DEPARTMENT OF TECHNOLOGY,
SHIVAJI UNIVERSITY KOLHAPUR
THIRD YEAR B.TECH
Scheme of Teaching and Examination: Semester- V (Food Technology)

Subject Code	Subject	Teaching Scheme with Credits (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credits	Scheme	Max. marks	Min. Passing	Scheme	Max. marks	Min. Passing
FT311	Technology of Cereals and Bakery Products	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT312	Fruits and Vegetables Processing Technology	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT313	Dairy Technology	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT314	Food Process Engineering-II	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT315	Process Instrumentation, Dynamics and control	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT311L	Technology of Cereals & Bakery Products Laboratory	-	-	02	01	-	-	-	EOE	50	20
FT312L	Fruits& Vegetables Processing Technology Laboratory	-	-	02	01	-	-	-	EPE	50	20
									IOE	50	20
FT313L	Dairy Technology Laboratory	-	-	02	01	-	-	-	EPE	50	20
FT314L	Food Process Engineering-II Laboratory	-	-	02	01	-	-	-	IOE	50	20
FT315L	Process Instrumentation, Dynamics and control Laboratory	-	-	02	01	-	-	-	IOE	50	20
	Total	**20**	**-**	**10**	**25**	-	**500**	-	-	**300**	-

Audit Course III											
LS311	Introduction to Foreign Language	**02**	-	-	-	Institute Level	-	-	-	-	-

Total contact hours per week: **30+2=32**

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

DEPARTMENT OF TECHNOLOGY,
SHIVAJI UNIVERSITY KOLHAPUR
THIRD YEAR B.TECH
Scheme of Teaching and Examination: Semester- VI (Food Technology)

Subject Code	Subject	Teaching Scheme with Credits (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credits	Scheme	Max. marks	Min. Passing	Scheme	Max. marks	Min. Passing
FT321	Sugar and Confectionery Technology	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT322	Food Packaging	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT323	Biochemical Engineering	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT324	Process Equipment Design and Drawing	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT325	Industrial Economics and Management	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT321L	Sugar and Confectionery Technology Laboratory	-	-	02	01	-	-	-	EPE	50	20
FT322L	Food Packaging Laboratory	-	-	02	01	-	-	-	EOE	50	20
FT323L	Biochemical Engineering Laboratory	-	-	02	01	-	-	-	EOE	50	20
FT324L	Process Equipment Design and Drawing Laboratory	-	-	02	01	-	-	-	IOE	50	20
FT325L	Seminar and Mini Project	-	-	02	01	-	-	-	IOE	100	40
	Total	**20**	**-**	**10**	**25**	-	**500**	-	-	**300**	-

Audit Course IV											
RM321	Research Methodology	02	-	-	-	-	-	-	-	-	-

Total contact hours per week: **30+2=32**

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

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EOE: External Oral Examination

Seminar and Mini Project: (Contact hours: 2) **Credit: 1**

Seminar which will carry 50 marks will be delivered by individual students in front of teachers panel based on Seminar Report and Seminar oral presentation.

Mini Project which will carry 50 marks will be carried out by group of maximum 4 students. Mini project will be based on market survey and product or model development. Product or model will be finalized by respective guide. Report should be submitted to teachers' panel. Evaluation will be based on market survey report and project/ Model Viva-Voce.

Equivalence of Third Year B.Tech (Food Technology) Semester V and VI

The above detailed syllabus is a revised version of the Third Year BTech (Food Technology) Program being conducted by the Shivaji University at the Technology Department of the University. This syllabus is to be implemented from June 2018, (Academic year 2018-19). The prime feature of this revision is the transformation of the existing curriculum into the Outcome based curriculum as specified in NBA rules and regulations.

The Equivalence for the subjects/courses of Food Technology at Third Year B Tech Semester V and VI pre-revised Program under the faculty of Engineering and Technology is as follows.

Third Year B.Tech Semester V (Food Technology)

Sr.No	Third Year B.Tech(Food Technology) Semester V Pre-revised syllabus	Third Year B.Tech(Food Technology) Semester V Revised syllabus	Remark
1.	Process Instrumentation, Dynamics & Control	Process Instrumentation, Dynamics & Control	Change in number of lectures and content
2.	Food Process Engineering-II	Food Process Engineering-II	Change in number of lectures and content
3.	Fruits and Vegetables Processing Technology	Fruits& Vegetables Processing Technology	Change in number of lectures and content
4.	Technology of Cereals & Bakery Products	Technology of Cereals and Bakery Products	Change in number of lectures and content
5.	Dairy Technology	Dairy Technology	Change in number of lectures and content
6.	Process Instrumentation, Dynamics & Control Lab	Process Instrumentation, Dynamics & Control Laboratory	Change in nomenclature Change in number and titles of practicals
7.	Food Process Engineering-II Lab	Food Process Engineering-II Lab Laboratory	Change in nomenclature Change in number and titles of practicals
8.	Fruits& Vegetables Processing Technology Lab	Fruits& Vegetables Processing Technology Laboratory	Change in nomenclature Change in number and titles of practicals
9.	Technology of Cereals & Bakery Products Lab	Technology of Cereals & Bakery Products Laboratory	Change in nomenclature Change in number and titles of practicals
10.	Dairy Technology Lab	Dairy Technology Laboratory	Change in nomenclature Change in number and titles of practicals
11.	Presentation and Communication	-	Shifted to Semester IV as soft skill development
12.	-	Introduction to Foreign Language	Shifted from Semester III for uniformity with Department with change in number of lectures and content

Third Year B.Tech Semester VI (Food Technology)

Sr.No	Third Year B Tech(Food Technology) Semester VI Pre-revised syllabus	Third Year B.Tech(Food Technology) Semester VI Revised syllabus	Remark
1.	Sugar and Confectionery Technology	Sugar and Confectionery Technology	Change in number of lectures and content
2.	Food Packaging	Food Packaging	Change in number of lectures and content
3.	Industrial Economics and Management	Industrial Economics and Management	Change in number of lectures and content
4.	Biochemical Engineering	Biochemical Engineering	Change in number of lectures and content
5.	Process Equipment Design And Drawing	Process Equipment Design And Drawing	Change in number of lectures and content
6.	Sugar and Confectionery Technology Lab	Sugar and Confectionery Technology Laboratory	Change in nomenclature Change in number and titles of practicals
7.	Food Packaging lab	Food Packaging Laboratory	Change in nomenclature Change in number and titles of practicals
8.	Biochemical Engineering lab	Biochemical Engineering Laboratory	Change in nomenclature Change in number and titles of practicals
9.	Process Equipment Design And Drawing lab	Process Equipment Design And Drawing Laboratory	Change in nomenclature Change in number and titles of practicals
10.	Mini Project	Seminar & Mini Project	Change in nomenclature and content
11.	Audit Course III Research Methodology	Audit Course III Research Methodology	Change in number of lectures and content

Audit course have not been assigned any credits. The students will be evaluated for these courses by the concerned course in charge. There will be grade conferred to the student. The grade will be based on conversion of marks obtained out (Obtaining passing grade is essential). Please refer to chart in the detail examination scheme. The chart shows the marks range and the respective grade.

DEPARTMENT OF TECHNOLOGY,
SHIVAJI UNIVERSITY KOLHAPUR
FINAL YEAR B.TECH
Scheme of Teaching and Examination: Semester- VII (Food Technology)

Subject Code	Subject	Teaching Scheme with Credits (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Total Credits	Scheme	Max. marks	Min. Passing	Scheme	Max. marks	Min. Passing
FT 411	Meat, Poultry and Fish Processing Technology	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT 412	Legume and Oilseed Technology	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT413	Food Quality and Safety Management	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT414	Food Biotechnology	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT415	Elective –I	03	-	-	03	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT416	Industrial Training Report	-	1	-	01	-	-	-	IOE	50	20
FT411L	Meat, Poultry and Fish Processing Technology Laboratory	-	-	02	01	-	-	-	EOE	50	20
FT412L	Legume and Oilseed Technology	-	-	02	01	-	-	-	EPE	50	20
FT413L	Food Biotechnology		-	02	01	-	-	-	IOE	50	20
FT414L	Major Project-Phase I	-	-	04	02	-	-	-	IOE	100	20
	Total	**19**	**1**	**10**	**25**	-	**500**	-	-	**300**	-

Audit Course V											
HS411	Introduction to Indian Constitution	**02**	-	-	-	Institute Level	--	---	---	----	----

Total contact hours per week: **30+2=32**

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

Note: There will be an industrial training for minimum 30 days after semester VI. This will cover the study of a reputed Food industry from standpoint of Food Technology. The students will submit a report of the training. This particular activity is equivalent to one credit and it carries 50 marks as an Internal Oral Evaluation (IOE) which is included in Semester VII. The students will follow one specific format recommended by the Program Advisory Board for submission of their industrial training report.

MAJOR PROJECT (Phase I)

Teaching Scheme: P: 4 hour/week **Credits: 02**

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 using LCD provided by the institute.

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 100 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.

INDUSTRIAL TRAINING REPORT

Credit: 1

The industrial training after Semester VI and before commencement of Semester VII will cover the study of reputed food industries from standpoint of food technology. The report of the training is required to be submitted by the students. The evaluation of this particular activity is included in this Semester VII.

DEPARTMENT OF TECHNOLOGY,
SHIVAJI UNIVERSITY KOLHAPUR
FINAL YEAR B.TECH
Scheme of Teaching and Examination: Semester- VIII (Food Technology)

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

Audit Course VI											
HS422	Professional Ethics	**02**	-	-	-	Institute Level	-	-	-	-	-

Total contact hours per week: **30+2=32**

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

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EOE: External Oral Examination

ELECTIVE-II (OPEN ELECTIVE)

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

Teaching Scheme: L: 3 hours/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 a external examiners 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 using the LCD 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. BTech (Food Technology) course being conducted by the Shivaji University at the Technology Department of the University. This syllabus is to be implemented from June 2019, (Academic year 2019-20). The prime feature of this revision is the transformation of the existing curriculum into the Outcome based curriculum as specified in NBA rules and regulations.

The Equivalence for the subjects of Food Technology at Final Year B Tech Semester VII and VIII pre-revised course under the faculty of Engineering and Technology is as follows.

Final Year B.Tech Semester VII (Food Technology)

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	Change in no of lectures
2.	Legume and Oilseed Technology	Legume and Oilseed Technology	Change in no of lectures
3.	Food Quality & Safety Management	Food Quality & Safety Management	Change in no of lectures
4.	Food Biotechnology	Food Biotechnology	Change in no of lectures
5.	Elective –I	Elective –I	No change
6.	Major Project Phase I	Major Project Phase I	Change in no of lectures
7.	Laboratory- I Meat, Poultry and Fish Technology Lab	Meat, Poultry and Fish Technology Laboratory	Slight change in nomenclature
8.	Laboratory- II Legume and Oilseed Technology Lab	Legume and Oilseed Technology Laboratory	Slight change in nomenclature
9.	Laboratory- III Food Quality & Safety Management Lab	-	Removed the lab and the practical are submerged in other subjects
10.	Laboratory- IV Food Biotechnology Lab	Food Biotechnology Laboratory	Slight change in nomenclature
11.	Seminar & Industrial Training Report	Industrial Training Report	Seminar shifted to Semester VI
12.	Audit Course V Professional Ethics	-	Shifted to semester VIII
13.	-	Audit Course V Introduction to Indian Constitution	Shifted from semester VIII

Final Year B.Tech Semester VIII (Food Technology)

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	Change in no of lectures
2.	Design and Development of New Products	Design and Development of New Products	Change in no of lectures
3.	Waste Management of Food Industries	Waste Management of Food Industries	No change
4.	Elective-II	Elective-II	No change
5.	Food Plant Design and Layout	Food Plant Design and Layout	Change in no of lectures
6.	Major Project (Phase-II)	Major Project (Phase-II)	Change in no of lectures
7.	Post Harvest Technology of Plantation Crops Lab	Post Harvest Technology of Plantation Crops Laboratory	Change in nomenclature
8.	Design and Development of New Products Lab	Design and Development of New Products laboratory	Change in nomenclature
9.	Entrepreneurship Development for Food Technologists	Entrepreneurship Development for Food Technologists	No change
10.	Audit Course VI Introduction to Constitution of India	-	Shifted to semester VII with title change.
11.	Waste Management of Food Industries Lab	-	Removed the lab and the practical are submerged in other subjects
12.		Audit Course VI Professional Ethics	Shifted from semester VII

Audit course have not been assigned any credits. The students will be evaluated for these courses by the concerned course in charge. There will be grade conferred to the student. The grade will be based on conversion of marks obtained out of 50. (Obtaining passing grade is essential). Please refer to chart in the detail examination scheme. The chart shows the marks range and the respective grade.

DEPARTMENT OF TECHNOLOGY,
SHIVAJI UNIVERSITY KOLHAPUR
SECOND YEAR B.TECH

Scheme of Teaching and Examination: Semester- III (Food Technology)

Subject Code	Subject	Teaching Scheme with Credits (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Total Credits	Scheme	Max. marks	Min. Passing	Scheme	Max. marks	Min. Passing
FT211	Principles of Food Preservation	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT212	Engineering Mathematics-III	03	1	-	04	CIE	50	20	IOE	50	20
						SEE	50	20	-	-	-
FT213	Food Microbiology	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT214	Food Chemistry	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT215	Heat Transfer	03	-	-	03	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT211L	Principles of food preservation Laboratory	-	-	02	01	-	-	-	EPE	50	20
FT212L	Food Microbiology Laboratory	-	-	02	01	-	-	-	EPE	50	20
FT213L	Food Chemistry Laboratory	-	-	02	01	-	-	-	EPE	50	20
FT214L	Heat Transfer Laboratory	-	-	02	01				IPE	50	20
FT215L	Programming practices for Food Technologists	1	-	02	02				IPE	50	20
	Total	**19**	**1**	**10**	**25**	-	**500**	-	-	**300**	-

HS211	Environmental Studies	**02**	-	-	-	Project* Theory*	30 70	40	-	-	-

Audit Course-I											
HS212	Soft Skills Development	**02**	-	-	-	Institute Level	-	-	-	-	-

Total contact hours per week: **30+2+2=34,** Total Credits=25

***** indicates Environmental Studies project evaluation and the theory examination will be at the end of the year i.e. along with Semester IV End Examination.

