Department of Technology
Second Year B. Tech.
Scheme of Teaching and Examination Semester- III (Food Technology)
To be implemented from Academic year 2021-22

Course Code	Course Title	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	30	40	-	-	-
						SEE	70		-	-	-
FT212	Engineering Mathematics-III	03	1	-	04	CIE	30	40	IOE	50	20
						SEE	70		-	-	-
FT213	Food Microbiology	04	-	-	04	CIE	30	40	-	-	-
						SEE	70		-	-	-
FT214	Food Chemistry	04	-	-	04	CIE	30	40	-	-	-
						SEE	70		-	-	-
FT215	Heat Transfer	03	-	-	03	CIE	30	40	-	-	-
						SEE	70		-	-	-
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	-	-	-	IOE	50	20
FT215L	Programming Practices for Food Technologists	1	-	02	02	-	-	-	IOE	50	20
	Total	**19**	**1**	**10**	**25**	-	**500**	-	-	**300**	-
HS211	Environmental Studies	**02**	-	-	-	Project*	30	40	-	-	-
						Theory*	70				
Audit Course-I											
HS212	Soft Skills Development	**02**	-	-	-	Institute Level	-	-	-	-	-

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

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

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

***** 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
Second Year B. Tech.
Scheme of Teaching and Examination Semester- IV (Food Technology)
To be implemented from Academic year 2021-22

Course Code	Course Title	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	30	40	-	-	-
						SEE	70		-	-	-
FT222	Food Additives and Contaminants	04	-	-	04	CIE	30	40	-	-	-
						SEE	70		-	-	-
FT223	Food Biochemistry	04	-	-	04	CIE	30	40	-	-	-
						SEE	70		-	-	-
FT224	Human Nutrition	04	-	-	04	CIE	30	40	-	-	-
						SEE	70		-	-	-
FT225	Fluid Mechanics	04	-	-	04	CIE	30	40	-	-	-
						SEE	70		-	-	-
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	-	-	-
HS222	Introduction to Performing Arts	**02**	-	-	-	Institute Level	-	-	-	-	-

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

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

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

***** 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 15students.

Class, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester III**					
Course Title	**:**	**Principles of Food Preservation**			***Course Code*:**	**:**	FT211
Teaching Scheme (Hours)	**:**	Lecture : 4	4 hours/week		***Total Credits***	**:**	04
		Tutorial : Nil	Nil				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total= 100	***Duration of SEE***	**:**	3 hours
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	knowledge of basic science					
Course Domain	**:**	Core					

Course Rationale:

A Principle of Food Preservation is a multi disciplinary course aimed towards imparting knowledge for students studying Food Technology. The course has wide applications in food processing industry (fruits and vegetables processing, bakery processing, and all other ready to eat packed foods and beverages, etc.). The course is completely Industry oriented which includes all the techniques that are expected in commercial industry. Hence the student will be well versed with advanced technique which is need of the hour for providing employment opportunities.

Course Objectives		***Course Outcomes***	
1.	The course teacher will support students in applying basic food science knowledge and understanding of biochemical changes that occur during various processing and conservation techniques.	1.	Students will be able to understand the need for food processing.
2.	The course teacher will introduce students to different food processing techniques.	2.	Students will be able to grasp the various food processing techniques.
3.	The course teacher will educate students on the technical mechanism for preserving food.	3.	Students will be able to understand the different preservation technique.
4.	The course teacher will introduce students to food preservation methods to avoid waste.	4.	Students will be able to understand the principles of food spoilage and the ways to prevent.
5.	The course teacher will introduce students to different non thermal ways of food processing.	5.	Students will be able to describe the principles involved in non thermal food processing.
6.	The course teacher will introduce students to different modern ways of processing and conserving food.	6.	Students will be able to describe the principles involved in the various modern ways of food processing.

Curriculum Content		**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 Non-thermal 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
Suggested list of Tutorials and Assignments: 1) Market Survey		
Suggested Text Books:		
1.	Fellows, P. and Ellis H. (1990). “Food processing technology: principles and practice”, Wood Head Publishing Ltd.	
2.	Manoranjan Kalia and Sangita Sood. (2019). “Food preservation and processing”, Kalyani Publishers. New Delhi.	
3.	Richardson, T. and Finley, J.W. (2003). “Chemical changes in food during processing”. Macmillon Publishers. Canada.	
4.	Desrosier, N.W. (2018). The Technology of Food Preservation.3rd Edition. Medtech Publishers.	
Suggested Reference Books:		
1.	Jelen, P. (1985). Introduction to Food Processing. Prentice Hall, Reston Virginia, USA.	
2.	Heldman, D.R. and Singh R. P. (2016). Introduction to Food Engineering.5th Edition. Elsevier India	
3.	William C. Frazier And Dennis C. Westoff (2017). Food Microbiology 5th Edition, McGraw Hill Education.	
4.	Singh, Anju. (2017). Handbook of Food Preservation. Agrotech Press.	

Class, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester III**					
Course Title	**:**	**Engineering Mathematics-III**			***Course Code*:**	**:**	FT212
Teaching Scheme (Hours)	**:**	Lecture : 3	03 hours/week		***Total Credits***	**:**	04
		Tutorial : 1	01 hour/week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total= 100	***Duration of SEE***	**:**	3 hours
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	BS-11A1, BS-12A1					
Course Domain	**:**	Basic Science					

Course Rationale:

This course is about the basic mathematics that is fundamental and essential component in all streams of undergraduate studies in sciences and engineering. The course consists of topics in differential equations, partial differential equations, Laplace transform - its inverse, Vector calculus and probability with applications to various engineering problems.

Course Objectives		***Course Outcomes***	
1.	The course teacher will describe solution of LDE and its applications.	1.	Students will be able to solve Linear Differential Equations and apply them to realistic problems.
2.	The course teacher will introduce Laplace Transform.	2.	Students will be able to gain the basic knowledge of Laplace transform and their applicability in solving initial value problems.
3.	The course teacher will introduce Partial Differential Equations and its Applications.	3.	Students will be able to solve Partial Differential Equations for solving problems in Food Engineering.
4.	The course teacher will introduce Probability and its Applications.	4.	Students will be able to solve engineering problems using Probability.
5.	The course teacher will explain Vector Differentiation and Vector Integration.	5.	Students will be able to analyze and solve engineering problems using vector differentiation.
6.	The course teacher will help to formulate a mathematical model of a real life and engineering problem, solve and interpret the solution in real world.	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.

Curriculum Content	**Hours**
Unit: I Linear Differential Equations:	07

Linear Differential Equations with constant coefficients, Homogenous Linear differential equations, method of variation of parameters	
Unit: II Laplace Transform: Definition, properties of Laplace transforms, transforms of derivatives, transforms ofintegral, Inverse Laplace transforms, Convolution theorem. Applications to initial value boundary problems, Heaviside Unit step function, Dirac delta 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 equations 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 Divergence theorem, Stoke's theorem, Green's theorem (Without proof).	07

Suggested list of Tutorials and 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. Each Student has to write at least 6 assignments on entire syllabus.

Suggested Text Books:

1.	Kreyszig, Erwin. (2015).Advanced Engineering Mathematics. 10th Edition.Wiley India Pvt. Ltd.
2.	Grewal,B. S. (2014). Higher Engineering Mathematic. Khanna Publications, New Delhi.
3.	Ramana, B.V. (2017). Higher Engineering Mathematics", McGraw Hill Education India.
4.	Wartikar, P. N. and Wartikar, J. N., "A Text Book of Engineering Mathematics (Volume-I, II and

	II)", Pune Vidyarthi Griha Prakashan, Pune.
5.	H. K. Das, "Advanced Engineering Mathematics", S. Chand Publication.
Suggested Reference Books:	
1.	Wylie, C.R. Advanced Engineering Mathematics", McGraw Hill Publication, New Delhi.
2.	Merle C. Potter, "Advanced Engineering Mathematics", OXFORD University Press, 3rdEdition
3.	Shanti Narayan, "Differential Calculus" S. Chand and company, New Delhi.
4.	Sastry, S. S. "Engineering Mathematics (Volume-I)", Prentice Hall Publication, New Delhi.
5.	M. D. Greenberg, "Advanced Engineering Mathematics", Pearson Education.

Class, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester III**				
Course Title	**:**	**Food Microbiology**			***Course Code*:**	**:** FT213
Teaching Scheme (Hours)	**:**	Lecture : 4	4 hours/week		***Total Credits***	**:** 04
		Tutorial : Nil	Nil			
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total= 100	***Duration of SEE***	**:** 3 hours
Revision:	**:**	Fourth			***Month***	**:** June 2021
Pre-requisites *(if any)*	**:**	knowledge of basic science				
Course Domain	**:**	Core				

Course Rationale:

Food microbiology is the study of the microorganisms that inhabit, create, or contaminate food. Microbes are being used for the production of foods, food supplements and food ingredients. Microorganisms are widely used in fermentative production, processing, and preservation of various kinds of foods and beverages. Microorganisms are also responsible for food spoilage and food poisoning which result in loss of food products and also cause damage to human and animal health causing health and economic losses. Studying the food microbiology and the effects of microbial contamination is vital to various food safety, production, processing, preservation, and storage aspects.

