



**Annasaheb Dange College of Engineering and
Technology, Ashta
An Autonomous Institute**

Curriculum Structure

**S. Y. B. Tech.
Food Technology**

**SEMESTER III- IV
w.e.f. 2020-21**

Department of Food Technology

**Teaching and Evaluation Scheme
S.Y.B.Tech.: Semester-III**

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks)		Practical (Marks)	
							Max.	Min. for Passing	Max.	Min. for Passing
0FTES201	Process Calculations	3	1	--	4	ISE I	10	40	--	--
					MSE	30			--	--
					ISE II	10			--	--
					ESE	50	20		--	--
0FTES202	Engineering Thermodynamics	3	--	--	3	ISE I	10	40	--	--
					MSE	30			--	--
					ISE II	10			--	--
					ESE	50	20		--	--
0FTES203	Unit Operations	3	--	--	3	ISE I	10	40	--	--
					MSE	30			--	--
					ISE II	10			--	--
					ESE	50	20		--	--
0FTPC204	Food Microbiology	3	--	--	3	ISE I	10	40	--	--
					MSE	30			--	--
					ISE II	10			--	--
					ESE	50	20		--	--
0FTPC205	Food Engineering-I	3	--	--	3	ISE I	10	40	--	--
					MSE	30			--	--
					ISE II	10			--	--
					ESE	50	20		--	--
0FTMC206	Environment Studies	2	--	--	--	ISE	50	Grade	--	--
0FTES251	Unit Operations Laboratory	--	--	2	1	ISE	--	--	25	10
0FTPC252	Food Microbiology Laboratory	--	--	2	1	ESE	--	POE	25	10
0FTPC253	Food Engineering-I Laboratory	--	--	2	1	ISE	--	--	25	10
						ESE	--	POE	25	10
Total		17	01	06	19	Total	550		150	
Total Contact Hours/Week: 24 hrs										
Course Category	HS	BS	ES	PC	PE	OE	PR			
Credits	00	00	11	08	00	00	00			
Cumulative Sum	03	29	24	08	00	00	00			


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Course Details:

Class:	S.Y.B.Tech, Semester - III
Course Code and Course Title:	0FTES201 - Process Calculations
Prerequisite/s:	0FTBS103 - Applied Mathematics-I, 0FTBS108 - Applied Physics 0FTBS109 - Applied Mathematics-II,
Teaching Scheme: Lecture/Tutorial	03/01
Credits:	04
Evaluation Scheme: ISE I /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After completing this course students will be able to

0FTES201_1	Apply basic laws and convert units into required systems of units
0FTES201_2	Carry out material balance calculations for reacting and non-reacting systems
0FTES201_3	Apply concept of material balance for a given food process operation
0FTES201_4	Carry out energy balance calculations for given system
0FTES201_5	Analyze the system and do stoichiometric calculations
0FTES201_6	Analyze the combustion of fuel and do combustion calculations

Course Contents:

		Hrs.
Unit 1	Principles and Physical Properties of systems: Unit processes and operations and their symbols, process flow sheet. Concept of steady and unsteady state operations, Units and dimensions. Properties of pure substances, PVT behavior, ideal and real gas laws. Mole fractions and partial pressures, concept of vapour pressure, Raoult's law and its applications.	07
Unit 2	Material Balance without Chemical Reactions: Concept of material balance calculations, recycling and bypass and Purge operations. Introduction to unsteady state processes, accumulation of inert components, etc.	07
Unit 3	Material Balance involving chemical reactions: Introduction to stoichiometry, Concept of limiting reactant, excess reactant, % excess, Conversion and yield calculations, recycle and By-pass, purging operations in reacting systems	07
Unit 4	Stoichiometry and Unit operations: Distillation, humidification, extraction, crystallization, psychrometry, drying, evaporation and industrial problems.	07
Unit 5	Energy Balance: Concept, energy and Thermo chemistry, Energy balances, heat capacity of pure substances and mixtures. Latent heats, enthalpy of pure substances and mixtures, absolute enthalpy, heat of reaction, adiabatic reactions, thermo chemistry of mixing processes, dissolution, liquid-liquid mixtures, gas-liquid systems.	07
Unit 6	Fuels and Combustion: Calorific values, coal, liquid fuels, gaseous fuels, air requirement and flue gases, combustion calculations.	07