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

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IPE: Internal Practical Evaluation
IOE: Internal Oral Evaluation
SEE: Semester End Examination
EPE: External Practical Examination
EOE: External Oral Examination

DEPARTMENT OF TECHNOLOGY,
SHIVAJI UNIVERSITY KOLHAPUR
SECOND YEAR B.TECH
Scheme of Teaching and Examination: Semester- IV (Food Technology)

Subject Code	Subject	Teaching Scheme with Credits (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Total Credits	Scheme	Max. marks	Min. Passing	Scheme	Max. marks	Min. Passing
FT221	Food Process Engineering-I	03	1	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT222	Food Additives and Contaminants	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT223	Food Biochemistry	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT224	Human Nutrition	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT225	Fluid Mechanics	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT221L	Food Process Engineering-I Laboratory	-	-	02	01	-	-	-	IOE	50	20
									EOE	50	20
FT222L	Food Additives and Contaminants Laboratory	-	-	02	01	-	-	-	EPE	50	20
FT223L	Food Biochemistry Laboratory	-	-	02	01	-	-	-	EPE	50	20
FT224L	Human Nutrition Laboratory	-	-	02	01	-	-	-	IOE	50	20
FT225L	Fluid Mechanics Laboratory	-	-	02	01	-	-	-	IOE	50	20
	Total	**19**	**1**	**10**	**25**	-	**500**	-	-	**300**	-

HS221	Environmental Studies	**02**	-	-	-	Project Theory	30 70	40	-	-	-

Audit Course-II											
HS222	Introduction to Performing Arts	**02**	-	-	-	Institute Level	-	-	-	-	-

Total contact hours per week: **30+2+2=34,** Total Credits=25

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

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SEE: Semester End Examination
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EOE: External Oral Examination

DEPARTMENT OF TECHNOLOGY,
SHIVAJI UNIVERSITY KOLHAPUR
SECOND YEAR B.TECH

Scheme of Teaching and Examination: Semester- III (Food Technology)

Subject Code	Subject	Teaching Scheme with Credits (Hours / Week)			
		L	**T**	**P**	**Total Credits**
FT211	Principles of Food Preservation	04	-	-	04
FT212	Engineering Mathematics-III	03	01	-	04
FT213	Food Microbiology	04	-	-	04
FT214	Food Chemistry	04	-	-	04
FT215	Heat Transfer	03	-	-	03
FT211L	Principles of food preservation Laboratory	-	-	02	01
FT212L	Food Microbiology Laboratory	-	-	02	01
FT213L	Food Chemistry Laboratory	-	-	02	01
FT214L	Heat Transfer Laboratory	-	-	02	01
FT215L	Programming practices for Food Technologists	1	-	02	02
	Total	**20**	**-**	**10**	**25**

HS211	Environmental Studies	**02**	-	-	-	Project* Theory*	30 70	40

Audit Course					
HS212	Soft Skills Development	**02**	-	-	Institute Level

Total contact hours per week: **30+2+2=34,** Total Credits=25

***** indicates Environmental Studies project evaluation and the theory examination will be at the end of the year i.e. along with Semester IV End Examination.

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

DEPARTMENT OF TECHNOLOGY,
SHIVAJI UNIVERSITY KOLHAPUR
SECOND YEAR B.TECH

Scheme of Teaching and Examination: Semester- IV (Food Technology)

Subject Code	Subject	Teaching Scheme with Credits (Hours / Week)			
		L	**T**	**P**	**Total Credits**
FT221	Food Process Engineering-I	03	1	-	04
FT222	Food Additives and Contaminants	04	-	-	04
FT223	Food Biochemistry	04	-	-	04
FT224	Human Nutrition	04	-	-	04
FT225	Fluid Mechanics	04	-	-	04
FT221L	Food Process Engineering-I Laboratory	-	-	02	01
FT222L	Food Additives and Contaminants Laboratory	-	-	02	01
FT223L	Food Biochemistry Laboratory	-	-	02	01
FT224L	Human Nutrition Laboratory	-	-	02	01
FT225L	Fluid Mechanics Laboratory	-	-	02	01
	Total	**13**	**01**	**10**	**25**

HS221	Environmental Studies	**02**	-	-	-	Project Theory	30 70	40

Audit Course					
HS222	Introduction to Performing Arts	**02**	-	-	Institute Level

Total contact hours per week: **30+2+2=34,** Total Credits=25

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

Detailed Evaluation and Examination Scheme

1. Out of total 100 theory marks, 50 marks are assigned for Continuous Internal Evaluation (CIE). In CIE, obtaining minimum 20 marks is essential. It is similar to term work, the completion of which is mandatory to become eligible to appear for the Semester End Examination (SEE). Failing to complete the term in a particular course i.e. not obtaining 20 marks in CIE out of 50 shall be treated as term not granted in that course and it is on the part of the course teacher to officially inform the particular case through the respective Program Coordinator and the Director to the University Examination Section. The section will take a kind note of the same and it will not issue the hall ticket of the particular students for the SEE in the particular course/s.
2. CIE (50 marks) includes :
    - Internal Test - I, of 20 marks in 5^{th} week on 1^{st} & 2^{nd} unit
    - Internal Test - II, of 20 marks in 10^{th} week on 3^{rd} & 4^{th} unit
    - Activities for the students: 10 marks. It is at the course owners' discretion to get the assignments of varied nature completed by the students. However, the course teacher will plan to cover those course objectives that suit course learning outcomes and program outcomes that may not be covered in the internal tests.
3. For the Semester End Examination (SEE), 100 marks (3 hours) paper will be set and finally it will be converted to 50 marks. The students must secure minimum 40 % i.e. 20 marks in SEE as the University examination passing head.
4. Final theory marks (out of 100) will be the addition of CIE (out of 50 marks) and SEE (out of 50 marks).
5. Internal Practical/Oral Evaluation (IPE/IOE) will be on the basis of Internal Oral/ Practical/Tutorials/Seminar in which students must secure minimum 40% i.e. 20 marks. It is similar to the term work the completion of which is mandatory to be eligible to appear for the Semester End Examination (SEE).
6. External Practical/Oral Evaluation (EPE/EOE) will be conducted under the supervision by some external course expert. The minimum score 40% i.e. 20 marks is required to be secured as the University's passing head in EPE/EOE.

7. *Semester End Examination duration will be 4 hrs.
8. Equivalence for the Course: As elaborated at the end of this whole curriculum document.

Academic Autonomy:

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 simply a means of attaching relative values to courses of different components. These 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 courses (Courses) under each Program/Discipline are unitized.

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 him/her to progress at an optimum pace suited to his/her ability or convenience. Each course by every student needs to fulfill minimum requirements of credits 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.

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 weightage 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: Chemistry-I: 5 credits (4-0-2)

The credits indicated for this course are computed as follows:

4 hours/week lectures = 4 credits

0 hours/week tutorial = 0 credit

2 hours/week practical = 2 *x* 0.5 = 1 credit

The contact hours in this case of **5** credits course is 6 hours per week. (**4** h Lectures + **0** h Tutorial + **2** h Practical=6 hours per week.)

For each lecture or tutorial credit, the self study component is 1 hour/week and 2 hours/week. In the above example, the student is expected to devote 3 + 1 = 4 hours per week on self study for this course, in addition to class contact of 5 hours per week.

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, 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.

Features of Credit System at Shivaji University, Kolhapur:

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

1. All Courses may not have same credits.
2. There will be 23 to 28 Credits / Semester.
3. Absolute Grading System with 7 Passing Grades viz. AA, AB, BB, BC, CC, CD, DD and FF for failure.
4. Getting FF grade in 4 heads in one academic year, he/she is considered as failed.
5. Continuous Evaluation: Unit Test I i.e. T_1 [20 marks], and Unit Test II i.e. T_2 [20 marks]. Activities will be for 10 marks and the course owner/in charge will have discretion to decide the nature of activities.
6. Standardization of courses: Each course is unitized in 6 numbers. Unit Test I on units I and II while Unit Test II on units III & IV, SEE will be based on all the units of the course curriculum.
7. Unit Test I & Unit Test II will be supervised and evaluated by internal course teachers while SEE will be evaluated mostly by external and internal teachers as joint examiner ships.

8. Any request for re-test will not be entertained after internal test.
9. For both the semesters' failure courses, re-examination will be only after the even Semester End Examination. No re-examination will be conducted for odd semester courses in even semester or vice-versa.

Attendance rule:

All students must attend every lecture, tutorial and practical class. However, to account for late registration, sickness or other such conditions, 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 practical taken together (as applicable), will be awarded the 'F' grade in that course irrespective of his/her performance in the tests.

Taking into account the consolidated attendance record for the whole semester, the course in charge in consultation with the Program Coordinator will award 'XX' grade to the student who is deficient in attendance. For the purpose of attendance calculation, every scheduled practical class will be counted 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 owner will maintain and consolidate attendance record for the course (lectures, tutorials and practical together, as applicable).

Evaluation system:

1. Semester Grade Point Average (SGPA) =

$$\frac{\sum (\text{course credits in passed courses X earned grade points})}{\sum (\text{Course credits in registered courses})}$$

2. Cumulative Grade Point Average (CGPA) =

$$\frac{\sum (\text{course credits in passed courses X earned grade points) of all Semesters}}{\sum (\text{Course credits in registered courses) of all Semesters}}$$

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 $\geq$ 8.25 and above

   Ist Division : CGPA $\geq$ 6.75 and < 8.25

II[nd] Division : CGPA $\geq$ 6.25 and < 6.75

As per AICTE Handbook (2011-12), gradation is as follows:

Grade Points	Equivalent Percentage Range
6.25	55
6.75	60
7.25	65
7.75	70
8.25	75

Conversion of CGPA to corresponding equivalent percentage marks for CGPA>5.0 may be obtained using the following equation:

Equivalent Percentage marks = (Respective CGPA x 10) – 7.5

An example of these calculations is given below:

Typical academic performance calculations - I semester

Course no.	**Course credits**	**Grade awarded**	**Earned credits**	**Grade points**	**Points Secured**
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6 (Col 4* Col 5)
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	0
TTNXXX	2	AB	2	9	18
Total	21		17	38	124

1. Semester Grade Point Average (SGPA) =

   (124)
   ---------- = 5.90
   (21)

2. Cumulative Grade Point Average (CGPA) =

   Cumulative points earned in all passed courses = 124 (past semesters) + 124 (this sem.) = 248 Cumulative earned credits = 23 (past semesters) + 21 (this sem.) = 44

$$\frac{\sum (124 + 124)}{\sum (23 + 21)} = 5.63$$

Chart for marks range and its corresponding grade and grade points

Marks Range	Grade Points	Grade	Description of Performance
91-100	10	AA	Outstanding
86-90	09	AB	Excellent
76-85	08	BB	Very Good
66-75	07	BC	Good
56-65	06	CC	Fair
46-55	05	CD	Average
40-45	04	DD	Poor
Below 40	00	FF	Fail
--	--	$	Passed in first attempt
--	--	PP	Passed (Audit Course)
--	--	NP	Not Passed (Audit Course)
--	--	** 2^{nd} *** 3^{rd} **** 4^{th}	One grade punishment for 2^{nd} ,3^{rd}, 4^{th}, …attempt,

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 do not contribute to SGPA or CGPA of the concerned student.

Award of Degree:

Following rules prevail for the award of degree:

1. A Student has registered and passed all the prescribed courses under the general institutional and departmental requirements.
2. A student has obtained CGPA≥ 4.5.

3. A student has paid all the institute dues and satisfied all the requirements prescribed.
4. A student has no case of indiscipline pending against him/her.
5. Institute authorities shall recommend the award of B.Tech degree to a student who is declared to be eligible and qualified for above norms.

CGPA Improvement Policy for award of degree:

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 100% examinations of maximum two theory courses of seventh and eighth semester. However, CGPA shall be limited to 4.5 even though the performance of a student as calculated through modified CGPA becomes greater than 4.5.

B. Tech (Food Technology)
Program Educational Objectives (PEOs), Program Outcomes (POs) and Program Specific Outcomes (PSOs) of the Program:

Program Educational Objectives (PEOs):	
PEO1	Students are expected to have strong theoretical and practical knowledge in the field of Food Engineering and Technology to cater the need of society by Integrating engineering and basic sciences
PEO2	To produce competent graduates who shall Pursue careers in the field of food processing, quality control, new product development and techno-marketing
PEO3	Graduates are expected to be equipped with innovative ideas, project management skills which will make them capable to start-up and grow as an entrepreneur
PEO4	To prepare graduates who will apply the technical knowledge and know-how to solve the problems related to food processing and preservation for the benefit of local region and of the country at large
PEO5	To get ready graduates who will be effective experts in government, academia, research and consulting firms in the field of food engineering and technology
Program Outcomes (POs)	
PO1	Acquire in depth knowledge, understanding and skills through competency in core areas: includes food chemistry, food microbiology, food engineering, food processing, nutrition and food safety and quality.
PO2	Graduates will have an ability to know the fundamental chemistry with respect to properties and reactions of various food components and will have sufficient knowledge to control reactions in foods during processing and storage
PO3	Graduates will have an ability to spot and resolve the problems in the actual situation during food processing, food quality controlling, food packaging and storage
PO4	Graduates will have an ability to express practical proficiency in a food analysis laboratory
PO5	Graduates will have a knowledge of food pathogens and spoilage microorganisms and

	will have an ability to inactivate or killing of food microorganism or food pathogens
PO6	Graduates will have an ability of designing and development of food products as per need of society
PO7	Graduates will have an ability to communicate effectively for self development
PO8	Graduates will have know ledge of quality management system and will have an ability to apply in food processing industries
PO9	Graduates will have knowledge of rules and regulations of food hygiene and sanitation and will able to apply for safe and nutritious food processing
PO10	Graduate will have knowledge and ability of industrial economics and management of food industries
PO11	Graduates will be recognized as food technologists as a responsible technocrats who impact society through their knowledge and actions
PO12	Graduates will have a perceptive of professional and ethical responsibility
Program Specific Outcomes(PSOs)	
PSO1	Graduates will apply the knowledge of food chemistry, food preservation, food processing and food packaging for the effective utilization of agricultural commodities to develop healthy and nutritious food
PSO2	Graduates will design the equipments for the modernization of traditional food process methods
PSO3	Graduates will apply principles from the various aspects of food technology and related disciplines to solve practical and real-world problems
PSO4	Gradates will able to develop quality food processes by considering cost, safety and health aspects

Class & Semester	:	**S. Y. B. Tech (Food Technology) Part II, Semester III**					
Course Title	:	**Principles of Food Preservation**			*Course Code*:	:	**FT211**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks= 52 hours minimum** **Tutorial= 0 hour/week** **Practical= 02 hours/week**			*Total Credits*	:	**04+01=05**
Evaluation Scheme (Marks)	:	**CIE = 50** **SEE = 50**	**IPE=50** **IOE=Nil** **EPE= 50**	: : :	**Grand Total=200**	*Duration of SEE*	:	**3 hours**
Revision:	:	**Third**				*Month*	:	**December 2016**

Pre-requisites	:	In order to complete the course studies successfully, it is important to have a good command of English and knowledge of basic science.
Type of Course	:	Theory
Course Domain	:	Core
Skills Imbibed	:	Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate Affective : Awareness, Respond, Value, Organize Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination.