Course Objectives		***Course Outcomes***	
1.	The course teacher will support students in understanding the various microbes associated with food and food groups.	1.	Students will be able to understand the various microbes associated with food and food groups.
2.	The course teacher will familiarize the role of microbes in food spoilage and food preservation.	2.	Students will be able to familiarize the role of microbes in food spoilage and food preservation.
3.	The course teacher will educate students to detect pathogens in food.	3.	Students will be able to detect pathogens in food.
4.	The course teacher will describe the beneficial role of microorganisms in fermented foods and in food processing.	4.	Students will be able to describe the beneficial role of microorganisms in fermented foods and in food processing.
5.	The course teacher will introduce students to different non thermal ways of food processing.	5.	Students will be able to apply the theories and principles of food microbiology in practical, real-world situations and problems.
6.	The course teacher will introduce students	6.	Students will be able utilize laboratory

	to utilize laboratory techniques to detect, quantify, and identify microorganisms in foods.		techniques to detect, quantify, and identify microorganisms in foods.

Curriculum Content	Hours
UNIT I Introduction to microbiology Evaluation and 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 and mutagenesis.	10
UNIT II Growth curve Physical and Chemical factors affecting growth and destruction of micro-organisms, growth curve.	8
UNIT III Viruses Structure and 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 and Maintenance of anaerobic condition.	10
UNIT V Spoilage of Food Microbial Spoilage of cereals and cereal products, milk and milk products, fruit and Vegetable products, meat, poultry egg and fish products, sugar and Sugar Products.	10
UNIT VI Food poisoning Intoxication, Food borne illness	6

Suggested Text Books:

1.	Prescott and Dunn. (2004). Industrial microbiology, 4th edition, CBS publishers and distributors Delhi.
2.	Purohit S. S. (2003). Microbiology fundamentals and applications" Edition, 6. Publisher, Agrobios.
3.	William C. Frazier And Dennis C. Westoff. (2017). Food Microbiology 5th Edition, McGraw Hill Education.

Suggested Reference Books:

1.	Jay, J. M. (2005). Modern Food Microbiology. 4th ed. Chapman & Hall. New York, N.Y.
2.	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, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester III**					
Course Title	**:**	**FOOD CHEMISTRY**			***Course Code*:**	**:**	**FT 214**
Teaching Scheme (Hours)	**:**	Lecture : 4	4 hours/week		***Total Credits***	**:**	04
		Tutorial : Nil	Nil				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total= 100	***Duration of SEE***	**:**	3 hours
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	Knowledge of Engineering Chemistry					
Course Domain	**:**	Core					

Course Rationale: The course covers a broad range of subjects related to foods including basic scientific principles to food systems and practical applications. Food chemistry deals with the chemical, physical and functional properties of food constituents and the chemical changes these constituents undergo during handling, processing and storage including those that limit food shelf life. Food chemistry is a major aspect of Food science, that is an interdisciplinary subject in which the engineering, biological, and physical sciences are used to study the nature of foods, the causes of deterioration, the principles underlying food processing, and the improvement of foods from a consumer and sustainability perspective. The aim of the course is to provide the students with a deep understanding of how food components contributes to overall quality of foods; and to enable students to evaluate and explain how the highly complex nature of food may result in a multitude of desired and undesired reactions which are controlled by a variety of parameters.

Course Objectives		***Course Outcomes***	
1.	The course teacher will help to understand functions of Food Chemistry and basic physico-chemical properties and chemical structures of food components.	1.	Students will be able to describe the various constituents present in foods and their roles respectively.
2.	The course teacher will helps to understand the importance and mechanisms of the reactions of food components taking place during food processing.	2.	Students will be able to describe the mechanisms and significance of physicochemical reactions involved in food processing and subsequent storage.
3.	The course teacher will help to understand the significance and mechanisms of the reactions of food components taking place storage and spoilage.	3.	Students will be able to report the mechanisms and significance of physicochemical reactions involved in spoilage of foods.
4.	The course teacher will help to think critically on the role of water and its	4.	Students will be able to explain the significance of water in food quality,

	various forms in food preservation.		preservation and storage.
5.	The course teacher will help to understand the role of food constituents responsible for quality of foods.	5.	Students will be able to describe and demonstrate the role of food constituents on nutritional/anti-nutritional and aesthetic quality of raw and processed foods.
6.	The course teacher will help to apply course concepts in solving problems related to food constituents.	6.	Students will be able to extrapolate the knowledge gained on food composition to practical problems in food quality.

Curriculum Content	**Hours**
Unit Introduction to Food Chemistry Importance of Food Chemistry, An introduction to food resources and its general composition	05
Unit II Water Water in food systems – Role and types of water in foods, Concept of water activity, Effect of water activity on food processing and storage	07
Unit III Carbohydrate Chemistry of carbohydrates (Classification, Structure and Sources and properties), Applications of Carbohydrates in Food processing Industry. Concept of fiber and its effect on Human Health.	10
Unit IV Protein Chemistry of amino acids and their properties (isoelectric pH, solubility profile); Functions of Proteins; Peptides; classification of proteins; structure (primary, secondary, tertiary and quaternary); Denaturation of proteins; estimation of proteins in Foods; Applications of Protein in Food processing Industry.	10
Unit V Lipids Chemistry of Lipids (Sources, Classification and properties), Processing of oil, Hydrogenation of fats, Changes occurring in fats and oils during processing, Applications of Fatin Food processing Industry.	10
Unit VI Vitamins and Minerals Vitamins: Classification 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	10

Suggested Text Books:

1.	deMan, John M.(1999).Principles of Food Chemistry. 3rdEdition, Springer.
2.	Meyer, Lillian Hoagland. (1987). Food Chemistry. CBS Publishers.
3.	Belitz, H.D. Grosch. Food Chemistry. 3rd revised ed. Springer Berlin, Heidelberg, New York**.**
4.	O. R. Fennema. Food Chemistry. Marcel Dekker, Inc., New York.

Suggested Reference Books:

1.	Chopra, H.K. and Panesar, P.S. (2010). Food Chemistry. Narosa.
2.	Aurand, L.W. and Woods, A.E. (1973).Food Chemistry. Avi Publishing Company, Inc, Westport, CT.
3.	Morris B Jacob. The Chemical analysis of foods and food products, 3rd Edition, Vam Nostr and Co, Princeston, New Jersey.
4.	Sakuntala Manay and Shadaksaraswamy, M. (1987). Food facts and principles. Allied Publishers, New Delhi.

Class, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester III**					
Course Title	**:**	**Heat Transfer**			***Course Code*:**	**:**	**FT215**
Teaching Scheme (Hours)	**:**	Lecture : 3	03 hours/week		***Total Credits***	**:**	03
		Tutorial : Nil	Nil				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Total=100	***Duration of SEE***	**:**	3 hours
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	Knowledge of Engineering Physics, Engineering Mathematics I and Engineering Mathematics II					
Course Domain	**:**	Core					

Course Rationale: The course is prepared to provide the detailed understating of heat transfer principles, numerical analysis, and heat exchanger and evaporation process.

Course Objectives		***Course Outcomes***	
1.	The course teacher will help to understand modes of heat transfer and formulate the equations for calculating heat rate of conduction.	1.	Students will be able to identify the various mechanisms of heat transfer and formulate models to solve one- dimension steady state heat conduction process.
2.	The course teacher will help to derive the empirical equations of free or forced convection for different fluid flow.	2.	Students will be able to recognize the key parameters which affect the convective heat transfer mode either forced or free convection.
3.	The course teacher will help 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.	3.	Students will be able to implement the principles of boiling, condensation of heat transfer.
4.	The course teacher will explain the various laws to understand radiation heat transfer.	4.	Students will be able to analyze and evaluate the radiation heat transfer between two bodies.
5.	The course teacher will help to design and analyze heat transfer equipment and to further make selection of heat exchangers (rearranging or redesigning of the heat transfer systems to save energy).	5.	Students will be able to design of heat exchangers using LMTD and NTU method.
6.	The course teacher will describe different types of evaporators further to assess, select evaporators for specific duty and to improve their performance through heat	6.	Students will be able to interpret and analyze evaporation process to heat transfer.

	transfer knowledge.		

Curriculum Content	Hours
Unit I: CONDUCTION **Fundamentals:** Introduction to three modes of heat transfer: Conduction, convection and radiation. General laws of heat transfer. **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 and application of insulators, Problems.	08
Unit II: CONVECTION Convection, types of convection and relationship between individual and overall heat transfer coefficient, dimensional co-relation for convective heat transfer, fouling factors. 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, Problems.	09
Unit III: 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, Energy balance.	06
Unit IV: Radiation 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 for Food process industry: Radiation Transfer between surfaces. Radiation through semi transparent materials.	04
Unit V: Heat Exchange equipment Heat exchange equipments and its classification, LMTD, LMTD correction factors and Flow arrangements in heat exchanger. Shell and tube heat exchanger, double pipe, plate type, Graphite block, fin tube heat exchanger.	06
Unit VI: Evaporation Evaporation, capacity, steam economy, material and enthalpy balance for single effect evaporators, classification and application of evaporators.	06

Suggested Text Books:

1.	McCabe, W. L., Smith, J. C.and Harriott, P. (2005). Unit Operations of Chemical Engineering. 7th Edition. McGraw Hill.
2.	Lienhard, John H. (2011). A Heat Transfer Textbook.4th Edition., Dover Publications Inc.