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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Stoichiometry And Process Calculations	K. V. Narayanan , B. Lakshmikutty	PHI Learning Pvt. Ltd.	2 nd	2016
2	Stoichiometry	B I Bhatt and S B Thakore	McGraw Hill Education	5 th	2017
3	Basic Principles And Calculations In Chemical Engineering	David Mautner Himmelblau, James B. Riggs	PHI Learning Pvt. Ltd.	8 th	2014

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Chemical Process Calculations	K. Asokan	CRC Press	1 st	2008
2	Handbook Of Chemical Engineering Calculations	Tyler G. Hicks, P.E.Nicholas P. Chohey	McGraw Hill Education	4 th	2012



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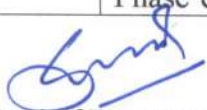
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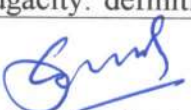
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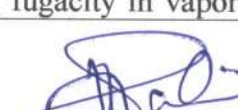
Class:	S.Y.B.Tech Semester III
Course Code and Course Title:	0FTES202 - Engineering Thermodynamics
Prerequisite/s:	0FTBS103 - Applied Mathematics- I, 0FTBS107 - Applied Chemistry, 0FTBS108 - Applied Physics
Teaching Scheme: Lecture/Tutorial	03/00
Credits:	03
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

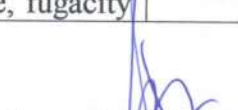
Course Outcomes: After successful completion of this course, students will able to	
0FTES202_1	Apply concepts of thermodynamics in food processing operation
0FTES202_2	Analyze thermodynamic systems
0FTES202_3	Describe the significance of thermodynamic properties of pure fluids and fluids in mixture.
0FTES202_4	Demonstrate the applications of the first and second laws of thermodynamics
0FTES202_5	Quantify the behavior of substances
0FTES202_6	Interpret thermodynamic data for application in process safety in food processing

Course Contents:		Hrs.
Unit 1	First Law and basic concepts Basic: Scope & limitation of thermodynamics, Dimension & Units, force, temperature, pressure, work, energy and heat, properties-extensive, intensive, dependent/independent. First law of thermodynamics: heat & work, reversible & irreversible process. Closed systems, internal energy, enthalpy, heat capacity, open systems, latent heat.	07
Unit 2	Volumetric properties of pure fluids: P-V-T behavior of pure substances, virial equation of state, ideal gas temperature, universal gas constant, the ideal gas & equations for various processes, application of the virial equation. The vander waal equation of state, concept of supercritical temperature.	07
Unit 3	Second law of thermodynamics: Second law of thermodynamics & entropy: reversibility, irreversibility, entropy, the second law of thermodynamics, thermodynamic cycles: carnot & renkine cycles, entroy changes of an ideal gas, significance of entropy in food industry	07
Unit 4	Solution thermodynamics: Partial properties, Equations relating molar and partial molar properties, partial properties in binary solutions, relations among partial properties, problems, ideal gas mixture.	07
Unit 5	Phase equilibrium: Phase equilibria, fugacity: definition, fugacity in vapor phase, fugacity	07


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	coefficients, mixing of ideal gases, criteria of phase equilibrium. Liquid-liquid equilibrium, solid-liquid equilibrium, solid-liquid equilibrium in food processes analysis of mixing & separation processes	
Unit 6	Chemical reaction equilibrium: Equilibrium of single reaction, application of equilibrium criteria to chemical reactions. Gibbs phase rule, the standard gibbs energy change & the equilibrium constant & their temperature. Evaluation of equilibrium constant.	07

Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Introduction to Chemical Engineering Thermodynamics	Smith, Van Ness, Abbott	McGraw-Hill Companies, inc., Series in Chemical Engineering	8 th	2018
2.	Thermodynamics of phase Equilibria in Food Engineering	Camila Gambini Pereira	Academic Press	1 st	2018
3	Chemical, Biochemical & Engineering Thermodynamics	S.I Sandler	Wiley publications	5 th	2017