Course Objectives:

1. This course helps the students to apply basic food science knowledge and get to know biochemical changes occurring during various processing and preservation techniques.
2. Introduce students to methods of preserving food to avoid losses.
3. Inform students on the technical mechanism of food preservation.
4. Introduce students to various methods of food processing and preservation.

Course Outcomes:

1. Understand the need for food processing.
2. Understand the various food processing techniques.
3. Understand the different preservation technique.
4. Identify the major and minor constituents of food and the chemical reactions in which they participate.
5. Describe the principles involved in the processing of the major types of food products.
6. Understand the principles of food spoilage and the ways to prevent.

	Hours
Unit I: Introduction Scope and Importance of food processing, National and International perspectives, Objectives and techniques of food preservation.	8
UNIT II Food preservation by low temperature Cooling, Refrigeration, freezing and freeze drying	8
UNIT III Food preservation by heating Blanching, pasteurization, sterilization, UHT processing, extrusion cooking of food.	8
UNIT IV Preservation by drying Processing and preservation by drying, concentration and evaporation-types of dryers and their suitability for different food products;	9
UNIT V Food preservation by Nonthermal method Chemical preservation, fermentation methods for food preservation, irradiation, membrane technology.	9
UNIT VI Recent methods for food preservation Pulsed electric field processing, high pressure processing, processing by using ultrasound, dielectric, ohmic and infrared heating etc.	10

Text Books :

1. Manoranjan Kalia and Sangita Sood, "Food preservation and processing", Kalyani Publishers. New Delhi 2004. 2.
2. Richardson, T. and Finley, J.W, "Chemical changes in food during processing". Macmillon Publishers. Canada 2003.

Reference Books :

1. Fellows, P. and Ellis H. 1990"Food processing technology: principles and practice", Wood Head Publishing Ltd.
2. Jelen, P. 1985. Introduction to Food Processing. Prentice Hall, Reston Virginia, USA.
3. Heldman, D.R. and Singh R. P.. Ed.IV 2009. Introduction to Food Engineering. Elsevier Pub
4. Desrosier, N.W, "The Technology of Food Preservation", CBS Publishers and Distributors, New Delhi 1996.

Class & Semester	:	**S. Y. B. Tech (Food Technology), Part II, Semester III**								
Course Title	:	**Principle of Food Preservation Laboratory**						*Course Code*:	:	**FT211L**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**50** **Nil**	**EPE** **EOE**	: :	**50** **Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**Third**						*Month*	:	**December 2016**

Pre-requisites : In order to complete the course studies successfully, it is important to have a good command of English and knowledge of basic science.

Type of Course : Practical

Course Domain : Core

Skills Imbibed : Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment, Internal Oral Examination and External Practical Examination

Course Objectives:

1. To impart knowledge and skills on processing and preservation methods for wholesome food products.
2. Preserve food by drying, freezing, water-bath canning and other methods.
3. Calculate the value of the food preserved.
4. Evaluate preserved products.

Course Outcomes:

1. To identify & select processing equipment and preservation methods appropriate for specific foods.
2. To describe the effects of preservation methods on the quality of food.
3. Food Product Development Exercise
4. To implement preservation methods that make use of heat/cold, drying, acid, added chemicals, controlled air, pressure, and high energy radiation.
5. To identify indirect approaches to food preservation: packaging, hygienic design, sanitation, GMP
6. To use SOPs and SSOPs during laboratory exercise.
7. To identify quality-loss mechanisms as biological, chemical, and physical.

Practical List :

1. Demonstration of various machineries used in processing
2. Demonstration of effect of blanching on quality of foods
3. Preservation of food by heat treatment- canning of fruits and vegetables
4. Preservation of food by sugar – preparation of jam
5. Preservation of food by salt – pickle
6. Preservation of food by chemicals – squash/ketchup/cordial
7. Drying of pineapple slices, apple slices in cabinet drier
8. Drying of green leafy vegetables
9. Drying of foods using freeze-drying process
10. Food preservation by maintaing anaerobic condition
11. Osmotic dehydration of fruit, canning of fruits and vegetables
12. Demonstration of preserving foods under cold v/s freezing process
13. Visit to canning or food processing Industry

Lab Manual :

1. Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Reference Books :

1. Fellows, P. and Ellis H. 1990"Food processing technology: principles and practice", Wood Head Publishing Ltd.
2. Jelen, P. 1985. Introduction to Food Processing. Prentice Hall, Reston Virginia, USA.
3. Heldman, D.R. and Singh R. P.. Ed.IV 2009. Introduction to Food Engineering. Elsevier Pub
4. Desrosier, N.W, "The Technology of Food Preservation", CBS Publishers and Distributors, New Delhi 1996.

Class & Semester	:	**S. Y. B.Tech (Food Technology) Part II, Sem III**						
Course Title	:	**Engineering Mathematics-III**				*Course Code*:	:	**FT212**
Teaching Scheme (Hours)	:	**Lectures= 3 hours/weeks** **=3 x 13 weeks= 39 hrs minimum** **Tutorial= 01 hrs /week** **=3 x 13 weeks= 13 hrs minimum** **Practical= 00 hrs /week**				*Total Credits*	:	***03+ 01+ 00 =04***
Evaluation Scheme (Marks)	:	**CIE = 50** **SEE = 50**	**IPE=00** **IOE=50** **EPE=00**	**:** **:** **:**	**Grand Total= 100**	*Duration of SEE*	*:*	**3 hrs**
Revision:	:	**Third**				*Month*	:	**December 2016**

Pre-requisites	**:**	Engineering Mathematics-I and Engineering Mathematics-II
Type of Course	**:**	Theory
Course Domain	**:**	**Core**
Skills Imbibed	**:**	Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate Affective : Awareness, Respond, Value, Organize Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination (SEE)

Course Objectives:

1. To describe solution of LDE and its applications.
2. To introduce Laplace Transform.

3. To introduce Partial Differential Equations and its Applications.
4. To introduce Probability and its Applications.
5. To explain Vector Differentiation and Vector Integration
6. The student must be able to formulate a mathematical model of a real life and engineering problem, solve and interpret the solution in real world.

Course Outcomes:

At the end of course student will able to

1. Solve Linear Differential Equations and apply them to realistic problems.
2. Solve Partial Differential Equations for solving problems in Food Engineering.
3. Understand Application of Laplace transform and Probability in Process Instrumentation Dynamics and Control.
4. Apply knowledge of Vector Calculus to solve engineering problems.

Curriculum Content	Hours
Unit: I Linear Differential Equations: Linear Differential Equations with constant coefficients, Homogenous Linear differential equations, method of variation of parameters	07
Unit: II Laplace Transform: Definition, properties of Laplace transforms, transforms of derivatives, transforms of integral, Inverse Laplace transforms, Convolution theorem. Applications to initial value boundary problems, Heaviside Unit step function, Diracdelta function, Periodic function.	07
Unit: III Partial differential equations: Four standard forms of partial differential equations of first order.	06
Unit: IV Application of Partial differential Equations Classification of PDE, Solution of Wave Equation, One dimensional heat equation and two dimensional Laplace equation by the method of separation of variables, use of Fourier series.	06
Unit :V Probability: Random variable, Probability mass function and probability density function, Binomial, Poisson and Normal distributions.	06
Unit : VI Vector Calculus: Vector Differentiation: Differentiation of vectors, Gradient of scalar point function, Directional derivative, Divergence of vector point function, Curl of a vector point function. Irrotational and solenoidal vector field. Vector Integration: The line integral, Surface integral, volume integral, Gauss's	07

Divergence theorem, Stoke's theorem, Green's theorem (Without proof).

Suggested list of Tutorials/Assignments-

1. To find solution of LDE with constant coefficients
2. Applications of LDE
3. Laplace Transform
4. Partial Differential Equations
5. Applications Of PDE
6. Probability
7. Vector differentiation
8. Vector Integration

General Instructions:

1. Batch wise tutorials are to be conducted. The number of students per batch should be as per the practical batches.
2. Students must be encouraged to solve engineering mathematics problems using different software's in tutorial class only.
3. Each Student has to write at least 6 assignments on entire syllabus.

Text Books :

1. Erwin Kreyszig, "Advanced Engineering Mathematics (7th Edition)", Wiley Eastern Ltd., Bombay.

Reference Books :

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publications, New Delhi.
2. C.R.Wylie, "Advanced Engineering Mathematics", McGraw Hill Publication, New Delhi.
3. Merle C. Potter, "Advanced Engineering Mathematics", OXFORD University Press, 3rd Edition
4. P. N. Wartikar and J. N. Wartikar, "A Text Book of Engineering Mathematics (Volume-I ,II & II)", Pune Vidyarthi Griha Prakashan, Pune.
5. Shanti Narayan, "Differential Calculus" S. Chand and company, New Delhi.
6. S. S. Sastry, "Engineering Mathematics (Volume-I)", Prentice Hall Publication, New Delhi.
7. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill.
8. M. D. Greenberg, "Advanced Engineering Mathematics", Pearson Education.
9. H. K. Das, "Advanced Engineering Mathematics", S. Chand Publication.

Class & Semester	:	**S. Y. B. Tech (Food Technology) Part II, Semester III**					
Course Title	:	**Food Microbiology**			*Course Code*:		**FT 213**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks= 52 hours minimum** **Tutorial= 0 hour/week** **Practical= 02 hours/week**			*Total Credits*	:	**04+01 =05**
Evaluation Scheme (Marks)	:	**CIE = 50** **SEE = 50**	**IPE=Nil** **IOE=Nil** **EPE= 50**	: : :	**Grand Total=150**	*Duration of SEE* :	**3 hours**
Revision:	:	**Third**			*Month*	:	**December 2016**

Pre-requisites	**:**	In order to complete the course studies successfully, it is important to have a good command of English and basic knowledge of general microbiology
Type of Course	**:**	Theory
Course Domain	**:**	Core
Skills Imbibed	**:**	Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate Affective : Awareness, Respond, Value, Organize Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments

2. Semester End Examination.

Course Objectives:

On completion of the course the student are expected to

1. Be able to understand and identify the various microbes associated with foods and food groups.
2. Be able to understand and identify the role of this microbe in food spoilage, food preservation.
3. Understand the role of pathogens in food borne infections.
4. Understand the method used to detect pathogens in foods.

Course Outcomes:

1. Better understanding of various microbes associated with food and food groups.
2. Familiarize the role of microbes in food spoilage and food preservation.
3. Obtain Knowledge in methods to detect pathogens in food.
4. Describe the beneficial role of microorganisms in fermented foods and in food processing.
5. Utilize laboratory techniques to detect, quantify, and identify microorganisms in foods.
6. Acquire, discover, and apply the theories and principles of food microbiology in practical, real-world situations and problems.
7. Develop success skills in communication, critical thinking, interaction, information acquisition and interpretation, organization, professionalism, leadership, auto-didactics and life-long-learning.

	Hours
UNIT I Introduction to microbiology Evaluation & Scope of microbiology. General Microbiology, Cultural characteristics and reproduction of bacteria, yeasts, fungi, actinomycetes, algae, protozoa and rickettsia. Genetic recombination, transduction, transformation and bacterial conjugation, mutation & mutagenesis.	**10**
UNIT II Growth curve Physical & Chemical factors affecting growth and destruction of micro-organisms, growth curve.	**8**
UNIT III Viruses Structure & reproduction with particular reference to food born viruses.	**8**
UNIT IV Food Preservation Principles of Food Preservation, Methods of preservations, Drying, Dehydration, Freezing, Chemical Preservation, Mechanical destruction & Maintenance of anaerobic condition.	**10**
UNIT V Spoilage of Food Microbial Spoilage & cereals & cereal products, milk & milk products, fruit & Vegetable products, meat, poultry egg & fish products, sugar & Sugar Products.	**10**

UNIT VI Food poisoning Intoxication, Food borne illness	**6**

Text Books	**:**	

1. Prescott Dunn, " Industrial Microbiology" CBS Publisher
2. Purohit S. S. "Microbiology fundamentals and applications" Edition, 6. Publisher, Agrobios, 2003

Reference Books	**:**	

1. Frazier, W.C., and Westhoff, D.C. 1988. Food Microbiology, 4th ed. McGraw-Hill, New York.
2. Jay, J. M. 2000. Modern Food Microbiology. 6th ed. Chapman & Hall. New York, N.Y.
3. Mossel, D.A.A., Corry, J. E. L., Struijk, C. B., and Baird, R. M. 1995. Essentials of the Microbiology of Foods. John Wiley & Sons. New York, NY.