3.	J. P. Holman. Heat Transfer.10th Edition. McGraw Hill.
Suggested Reference Books:	
1.	McAdams, W. H. Heat Transmission.3rd Edition. McGraw Hill.
2.	Kern, D. Q. Process Heat Transfer. 1st Edition. McGraw Hill.
3.	Don W. Green, Robert H. Perry. Perry's Chemical Engineer's Handbook. 8th Edition. McGraw-Hill: New York.
4.	Warren, M. Rohsenow, James, P. Hartnett and Young I. Cho (1998). Handbook of Heat Transfer, McGraw-Hill Education: New York.

Class, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester III**					
Course Title	**:**	**Principle of Food Preservation Laboratory**			***Course Code*:**	**:**	FT211L
Teaching Scheme (Hours)	**:**	Practical :-	2 hours/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE: Nil IOE: Nil	EPE =50	Total = 50	***Duration of EPE***	**:**	2 hours
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	knowledge of basic science					
Course Domain	**:**	Core					

Course Rationale:

This course has wide applications in food processing industry (fruits and vegetables processing, canning, dairy processing and beverages, etc.).The course is completely Industry oriented which includes all the practical techniques that are expected in commercial industry. Hence the student will be well versed with basic and advanced technique which is need of the hour for providing employment opportunities.

Course Objectives		***Course Outcomes***	
1.	The course teacher imparts knowledge and expertise on preservation and food processing methods.	1.	Students will identify processing equipment and select suitable processing equipment and storage methods for certain foods.
2.	The course teacher will help students familiarize themselves with good manufacturing practices and standard operating procedures used in laboratory activities.	2.	Students will familiarize themselves with good manufacturing practices and standard operating procedures used in lab exercises.
3.	The course teacher will teach to preserve food through drying.	3.	Students will be able to preserve food through drying.
4	The course teacher will teach to preserve food through freezing.	4.	Students will be able to preserve food through freezing.
5.	The course teacher will teach to preserve food with the help of sugar, salt and acids.	5.	Students will be able to preserve food with the help of sugar, salt and acids.
6	The course teacher will assist with the quality assessment of conservation products.	6.	Students will be able to evaluate the quality of the preserved products.

Sr. No.	***List of Experiments***
1.	Introduction to food processing equipments
2.	To study effect of blanching on quality of foods

3.	To check the adequacy of Blanching treatment
4.	Preservation of food by the process of freezing
5.	Drying of food using Tray dryer/other dryer
6.	Preparation of product by using sugar as preservative
7.	Preparation of product by using salt as preservative
8.	Preservation of product by using chemical preservatives
9.	Preservation of food by canning
10.	Extrusion cooking of food
11.	Food Fermentation
12.	Market Survey
Suggested Text Books/ Reference Books/Manual	
1.	Fellows, P. J. (2009). Food processing technology: principles and practice. Elsevier.
2.	Singh, R. P., and Heldman, D. R. (2001). Introduction to food engineering. Gulf Professional Publishing.
3.	Desrosier, N. W., and James N. Desrosier. (1977). The technology of food preservation. 4th Ed. AVI Publishing Company, Inc.

Class, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester III**					
Course Title	**:**	**Food Microbiology Laboratory**			***Course Code*:**	**:**	FT212L
Teaching Scheme (Hours)	**:**	Practical :-	2 hours/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE: Nil IOE: Nil	EPE =50	Total = 50	***Duration of EPE***	**:**	2 hours
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	knowledge of basic science					
Course Domain	**:**	Core					

Course Objectives		***Course Outcomes***	
1.	The course teacher will imparts knowledge to understand isolation, characterization of various microbes associated with foods and food groups.	1.	Students will be able to understand isolation, characterization of various microbes associated with foods and food groups.
2.	The course teacher will help students familiarize themselves with microbiological techniques for the study of foods.	2.	Students will familiarize themselves with microbiological techniques for the study of foods.
3.	The course teacher will teach to detect microorganism in foods.	3.	Students will be able to detect microorganisms in foods.
4	The course teacher will teach to understand the activities of microorganisms in food.	4.	Students will be able to understand the activities of microorganisms in food.
5.	The course teacher will teach to quantify the microorganisms present in the food.	5.	Students will be able to quantify the microorganisms present in food.
6	The course teacher will describe the characteristics of food borne, waterborne and spoilage microorganisms, and methods for their isolation, detection and identification.	6.	Students will be able to describe the characteristics of food borne, water borne spoilage microorganisms, and methods for their isolation, detection and identification.

Sr. No.	***List of Experiments***
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 and 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

General Instructions:-

Suggested Text Books/ Reference Books/Manual

1.	Frazier, W.C., and Westhoff, D.C. 1988. Food Microbiology, 4th ed. McGraw-Hill, New York.
2.	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
3.	Purohit S. S. (2003). "Microbiology fundamentals and applications" Edition, 6. Publisher, Agrobios.

Class, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester III**					
Course Title	**:**	**Food Chemistry Laboratory**			***Course Code*:**	**:**	FT 213L
Teaching Scheme (Hours)	**:**	Practical :--	2 hours /week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE: Nil IOE: Nil	EPE: 50 EOE: Nil	Total= 50	***Duration of EPE***	**:**	2 hours
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	Knowledge of Engineering Chemistry					
Course Domain	**:**	Core					

Course Rationale: The course covers a broad range of subjects related to foods including basic scientific principles to food systems and practical applications. Food chemistry deals with the chemical, physical and functional properties of food constituents and the chemical changes these constituents undergo during handling, processing and storage including those that limit food shelf life. Food chemistry is a major aspect of Food science, that is an interdisciplinary subject in which the engineering, biological, and physical sciences are used to study the nature of foods, the causes of deterioration, the principles underlying food processing, and the improvement of foods from a consumer and sustainability perspective. The aim of the course is to provide the students with a deep understanding of how food components contributes to overall quality of foods; and to enable students to evaluate and explain how the highly complex nature of food may result in a multitude of desired and undesired reactions which are controlled by a variety of parameters.

Course Objectives		***Course Outcome***	
1.	The course teacher will train the students with hands on experience with chemical compositions of foods.	1.	Students will be able to understand the principles behind analytical techniques associated with food.
2.	The course teacher will assist them in analysis of various food constituents, additives present in the food.	2.	Students will be able to select the appropriate analytical technique when presented with a practical problem.
3.	The course teacher will help to study the basic nutrients and their requirements for human nutrition.	3.	Students will be able to demonstrate practical proficiency in a food analysis laboratory.
4.	The course teacher will help to evaluate new product development.	4.	Students will be able to describe and use principal analytical methods used for quantifying the composition and reactions of food components.

Sr. No.	***List of Experiments***
1.	Determination of moisture by hot air oven method

2.	Estimation of crude protein by micro-Kjeldahlmethod
3.	Estimation of gluten
4.	Estimation of ash / mineral matter
5.	Estimation of crude fat
6.	Determination of acid value of oil
7.	Determination of saponification value/number of an oil or fat
8.	Determination of reducing sugar and total sugar
9.	Estimation of starch by Anthrone reagent
10.	Determination of vitamin c content
11.	Extraction of chlorophyll from leaf tissue
12.	Extraction of carotenoids from leaf tissue
Suggested Text Books/ Reference Books/Manual	
1.	Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.
2.	Association of Official Agricultural Chemists, and Horwitz, W. (1975). Official methods of analysis (Vol. 222). Washington, DC: Association of Official Analytical Chemists.

Class, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester III**					
Course Title	**:**	**Heat Transfer Laboratory**			***Course Code*:**	**:**	**FT214L**
Teaching Scheme (Hours)	**:**	Practical :--	2 hours/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE= Nil IOE=50	EPE= Nil EOE=Nil	Total=50	***Duration of EPE***	**:**	2 hours
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	Knowledge of Engineering Physics, Engineering Mathematics I and Engineering Mathematics II					
Course Domain	**:**	Core					

Course Rationale:

The main purpose to apply the basic of heat transfer. It also provides an idea about various equipments used for heat transfer.

Course Objectives		***Course Outcomes***	
1.	The course teacher will recognize food process for fundamentals of some major heat transfer operations through experimental set ups.	1.	Students will be able to understanding fundamentals of some major Heat transfer operations through practical work.
2.	The course teacher will explain them hands on training on important heat transfer devices and to motivate them for team work	2.	Students will be able to work in group and imitate Standard Operating Procedure for practical work v.i.z. responding to the guide.
3.	The course teacher will help to apply new ideas in a miniature process plant environment using steam and the other process utilities.	3.	Students will be able to learn design principles and be mechanic for heat transfer devices.
4.	The course teacher will demonstrate the 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	4.	Students will be able to build foundation for process intensification and be adapted to handle heat transfer operations.

Sr. No.	***List of Experiments***
1.	Thermal conductivity of metal rod apparatus
2.	Composite wall apparatus
3.	Thermal conductivity of insulating powder apparatus

4.	Lagged pipe apparatus
5.	Heat transfer by natural convection apparatus
6.	Heat transfer by forced convection apparatus
7.	Study of two phase flow apparatus
8.	Stefan Boltzmann apparatus
9.	Emissivity measurement of radiating surfaces apparatus
10.	Parallel flow/counter flow heat exchanger apparatus
General Instructions:--	
Suggested Text Books/ Reference Books/Manual	
1.	Kern, D. Q. Process Heat Transfer. McGraw-Hill, 1st Edition.
2.	Binay K. Dutta .Heat Transfer: Principles and Applications, Prentice-Hall of India, 1st Edition.
3.	William H. Mc Adams .Heat Transmission. McGraw-Hill, 3rd Edition.