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Phase equilibrium in Chemical Engineering	S. M. Walas	Butterworth publishers	1st	1985
2.	Chemical Engineering Thermodynamics	K. V. Narayan	Prentice Hall India, New Delhi	2 nd	2013


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Course Details:

Class:	S.Y.B.Tech Semester III
Course Code and Course Title:	0FTES203 - Unit operations
Prerequisite/s:	0FTES201 – Process Calculations
Teaching Scheme: Lecture/Tutorial	03/00
Credits:	03
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes:

0FTES203_1	Acquire the knowledge of materials handling during commercial processing.
0FTES203_2	Apply various laws related to size reduction of food materials.
0FTES203_3	Differentiate types of conveyors and its working
0FTES203_4	Analyze the characteristic of foods in different process
0FTES203_5	Justify the use of filtration
0FTES203_6	Describe the fluidization operation

Course Contents:

Course Contents:		Hrs.
Unit 1	Introduction of Particulate, Sizes and Shapes Materials handling from harvesting to finish goods, storage conditions, Sorting and grading:-Size, colour, screening, equipment for grading, grading efficiency	07
Unit 2	Screening, Size Reduction Separations, Reduction of solid pieces of food by using grinding, compression, or impact forces, factors affecting of size reduction like hardness, stickiness, moisture content purity required, different laws.	07
Unit 3	Storage and Conveying of Bulk Solids, Size Enlargement Belt conveyor, chain conveyor, Pneumatic conveying. Aggregation fundamentals, agglomeration methods and selection criteria	07
Unit 4	Agitation and Mixing Beating, emulsifying, homogenizing, whipping Characteristics of mixing, sample size, types of mixers, paddle agitators, impeller agitators	07
Unit 5	Filtration Theory of filtration, rate of filtration, applications of filtrations rotary filter, air filters filter aids	07
Unit 6	Fluidization Fluid statics, fluid pressure, viscosity, pump and fans. Jet pump, centrifugal fans	07

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Unit Operations In	Albert Ibarz,	CRC Press	1 st	2003


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	Food Engineering	Gustavo V. Barbosa-Canovas			
2	Unit Operations For The Food Industries	Wilbur A. Gould	CTI Publications	1 st	1996
3	Food Science	Norman N. Potter & Joshep H. Hotchkiss	Springer	5 th	1995

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food powders	Ghustavo v Barbosa – canvosa Enrique Ortega - rivas Pablo Juliano Hong Yan	Kluwer Academic/Plenum	1 st	2005
2	Food engineering operations	Brennan J.G. Butters, J. R., Cowell, N. D. and Lilly, A. E.	Applied science London	3 rd	1990
3	Unit Operations of Chemical Engineering	McCABE, W. L., SMITH, J. C. and HARRIOTT, P.	McGraw-Hill, New York.	3 rd	1975


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Course Details:

Class:	S.Y.B.Tech Semester III
Course Code and Course Title:	0FTPC204 - Food Microbiology
Prerequisite/s:	--
Teaching Scheme:	
Lecture/Tutorial	03/00
Credits:	3
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After completing this course students will be able to

0FTPC204_1	Identify the microbes associated with food and food groups
0FT PC204_2	Describe the role of micro-organisms in food preservation & spoilage
0FT PC204_3	Demonstrate the methods of detections of pathogens in food
0FT PC204_4	Apply the theories& principles to reduce the spoilage in all types of foods
0FT PC204_5	Analyze the preventative measurements during handling, processing & consuming of food

Course Contents:

		Hrs.
Unit 1	Introduction to Microbiology Evaluation & Scope of microbiology. General Microbiology, Cultural characteristics and reproduction of bacteria, yeasts, fungi, actinomycetes, algae, protozoa and rickettsia.	07
Unit 2	The Microbiology of Food Preservation and Food Commodities Methods of preservations, drying, dehydration, freezing, chemical preservation, mechanical destruction & Maintenance of anaerobic condition. Growth curve Physical & Chemical factors affecting growth and destruction of micro-organisms.	07
Unit 3	Principals and Methods for the Microbiology Examinations for Foods and Microbiological Quality Control Cultural Technics, plate count, dye reduction test. Structure & reproduction with reference to food born viruses.	07
Unit 4	Food Spoilage Spoilage of food microbial spoilage & cereals & cereal products, milk & milk products, fruit & vegetable products, meat, poultry egg & fish products, sugar & Sugar Products.	07
Unit 5	Food Poisoning Intoxication, Food borne illness	07