Class & Semester	:	**S. Y. B. Tech (Food Technology), Part II, Semester III**									
Course Title	:	**Food Microbiology Laboratory**						*Course Code*:	:	**FT 212L**	
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**1**	
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**Nil** **Nil**	**EPE** **EOE**	: :	**50** **Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**	
Revision:	:	**Third**						*Month*	:	**December 2016**	

Pre-requisites : Must be capable of safe lab work with cultures.

Type of Course : Practical

Course Domain : Core

Skills Imbibed : Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment, Internal Oral Examination and External Practical Examination

Course Objectives:

1. Enable students to understand the methods of isolating and characterizing various microbes associated with foods and food groups.
2. Enable students to understand and use various microbiological techniques for the study of foods.
3. Understand the methods used to detect pathogens in foods.

Course Outcomes:

1. Complete understanding of isolation, characterization of various microbes associated with foods and food groups.
2. Familiarize with microbiological techniques for the study of foods.
3. Better understanding of methods to detect pathogens in foods.
4. Students should be able to significance and activities of microorganisms in food.
5. Students should be able to microbiology of different types of food commodities.
6. Students should be able to : Describe the characteristics of food borne, waterborne and spoilage microorganisms, and methods for their isolation, detection and identification.

Practical List :

1. Study of instruments used for microbiology, cleaning and sterilization of glassware.
2. Preparation of media, techniques of incubation,
3. Staining methods (monochrome staining, gram staining, flagella staining, capsule staining and endo spore staining),
4. Quantification of Microbes: Sampling and Serial Dilution; Bacterial count in food products– TVC
5. Pure culture techniques (streak plate/pour plate), growth curve.
6. Isolation of molds from foods, microbial examination of cereal and cereal products.
7. Microbial examination of fruits and vegetables.
8. Microbial examination of milk and milk products, microbial examination of sugar, salt and spices.
9. Microbial examination of meat and meat products.
10. Microbial examination of water.
11. Microbial examination of fermented food.
12. Enumeration & Isolation of *Staphylococci* from ready to eat street foods
13. Effect of cleaning and disinfection on microbial load Effect of cleaning and disinfection on microbial load.

Lab Manual :

1. I Harrigan, W.F. “Laboratory Methods in Food Microbiology” Academic Press, 2011.

Reference Books :

1. Frazier, W.C., and Westhoff, D.C. 1988. Food Microbiology, 4th ed. McGraw-Hill, New York.
2. Jay, J. M. 2000. Modern Food Microbiology. 6th ed. Chapman & Hall. New York, N.Y.
3. Mossel, D.A.A., Corry, J. E. L., Struijk, C. B., and Baird, R. M. 1995. Essentials of the Microbiology of Foods. John Wiley & Sons. New York, NY.
4. Prescott Dunn, “ Industrial Microbiology” CBS Publisher
5. Purohit S. S. “Microbiology fundamentals and applications” Edition, 6. Publisher, Agrobios, 2003

Class & Semester	:	**S. Y. B.Tech (Food Technology) Part II, Semester III**					
Course Title	:	**FOOD CHEMISTRY**			*Course Code*:	:	**FT 214**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks= 52 hours minimum Tutorial= 0 hour/week Practical= 02 hours/week**			*Total Credits*	:	**04+01 =05**
Evaluation Scheme (Marks)	:	**CIE = 50 SEE = 50**	**IPE=Nil : IOE=Nil : EPE= 50 :**	**Grand Total=150**	*Duration of SEE*	*:*	**3 hours**
Revision:	:	**Third**			*Month*	:	**December 2016**

Pre-requisites	**:**	In order to complete the course studies successfully, it is important to have a good command on English and Basic knowledge of chemistry
Type of Course	**:**	Theory
Course Domain	**:**	Core
Skills Imbibed	**:**	Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate Affective : Awareness, Respond, Value, Organize Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination.

Course Objectives:

To enable the students to understand

1. The chemistry underlying the properties and reactions of various food components and their role in human nutrition
2. The chemistry of food to control a chemical and biochemical reaction that

influence food quality
3. The principles behind analytical techniques associated with food components and related problems
4. The role of food nutrients and its use for preservation of food (concepts emphasized in a laboratory experiment)
5. The function of food enzymes; effect of pH, temperature, water activity, ionic strength; applications of chymosin and amylases as food processing aids
6. The functional role of food components and their interaction in food products in terms of colour, flavour, texture and nutrient composition

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Recognize, distinguish and describe the molecular structures and properties of major food components.
2. Describe major food chemical reactions and their mechanisms.
3. Relate key chemical groups on food molecules to their role in common reaction mechanisms of importance in foods.
4. Analyze and predict how the composition of foods with regard to carbohydrates, lipids, protein and water influence their stability.
5. Examine and assess implications for food formulations for achieving objectives of food quality and palatability, cost and healthfulness.
6. Analyze and interpret the role of food chemistry in practical food situations.
7. Assess and evaluate the implications of food chemistry principles for current topics of importance in the food industry and for consumers.

	Hours
UNIT I Introduction to Food Chemistry Importance, Scope and Recent Development	**5**
UNIT II Water Role and types of water in foods, functional properties of water activity and sorption isotherm.	**7**
UNIT III Carbohydrate Chemistry of carbohydrates (Classification, Structure and Sources and properties), Functional Characteristics of carbohydrates and chemical changes, modification of carbohydrate.	**9**
UNIT IV Protein Chemistry of proteins (Classification, Structure and Sources and properties) Functional characteristics of protein and chemical changes in protein, modification of protein, enzymatic and non-enzymatic browning	**9**

UNIT V Lipids **10**

Chemistry of lipids (Classification, Structure and Sources and properties) Functional characteristics of
lipids and chemical changes in lipids, hydrogenation of fat.

12

UNIT VI Vitamins & Minerals

Vitamins: Classification of Vitamins, Structure of Vitamins, Sources of Vitamins, properties, effect of processing on Vitamins and deficiency problems of Vitamins.
Minerals : Classification, Structure, Sources and properties of minerals, effect of processing on of Minerals and deficiency problems of minerals.

Text Books :

1. Belitz H.-D, Grosch W and Schieberle P. Food Chemistry, 3rd Revised Edition, Springer-Verlag, 2004.
2. Meyer, Lillian Hoagland "Food Chemistry". CBS Publishers, 1987.
3. deMan, John M. "Principles of Food Chemistry". 3rd Edition, Springer, 1999.
4. Chopra, H.K. and P.S. Panesar. "Food Chemistry". Narosa, 2010.

Reference Books :

1. Belitz, H.D.. Grosch "Food Chemistry" 3rd revised ed. Springer Berlin, Heidelberg, New York.
2. O.R.Fennema "Food Chemistry" Marcel Dekker, Inc., New York
3. Mayer Liiiian H. "Food Chemistry" AVI Publishing Co., Westport, CT, 1978, 3rd ed
4. Introductory foods, Bennion M. and Hughes, D. (1975), Macmillan publishing Co., New York.
5. Food facts and principles, Sakuntala Manay and shadaksaraswamy, M (1987) Allied Publishers,
New Delhi.

Class & Semester	:	**S. Y. B. Tech (Food Technology), Part II, Semester III**								
Course Title	:	**FOOD CHEMISTRY LABORATORY**						*Course Code*:	:	**FT 213L**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**Nil** **Nil**	**EPE** **EOE**	: :	**50** **Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**Third**						*Month*	:	**December 2016**

Pre-requisites **:** In order to complete the course studies successfully, it is important to have a good command on English and subject proficiency.

Type of Course **:** Practical

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment, Internal Oral Examination and External Practical Examination

Course Objectives:

1. To impart practical knowledge and skills.
2. To study and understand the physical and chemical properties of foods
3. To study and calculate the value of food components
4. To study the basic nutrients and their requirements for human nutrition
5. Evaluate new product development.
6. Demonstrate practical proficiency in a food analysis laboratory.

Course Outcomes:

1. Better understanding of physical and chemical properties of food.
2. Familiarize in precipitation of casein and gellation of starch.
3. Laboratory exercises on specific analytical problems.

4. Understand proper use of methods of analytical analyses
5. Understand various methodologies for analysis of various components in foods
6. Understand how government regulations affect analysis of components in food.

Practical List **:**

1. Determination of moisture content.
2. Qualitative test for carbohydrates, Qualitative tests for amino acid, Qualitative tests for lipid.
3. Estimation of crude fat.
4. Estimation of crude protein by microkjldhal method.
5. Determination of reducing sugar by filling method.
6. Determination of total sugar by filling method.
7. Determination of acid value, saponification volume and iodine number of fats.
8. Determination of Ca , Iron , phosphorus and Ash content of food .
9. Estimation of Viscosity of foods.
10. Properties of solutions- sugar & salt
11. Preparation of emulsions.
12. Foaming properties of proteins.
13. Iso-electric precipitation of casein, Effect of rennin on milk proteins.

Lab Manual **:**

1. Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Reference Books **:**

1. Belitz, H.D.. Grosch "Food Chemistry" 3rd revised ed. Springer Berlin, Heidelberg, New York.
2. O.R.Fennema "Food Chemistry" Marcel Dekker, Inc., New York
3. Mayer Liiiian H. "Food Chemistry" AVI Publishing Co., Westport, CT, 1978, 3rd ed
4. Introductory foods, Bennion M. and Hughes, D. (1975), Macmillan publishing Co., New York.
5. Food facts and principles, Sakuntala Manay and shadaksaraswamy, M (1987) Allied Publishers,New Delhi.

<table>
<tr><td>Class & Semester</td><td>:</td><td colspan="5">S. Y. B. Tech (Food Technology) Part II, Semester III</td></tr>
<tr><td>Course Title</td><td>:</td><td colspan="2">Heat Transfer</td><td colspan="2">Course Code:</td><td>FT215</td></tr>
<tr><td rowspan="3">Teaching Scheme (Hours)</td><td rowspan="3">:</td><td colspan="2">Lectures
3 hours/weeks=3 x 13 weeks= 39 hours minimum</td><td rowspan="3">Total Credits</td><td rowspan="3">:</td><td rowspan="3">03+01 =04</td></tr>
<tr><td colspan="2">Tutorial= 00 hour/week</td></tr>
<tr><td colspan="2">Practical= 02 hours/week</td></tr>
<tr><td>Evaluation Scheme (Marks)</td><td>:</td><td>CIE = 50
SEE = 50</td><td>IPE=50
IOE=Nil
EPE= Nil</td><td>:
:
:</td><td>Grand Total=150</td><td>Duration of SEE</td><td>:</td><td>3 hours</td></tr>
<tr><td>Revision:</td><td>:</td><td colspan="3">Third</td><td>Month</td><td>:</td><td>December 2016</td></tr>
</table>

Pre-requisites : In order to complete the course studies successfully, it is important to have a good command of English. Other Pre-requisites include Engineering Physics, Chemistry-I, and Fluid Flow Operations.

Type of Course : Theory

Course Domain : Core

Skills Imbibed : Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate
Affective : Awareness, Respond, Value, Organize Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination.

Course Objectives:

1. To introduce the course with respect to importance of professional ethics, engineering design, communications and teamwork, use of modern tools and life-long learning and further to understand, identify and explain three modes of heat transfer namely conduction, convection and radiation.
2. To formulate the equations for calculating heat flux for conduction, convection, radiation, boiling, condensation.
3. To apply knowledge and information gained on design and analysis of Heat transfer systems, further to interpret and select the type of heat transfer system and to evaluate heat transfer rates.
4. To understand phase-change phenomena and latent heat of vaporization, including free convective, nucleate and film boiling, as well as drop wise and film condensation.
5. To understand, distinguish and describe different types of evaporators further to assess, select evaporators for specific duty and to improve their performance through heat transfer knowledge

6. To construct the governing equations for designing and analyzing heat transfer equipment and to further make selection of heat exchangers also to think of possible rearranging or redesign of the heat transfer systems to save energy.

Course Outcomes:

1. Learn fundamentals of heat transfer
2. Identify principles of different modes of heat transfer
3. Design and analyze heat transfer operations and equipment
4. Compare performances and select type of heat transfer equipment
5. Learn industrial applications of heat exchangers and evaporators
6. Solve heat transfer problems of different difficulty levels through tutorials
7. Complete design of a heat exchanger through assignments/ group task
8. Understand importance of heat transfer with respect to societal aspects, environmental concerns, professional ethics, team work, interdisciplinary tasks

Curriculum Content

Hours

Unit I: Introduction Heat Transfer

Introduction to three modes of heat transfer: Conduction, convection & radiation. General laws of heat transfer. **4**

Unit II: Conduction:

Fourier's law, Thermal Conductivity- its variation with temperature and Pressure and its relationship with electrical conductivity. Heat transfer through composite walls and cylinders. Unsteady state heat transfer through some important shapes. Different types of insulating materials, general properties & application of insulators. **7**

Unit III: Natural and Forced Convection **7**

Natural convection from vertical plates and horizontal cylinders. Forced convection: In laminar flow-Heat transfer in plate and tubes. In turbulent flow-Empirical equations for individual coefficients: inside tubes, outside tubes, outside bundle of tubes, flow past spheres. Significance of Prandtl number, Nusselt number, Grashof number, Graetz number and Peclet number etc. Correction for tube length. Corrections for heating and cooling the fluid. Various analogies between heat & momentum transfer.

Unit IV: Radiation **7**

Radiation laws like Stefan Boltzmann's law, Kirchhoff's law, Wien's law, Plank's law etc. Black body, Grey body. Transmissivity, Absorptivity, Reflectivity, Emissivity of black bodies and gray bodies. Application of thermal radiation: Radiation Transfer between surfaces. Radiation through semi transparent materials. **7**

Unit V: Heat transfer with phase change

Boiling of liquids, Pool boiling curve, different types of pool boiling, Condensation of vapor, film wise and drop wise condensation, weighted LMTD & Overall Heat transfer Coefficient for de superheating & sub cooling. **7**

Unit VI: Heat Exchange equipment

Double pipe heat exchangers. Individual and overall heat transfer coefficient, LMTD, Variable

overall Heat transfer coefficient, fouling factors, Shell & tube heat exchangers, LMTD correction factors, Extended surface heat exchangers, Fin efficiency and fin effectiveness.