Class, Part & Semester	:	**Second Year B. Tech. (Food Technology), Part II, Semester III**					
Course Title	:	**Programming Practices for Food Technologists**			***Course Code*:**	:	FT215L
Teaching Scheme (Hours)	:	Theory:-	1 hour/week		***Total Credits***	:	1+1=02
		Practical:-	2 hours/week				
Evaluation Scheme (Marks)	:	IOE=50 IPE= Nil	EPE= Nil EOE=Nil	Total = 50	***Duration of EPE***	:	Nil
Revision:	:	Fourth			***Month***	:	June 2021
Pre-requisites *(if any)*	:	Knowledge of computer					
Types of Course	:	Practical					
Course Domain	:	Core					

Course Rationale: This course exposes students to the depth and breadth of programming practice, with the goal of making students better programmers. It is, however, basic level of course in which some programming concepts are taught.

	Course Objectives		***Course Outcomes***
1.	The course teacher will help to identify and describe the purpose of various components of the VB integrated development environment (IDE).	1.	Students will be able to design, create, build, and debug visual basic applications.
2.	The course teacher will help To understand and apply Arithmetic operators, Logical operators and relational operators to build small application using visual basic.	2.	Students will be able to explore Visual Basic's Integrated Development environment (IDE).
3.	The course teacher will help to understand the concept of strings and their use in built functions.	3.	Students will be able to implement syntax rules in visual basic programs.
4	The course teacher will help to construct conditional and repetition statements and other control structures.	4.	Students will be able to explain variables and data types used in program development.
5.	The course teacher will help to Create Windows applications that store and access data to and from files and databases.	5.	Students will be able to apply arithmetic operations for displaying numeric output.
6.	The course teacher will help to apply procedures, sub-procedures, and functions to create manageable code.	6.	Students will be able to 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	2
Unit: I 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	3
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, Input Box, Msg Box, Examples: Food Engineering Applications.	2
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	2
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 variable name As Data type, Using Suffix: Integer, Long, Single, Double, String, Constant Variable, Examples: Food Engineering Applications.	2
Unit : VI Database Accessing Database, Data Control DAO, ADO, RDO, Visual Basic and Access Connectivity, Examples: Food Engineering Applications	2

Sr. No.	***List of Experiments***
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
Suggested Text Books/ Reference Books/Manual	
1.	Diane Zak, (2012). Programming with Microsoft Visual Basic. Course Technology, Cengage Learning, 6th edition.
2.	Evangelos Petroutsos. (2008). Mastering Microsoft Visual Basic. Wiley publishing, Inc., 1st edition.
3.	Noel Jerke. Visual Basic 6: The Complete Reference. Osborne/McGraw-Hill.
4.	Michael Halvorson. E-Book: Microsoft Visual Basic 2010.

Class, Part & Semester	**:**	**Second Year B. Tech (Food Technology), Part II, Semester III**						
Course Title	**:**	**Environmental Studies**				***Course Code***	**:**	HS221
Teaching Scheme (Hours)	**:**	Lecture : 2	02 hours/week			***Total Credits***	**:**	Nil
		Tutorial :	Nil					
Evaluation Scheme (Marks)	**:**	CIE = Nil SEE = 70	IPE=30 (Project)	:	Total=100	***Duration of SEE***	**:**	3 hrs. At the year end
Revision	**:**	Fourth				***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	Knowledge of Basic Environmental Science						
Course Domain	**:**	Language and Arts						

Course Rationale: The course is all about learning the way we should live and how we can develop sustainable strategies to protect the environment. It helps individuals to develop an understanding of living and physical environment and how to resolve challenging environmental issues affecting nature.

Course Objectives		***Course Outcomes***	
1.	The course teacher will explain the types of environmental pollution.	1.	Students will be able to identify the pollutants and respond to the pollution problem
2	The course teacher will make the students recognize social issues and the environment connectivity with the same.	2.	Students will be able to acquire knowledge of ecological threats and choose for sustainable developments.
3.	The course teacher will discuss various environmental Protection Acts reveal the students the importance of the same.	3.	Students will be able to anticipate all these laws and follow the same for the care of the environment.
4.	The course teacher will explain the students to adapt to various environmental technologies.	4.	Students will be able to apply their knowledge to implement pollution prevention measure through some practical work.

Curriculum Content	**Hours**
Unit V 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	06
Unit VI 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,	08

ozone layer depletion, nuclear accidents and holocaust; Wasteland reclamation; Consumerism and waste products.	
Unit VII 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.	06
Unit VIII Project / Field work:	10

Suggested Text Books:	
1.	Agarwal, K. C. (2001), Environmental Biology, Nidi Publ. Ltd., Bikaner.
2.	BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad, 380013, India
3.	Brunner R. C., (1989), Hazardous Waste Incineration, McGraw Hill Inc. 480p.
Suggested Reference Books:	
1.	Clark R. S., Marine Pollution, Clanderson Press Oxford (TB) Pg No. 6
2.	Cunningham, W. P. Cooper, T. H. Gorhani, E. and 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. and Watson, R. T. (1995), Global Biodiversity Assessment, Cambridge Univ. Press 1140p.
8.	Jadhav, H. and Bhosale, V. M. (1995), Environmental Protection and Laws, Himalaya Pub. House, Delhi, 284p.
9.	Mckinney, M. L. and Schocl. R. M. (1996), Environmental Science Systems and 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. and Datta, A. K. (1987), Waste Water Treatment, Oxford and 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.

Class, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester III**								
Course Title	**:**	**Soft Skills Development**						***Course Code***	**:**	HS212
Teaching Scheme (Hours)	**:**	2 hours /week						***Total Credits***	**:**	Nil
Evaluation Scheme (Marks)	**:**	Assignments Viva voce	**:** **:**	50 25	Written Test Grand Total	**:** **:**	25 100	***Duration of SEE***	**:**	NA
Revision	**:**	Fourth						***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	H. S. C. Level English language competency								
Course Domain	**:**	Humanity and Arts								

Course Rationale: The course skills focus on who people are, as opposed to what they are trained in. These skills serve to represent learners' approach to life and work. The course develops interpersonal skills hardwired to an individual's personality, and such skills characterize how we interact with other people in the workplace. These skills are important because they enable students to adjust to the frustrations and challenges they will encounter in their adult life, as well as the demands of work. Mastering soft skills help students learn, live and work better.

Course Assessment Method: 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. All these assessments will be 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		***Course Outcomes***	
1.	The course teacher will illustrate the components of self-development and state the importance of career planning.	1.	Students will be able to identify components of self-development and realize its importance in their career planning.
2.	The course teacher will define communication and classify the same.	2.	Students will be able to differentiate communication types and apply the same.
3.	The course teacher will explain behavioral skills, team skills and interpersonal skills.	3.	Students will be able to acquire behavioral, team and interpersonal skills and display the same.
4.	The course teacher will classify documentation types and describe various types of report writing.	4.	Students will be able to follow different document formats and acquire report and proposal writing skills.
5.	The course teacher will describe emotional intelligence and its role.	5.	Students will be able to receive and respond to emotions with intelligence.
6.	The course teacher will paraphrase interview skills and demonstrate resume writing.	6.	Students will be able to acquire interview skills and apply those when required.

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 IV Documentation: Report writing-Formal report, study tour report, project report, Writing proposal-solicited proposals and unsolicited proposals.	03
Unit V 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

Suggested Text Books:	
1.	Soft Skills. (2015). Career Development Centre, Green Pearl Publications.
Suggested Reference Books:	
1.	Covey Sean. (1998). Seven Habits of Highly Effective Teens. New York, Fireside Publishers.
2.	Carnegie Dale. (1998). How to win Friends and Influence People, New York: Simon and Schuster.
3.	Thomas A Harris (1972). I am ok, You are ok. New York-Harper and Row.
4.	Daniel Goleman. (2006). Emotional Intelligence, Bantam Book.
5.	Effective communication skill, MTD training and Ventus publishing ApS ISBN 978-87-7681-598-1.

Class, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester IV**					
Course Title	**:**	**Food Process Engineering I**			***Course Code*:**	**:**	FT221
Teaching Scheme (Hours)	**:**	Lecture : 3	3 hours/week		***Total Credits***	**:**	04
		Tutorial :1	1 hour/week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hours
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	Knowledge of Principles of Food Preservation					
Course Domain	**:**	Core					

Course Rationale:

This course deals with mass and energy balances, basic knowledge, principles, working about various mechanical operations and mass transfer operations with their respective applications in the food industry.

