs		
2.	Describe physicochemical qualities of spices and herbs			2.	Know about physicochemical qualities of spices and herbs		
3.	Demonstrate extraction of spice and Herb oil			3.	Learn extraction of spice and Herb oil and oleoresins		
4.	Discuss about formulation of different spices premixes			4.	Have practical experience to develop different spice powders		
5.	Impart the knowledge of suitability and compatibility of packaging material			5.	Understand technology for spices and herbs		
General Instructions: Any 8 experiments to be performed from the list.							
Sr. No.	List of Experiments						
1.	Physical analysis of different Spice Samples						
2.	Chemical analysis of different Spice Samples						
3.	Demonstration of process of oil extraction spices.						
4.	Demonstration of process of oleoresin extraction from different Spices						
5.	Study of detection of adulteration in spices.						
6.	Study of sensory characteristics of Spices and oleoresin						
7.	Demonstration of Dehydration of ginger, process of turmeric						
8.	Preparation of curry powder						

9.	Preparation of Spice Album
10.	Demonstration of processing of locally available spices and herbs
11.	Practical about Blending Technology
12.	Visit to the Spice processing Plant
Lab Manual :	
1.	Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Class, Part & Semester	:	Final Year B. Tech (Food Technology), Part IV, Semester VIII					
Course Title	:	Biochemical Engineering Laboratory		Course Code:	:	F422L	
Teaching Scheme (Hours)	:	Practical :	2 hr/week		Total Credits	:	1
Evaluation Scheme (Marks)	:	EOE=50 marks	EPE/IOE= NA	Grand Total=50	Duration of EPE	:	--
Revision:	:	Fourth revision			Month	:	June 2023
Pre-requisites (if any)	:	The students should have basic knowledge of Food engineering I and II, Food microbiology, Food chemistry, physics and mathematics.					
Course Domain	:	Core					
Course Rationale:							
Course Objectives: The Course teacher will				Course Outcomes: Students will be able to			
1.	Studies of various techniques used in biochemical engineering.			1.	Describe and identify the main groups of microorganisms.		
2.	Design experiments to evaluate the performance of the bioreactor.			2.	Describe and compare the different structures and growth kinetics of diverse microorganisms		
3.	Explain practical skills in the areas of biochemical processes.			3.	Explain how (microbial) genetics determines microbial metabolic and functional activity.		
4.	States different fermentation processes in laboratory.			4.	Describe key biochemical and cellular components and biochemical pathways		
5.	Evaluate industrial problems in food product development.			5.	Calculate yield and production rates in a biological production process and also interpret data.		
6.	Apply the principles of heat transfer and mass transfer phenomena.			6.	Justify a range of practical approaches associated with microbiology and biochemistry		
List of Experiments							
Sr. No.	Name of experiment						
1.	Instrumentation and their control in fermentation industry - physical parameter						

2.	Instrumentation and their control in fermentation industry – chemical parameter,
3.	To study the different parts and operation of laboratory fermentors
4.	To study the thermal stability of peroxidase enzyme in potato.
5.	To assess the amylase activity from given foods sample.
6.	To measure the microbial growth during fermentation.
7.	To study the ethyl alcohol production through bioconversion.
8.	Starch hydrolysis by amylase
9.	Batch submerged fermentation of baker's yeast in a shaker flask
10.	Wine fermentation.
11.	To study the time temperature relationship for destruction of microorganisms.
12.	Visit to distillation plant.

Course Assessment Methods:

Practical Journal Assessment, Internal Oral Examination

Suggested Text Books/ Reference Books/Manual

1.	Biotechnology procedures and experiments handbook by S.Harisha
2.	Guide to food biotechnology (1996) IFST
3.	Mosier, N S and Ladisch,M.R (2009)Modern biotechnology. John Wiley and sons
4.	Meenakshi Paul. 2007. Biotechnology and Food Processing Mechanics. Gene-Tech Books, New Delhi.

Class, Part & Semester	:	Final Year B. Tech (Food Technology), Part IV, Semester VIII					
Course Title	:	Major Project –Phase II		Course Code	:	FT423L	
Teaching Scheme (Hours)	:	Practical	06 hr/week		Total Credits	:	03
Evaluation Scheme (Marks)	:	IPE = 100	EOE=50	Grand Total = 150	Duration of EOE	:	NA
Revision	:	Fourth			Month	:	June 2023
Pre-requisites (If any)	:	Pre-requisites include basic knowledge of soft skills, presentation and all specialized courses of food technology.					
Course Domain	:	Research Skills					
Course Rationale: Students' evaluation is by continuous internal examination and based on External Oral Evaluation at the end of the semester, based on attendance during the entire semester, project report submission at the end of semester.							
Course Objectives: The Course Teacher will				Course Outcomes: Students will be able to			
1.	Plan for various activities of the project and distribute the work amongst team members;	1.	Apply fundamental and disciplinary concepts and methods to solve problems				
2.	Promote self-study, critical thinking and independent research ability;	2.	Identify, analyze, and solve problems				
3.	Make the students initiate their own small conceptual or practical based projects individually or as a team of no more than 4 members;	3.	Integrate information from multiple sources.				
4.	Make them use Research Methodology for the task undertaken;	4.	Analyze developed products				
5.	Trial exercise that may help them to satisfactorily complete their project	5.	Design, project manage and evaluate a concept/model/product				
Curriculum content							
The students either individually or in a group of maximum 4 members will undertake a Major project on a particular topic under the guidance of an internal course teacher. Prior to the topic selection, the course in charge will guide them about searching topic related to requirements of industry, farmers and other societal issues. During phase II student will complete all objectives of their proposed work. A report is to be written upon completion of the activity. The Department will provide a specific format for report writing. The assessment of the major project work will be based on: 1. Attendance 2. Physical Demonstration of their work 3. Presentation based on the work carried out 4. Major Project reports submitted							