Text Books **:**

"A Heat Transfer Textbook", John H. Lienhard, Phlogiston Press, Cambridge, Massachusetts, U.S.A. 4th Edition.

Reference Books **:**

1. "Heat Transmission", W. H. McAdams, McGraw Hill, 3rd Edition.
2. "Process Heat Transfer", D. Q. Kern, McGraw Hill, 1st Edition.
3. "Unit Operations of Chemical Engineering", McCabe W L, Smith J C, Harriott P, 7th Ed. McGraw Hill, 2005.
4. "Heat Transfer", J. P. Holman, McGraw Hill, Tenth Edition.
5. "Perry's Chemical Engineer's Handbook", Don W. Green, Robert H. Perry, McGraw-Hill: New York, 8th Edition.
6. "Handbook of Heat Transfer", Warren M. Rohsenow , James P. Hartnett, Young I. Cho, McGraw-Hill Education: New York,1998

Class & Semester	:	**S. Y. B. Tech (Food Technology), Part II, Semester III**									
Course Title	:	**Heat Transfer Laboratory**						*Course Code*:	:	**FT214L**	
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**1**	
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**50** **Nil**	**EPE** **EOE**	: :	**Nil** **Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**	
Revision:	:	**Third**						*Month*	:	**December 2016**	

Pre-requisites : Laboratory work in Engineering Physics, Chemistry-I and Fluid Flow Operations.

Type of Course : Practical

Course Domain : Core

Skills Imbibed : Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment, Internal Oral Examination and External Practical Examination

Course Objectives:

1. To allow budding food process engineers to understand fundamentals of some major heat transfer operations through experimental set ups.
2. To provide them hands on training on important heat transfer devices and to motivate them for team work.
3. To provide them exposure in the laboratory like a miniature process plant environment using steam and the other process utilities.
4. To develop skill of learners in safe handling of major heat transfer equipment/devices, in close observation of their operation, in developing analytical ability in correlating the performance of the devices with their operational conditions.

Course Outcomes:

1. Understanding fundamentals of some major Heat transfer operations through practical work.
2. Getting set for practical heat transfer operations.
3. Application of heat transfer design principles and be mechanic for heat transfer devices.
4. Building foundation for process intensification and be adapted to handle heat transfer operations.
5. Learning to work in group and imitate Standard Operating Procedure for practical work v.i.z. responding to the guide.
6. Motivation towards innovations for novel systems of heat transfer.

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Practical List

1. **Metal Rod Apparatus:** To understand conduction heat transfer.
2. **Composite Wall Apparatus:** To understand conduction heat transfer through composite system.
3. **Sphere in Sphere Apparatus:** To study heat flow through a sphere and to estimate thermal conducting of powdered insulating material using the set up.
4. **Thermal Conductivity of liquid Apparatus:** To estimate thermal conductivity of liquid.
5. **Heat Transfer through lagged pipe Apparatus:** To analyze problems involving steady state heat conduction in simple geometries with lagged material
6. **Unsteady state heat transfer Apparatus:** To estimate the film heat transfer coefficient between the medium in which body is heated.
7. **Heat Transfer through Agitated vessels Apparatus:** To understand heat transfer during agitation and mixing.
8. **Natural Convection Apparatus:** To understand fundamentals of convective heat transfer process and to evaluate heat transfer coefficients for natural convection.
9. **Forced Convection Apparatus:** To understand fundamentals of convective heat transfer process and to evaluate heat transfer coefficients for forced convection.
10. **Stefan Boltzmann's Apparatus:** To understand radiation heat transfer through verification of the basic law of radiation.
11. **Emissivity Measurement Apparatus:** To understand radiation heat transfer and to evaluate emissivity of a material.
12. **Critical Heat Flux apparatus:** To study different types boiling and to draw boiling curve.
13. **Study of Heat Exchangers:** Analyze heat exchanger performance of different types of heat exchangers by using the method of log mean temperature difference or by method of heat exchanger effectiveness.
    i. Shell & Tube Heat Exchanger ii. Double pipe Heat Exchanger iii. Finned tube heat Exchanger
    iv. Plate Type Heat Exchanger v. Fluidized Bed Heat Transfer Unit

Lab Manual **:**

1. Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Reference **:**

Books

1. "Process Heat Transfer", D. Q. Kern, McGraw-Hill, 1st Edition.
2. "Heat Transfer: Principles and Applications", Binay K. Dutta, Prentice-Hall of India, 1st Edition.
3. "Heat Transmission", William H. Mc Adams, McGraw-Hill, 3rd Edition.

Class & Semester	:	**S. Y. B.Tech (Food Technology) Part II, Semester III**					
Course Title	:	**Programming practices for Food Technologists**			*Course Code*:	:	**FT215L**
Teaching Scheme (Hours)	:	**Theory** **1 hours/weeks= 1 x 13 weeks= 13 hrs minimum** **Tutorial= Nil** **Practical** **2 hours/weeks= 2 x 13 weeks= 26 hrs minimum**			*Total Credits*	:	**01+ 00 +01 =02**
Evaluation Scheme (Marks)	:	**CIE = Nil** **SEE = Nil**	**IPE=50** **IOE=Nil** **EPE=Nil**	: : :	**Grand Total=50**	*Duration of IPE*	: **2 hours**
Revision:	:	**Third**			*Month*	:	**December 2016**

Pre-requisites	**:**	In order to complete the course studies successfully, it is important to have a good command of English. The learners ought to be sound in the basic concepts of basic computer programmes
Type of Course	**:**	Practical
Course Domain	**:**	Core
Skills Imbibed	**:**	Cognitive: Recall, Understand, Apply, Affective : Awareness Psychomotor: manipulation

Course Assessment Methods:

Student is evaluated during Internal Practical Examination.

Course Objectives:

1. To Identify and describe the purpose of various components of the VB integrated development environment (IDE).
2. To understand and apply Arithmetic operators, Logical operators and relational operators to build small application using Visual Basic.
3. To understand the concept of strings and their use in built-in functions.
4. To construct conditional and repetition statements and other control structures.
5. To Create Windows applications that store and access data to and from files and databases.

Course Outcomes:

1. Students will be able to Design, create, build, and debug Visual Basic applications.
2. Students will be able to Explore Visual Basic's Integrated Development environment (IDE).
3. Students will be able to implement syntax rules in Visual Basic programs.
4. Explain variables and data types used in program development.
5. Apply arithmetic operations for displaying numeric output.
6. Apply procedures, sub-procedures, and functions to create manageable code.

Curriculum Content	Hours
Unit:I Introduction to Visual Basic Programming Menu bar, Tools bar, Project explorer, Tool box, Properties windows, Form Code, Controls: Command Buttons, Label, Textbox, Pointers, Picture box, frame, Naming Controls, Properties for controls: Height, Width, Left, Top, Font, Forecolor, Backcolor, Name, Caption, Text, and Visible, Events, Saving Visual Basic Project, Examples: Food Engineering Applications	02
Unit:II Mathematics Arithmetic Operations: +, , *, /, \, mod, ^. (Using Simple Example for each Operation, Logical Operations. AND, OR, NOT. And the Truth Table for each Operation, (Using Simple Example for each Operation), Relational Operation: >, <, >=, <=, <>, =, String Concatenation (&),Operation Precedence. For all arithmetic, logical, relational operators, Print statement and Formatting, Illustrate (colon, comma, and semicolon), Examples: Food Engineering Applications	03
Unit:III Built in Functions Builtin math functions: Abs(x), Int(x), Rnd(x), sgn(x), sqr(x), str(x), val(x), round(x, n), CInt(x), Fix(x),String Functions, InputBox, MsgBox, Examples: Food Engineering Applications.	02

Unit:IV Selection Structure/ Reputation Structure Single Selection: If/Then structure, Double Selection: If/Then/Else structure, Nested If/Then/Else structure, Select Case Multiple Selection Structure, For ... Next Loop, While ... Wend, Do .... While ... Loop, Do ... Loop Until, Exit Do, Exit For, Examples: Food Engineering Applications	02
Unit :V Variables Data Types: Boolean, Integer, Long, Single, Double, String, Valid Naming of Variables, Initial Value for each Type of the Variables (Initial Value for each Data Type), Size of each Variable Type in Bytes, How to Declare Variables. (Dim statement), Using: Dim variablename As Data type, Using Suffix: Integer, Long, Single, Double, String, Constant Variable, Examples: Food Engineering Applications.	02
Unit : VI Database Accessing Database,Data Control DAO, ADO, RDO, Visual Basic and Access Connectivity, Examples: Food Engineering Applications	02
Practicals: 1.To study VB environment 2. To design and develop form to perform mathematical operations. 3. To study date, string and math functions. 4. To design the form using image control and scroll bars. 5. To design menu editor as text editor. 6. To design stop watch. 7. To design form using file controls, OLE control. 8. To design form using Access Database 9-13 To build a small Food Engineering applications.	

Text Books	:	

1. "Programming with Microsoft Visual Basic 2012", Diane Zak, Course Technology, Cengage Learning, 6th edition.

Reference Books	:	

1) "Mastering Microsoft Visual Basic 2008", Evangelos Petroutsos, Wiley publishing,Inc., 1st edition.
2) "Visual Basic 6: The Complete Reference", Noel Jerke, Osborne/McGraw- Hill
3) E-Book: "Microsoft Visual Basic 2010", Michael Halvorson

Class & Semester	:	**S. Y. B.Tech (Food Technology)Part II, Semester III**					
Course Title	:	**Environmental Studies**			*Course Code*:	:	**HS211**
Teaching Scheme (Hours)	:	**Lectures 2 hours/weeks = 2 x 13 weeks= 26 hours** **Tutorial= 00 hour/week** **Practical= 00 hours/week**			*Total Credits*	:	**Nil**
Evaluation Scheme (Marks)	:	**CIE = 00** **SEE = 70**	**IPE=30**	:	**Grand Total=100**	*Duration of SEE*	:	**2 hours** (SEE at the yearend)
Revision:	:	**Third**				*Month*	:	**December 2016**

Pre-requisites	**:**	Engineering Chemistry
Type of Course	**:**	Theory and field work
Course Domain	**:**	Humanities and Applied Science
Skills Imbibed	**:**	Affective : Awareness, Respond, Value, Organize Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Project / Field work
2. Semester End Examination.

Course Objectives:

1. To recall fundamental physical and biological principles those govern natural processes.
2. To understand the importance of ecological balance for sustainable development.
3. To Understanding the impacts of developmental activities and mitigation measures and to further understand the environmental policies and regulations.
4. To identify the complex relationships between scientific approaches to environmental issues and political, social, economic, and ethical perspectives on the environment.
5. To collect and interpret scientific data in both field and laboratory settings.
6. To integrate and apply perspectives from across the natural sciences, social sciences, and the humanities in the context of complex environmental problems.
7. To communicate scientific information to both professional and lay audiences.

Course Outcomes:

1. Develop an understanding of different natural resources including renewable resources.
2. Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
3. Aware of important acts and laws in respect of environment.

4. Demonstrate critical thinking skills in relation to environmental affairs
5. Develop an understanding of environmental pollutions and hazards due to engineering/technological activities and general measures to control them.
6. Demonstrate knowledge and application of communication skills and the ability to write effectively in a variety of environmental contexts.
7. Demonstrate an ability to integrate the many disciplines and fields that intersect with environmental concerns.
8. Demonstrate an appreciation for need for sustainable development and role of science.

Curriculum Content	Hours
UNIT I: Significance of environmental studies Multidisciplinary nature of environmental studies Need for public awareness. a) Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Usage and exploitation, environmental effects of extracting and using mineral resources. d) Food resources: World food problem, changes caused by agriculture effects of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. g) Role of an individual in conservation of natural resources. h) Equitable use of resources for sustainable lifestyle.	**04**
UNIT II: Ecosystems Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following Ecosystem: - a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	**04**
UNIT III: Biodiversity and its Conservation Introduction – Definition: genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.; Biodiversity at global, National and local levels.; India as a mega-diversity nation; Western Ghats as a bio-diversity region; Hot-spots of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	**04**
UNIT IV: Environmental Pollution Definition: Causes, effects and control measures of: a) Air pollution, b) Water pollution, c) Soil pollution, d) Marine pollution, e) Noise pollution, f) Thermal pollution, g) Nuclear hazards • Solid waste Management: Causes, effects and control measures of urban and industrial wastes. • Role of an individual in prevention of pollution.• Pollution case studies• Disaster management: Floods, earthquake, cyclone and landslides. Tsunami	**04**
UNIT V: Social Issues and the Environment From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its problems and concerns; Environmental ethics: Issue and possible solutions; Climate change, Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust; Wasteland reclamation; Consumerism and	**05**

waste products. **UNIT VI: Environmental Protection** Environment Protection Act.; Air (Prevention and Control of Pollution) Act.; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Population Growth and Human Health, Human Rights. ;Field Work--Visit to a local area to document environmental assets river/forest/grassland/hill/mountain or Visit to a local polluted site –urban/rural/Industrial/Agricultural or Study of common plants, insects, birds or Study of simple ecosystems-ponds, river, hill slopes, etc.	**05**

Text Books	**:**	

1. Agarwal, K. C. 2001, Environmental Biology, Nidi Publ. Ltd., Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad, 380013, India, Email:mapin@icenet.net (R)
3. Brunner R. C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p

Reference Books	**:**	

1. Clark R. S., Marine Pollution, Clanderson Press Oxford (TB) Pg No. 6
2. Cunningham, W. P. Cooper, T. H. Gorhani, E. & Hepworth, M. T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
3. De A. K., Environmental Chemistry, Wiley Eastern Ltd.
4. Down to Earth, Centre for Science and Environment (R)
5. Gleick, H., 1993, Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press 473p
6. Hawkins R. e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
7. Heywood, V. H. & Watson, R. T. 1995, Global Biodiversity Assessment, Cambridge Univ. Press 1140p.
8. Jadhav, H. & Bhosale, V. M. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi 284p.
9. Mckinney, M. L. & Schocl. R. M. 1996, Environmental Science Systems & Solutions, Web enhanced edition
10. Mhskar A. K., Matter Hazardous, Techno-Science Publications (TB)
11. Miller T. G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
12. Odum, E. P. 1971, Fundamentals of Ecology, W. B. Saunders Co. USA, 574p.
13. Rao M. N. & Datta, A. K. 1987, Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd.,
14. Sharma B. K., 2001, Environmental Chemistry, Goel Publ. House, Meerut
15. Survey of the Environment, The Hindu (M)
16. Townsend C., Harper, J. and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
17. Trivedi R. K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media (R)
18. Trivedi R. K. and P. K. Goel, Introduction to air pollution Techno-Science Publications (TB)
19. Wagner K. D., 1998, Environmental Management, W. B. Saunders Co. Philadelphia, USA.