Course Objectives		***Course Outcomes***	
1.	The course teacher will define the course and indicate the importance of the same to the students.	1.	Students will be able to recognize the scope and need of the course.
2.	The course teacher will explain the basic concepts of mass balance and energy balance with its applications in food processing unit operations.	2.	Students will be able tounderstand all unit operations and its applications in food processing.
3.	The course teacher will describe the basic theory and concept involved in food processing unit operations.	3.	Students will be able to apply the principles of mass and energy balance to food processing systems.
4.	The course teacher will enable the students to solve problems in food processing industries.	4.	Students will be able toanalyse the working of the food processing equipment used for the different unit operations.
5.	The course teacher will describe the working of various processing equipment with its application in food processing industries.	5.	Students will be able to evaluate how various unit operations work individually and together.
6.	The course teacher will enable students to design equipment or food processing operations	6.	Students will be able to design and construct the food processing equipment or food processing unit operations.

Curriculum Content	**Hours**

Unit I Introduction and Size Reduction Introduction: Unit operations in food engineering, Mass and energy balance Size Reduction : Particle size analysis, equipment, application to food industries	7
Unit II Mixing Basic theory of solid – solid mixing, liquid- liquid mixing, equipment, applications to food industries.	6
Unit III Filtration and Centrifugation Filtration :Theory of filtration, industrial filters, applications to food industries Centrifugation: Theory of centrifugation, equipment, applications to food industries	7
Unit IV Distillation Vapour liquid equilibria, batch and continuous distillation, steam distillation, equipment, applications to food industries	7
Unit V Diffusion and Gas Absorption Diffusion : Basics of mass transfer and diffusion in food systems ,Molecular diffusion and Fick's Law; Diffusion of gases in liquid and solid foods Gas Absorption : Principles, equipment and applications in food processing	7
Unit VI Extraction Solvent extraction, leaching, equipment, applications for food industries	5

Suggested Text Books:

1.	Rao, D. G. (2012). Fundamental of Food Engineering. PHI Learning Private Limited, New Delhi.
2.	Singh, R.P., and Heldman, D.R. (2001). Introduction to Food Engineering, 3rd ed., Academic Press, San Diego, CA. Academic Press publications. 69–78, 144–157.
3.	Geankoplis, C. J. (2002). Transport processes and unit operations. 3rd Edition. Prentice Hall of India.
4.	Coulson and Richardsons. (1998).Chemical Engineering ,Vol I and II, Asiali Books Pvt ltd.
5.	McCabe and Smith "Unit Operations" McGraw-Hill, New York

Suggested Reference Books:

1.	Treybal, R. E. (1981). Mass Transfer Operations. 3rd edition. McGraw Hill.
2.	Dennis, R.H. (1981). "Food Process Engineering. Academic Publishing and Press, King Saud University.
3.	Rao, M.A. Syed S.H. Rizvi, and Ashim K. Datta. (2008). Engineering properties of foods. CRC Press.
4.	ZekiBer. (2018). Food Process Engineering and Technology. 3rdEdition. Academic Press.
5	Sahay, K.M. and Singh, K. K. (2003). UNIT Operations in Agricultural Processing. Vikas Publishing House Pvt. Ltd., New Delhi.

Class, Part & Semester	**:**	**Second Year B. Tech (Food Technology), Part II, Semester IV**					
Course Title	**:**	**Food Additives and Contaminants**			***Course Code*:**	**:**	**FT222**
Teaching Scheme (Hours)	**:**	Lecture : 4	4 hours/week		***Total Credits***	**:**	04
		Tutorial : Nil	Nil				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total= 100	***Duration of SEE***	**:**	3 hours
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	Knowledge of Food Chemistry, Food Microbiology and Principles of Food Preservation					
Course Domain	**:**	Core					

Course Rationale: The course covers a broad range of subjects related to foods additive and its practical applications. Introduction to the types of food additives currently used in the food industry and the function(s) of these chemical compounds. The safety of food additives will be addressed as related to their toxicological information. The overarching question of the need for food additives and their safety is being presented. In addition, a selection of naturally-occurring toxicants in foods will be examined and discussed.

Course Objectives		***Course Outcomes***	
1.	The course teacher will help to understand the classification of food additives and ingredients.	1.	Students will be able to describe the various additives and ingredients used in food industries.
2.	The course teacher will help to understand the significance of different food additives and ingredients in food quality, preservation and storage.	2.	Students will be able to describe the mechanisms of food additives involved in foods.
3.	The course teacher will help to understand the safety of use of food additives and ingredients.	3.	Students will be able to explain the significance of different additives in food quality, preservation and storage
4.	The course teacher will help to understand their Maximum Permissible Limit (MPL) of additives and ingredients in foods.	4.	Students will be able to describe the safety of use of food additives and ingredients.
5.	The course teacher will help to understand the effect of different process conditions on stability of food additives and ingredients.	5.	Students will be able to extrapolate the knowledge gained on food additives and ingredients in food industries.
6.	The course teacher will help to understand the process of preparation of food additives and ingredients.	6.	Students will be able to describe the process of preparation of food additives and ingredients.

Curriculum Content	Hours
Unit I Definitions of Food Additives, Classification and Functions, Legitimate uses of Additives in foods, Intentional and Non Intentional additives, Difference between Additives and Adulterants, Toxicological evaluation of food additives.	05
Unit II Uses and functions and Applications of: Buffers, Acids, Chelating agents, Low calorie, nonnutritive sweeteners and Polyols, Antioxidants, Antimicrobial Agents	07
Unit III Uses and functions and Applications of: Emulsifying and stabilizing agents, Anti-caking agents, Thickeners, Firming agents, Hydrocolloids	10
Unit IV Use and Functions of Flour bleaching agents and Bread improvers. Food Preservatives : Introduction; Classification- Natural and chemical Preservatives; Mode of action; Role in Food processing,	10
Unit V Food colorants: Introduction; Natural and Synthetic food colorants; Classification of Food colorants; Chemical nature; Impact on health. Application of colors in food. Food Flavor: Introduction; Classification of food flavor; Application of colors in food.	10
Unit VI Inherent toxicants terms in toxicology, safety evaluation using traditional and modern approach contaminants, pesticide residues, toxicology and public health.	10

Suggested Text Books:	
1.	Furia,T. E., (1980). Handbook of Food Additives, CRC Press, Boca Raton, Flor.
2.	Branen, A. F. et al (2001). Food Additive s, 2nd Edition, Marcel. Dekker.
3.	Msagati, T. A. (2013). The chemistry of food additives and preservatives. Wiley-Blackwell.
4.	Joint, F. A. O., WHO Expert Committee on Food Additives, and World Health Organization. (1993). Toxicological evaluation of certain food additives and contaminants. World Health Organization.
5.	Saltmarsh, M. (Ed.). (2020). Saltmarsh's Essential Guide to Food Additives. Royal Society of Chemistry.
Suggested Reference Books:	
1.	Fennema, O. R. (1996). Food Chemistry, Marcel Dekker. *New York, NY*.
2.	DeMan. (1982). Food chemistry" Hardcover, A V I Publishing Company.
3.	William C. Frazier And Dennis C. Westoff. (2017). Food Microbiology 5th Edition, McGraw Hill Education
4.	Baines, D., and Seal, R. (Eds.). (2012). Natural food additives, ingredients and flavourings. Elsevier.

5.	Wood, R., Foster, L., Damant, A., & Key, P. (2004). Analytical methods for food additives. Elsevier.
6.	Saltmarsh, M., and Saltmarsh, M. (Eds.). (2013). Essential guide to food additives. Royal Society of Chemistry.
7.	Smith, J., and Hong-Shum, L. (2011). Food additives data book. John Wiley and Sons.
8.	Branen, A. L., Davidson, P. M., Salminen, S., and Thorngate, J. (Eds.). (2001). Food additives. CRC Press.
9.	Wood, R., Foster, L., Damant, A., & Key, P. (2004). Analytical methods for food additives. Elsevier.

Class, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester IV**					
Course Title	**:**	**Food Biochemistry**			***Course Code*:**	**:**	FT223
Teaching Scheme (Hours)	**:**	Lecture : 4	4 Hrs/week		***Total Credits***	**:**	04
		Tutorial : Nil	Nil				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total= 100	***Duration of SEE***	**:**	3 hours
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	Knowledge of basic science					
Course Domain	**:**	Core					

Course Rationale:

	Course Objectives		***Course Outcomes***
1.	The course teacher support students in the understanding of biochemical cycles.	1.	Students will be able to understand the biochemical cycles.
2.	The course teacher educates students on the biosynthesis of macromolecules and micro molecules.	2.	Students will be able to grasp the biosynthesis of macromolecules and micro molecules various food processing techniques.
3.	The course teacher helps to understand the fundamental biochemical principles, structure/function of bio-molecules, metabolic pathways and the regulation of biochemical processes.	3.	Students will be able to understand the fundamental biochemical principles, structure/function of bio-molecules, metabolic pathways and the regulation of biochemical processes.
4.	The course teacher helps to understand the mechanism of enzyme action and identify factors affecting their action.	4.	Students will be able to understand the mechanism of enzyme action and identify factors affecting their action.
5.	The course teacher helps to understand the major chemical and biochemical (enzymatic) reactions that influence food quality with emphasis on food industry applications.	5.	Students will be able to understand the major chemical and biochemical (enzymatic) reactions that influence food quality with emphasis on food industry applications.
6.	The course teacher helps to understand how the properties of different food components and interactions among these components modulate the specific quality attributes of food systems.	6.	Students will be able to describe the properties of different food components and interactions among these components modulate the specific quality attributes of food systems.