Class & Semester	: Final Year B.Tech Food Technology, Part IV, Semester VIII				
Course Title	: Professional Ethics			Course Code:	: HS422
Teaching Scheme (Hours)	: Lecture= 2 hr /Week			Credits	: Nil
Evaluation Scheme (Marks)	Assignments	: 50	Written Test	: 25	Duration of Exam
	Viva voce	: 25	Grand Total	: 100	: Not Applicable
Revision	: Third			Month	: June 2023
Pre-requisites	: It does not require any pre-requisite as such but eager to know about our profession's connectivity, role and responsibility towards society and environment.				
Course Domain	: Audit Course at institute level , Humanities & Social Science				

Course Rationale:

Course Objectives: The Course Teacher will

Course Outcomes: Students will be able to

1.	Explain importance of engineers' connectivity with society and environment.	1.	Realize the role of engineers towards society and environment.
2.	Make students aware of ethics and responsibility of engineers as professionals.	2.	Demonstrate ethical practices and responsibility as a professional.
3.	Make them able to undergo ethical judgments and solve problems.	3.	Make ethical judgments and solve problems.
4.	Develop attitudes required of engineers and values shared by engineers	4.	Get developed for engineers' attitude with sharing of values.
5.	Help them practice decision making & team players.	5.	Practice decision making and team culture.
6.	Describe importance of lifelong learning.	6.	Follow lifelong learning attitude.

Curriculum Content

Unit I: Engineer, Society and Environment

1. Understanding of the relation between engineering and society/Environment. 1.1 Understanding of the effects and impacts of science and technology on human society. 1.2 Understanding the effects and impacts of science and technology on the natural environment. 1.3 Understanding the characteristics of the modern globalized world.

Unit II: Ethics and engineering Profession

2 Understanding of ethics and responsibilities of engineers as Professionals. 2.2 Understanding of the roles and responsibilities of engineers in Society. 2.3 Understanding of the basic concepts and theories of ethics. 2.4 Understanding the relation between law and ethics and having basic legal literacy. 2.5 Understanding of the nature of professional ethics. 2.6 Understanding of the purposes and roles of codes of ethics and those of conduct set by engineering societies and associations. 2.7 Understanding of the social responsibility (SR) of organizations (companies in particular). 2.8 Understanding of ethics in specific areas (and knowledge of concrete cases) 2.9 Understanding the nature of ethics in research and development

Unit III: Ethical Perception and Problem solving

3 Ability to make ethical judgments and solve problems. 3.2 Understanding and application of methods to identify related factors in ethical issues and to make a structural analysis of them. 3.3 Understanding and application of methods to analyze technical factors in ethical issues and make structural analysis of them. 3.4 Understanding and application of methods to analyze

Hours
07

07

06

organizational factors and provide organizational solutions. 3.5 Ability to design one's conduct to solve ethical problems Based on the abilities to analyze factors gained through 3.2–3.4, 3.6 Comprehensive problem-solving capability

Unit IV: Engineer's attitude and Social Responsibility

4 Attitude required of engineers and values shared by engineers. 4.1 Attitude to think autonomously and independently based on an understanding of the responsibility of an engineer. 4.2 Attitude to accept a diversity of values (recognizing the existence of the various value systems different from their own as well as the multiplicity of values). 4.3 Attitude to share values (such as safety emphasized in the codes of ethics) to which engineers should assign paramount importance. 4.4 Attitude and willpower to act on ethical judgments of their own.

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Reference Books:

1. Charles D. Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.
2. Seth, M. L., "Principles of Economics", Lakshmi Narain Agarwal, Agra.
3. Agarwal, A. N., "Indian Economy", Vikas Publishing House Pvt. Ltd., New Delhi.
4. Datta R. and Sundharam, "Indian Economy", K. P. M., S. Chand & Co. Ltd., New Delhi
5. Prof. M P Raghavan, "Professional Ethics in Engineering", SCITECH Publication(India) Pvt.Ltd, Second Edition