(M) Magazine
(R) Reference
(TB) Textbook

20. Paryavaram Swhastra – Gholap T. N.
21. Paryavaram Shastra - Gharapure.
22. Paryavaran Vighyan - V. R. Ahirrao - Nirali Prakashan, Pune.
23. Paryavaram Shastra Parichay - Jay Kumar Magar Vidya Prakashan, Nagpur.
24. Desh Ka Paryavaran - Anupam Misra, Ganolai santi Pratisthan. New Delhi.

Class & Semester	:	**S. Y. B. Tech (Food Technology), Part II, Semester III**								
Course Title	:	**Soft Skills Development**						*Course Code*:	:	**HS212**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**Nil**
Evaluation Scheme (Marks)	:	**Assignments** **Viva voce**	: :	**50** **25**	**Written Test** **Grand Total**	: :	**25** **100**	*Duration of Exam*	:	**Not Applicable**
Revision:	:	**Third**						*Month*	:	**December 2016**

Pre-requisites	**:**	H.S.C level English Language Competency
Type of Course	**:**	Audit Course at institute level
Course Domain	**:**	Humanity and Arts
Skills Imbibed	**:**	Cognitive: Understand, Predicting Situation, Comprehend, Affective : Receive, Listen, Respond, Showing self reliance, Organize Psychomotor: Imitation, adaptation, articulation, origination

Course Assessment Methods:

The students will be given five assignments each for 10 marks. At the end of the course, there will be a written test of 25 marks and a viva voce of 25 marks. There will be assessment for a total of 100 marks. Based on the marks obtained, they will be awarded with a grade similar to other credit courses. Though it is an audit course, obtaining passing grade is essential.

Course Objectives:

1. To develop effective communication skills (spoken and written).
2. To develop effective presentation skills.
3. To compete successfully in the business environment.
4. To generate ability in the learners to put their domain knowledge into effective practice.
5. To make the students self-confident individuals by mastering inter-personal skills, team management skills, and leadership skills.
6. To prepare the learners to take part effectively in various selection procedures adopted by the recruiters and to increase employment opportunities

Course Outcomes:

1. Students are able to expertise in self development, effective communication skills and interview skills
2. Understand how to handle situation and take decision
3. Equip to any sort of interviews particularly job interviews
4. Acquaintance with documentation skills
5. Become self reliant and responsible

6. Team build up, its development and management

Curriculum Content	Hours
Unit I : Self Development Self analysis, creativity, attitude, motivation, goal setting. Importance of career visioning and planning.	**02**
Unit II : Effective Communication Skills Importance of communication, Communication process, Elements of communication, Communication Types- verbal and non verbal, objectives of communication. Business Communication, current English usage, debates, language games, situational dialogues, precise writing, essay writing, presentations.	**06**
Unit III : Behavioral Skills **Psychological Tests:** Aptitude and personality assessment, suggestions for improvement, **Team Skills:** Team building and leadership, evolution of groups into teams, group dynamics, emergence of leadership, intra-group dynamics, inter-group dynamics, conflict management, inter dependency, assessment of team-based projects, **Time Management:** Pareto's Principle, Parkinson's Laws, Murphy's Laws, Law of Clutter, prioritization, goal setting, effective time management, **Interpersonal Skills:** Negotiations, listening skills, social skills, assertive skills, cross-cultural communications, **Leadership Skills:** Concepts of leadership, leadership styles, insights from great leaders.	**08**
Unit II : Documentation Report writing-Formal report, study tour report, project report, Writing proposal-solicited proposals and unsolicited proposals.	**03**
Unit III: Emotional Intelligence Emotional Brain, Nature of emotional intelligence, emotional intelligence applied windows of opportunity, emotional literacy.	**04**
Unit VI: Interview Skills Importance of Interview Skills, Resume Building, Group discussion and personal interview, Psychometric Test, actual career planning.	**03**
Text Book :	
1. Soft Skills, 2015, Career Development Centre, Green Pearl Publications.	
Reference Books :	
1. "*Seven Habits of Highly Effective Teens"*, Covey Sean, , New York, Fireside Publishers, 1998. 2. "*How to win Friends and Influence People"*, Carnegie Dale, New York: Simon & Schuster, 1998. 3. "*I am ok, You are ok* ",Thomas A Harris, New York-Harper and Row, 1972 4. "*Emotional Intelligence*", Daniel Goleman, Bantam Book, 2006 5. "Effective communication skill", MTD training & Ventus publishing ApS ISBN 978-87-7681-598-1.	

Class & Semester	:	**S. Y. B. Tech (Food Technology) Part II, Semester IV**					
Course Title	:	**Food Process Engineering-I**			*Course Code*:	:	**FT221**
Teaching Scheme (Hours)	:	**Lectures 3 hours/weeks=3 x 13 weeks= 39 hours minimum** **Tutorial =01 hours/week =1x13 weeks=13 hours minimum** **Practical= 02 hours/week**			*Total Credits*	:	**04+01 =05**
Evaluation Scheme (Marks)	:	**CIE =50** **SEE = 50**	**IPE=Nil** **IOE=50** **EOE= 50**	: : :	**Grand Total=200**	*Duration of SEE*	*:*	**3 hours**
Revision:	:	**Third**				*Month*	:	**December 2016**

Pre-requisites	**:**	In order to complete the course studies successfully, it is important to have a good knowledge of applied mathematics and basic science
Type of Course	**:**	Theory
Course Domain	**:**	Core
Skills Imbibed	**:**	Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate Affective : Awareness, Respond, Value, Organize Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination.

Course Objectives:

1. To understand units and dimensions, ability to solve engineering problems related to food processing, and familiarization with some food processing unit operations.
2. To understand the principle involved in food processing engineering
3. To enable the students to solve problems in food processing industries
4. To impart knowledge of the principles of unit operations and its importance in food Industries.
5. To understand the principle and working of various processing equipments
6. To know the methods of product recovery

Course Outcomes:

1. Understanding of all unit operations and its applications in food processing
2. Calculate the effectiveness and the amount of heat exchanged in heat exchangers under various flow conditions and determination of the ideal conditions for heat transfer
3. Calculate the amount of mass going into the system and coming out of the system for the processing of products
4. Knowledge of the food processing equipments used for the different unit operations.
5. Describe how various unit operations work individually and together.
6. Understanding of the principles in solving the problems of food processing industries

	Hrs
Unit I: Introduction and Size Reduction Introduction: Unit operations in food engineering, Mass and energy balance Size Reduction : Particle size analysis, equipments, application to food industries	**8**
Unit II: Mixing Basic theory of solid – solid mixing, liquid- liquid mixing, equipments, applications to food industries.	**8**
Unit III: Filtration and Centrifugation Filtration :Theory of filtration, industrial filters, applications to food industries Centrifugation: Theory of centrifugation, equipments, applications for food industries	**10**
Unit IV: Distillation Vapour liquid equilibria, batch and continuous distillation, steam distillation, equipments and applications to food industries	**10**
Unit V: Diffusion and Gas Absorption Diffusion-Basics of absorption- Diffusion of gases in liquid and solid foods. Gas Absorption – Principles, equipments and applications in food processing	**10**
Unit VI: Extraction Solvent extraction, leaching, equipments. applications for food industries	**06**

Text Books :

1. D G Rao 2012. Fundamental of Food Enginnering. PHI Learning Private Limited, New Delhi.
2. George D. Saravacos and Athanasios E. Kostaropoulos. 2002. Handbook of Food Processing Equipment. Springer Science+Business Media, New York, USA

Reference Books :

1. McCabe and Smith “Unit Operations” McGraw-Hill, New York
2. Transport Process and Unit Operations: Geankoplis, 3rd Edn. PHI
3. Singh and Heldman “Introduction to food engineering” Academic Press publications

Class & Semester	:	**S. Y. B. Tech (Food Technology), Part II, Semester IV**								
Course Title	:	**Food Process Engineering-I Laboratory**						*Course Code*:	:	**FT221L**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**Nil** **50**	**EPE** **EOE**	: :	**Nil** **50**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**Third**						*Month*	:	**December 2016**

Pre-requisites **:** Laboratory work in Engineering Physics and Engineering Chemistry.

Type of Course **:** Practical

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment, Internal Oral Examination and External Practical Examination

Course Objectives:

1. To study the mass balance and energy balance of food processing.
2. To study the properties and pretreatment of food materials.
3. To study the unit operations of food processing
4. To have the practical experience of all unit operations

Course Outcomes:

1. Understanding the calculations of mass balance and energy balance of food processes
2. Understanding of basic principles of unit operations
3. Understanding of practical experience of various equipments
4. Reorganization of key food processing and product parameters that can influence microbiological safety and quality of the processed product.

Practical List :

1. Design problems on mass balance equations
2. Design problems on energy balance equations
3. Experiment on Particle size analysis
4. Experiment on Size reduction
5. Experiment on Solid Solid Mixing
6. Experiment on liquid Liquid mixing
7. Experiment on Filtration
8. Experiment on Centrifugation
9. Experiment on sieve tray Distillation
10. Experiment on Diffusion
11. Experiment on Gas Absorption
12. Experiment on Solvent extraction
13. Experiment on Leaching

Lab Manual :

1. Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Reference Books :

1. "McCabe and Smith "Unit Operations" McGraw-Hill, New York
2. Transport Process and Unit Operations: Geankoplis, 3rd Edn. PHI
3. Singh and Heldman "Introduction to food engineering" Academic Press publications

Class & Semester	:	**S. Y. B. Tech (Food Technology) Part II, Semester IV**					
Course Title	:	**Food Additives and Contaminants**			*Course Code*:	:	**FT222**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks= 52 hours minimum** **Tutorial= 0 hour/week** **Practical= 02 hours/week**			*Total Credits*	:	**04+01=05**
Evaluation Scheme (Marks)	:	**CIE = 50** **SEE = 50**	**IPE=Nil** **IOE=Nil** **EPE= 50**	: : :	**Grand Total=150**	*Duration of SEE*	:	**3 hours**
Revision:	:	**Third**			*Month*	:	**December 2016**

Pre-requisites	:	In order to complete the course studies successfully, it is important to have a good command of English. Other Pre-requisites include basic knowledge of Food science and food analysis, labeling and food microbiology.
Type of Course	:	Theory
Course Domain	:	Core
Skills Imbibed	:	Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate Affective : Awareness, Respond, Value, Organize Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II l, home assignments
2. Semester End Examination.

Course Objectives:

1. To understand the permitted levels of all types of food additives.
2. To understand the principles of chemical preservation of foods.
3. To maintain the nutritional quality of food, to enhance stability with resulting reduction in waste, to make food more attractive.
4. To provide efficient aids in processing, packaging and transport.
5. To demonstrate skills for the identification and control of microbial and other food contaminants.
6. To provide students an in depth understanding of how the science of food additives and contaminants, Toxicology is applied to food and feed safety including food regulation and risk assessment.

Course Outcomes:

1. Better understanding of the functions of different food additives in improving shelf life, quality, texture and other physical and sensory characteristics of foods.
2. Exposure about food additives related to bakery and confectionary.
3. Exposure about types and chemical properties of pigments and processing effect.
4. Exposure about types and chemistry of flavoring compounds.
5. Exposure about sensory analysis.
6. Provide students with a basic understanding of the principles of food toxicology.

	Hours
UNIT-I Food Additives General attributes, buffer system/salt/, acids, antimicrobial agents, chelating agent and sequestrants,	12
UNIT- II Bakery and Confectionery Additives Antioxidants, emulsifiers, non nutritive and low calories sweeteners, stabilizer and thickeners and dough improvers.	**8**
UNIT-III Flavour Philosophy and definition of flavor, chemistry of flavoring compounds.	**8**
UNIT-IV Pigments Chlorophyll, carotenoid, phenolic & flavonoids, Betalins effect of processing on pigments, Retention of natural food colours, Food colourants ,Regulatory aspects.	**8**
UNIT-V Sensory Assessment Sensory assessment of flavours ,technology for flavour retention.	**8**
UNIT-VI Food Toxicology Inherent toxicants terms in toxicology, safety evaluation using traditional & modern approach contaminants, pesticide residues, toxicology & public health**.**	**8**

Reference Books :

1. Furia,T. E., Handbook of Food Additives, CRC Press, Boca Raton, Flor., 1980
2. Branen, A. F. et al (2001). Food Additive s, 2nd Edition, Marcel. Dekker
3. Fennema O.R. “Food Chemistry” Francois Castaigne, Rohanie Maharaj - 1996
4. DeMan “Food chemistry” Hardcover, A V I Publishing Company, 1982

Class & Semester	:	**S. Y. B. Tech (Food Technology), Part II, Semester IV**									
Course Title	:	**Food Additives and Contaminants Laboratory**						*Course Code*:	:	**FT222L**	
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**1**	
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**Nil** **Nil**	**EPE** **EOE**	: :	**50** **Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**	
Revision:	:	**Third**						*Month*	:	**December 2016**	

Pre-requisites : In order to complete the course studies successfully, it is important to have a good command of English. Other Pre-requisites include basic knowledge of Food science and food Analysis, Labeling and Food Microbiology.

Type of Course : Practical

Course Domain : Core

Skills Imbibed : Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment, Internal Oral Examination and External Practical Examination

Course Objectives:

On completion of the course the students are expected to

1. Be able to study types of food adulterant used and their detection .
2. Be able to study different types of pigments, coloring compounds
3. Be able to determine the major macro and micronutrients
4. Be able to recognize the common analytical techniques for detection of food toxicants
5. Be able to demonstrate critical and analytical thinking as well as problem solving skills

Course Outcomes:

1. Recognize the common analytical techniques for detection of food adulterant
2. Detection of different types of vitamins, pigments.