Curriculum Content	**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

Suggested Text Books:	
1.	Cox, M.M. and Nelson, David L. Lehininger. (2008). Principles of Biochemistry. 5th Edition. W. H. Freeman.
2.	Murray, Robert K. *et al*., (2006). Harper's Illustrated Biochemistry. 27th Edition. McGraw-Hill.
3.	Satyanarayanan, U. (2005). Biochemistry. Books and Allied.
4.	Voet, D .J. and J. G. Voet. (2008). Principles of Biochemistry. 3rd Edition. John Wiley.
5.	Rastogi, S.C. (2003). Biochemistry. 2nd Edition. Tata McGraw-Hill.
Suggested Reference Books:	
1.	Lehninger. (1993). Biochemistry. CBS. Publications.
2.	Stryer. (1988). Biochemistry. W H Freeman, New York.
3.	LubertStryen. (2006). Biochemistry, 6th Edition, W H Freeman and Co.
4.	Shubhangini A. Joshi. (2002). Nutrition and Dietetics.2ndEdition. Tata McGraw Hill publishing Company Ltd.
5.	J. H. Weil, (1990). General Biochemistry, 6th Edition, New Age International Private Limited.

Class, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester IV**					
Course Title	**:**	**Human Nutrition**			***Course Code*:**	**:**	FT224
Teaching Scheme (Hours)	**:**	Lecture : 4	4 hours/week		***Total Credits***	**:**	04
		Tutorial : Nil	Nil				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total= 100	***Duration of SEE***	**:**	3 hours
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	Knowledge of basic science					
Course Domain	**:**	Core					

Course Rationale: This course is all about nutritional aspects of foods. The aim of the course is to provide the students with deep understanding of how nutrients and balanced diet contributes to maintain healthy life; and explain how to deal with nutrition related problems, diseases by health promoting balanced diet. Human nutrition deals with physiological and metabolic functions of human digestive system; Nutritional requirements of special group of people such as aged, infants, pregnant & lactating mothers, patients etc. Human nutrition is major aspect of basic nutrients requirements, Balanced diet and awareness about food faddism. It helps to solve nutrient deficiencies diseases, Malnutrition etc. It promotes awareness about RDA, Food components and nutrients that affecting on immune systems such as undesirable constituents, toxic substances and their disorders.

Course Objectives		***Course Outcomes***	
1.	The course teacher helps to understand the physiological and metabolic functions of human digestive system.	1.	Students will be able to understand the physiological and metabolic functions of nutrients.
2.	The course teacher helps to understand an overview of the major macro and micronutrients relevant to human health.	2.	Students will be able to Familiarize nutritional assessment, RDA and Dietary Recommendations and guidelines.
3.	The course teacher will help to formulate dietary recommendations.	3.	Students will be able to understand the importance of energy and water balance.
4.	The course teacher helps to understand proper diet planning, nutritional facts for balanced nutrition and healthy diets.	4.	Students will be able to understand malnutrition, their causes and treatment.
5.	The course teacher helps to understand the role of diet in causing and preventing various diseases.	5.	Students will be able to understand the principles involved in the diet, exchange lists, food labels and nutritional facts for balanced nutrition and healthy diets.
6.	The course teacher helps to get a basic foundation in human nutrition in preparation for any of the health professions.	6.	Students will be able to tell Undesirable Constituents and toxic substances and their disorders.

Curriculum Content	**Hours**
UNIT-I Introduction Scope, concepts and importance of nutrition, human digestive system	8
UNIT- II Nutritional aspects Nutritional aspects of carbohydrate, protein, lipids, water, vitamin and minerals, food, fad and faddism.	8
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.	8
UNIT- VI Undesirable Constituents and toxic substances Undesirable Constituents and toxic substances and their disorders, hormones	8

Suggested Text Books:

1.	Joshi, Shubhangini A., (1992). Nutrition and Dietetics. Tata Mc Grow- Hill publishing Company Ltd., New Delhi.
2.	Geissler. (2009). Fundamentals of Human Nutrition. Elsevier Science.
3.	Gropper, S. S. (2013). Advance Nutrition and Human Metabolism. Cenage Learning.
4.	Swaminathan, M. (2006). Advanced Text Book on Food and Nutrition (Volume I and II). The Bangalore Printing and Publishing Co. Ltd., Bangalore.

Suggested Reference Books:

1.	Stewart Truswell. (2003) .ABC of Nutrition .4th edition. BMJ Publishing Group.
2.	Carolyn D. Berdanier, Elaine B. Feldman and Johanna Dwyer. (2008). Handbook of Nutrition and Food. 2nd Ed. CRC Press, Boca Raton, FL, USA.
3.	Swaminathan, N. (1987). Food Science and experimental foods. Ganesh Publications, Madras.

Class, Part & Semester	**:**	**Second Year B. Tech (Food Technology), Part II, Semester IV**					
Course Title	**:**	**Fluid Mechanics**			***Course Code*:**	**:**	FT225
Teaching Scheme (Hours)	**:**	Lecture : 4	04 hours/week		***Total Credits***	**:**	04
		Tutorial : Nil	Nil				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Total=100	***Duration of SEE***	**:**	3 hours
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	Knowledge Engineering Mechanics and Engineering physics					
Course Domain	**:**	Core					

Course Rationale:

This course will give fundamental knowledge of fluid mechanics and use of fluid mechanics in chemical engineering domain.

Course Objectives		***Course Outcome***	
1.	The course teacher will explain fundamentals of Fluid Mechanics, which is used in the applications of Aerodynamics, Hydraulics, Marine Engineering, Gas dynamics etc.	1.	Students will be able tostate the Newton's law of viscosity and Explain the mechanics of fluids at rest and in motion by observing the fluid phenomena.
2.	The course teacher will give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows	2.	Students will be able tocompute force of buoyancy on a partially or fully submerged body and Analyze the stability of a floating body.
3.	The course teacher willdevelop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.	3.	Students will be able toderive Euler's Equation of motion and Deduce Bernoulli's equation.
4.	The course teacher will help to imbibe basic laws and equations used for analysis of static and dynamic fluids.	4.	Students will be able toexamine energy losses in pipe transitions and sketch energy gradient lines.
5.	The course teacher will inculcate the importance of fluid flow measurement and its applications in Industries.	5.	Students will be able toevaluate pressure drop in pipe flow using Hagen-Poiseuille's equation for laminar flow in a pipe.
6.	The course teacher will help to determine the losses in a flow system, flow through	6.	Students will be able todistinguish the types of flows and Determine sonic velocity in a

	pipes, boundary layer flow and flow past immersed bodies.		fluid.

Curriculum Content	Hours
Unit I:Unit systems and Fundamentals 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.	08
Unit II: Fluid flow phenomena and Basic equations of fluids flow Behavior of flowing fluid, Types of flow, Newtonian and non-Newtonian Fluids, viscosity and momentum 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 in straight tubes, Boundary layer separation and wake formation .Mass balance, mass velocity, momentum balance, and Bernoulli's equation without and with friction, kinetic energy correction factor, correction for fluid friction, Pump Bernoulli's equation, Euler's equation, Problems.	08
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, the friction factor. Relations between skin friction parameters .Laminar flow in pipes, Laminar flow of Newtonian 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 fittings and valves, couette flow, Layer flow with free surfaces, Flow through annulus, Problems.	12
Unit IV:Transportation and metering of fluids Pipe and tubing, joints and fittings. Prevention of leakage around moving parts. Valves like Gate valve, 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.	08
Unit V:Flow past immersed bodies Drag coefficients of typical shapes, form drag and stream lining, Friction in flow through beds of solids, Ergun's equation, Kozeny- Carman equation, Burke Plummer equation, Fluidization, Mechanism of fluidization, particulate and aggregative fluidization, minimum fluidization velocity, expansion of -fluidized beds, and application of fluidization.	08

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.	08

Suggested Text Books:	
1.	Mc Cabe, W. L. and Smith, J. C (1993). 'Unit operations of Chemical Engineering.' VII edition, Mcgraw Hill Book Co., International ed.
2.	Rajput, R. K. Fluid mechanics and Hydraulic machines. VI edition, S. Chand Publication.
3.	Bansal, R. K. Fluid mechanics and Hydraulic machines.' VII edition, LP Publication.
Suggested Reference Books:	
1.	Steeter, U.L (1971).Fluid Mechanics' V ed. Mcgraw Hill Book Co., International Edn.
2.	Richardson, J.E. and Coulson, J.M. C.(1985). Chemical Engineering. 3rd Edition, Vol. 1 Pergamum on Press.
3.	Miohell, B.I. (1970). Fluid and Particle Mechanics Pergamum on Press.
4.	Gupta, S.K. (1979).Momentum Transfer Operations, Tata McGraw Hill.

Class, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester IV**					
Course Title	**:**	**Food Process Engineering-I Laboratory**			***Course Code*:**	**:**	**FT221L**
Teaching Scheme (Hours)	**:**	Practical :-	2 hours/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IOE= 50 Marks	EOE= 50 Marks	Total= 100 Marks	***Duration of EPE***	**:**	2 hours
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	Knowledge of Principles of Food Preservation					
Course Domain	**:**	Core					

Course Rationale:

This course deals with mass and energy balances, basic knowledge, principles, working about various mechanical operations and mass transfer operations with their respective applications in the food industry.

Course Objectives	***Course Outcomes***

1.	The course teacher will give the knowledge about various unit operations used in food industries.	1.	Students will be able to identify the various unit operations used in food industries.
2.	The course teacher will describe the basic principles of food processing unit operations.	2.	Students will be able to understand the basic principles of unit operations based on experiment.
3.	The course teacher will enable student to calculate the mass balance and energy balance equations of food processing operations.	3.	Students will be able to solve the mass balance and energy balance equations of food processes operations.
4.	The course teacher will explain the working of various equipment involved in various unit operations with experiments	4.	Students will be able to analyze the working of various equipments by practical experience.
5.	The course teacher will enable the student to evaluate the issues in working of equipment.	5.	Students will be able to evaluate the issues in the working of equipment.

Sr. No.	***List of Experiments***
1.	Design problems on mass balance and energy balance equations
2.	Experiment of Particle Size Analysis
3.	Experiment on Size Reduction
4.	Experiments on Solid-Solid Mixing
5.	Experiment on Liquid-Liquid Mixing
6.	Experiment on Filtration
7.	Experiment on Centrifugation
8.	Experiment on sieve tray Distillation
9.	Experiment on Diffusion
10.	Experiment on Gas Absorption
11.	Experiment on Solvent extraction
12.	Experiment on Leaching

Suggested Text Books/ Reference Books/Manual

1.	Gustavo V Barbosa-Canovas and Li Ma, Blas J Barletta. (1997). Food Engineering Laboratory Manual. CRC Press.
2.	Christie J. Geankoplis. Transport Processes And Separation Process Principles (Includes Unit Operations) 4th Edition.

3.	Singh and Heldman. Introduction to food engineering. Academic Press publications

Class, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester IV**					
Course Title	**:**	**Food Additives and Contaminants Laboratory**			***Course Code*:**	**:**	**FT 222L**
Teaching Scheme (Hours)	**:**	Practical :--	2 hours/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE: Nil IOE: Nil	EPE: 50 EOE: Nil	Total= 50	***Duration of EPE***	**:**	2 hours
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	Knowledge of Food Chemistry, Food Microbiology and Principles of Food Preservation					
Course Domain	**:**	Core					

Course Rationale: The course covers a broad range of subjects related to foods additive and its practical applications. Introduction to the types of food additives currently used in the food industry and the function(s) of these chemical compounds. The safety of food additives will be addressed as related to their toxicological information. The overarching question of the need for food additives and their safety is being presented. In addition, a selection of naturally-occurring toxicants in foods will be examined and discussed.

Course Objectives		***Course Outcomes***	
1.	The course teacher will help to train the students with hands on experience with estimation and use of food additives.	1.	Student will get hands on experience with estimation and use of food additives.
2.	The course teacher will help to study the basic food additives and their role in food production.	2.	Students will get knowledge related to the basic food additives and their role in food production respectively.
3.	The course teacher will help to study the effect of food additives on human health.	3.	Students will learn the effect of food additives on human health.
4.	The course teacher will help to evaluate the quality of developed products.	4.	Students will be able to evaluate the quality of developed products.

Sr. No.	***List of Experiments***
1.	Detection/Estimation of adulterants in some foods
2.	Determination of carotenoids content
3.	Determination of chlorophyll content
4.	Estimation of tannins content
5.	Extraction of essential oils
6.	Determination of vitamin c content
7.	Effect of acidulants in food products
8.	Effect of thickener in food products

9.	Effect of natural sweeteners/ artificial sweeteners in food products
10.	Effect of stabilizing agents in food products
11.	Effect of emulsifier in food products
12.	Effect of bread improver
Suggested Text Books/ Reference Books/Manual	
1.	Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.
2.	Association of Official Agricultural Chemists and Horwitz, W. (1975). Official methods of analysis (Vol. 222). Washington, DC: Association of Official Analytical Chemists.
3.	Wood, R., Foster, L., Damant, A., & Key, P. (2004). Analytical methods for food additives. Elsevier.
4.	Saltmarsh, M., and Saltmarsh, M. (Eds.). (2013). Essential guide to food additives. Royal Society of Chemistry.
5.	Smith, J., and Hong-Shum, L. (2011). Food additives data book. John Wiley and Sons.
6.	Branen, A. L., Davidson, P. M., Salminen, S., &Thorngate, J. (Eds.). (2001). *Food additives*. CRC Press.

Class, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester IV**					
Course Title	**:**	**Food Biochemistry Laboratory**			***Course Code*:**	**:**	**FT 223L**
Teaching Scheme (Hours)	**:**	Practical :-	2 hours /week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE: Nil IOE: Nil	EPE: 50 EOE: Nil	Total=50	***Duration of EPE***	**:**	2 hours
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	Knowledge of Food Chemistry					
Course Domain	**:**	Core					

Course Rationale:

	Course Objectives		***Course Outcomes***
1.	The course teacher helps to evaluate the food component on qualitative and quantitative basis.	1.	The student will able to evaluate the food component on qualitative and quantitative basis.
2.	The course teacher teaches some laboratory techniques and different methodology used in biological assay.	2.	The student will be able to know the laboratory techniques and different methodology for biological assay.
3.	The course teacher helps to conduct qualitative analysis of protein, lipid and fats.	3.	The student will be able to conduct qualitative analysis of protein, lipid and fats.
4.	The course teacher help to determine vitamin C and vitamin A.	4.	The student will be able to identify appropriate techniques for analysis.
5.	The course teacher transfer sufficient knowledge of food biochemistry to control reactions in foods.	5.	The student will be able to gain sufficient knowledge of food biochemistry to control reactions in foods.
6.	The course teacher helps to develop a practical proficiency in a food biochemistry and analysis laboratory.	6.	The student will able to develop a practical proficiency in a food biochemistry and analysis laboratory.

Sr. No.	***List of Experiments***
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
Suggested Text Books/ Reference Books/Manual	
1.	Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Class, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester IV**					
Course Title	**:**	**Human Nutrition Laboratory**			***Course Code*:**	**:**	**FT 224L**
Teaching Scheme (Hours)	**:**	Practical :-	2 hours/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE: Nil IOE: 50	EPE: Nil EOE: Nil	Total=50	***Duration of EPE***	**:**	2 hours
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	Knowledge of basic science					
Course Domain	**:**	Core					

Course Rationale:

The course is all about learning the way we should evaluate BMR Anthropometric measurements, energy value of product. It helps to determine and understanding of micro and macro nutrients such as vitamin A, C, also minerals like iron, Ca, etc. and their requirement for human body. It helps to prepare balanced diet on the basis of physical activity.

Course Objectives		***Course Outcomes***	
1.	The course Teacher helps to understand the physiological and metabolic functions of nutrients.	1.	The student will be able to understand the methods used for nutritional assessment.
2.	The course teacher helps to determine the major macro and micronutrients relevant to human health	2.	The student will be able to familiarize nutritional assessment, RDA and Dietary Recommendations and guidelines.
3.	The course teacher helps to understand methods of nutritional assessment, RDA and guidelines.	3.	The student will be able to determine BMR and body surface area.
4.	The course teacher will explain how dietary recommendations are formulated.	4.	The student will be able to understand the food composition and energy balance requires in diet planning.
5.	The course Teacher will describe the methods used to carry out nutrition research.	5.	The student will be able to understand the methods used to carry out nutrition research.
6.	The course Teacher helps to compute energy requirement on the basis of physical activity.	6.	The student will able to identify the appropriate techniques requires for Biochemical analysis of blood and urine.

Sr. No.	***List of Experiments***
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 ACU units
8.	Role of various national and international agencies in field of human nutrition
9.	Nutritional labeling of food products
10.	Nutritional survey
11.	Determination of energy value of food by bomb calorimeter
12.	Diet for specific health condition
13.	Visit to Pathological laboratory
Suggested Text Books/ Reference Books/Manual	
1.	Swaminathan, M. (2006). Advanced Text Book on Food and Nutrition (Volume I and II). The Bangalore Printing and Publishing Co.Ltd, Bangalore.
2.	Stewart, Truswell. (2003) ABC of Nutrition (4th edition). BMJ Publishing Group. ISBN 0727916645.
3.	Carolyn D. Berdanier, Elaine B. Feldman and Johanna Dwyer. (2008). Handbook of Nutrition and Food. 2nd Ed. CRC Press, Boca Raton, FL, USA.

Class, Part & Semester	**:**	**Second Year B. Tech. (Food Technology), Part II, Semester IV**					
Course Title	**:**	**Fluid Mechanics Laboratory**			***Course Code*:**	**:**	FT225L
Teaching Scheme (Hours)	**:**	Practical :-	02 hours/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IOE =50	EPE/EOE= Nil	Total=50	***Duration of EPE***	**:**	Nil
Revision:	**:**	Fourth			***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	Knowledge Engineering Mechanics and Engineering physics					
Course Domain	**:**	Core					

Course Rationale: Introduction to fluid mechanics laboratory and design of experiments, including experiments on flow patterns, velocity profile in an air pipe, wind tunnel calibration, draining of a tank, pipe friction, drag forces, boundary- layer studies, falling-ball experiments, and measurements of fluid properties.