3. Identification of appropriate techniques for analysis
4. Detection of different properties of protein, starch ,fat
5. Understanding the effect of emulsifier, hydrocolloids as food additive.
6. Knowledge of regulations and the monitoring agencies involved in controlling the safer use of additives in foods.

Practical:

1. Determination of Food adulterants
2. Determination of carotenoids
3. Assessments of hydrocolloids as food additives
4. Estimation of tannins
5. Estimation of phytic acids
6. Solubility characteristics of starches.
7. Determination of Vitamin E
8. Effect of emulsifier in food products
9. Determination of chlorophyll
10. Determination of Vitamin C
11. Determination of color
12. Foaming properties of proteins
13. Determination of peroxide value of fat

Lab Manual :

1. Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Reference Books :

1. Furia,T. E., Handbook of Food Additives, CRC Press, Boca Raton, Flor., 1980
2. Branen, A. F. et al (2001). Food Additive s, 2nd Edition, Marcel. Dekker
3. Fennema O.R. "Food Chemistry" Francois Castaigne, Rohanie Maharaj - 1996
4. DeMan "Food chemistry" Hardcover, A V I Publishing Company, 1982

Class & Semester	:	**S. Y. B.Tech (Food Technology) Part II, Semester IV**					
Course Title	:	**FOOD BIOCHEMISTRY**			*Course Code*:	:	**FT223**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks= 4 x 13 weeks= 52 hours minimum** **Tutorial= 00 hour/week** **Practical= 02 hours/week**			*Total Credits*	:	**04+01 =05**
Evaluation Scheme (Marks)	:	**CIE = 50** **SEE = 50**	**IPE=Nil** **IOE=Nil** **EPE= 50**	: : :	**Grand Total=150**	*Duration of SEE*	*:* **3 hours**
Revision:	:	**Third**				*Month*	: **December 2016**

Pre-requisites	**:**	In order to complete the course studies successfully, it is important to have a good command of English.
Type of Course	**:**	Theory
Course Domain	**:**	Core
Skills Imbibed	**:**	Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate Affective : Awareness, Respond, Value, Organize Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination.

Course Objectives:

To enable the students to understand

1. Biochemical cycles
2. Biosynthesis of macromolecules and micromolecules
3. The changes of biological function of food components due to food processing and storage
4. Understand the major chemical reactions that limit shelf life of foods
5. life processes at the molecular level
6. The basic concepts in food chemistry and food analysis.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Understand the chemistry underlying the properties and reactions of various food components
2. To describe the biochemistry process, basic concept of nutrients and the relationship of the consumption of foods to nutritional status and health
3. Identify some of common reaction mechanisms in biochemical processes
4. Describe how enzymes work and know how to determine basic enzyme kinetics
5. Analyze and predict how the composition and conditions within a food influence the functional properties of food molecules.
6. Comprehend the degree of knowledge that is being acquired through current research in understanding how cells function

	Hours
UNIT-I Digestion, absorption and metabolism Digestion, absorption and metabolism of carbohydrate, fat and protein.	**12**
UNIT-II Enzymes Chemical nature and nomenclature, classification, sources and properties, mechanism of action, Coenzyme and prosthetic groups application.	**8**
UNIT-III Biochemical changes in meat Biochemical changes in meat and meat products during processing.	**8**
UNIT-IV Biochemical changes in fruits and vegetables Biochemical changes in fruits and vegetables during post harvest handling, processing and storage.	**8**
UNIT-V Biochemical changes in milk Biochemical changes in milk and milk products during handling, processing and storage.	**8**
UNIT-VI Hormones Hormones – related to metabolic process.	**8**

Text Books :

1. Cox, M.M. and Nelson, David L. Lehininger, “Principles of Biochemistry”. 5thEdition. W.H.Freeman , 2008
2. Murray, Robert K. etal., “Harper’s Illustrated Biochemistry” 27th Edition. McGraw-Hill, 2006.
3. Satyanarayanan, U. “Biochemistry” Books and Allied. 2005
4. Voet, D.J. and J.G.Voet “Principles of Biochemistry” 3rd Edition. John wiley, 2008.
5. 5. Rastogi, S.C. “Biochemistry” 2nd Edition. Tata Mc Graw-Hill, 2003

Reference Books	:	

1. Lehninger, "Biochemistry", CBS. *Publications*, 1993.
2. Stryer, "Biochemistry" W H Freeman, New York. 1988.
3. Voet and Voet, " Principles of Biochemistry" John Wiley & Sons, Inc.. Edition

Class & Semester	:	**S. Y. B. Tech (Food Technology), Part II, Semester IV**								
Course Title	:	**FOOD BIOCHEMISTRY LABORATORY**						*Course Code*:	:	**FT223L**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**Nil** **Nil**	**EPE** **EOE**	: :	**50** **Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**Third**						*Month*	:	**December 2016**

Pre-requisites **:** In order to complete the course studies successfully, it is important to have a good command on English and subject proficiency.

Type of Course **:** Practical

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment, Internal Oral Examination and External Practical Examination

Course Objectives:

1. To learn and understand the principles behind the qualitative and quantitative estimation of biomolecules (proteins, carbohydrates, lipids, metabolites etc.,) and laboratory analysis of the same in the body fluids.

Course Outcomes:

1. The student will able to evaluate the food component on qualitative and quantitative basis.
2. Be able to know the laboratory techniques and different methodology for biological assay.
3. The student will be able to apply principles of laboratory techniques.
4. The student will be able to identify appropriate techniques for analysis.
5. Have sufficient knowledge of food biochemistry to control reactions in foods.
6. Develop a practical proficiency in a food biochemistry and analysis laboratory.

Practical List :

1. Preparation of standard solutions and buffers
2. Quantitative determination of carbohydrate by DNSA method.
3. Isolation and characterization of starch
4. Quantitative determination of protein
5. Determination of vitamins C.
6. Determination of vitamins A.
7. Isolation of enzymes from various sources
8. Enzyme assay methods
9. Immobilization of enzymes.
10. Qualitative analysis of proteins
11. Qualitative analysis of lipids.
12. Quantitative analysis of lipids (Benedict's method etc.)
13. Quantitative estimation of blood glucose.

Lab Manual :

1. Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Reference Books :

1. Lehninger, "Biochemistry", CBS. *Publications*, 1993.
2. Stryer, "Biochemistry" W H Freeman, New York. 1988.
3. Voet and Voet, " Principles of Biochemistry" John Wiley & Sons, Inc.. Edition

Class & Semester	:	**S. Y. B. Tech (Food Technology) Part II, Semester IV**					
Course Title	:	**Human Nutrition**			*Course Code*:	:	**FT224**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks= 52 hours minimum** **Tutorial= 0 hour/week** **Practical= 02 hours/week**			*Total Credits*	:	**04+01 =05**
Evaluation Scheme (Marks)	:	**CIE = 50** **SEE = 50**	**IPE=Nil** **IOE=50** **EPE=Nil**	: : :	**Grand Total=150**	*Duration of SEE*	:	**3 hours**
Revision:	:	**Third**			*Month*	:	**December 2016**

Pre-requisites	:	Knowledge of basic food chemistry and food processing.
Type of Course	:	Theory
Course Domain	:	Core
Skills Imbibed	:	Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate Affective : Awareness, Respond, Value, Organize Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination.

Course Objectives:

1. Be able to understand the physiological and metabolic functions of human digestive system
2. Be able to understand an overview of the major macro and micronutrients relevant to human health
3. Be able to explain how dietary recommendations are formulated
4. Be able to understand proper diet planning, nutritional facts for balanced nutrition and healthy diets
5. Be able to understand the role of diet in causing and preventing various diseases
6. Be able to get a basic foundation in human nutrition in preparation for any of the health professions.

Course Outcomes: 1. Better understanding in physiological and metabolic functions of nutrients 2. Familiarize nutritional assessment, RDA and Dietary Recommendations & guidelines. 3. Understanding of energy and water balance 4. Understanding of malnutrition ,their causes and nutrition education 5. Effective understanding of Diet planning Principles, exchange lists, food labels and nutritional facts for balanced nutrition and healthy diets 6. Understanding of Undesirable Constituents & toxic substances and their disorders.	
UNIT-I Introduction Scope, concepts and importance of nutrition, human digestive system	**Hours** 08
UNIT- II Nutritional aspects Nutritional aspects of carbohydrate, protein, lipids, water, vitamin and minerals, food, fad and faddism.	**08**
UNIT- III Energy and water balance Energy and water balance, Water intake and losses, energy requirement, and physiological energy value, bomb colorimeter.	**10**
UNIT- IV Malnutrition Types of malnutrition, multi-factorial causes, epidemiology of under nutrition and over nutrition, nutrition infection and immunity, nutrition education.	**10**
UNIT- V Balance diet Balance diet, types of balance diet, diets for specific purposes.	**08**
UNIT- VI Undesirable Constituents & toxic substances Undesirable Constituents & toxic substances and their disorders, hormones.	**08**
REFERENCE BOOKS: 1. Shubhangini A. Joshi, "Nutrition and Dietetics" "Tata Mc Grow- Hill *publishing* Company Ltd,.New Delhi (1992) 2. Dr. M. Swaminathan, Vol I & II "Foods and Nutrition" NIN Publications 3. Swaminathan, N.Food Science and experimental foods, (1987) Ganesh Publications, Madras.	

Class & Semester	:	**S. Y. B. Tech (Food Technology), Part II, Semester IV**								
Course Title	:	**Human Nutrition Laboratory**						*Course Code*:	:	**FT224 L**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**Nil** **50**	**EPE** **EOE**	: :	**Nil** **Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**Third**						*Month*	:	**December 2016**

Pre-requisites : Knowledge of basic chemistry and biology.

Type of Course : Practical

Course Domain : Core

Skills Imbibed : Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment, Internal Oral Examination and External Practical Examination

Course Objectives:

2. Be able to understand the physiological and metabolic functions of nutrients.
3. Be able to determine the major macro and micronutrients relevant to human health
4. Be able to understand methods of nutritional assessment, RDA and guidelines.
5. Be able to explain how dietary recommendations are formulated
6. Be able to describe the methods used to carry out nutrition research
7. Be able to Compute energy requirement on the basis of physical activity

Course Outcomes:

1. Understanding of methods used to assess nutrition status
2. Familiarize nutritional assessment, RDA and Dietary Recommendations & guidelines.
3. Understanding and determining BMR and body surface area
4. understanding of food composition and energy balance in dietary planning
5. Effective understanding of diet plan formulation for health and for nutrition-related disorders.

6. Identifying appropriate techniques for Biochemical analysis of blood, urine

Practical:

1. Calculation of BMR and body surface area,
2. Calculation of energy value of food.
3. Preparation of balance diet,
4. Anthropometric measurements,
5. Biochemical analysis of blood
6. Biochemical analysis of urine.
7. Computation of energy requirement on the basis of physical activity
8. ACU units.

9 Quantitative determination of carbohydrate by DNSA method.

10. Determination of vitamins C.
11. Determination of vitamins A.
12. Qualitative analysis of proteins
13. Determination of Ca , Iron , phosphorus and Ash content of food

Lab Manual:

1. Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Reference Books **:**

1. Steeter U.L, 'Fluid Mechanics' V ed. Mc graw Hill Book Co., International Edn.1971.
2. Richardson J.E. and Coulson J.M. Chemical Engineering. 3rd ed. Vol. 1 Pergamon Press 1985.
3. Miohell B.I. Fluid and Particle Mechanics Pergamon Press 1970.
4. Gupta S.K., Momemtum Transfer Operations, Tata McGraw Hill, 1979

Class & Semester	:	**S. Y. B. Tech (Food Technology) Part II, Semester IV**					
Course Title	:	**Fluid Mechanics**			*Course Code*:	:	**FT225**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks= 52 hours minimum** **Tutorial= 0 hour/week** **Practical= 02 hours/week**			*Total Credits*	:	**04+01 =05**
Evaluation Scheme (Marks)	:	**CIE = 50** **SEE = 50**	**IPE=Nil** **IOE=50** **EPE= Nil**	: : :	**Grand Total=150**	*Duration of SEE*	: **3 hours**
Revision:	:	**Third**			*Month*	:	**December 2016**

Pre-requisites	**:**	Fundamental knowledge of applied mathematics, science and engineering
Type of Course	**:**	Theory
Course Domain	**:**	Core
Skills Imbibed	**:**	Cognitive: Recall, Understand, Apply, Analyze, Synthesize, Evaluate Affective : Awareness, Respond, Value, Organize Psychomotor: Imitation, manipulation, articulation, naturalization

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination.

Course Objectives:

To give the student

1. To give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.
2. Understand the dynamics of fluid flows and the governing non-dimensional parameters,
3. Apply concepts of mass, momentum and energy conservation to flows,
4. Practice in the analytical formulation of fluid mechanics problems using Newton's Laws of motion and thermodynamics
5. To inculcate the importance of fluid flow measurement and its applications in Industries**.**
6. An exposure to practical applications, work on a small design project, and the writing of a technical report related to the design project.