Course Objectives		***Course Outcomes***	
1.	The course teacher will help to compare the results of analytical models introduced in lecture to the actual behavior of real fluid flows.	1.	Students will be able to compare the results of analytical models introduced in lecture to the actual behavior of real fluid flows.
2.	The course teacher will discuss standard measurement techniques used in fluid mechanics and their applications respectively.	2.	Students will be able to use standard measurement techniques in fluid mechanics.
3.	The course teacher will help to learn and practice writing the technical reports.	3.	Students will be able to write technical reports.
4.	The course teacher helps to work on small design projects.	4.	Students will be able to work on small design projects.

Sr. No.	***List of Experiments***
1.	Study of Bernoulli's Theorem
2.	To Find the Characteristics of Centrifugal Pump
3.	To find out LOSSES in different sizes of Pipe fittings
4.	To determine the friction Losses in Pipes
5.	To determine the coefficient of discharge of Orifice meter
6.	To determine the Velocity of flowing fluid & Coefficient of the given Pitot tube

7.	Measurement of Pressure by using Bourdon Tube Pressure Gauge, Pizometer, U Tube Manometer (500mm)
8.	Measurement of Pressure by using Differential manometer (500 mm & 1000mm), Inclined Tube Manometer (500mm) & Hulshof Apparatus
9.	To study the performance of Reciprocating Pump and draw characteristic curves.
10.	To study laminar flow in pipes by using the Reynolds apparatus
11.	To determine coefficient of discharge of Rotameter
12.	To determine the Coefficient of Discharge of the given Venturimeter

General Instructions:

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

Suggested Text Books/ Reference Books/Manual

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

Class, Part & Semester	**:**	**Second Year B. Tech.(Food Technology), Part II, Semester IV**						
Course Title	**:**	**Environmental Studies**				***Course Code***	**:**	HS221
Teaching Scheme (Hours)	**:**	Lecture :	2 hours/week			***Total Credits***	**:**	Nil
		Tutorial :	Nil					
Evaluation Scheme (Marks)	**:**	CIE = 00 SEE = 70	IPE=30 Project	:	Total=100	***Duration of SEE***	**:**	3 hrs. At the year end
Revision	**:**	Fourth				***Month***	**:**	June 2021
Pre-requisites *(if any)*	**:**	Knowledge of Basic Environmental Science						
Course Domain	**:**	Language and Arts						

Course Rationale: The Course is all about learning the way we should live and how we can develop sustainable strategies to protect the environment. It helps individuals to develop an understanding of living and physical environment and how to resolve challenging environmental issues affecting nature.

Course Objectives		***Course Outcomes***	
1.	The course teacher will explain the types of environmental pollution.	1.	Students will be able to identify the pollutants and respond to the pollution problem
2	The course teacher will make the students recognize social issues and the environment connectivity with the same.	2.	Students will be able to acquire knowledge of ecological threats and choose for sustainable developments.
3.	The course teacher will discuss various environmental Protection Acts reveal the students the importance of the same.	3.	Students will be able to anticipate all these laws and follow the same for the care of the environment.
4.	The course teacher will explain the students to adapt to various environmental technologies.	4.	Students will be able to apply their knowledge to implement pollution prevention measure through some practical work.

Curriculum Content	**Hours**
Unit V 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	06
Unit VI 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,	08

ozone layer depletion, nuclear accidents and holocaust; Wasteland reclamation; Consumerism and waste products.	
Unit VII 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.	06
Unit VIII Project / Field work:	10

Suggested 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
3.	Brunner R. C., (1989), Hazardous Waste Incineration, McGraw Hill Inc. 480p.

Suggested Reference Books:

1.	Clark R. S., Marine Pollution, Clanderson Press Oxford (TB) Pg No. 6.
2.	Cunningham, W. P. Cooper, T. H. Gorhani, E. and 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. and Watson, R. T. (1995), Global Biodiversity Assessment, Cambridge Univ. Press 1140p.
8.	Jadhav, H. and Bhosale, V. M. (1995), Environmental Protection and Laws, Himalaya Pub. House, Delhi, 284p.
9.	Mckinney, M. L. and 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. and 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. and 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 Goel, P. K. Introduction to air pollution Techno-Science Publications (TB).
19.	Wagner, K. D., (1998), Environmental Management, W. B. Saunders Co. Philadelphia, USA.

Class, Part & Semester	**:**	**Second Year B. Tech.(Food Technology), Part II, Semester IV**									
Course Title	**:**	**Introduction to Performing Arts**						***Course Code***	**:**	HS222	
Teaching Scheme (Hours)	**:**	2 hours /week						***Total Credits***	**:**	Nil	
Evaluation Scheme (Marks)	**:**	Assignments Viva voce	: :	50 25	Written Test Grand Total	: :	25 100	***Duration of SEE***	**:**	NA	
Revision	**:**	Fourth						***Month***	**:**	June 2021	
Pre-requisites *(if any)*	**:**	Student's involvement and interest in the classroom is the pre- requisite.									
Course Domain	**:**	Humanity and Fine Arts									

Course Rationale:

Course Assessment Method: 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		***Course Outcomes***	
1.	The course teacher will state the various performing arts and explain the importance of the same.	1.	Students will be able to identify the types of performing arts and their differences with importance.
2.	The course teacher will elucidate about drama and Natya-Shastra etc.	2.	Students will be able to acquire knowledge about drama, Natya-Shastra, street play etc.
3.	The course teacher will explain types of dance, will reveal about theaters.	3.	Students will be able to demonstrate dance skills and organize about theater activities.
4.	The course teacher will demonstrate about Rag and Taal.	4.	Students will be able to receive and respond to the Rag and Taal.
5.	The course teacher will explain Gharana system and classify Indian musical instruments.	5.	Students will be able to identify Gharana and instruments of their choice and interest for practice.
6.	The course teacher will Summarize contribution of great musicians and outline about music concerts	6.	Students will be able to recognize contribution of great musicians and display performances for a music concert.

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 natyashastra, street play, Sanskrit natya, Marathi sangitrangbhum	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

Suggested Reference Books:

1.	Vasant, Sangeet Karyalaya. Sangeet Visharad. Hatras Prakashan.
2.	Bidkar, Suchita. (2015). Sangeetshastra Vidnyan Bhag 1, Sanskar Prakashan.
3.	Bidkar, Suchita. (2015). Sangeetshastra Vidnyan Bhag 2, Sanskar Prakashan.
4.	Mainkar, Sudhir. Sangeet Kala Aani Shikshan. Sanskar Prakashan.
5.	Chandavarkar, Bhaskar. (2011). Vadyavedh. 2nd Edition.SanskarPrakashan.
6.	Mulgaonkar, Arvind. (2015).Tabla. Popular Prakashan.
7.	Chris Hogget. (1977).Stage Crafts. St Martins Pr.
8.	Sarabhai, Mrinalini. Understanding of Bharat Natyam.
9.	Borysenko, Joan. (2007). Minding the body and mending the mind. Bantam.
10.	Subbanna, V.K., Ragadalli Antrang.

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

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. (Food Technology) Semester III

Sr. No.	Second Year B. Tech.(Food Technology) Semester III Pre-revised syllabus	Second Year B. Tech.(Food Technology) Semester III Revised syllabus	Remarks
1.	Principles of Food Preservation	Principles of Food Preservation	Slight modification in content
2.	Engineering Mathematics-III	Engineering Mathematics-III	Slight modification in content
3.	Food Microbiology	Food Microbiology	Slight modification in content
4.	Food Chemistry	Food Chemistry	Slight modification in content
5.	Heat Transfer	Heat Transfer	Slight modification in content
6.	Principles of food Preservation Laboratory	Principles of Food Preservation Laboratory	Slight modification in content
7.	Food Microbiology Laboratory	Food Microbiology Laboratory	Slight modification in content
8.	Food Chemistry Laboratory	Food Chemistry Laboratory	Slight modification in content
9.	Heat Transfer Laboratory	Heat Transfer Laboratory	Slight modification in content
10.	Programming practices for Food Technologists	Programming practices for Food Technologists	Slight modification in content
11.	Environmental Studies	Environmental Studies	Slight modification in content
12.	Soft Skills Development	Soft Skills Development	Slight modification in content

Second Year B. Tech. (Food Technology) Semester IV

Sr. No.	Second Year B. Tech. (Food Technology) Semester IV Pre-revised syllabus	Second Year B. Tech.(Food Technology) Semester IV Revised syllabus	Remarks
1.	Food Process Engineering-I	Food Process Engineering-I	Slight modification in content
2.	Food Additives and Contaminants	Food Additives and Contaminants	Slight modification in content
3.	Food Biochemistry	Food Biochemistry	Slight modification in content
4.	Human Nutrition	Human Nutrition	Slight modification in content
5.	Fluid Mechanics	Fluid Mechanics	Slight modification in content
6.	Food Process Engineering-I Laboratory	Food Process Engineering-I Laboratory	Slight modification in content
7.	Food Additives and Contaminants Laboratory	Food Additives and Contaminants Laboratory	Slight modification in content
8.	Food Biochemistry Laboratory	Food Biochemistry Laboratory	Slight modification in content
9.	Human Nutrition Laboratory	Human Nutrition Laboratory	Slight modification in content
10.	Fluid Mechanics Laboratory	Fluid Mechanics Laboratory	Slight modification in content
11.	Environmental Studies	Environmental Studies	Slight modification in content
12.	Introduction to Performing Arts	Introduction to Performing Arts	Slight modification in content