Course Outcomes:

1. An understanding of fluid mechanics fundamentals, including concepts of mass and momentum conservation.
2. An ability to apply the Bernoulli equation to solve problems in fluid mechanics.
3. An ability to apply control volume analysis to problems in fluid mechanics.
4. An ability to use potential flow theory to solve problems in fluid mechanics.
5. An ability to perform dimensional analysis for problems in fluid mechanics.
6. A knowledge of laminar and turbulent boundary layer fundamentals.
7. An understanding of how fluid mechanics apply to biological, environmental, and micro-fluid systems

Unit I Unit systems and Introduction to Fluid statics Physical quantities, S.I., CGS, FPS engineering units, Conversion of Units, Units and Equations, dimensional analysis, Application of dimensional analysis, Problems. Nature of fluids,Hydrostatic equilibrium, Barometric equation, Hydrostatic equilibrium in centrifugal field, Manometers,Example, U tube, inclined tube manometers.	8
Unit II Fluid flow phenomena and Basic equations of fluids flow Behaviour of flowing fluid, Types of flow, Newtonian and non-Newtonian Fluids, viscosity andmomentum flux, viscosities of gases and liquids, Turbulence, Reynolds experiment, Eddy viscosity,Flow in boundary layers, Laminar and Turbulent flow in Boundary layers, Boundary layer formation instraight tubes, Boundary layer separation and wake formation .Mass balance, mass velocity, momentum balance, and Bernoulli's equation without and withfriction, kinetic energy correction factor, correction for fluid friction, Pump Bernoulli's equation,Euler's equation, Problems.	12
Unit III Flow of incompressible fluids in conduits and thin layers Shear stress distribution in a cylindrical tube, relation between skin friction and wall shear, thefriction factor. Relations between skin friction parameters .Laminar flow in pipes, Laminar flow ofNewtonian fluids. Average velocity, kinetic energy correction factor (Derivation), Momentum correction factor (Derivation), Hagen-poiseuille equation. Turbulent flow in pipes and closed channels. Velocity distribution for turbulent flow, universal velocity distribution equations for laminar sub layer and buffer layer, Relations between maximum and average velocities, Effect of roughness, the friction factor chart(Moody's diagram), friction factor in flow through channels of non-circular section, friction from changes in velocity or direction, Effect of	8

fittings and valves, couette flow, Layer flow with free surfaces , Flow through annulus, Problems. **Unit IV Transportation and metering of fluids** Pipe and tubing, joints and fittings. Prevention of leakage around moving parts. Valves like Gatevalve, globe valve, checks valve butterfly valve, needle valve, ball valve etc. Measurement of flowing fluids. Venturimeter, orifice meter, pitot tube, Rota meters, target meters, vortex-shedding meters ,turbine meters, positive displacement meters, magnetic meters: ultrasonic meters. **Unit V Flow past immersed bodies** Drag coefficients of typical shapes, form drag and stream lining, Friction in flow through bedsof solids, Erguns equation, Kozeny- Carman equation, Burke Plummer equation, Fluidization, Mechanism of fluidization, particulate and aggregative fluidization, minimum fluidization velocity,expansion of -fluidized beds, application of fluidization. **Unit VI Flow of compressible fluids and Agitation of fluids** Mach number, continuity equation, Total energy Balance, velocity of sound, ideal gas equations, the asterisk condition, stagnation temperature.Agitation of liquids, Agitation equipment, flow patterns in agitated vessels, circulation rates,Flow numbers, power consumption, power correlations, power correlations for specific impellers, effect of system geometry and calculations for power consumption..	8 8 8

TEXT BOOK:	:	1. Mc Cabe W.L. and Smith J.C,'Unit operations of Chemical Engineering.' VII edition, Mcgraw Hill Book Co., International ed. 1993
Reference Books		REFERENCES: 1. Steeter U.L, 'Fluid Mechanics' V ed. Mc graw Hill Book Co., nternational Edn.1971. 2. Richardson J.E. and Coulson J.M. Chemical Engineering. 3rd ed. Vol. 1 Pergamon Press 1985. 3. Miohell B.I. Fluid and Particle Mechanics Pergamon Press 1970. 4. Gupta S.K., Momemtum Transfer Operations, Tata McGraw Hill, 1979.

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Class & Semester	:	**S. Y. B. Tech (Food Technology), Part II, Semester IV**								
Course Title	:	**Fluid Mechanics Laboratory**						*Course Code*:	:	**FT225L**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**Nil** **50**	**EPE** **EOE**	: :	**Nil** **Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**Third**						*Month*	:	**December 2016**

Pre-requisites **:** Fundamental knowledge of applied mathematics, science and engineering

Type of Course **:** Practical

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment, Internal Oral Examination and External Practical Examination

Course Objectives:

To give the student

1. To give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.
2. Understand the dynamics of fluid flows and the governing non-dimensional parameters,
3. Apply concepts of mass, momentum and energy conservation to flows,
4. Practice in the analytical formulation of fluid mechanics problems using Newton's Laws of motion and thermodynamics
5. To imbibe basic laws and equations used for analysis of static and dynamic fluids**.**
6. Apply fundamental principles of fluid mechanics for the solution of practical

Course Outcomes:

1. An understanding of fluid mechanics fundamentals, including concepts of mass and momentum conservation.
2. An ability to apply the Bernoulli equation to solve problems in fluid mechanics.
3. An ability to apply control volume analysis to problems in fluid mechanics.
4. An ability to use potential flow theory to solve problems in fluid mechanics.
5. An ability to perform dimensional analysis for problems in fluid mechanics.
6. A knowledge of laminar and turbulent boundary layer fundamentals.
7. An understanding of how fluid mechanics applies to biological, environmental, and micro-fluidic systems

Practical List :

1. Venturimeter
2. Orifice meter
3. Reynolds's experiment
4. Bernoulli's experiment
5. Flow through helical coils
6. Flow through annular pipe
7. Flow through pipe & pipe fittings.
8. Flow through spiral coils.
9. Flow through packed bed
10. Flow through fluidized bed.
11. To study the properties of Newtonian and Non- Newtonian fluids.
12. Demonstration of – a) Rotameter b) Pitot tube
13. Two phase flow system

Lab Manual:

1. Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Reference Books :

REFERENCES:

1. Steeter U.L, 'Fluid Mechanics' V ed. Mc graw Hill Book Co., International Edn.1971.
2. Richardson J.E. and Coulson J.M. Chemical Engineering. 3rd ed. Vol. 1 Pergamon Press 1985.
3. Miohell B.I. Fluid and Particle Mechanics Pergamon Press 1970.
4. Gupta S.K., Momemtum Transfer Operations, Tata McGraw Hill, 1979

Class & Semester	:	**S. Y. B.Tech (Food Technology), Part II, Semester IV**								
Course Title	:	**Environmental Studies Project Work**						*Course Code*:	:	**HS221**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x12= 24 hours**						*Credits*	:	**Nil**
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**30** **Nil**	**EPE** **EOE**	: :	**Nil** **Nil**	*Duration of SEE for Theory part*	:	**2 hours** (SEE at the yearend)
Revision	:	**Third**						*Month*	:	**December 2016**

Pre-requisites	**:**	Knowledge of fundamentals of Physics and Chemistry
Type of Course	**:**	Filed work with necessary laboratory experimentation
Course Domain	**:**	Humanities and Applied Science
Skills Imbibed	**:**	Cognitive: Understand, Apply, Analyze, Evaluate, Create Psychomotor: Imitation, manipulation, articulation, naturalization
Course Assessment Methods: Students Project/ field work assessment. However, their overall response during entire semester is also considered for evaluation.		
Practical List	**:**	
Field work under the supervision of course coordinator.		
Lab Manual	**:**	
Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow in case of use of related apparatus, equipment.		

Class & Semester	:	**S. Y. B.Tech (Food Technology) Part II, Semester IV**								
Course Title	:	**Introduction to Performing Arts**						*Course Code*:	:	**HS222**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**Nil**
Evaluation Scheme (Marks)	:	**Assignments** **Viva voce**	: :	**50** **25**	**Written Test** **Grand Total**	: :	**25** **100**	*Duration of Exam*	:	**Not Applicable**
Revision:	:	**Third**						*Month*	:	**December 2016**

Pre-requisites	**:**	In order to conduct the course successfully, student's involvement and interest in the classroom is the pre- requisite.
Type of Course	**:**	Audit Course at institute level
Course Domain	**:**	Humanity and Fine Arts
Skills Imbibed	**:**	Cognitive: Understand, Apply Affective : Awareness, Respond, Value, Organize Psychomotor: Perceive, Imitate, Manipulate, Articulate, Adapt

Course Assessment Methods:

The students will be given five assignments each for 10 marks. At the end of the course, there will be a written test of 25 marks and a viva voce of 25 marks. There will be assessment for a total of 100 marks. Based on the marks obtained, they will be awarded with a grade similar to other credit courses. Though it is an audit course, obtaining passing grade is essential.

Course Objectives:

1. To understand the history of arts.
2. To cultivate and enhance the interest in Music and other performing arts.
3. To highlight that these arts are not only the medium of entertainment but also a medium for proper channelization of emotions as this plays a vital role in determining the quality of life.
4. To form and defend value judgments about music.
5. To acquire audience skills such as listening and viewing responsibly.
6. To understand & develop skills to become lifelong learners in the musical art, both as participants and as audience members.

Course Outcomes:

1. Students will be able to learn Fundamentals and types of Music and other allied arts.
2. Students will be able to analyze, appreciate, and interpret significant works of art.
3. Students will demonstrate critical thinking through analysis and evaluation of works of art.
4. Students will develop good listening and viewing skills.
5. Students will be able to understand the '*Gharana'* system in Music.
6. Students will understand the classification of Musical instruments.
7. Students will demonstrate mastery of their designated area of concentration.
8. Students will demonstrate comprehension of global perspectives in visual culture.

Curriculum Content	Hours
Unit I: Introduction to Music, Dance & Drama, History of Indian Music, Various Forms of Vocal Music.	**04**
Unit II: History and introduction of Drama, Bharat muni natya shastra, street play, Sanskrit natya, Marathi sangit rangbhumi	**04**
Unit III: Dance, its type, greek and roman theatres,	**04**
Unit IV: Concept of *Raga*, Concept of *Taal*.	**04**
Unit V: Notation System, Study of *Gharana* system in Music, Classification of Indian Instruments, Instrumental Music.	**05**
Unit VI: Contribution of Great Musicians, Appreciation of Music. Performance of a Music Concert.	**05**

Reference Books :

1. 'Sangeet Visharad', Vasant, Sangeet Karyalaya, Hatras Prakashan.
2. Suchita Bidkar, 'Sangeet Shastra Vigyan', Sanskar Prakashan.
3. Sudhir Mainkar, 'Sangeet Kala Aani Shikshan', Sanskar Prakashan.
4. Bhaskar Chandavarkar, 'Vadyavedh', Sanskar Prakashan.
5. Arvind Mulgaonkar, 'Tabla', Popular Prakashan.
6. Chris Hogget ,'All about theatre-Off stage'.
7. Mrinalini Sarabhai,'Understanding of Bharat Natyam'.
8. Joan Borysenko ,'Minding the body and mending the mind',.
9. V.K.Subbanna ,'Ragadalli Antrang'.

Equivalence of Second Year B.Tech (Food Technology) Semester III and IV

The above detailed syllabus is a revised version of the Second Year B.Tech(Food Technology)Program being conducted by the Shivaji University at the Technology Department of the University. This syllabus is to be implemented from June 2017, (Academic year 2017-18). The prime feature of this revision is the transformation of the existing curriculum into the Outcome based curriculum as specified in NBA rules and regulations.

The Equivalence for the subjects/courses of Food Technology at Second Year B Tech Semester III and IV pre-revised Program under the faculty of Engineering and Technology is as follows.

Second Year B. Tech Semester III (Food Technology)

Sr.No	Second YearB.Tech(Food Technology) Semester III Pre-revised syllabus	Second Year B.Tech(Food Technology) Semester III Revised syllabus	Remark
1.	Engineering Mathematics-III	Engineering Mathematics-III	Slight change in no of lectures and content
2.	Principles of Food Preservation	Principles of Food Preservation	Slight change in no of lectures and content
3.	Food Chemistry	Food Chemistry	Slight change in no of lectures and content
4.	Food Microbiology	Food Microbiology	Slight change in no of lectures and content
5.	Process Fluid Mechanics	Heat Transfer	Shifted to Semester IV with slight change in title, content and no of lectures
6.	Programming Practices	Programming Practices for Food Technologists	Modification in the content and title. Slight change in no of practicals and content
7.	Principles of Food Preservation Lab	Principles of Food Preservation Laboratory	Change in nomenclature. Slight change in no of practicals
8.	Food Chemistry lab	Food Chemistry laboratory	Change in nomenclature. Slight change in no of practicals
9.	Process Fluid Mechanics Lab	Heat Transfer Laboratory	Shifted to Semester IV with slight change in title. Slight change in no of practicals
10.	Food Microbiology lab	Food Microbiology Laboratory	Change in nomenclature. Slight change in no of practicals
11.	Introduction to Foreign Language	-	Shifted to semester V
12.	Environmental Studies	Environmental Studies	Change in no of lectures
13.		Soft Skills Development	Shifted from semester V with title change

Second Year B.Tech Semester IV (Food Technology)

Sr.No	Second YearB.Tech (Food Technology) Semester IV Pre-revised syllabus	Second Year B.Tech(Food Technology) Semester IV, Revised syllabus	Remark
1.	Food Process Engineering-I	Food Process Engineering-I	Slight change in no of lectures and content
2.	Food Additives and Contaminants	Food Additives and Contaminants	Slight change in no of lectures and content
3.	Food Biochemistry	Food Biochemistry	Slight change in no of lectures and content
4.	Fundamentals and Applications of Heat Transfer	Fluid Mechanics	Shifted to semester III with change in nomenclature, no of lectures and content
5.	Human Nutrition	Human Nutrition	Slight change in no of lectures and content
6.	Food Process Engineering-I lab	Food Process Engineering-I laboratory	Slight modification in nomenclature. Slight change in no of practicals and content
7.	Food Additives and Contaminants lab	Food Additives and Contaminants laboratory	Slight modification in nomenclature. Slight change in no of practicals and content
8.	Food Biochemistry lab	Food Biochemistry laboratory	Slight modification in nomenclature. Slight change in no of practicals and content
9.	Fundamentals and Applications of Heat Transfer lab	Fluid Mechanics laboratory	Shifted to semester III with change in nomenclature and no of practical
10.	Human Nutrition lab	Human Nutrition laboratory	Slight modification in nomenclature and no of practical
11.	Introduction to Performing Arts	Introduction to Performing Arts	Slight modification in the content

Audit course have not been assigned any credits. The students will be evaluated for these courses by the concerned course in charge. There will be grade conferred to the student. The grade will be based on conversion of marks obtained (Obtaining passing grade is essential). Please refer to chart in the detail examination scheme. The chart shows the marks range and the respective grade.