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food Microbiology	S. P Narang	APH	1 st	2016
2	Microbiology Fundamentals and Applications	Purohit S. S.	Agrobios	6 th	2003
3	Food Microbiology	M.R.Adams, M.O.Moss	Royal society of chemistry	3 rd	2008


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Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food Microbiology	Frazier, W.C., and Westhoff, D.C.	McGraw-Hill, New York.	4 th	1988
2	Modern Food Microbiology	Jay, J. M.	Chapman & Hall. New York, N.Y.	6 th	2000
3	Essentials of the Microbiology of Foods.	Mossel, D.A.A., Corry, J. E. L., Struijk, C. B., and Baird, R. M.	John Wiley & Sons. New York, NY	1 st	1995



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Course Details:

Class:	S. Y. B. Tech Semester III
Course Code and Course Title:	0FTPC205 - Food Engineering-I
Prerequisite/s:	0FTES201- Process Calculations, 0FTES203 – Unit Operations
Teaching Scheme:	
Lecture/Tutorial	03/00
Credits:	04
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After successful completion of this course, students will able to

0FTPC205 1	Apply concepts of heat transfer to food process operations
0FTPC205 2	Analyze the heat transfer due to conduction
0FTPC205 3	Apply concept of convection to food process operations
0FTPC205 4	Evaluate the heat transfer through radiation
0FTPC205 5	Analyze the heat exchange operations and equipments
0FTPC205 6	Analyze the industrial applications of evaporators

Course Contents:

		Hrs.
Unit 1	Introduction To Heat Transfer, Modes Of Heat Transfer -- Basic heat transfer processes- Conduction- Convection-Radiation- General laws of heat transfer.- use of heat transfer in food industry.	07
Unit 2	Conduction- Steady-State Heating -Theory of heat conduction-Fourier's law – Thermal conductivity-Heat transfer through composite walls and cylinders- different types of insulating materials- general properties of insulators- Application of insulators.	07
Unit 3	Convection- Steady-State Heating-Forced and free convection- Convective Heat Transfer in Non-Newtonian Fluids- Natural convection from vertical plats and horizontal cylinders- Prandtl number, Nusselt number, Grashof number, Graetz number and pecelet number etc.	07
Unit 4	Radiation- Unsteady-State Heating- Radiation laws like Stefan Boltzmann's law- Kirchhoff's law –Black boy, Grey body- Transmissivity, absorptivity, Reflectivity, Emissivity of black and grey bodies-Negligible Internal Resistance to Heat Transfer- Negligible Surface Resistance to Heat Transfer- Finite Surface and Internal Resistance to Heat Transfer- Application of thermal radiation etc.	08
Unit 5	Heat transfer equipments- shell and tube and plate heat exchanger- Scraped-Surface Heat Exchangers - jacketed kettles- Heat Transfer in Agitated Vessels- Application of different types of heat exchangers in dairy and food industry.etc	08
Unit 6	Evaporation Introduction-Typical Applications in the Food Industry-	08


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	Evaporation: Principles of evaporation, mass and energy balance, factors affecting rate of evaporation-Types of Evaporators-Short-Tube Evaporator-Long-Tube Vertical Rising Film-Long-Tube Vertical Falling Film-Forced Circulation-Scraped Surface Thin Film-Plate Evaporators-Thin-Film Spinning Cone.etc	
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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Handbook of food engginering	Dennis R. Heldman.	CRC Press	2 nd	2007
2.	Heat transfer	Alan Jesse chapman	Macmillan Publishers Limited.	4 th	1984
3.	Introduction to Food Engineering,	R. Paul Singh and Dennis R. Heldman.	Elsevier, Amsterdam, The Netherlands.	5th	2014.

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Heat transfer	J.P Holman	McGraw Hill	10 th	2008
2.	Handbook of heat transfer	Warren M.Rohsenow,james P.Hartnett	McGraw Hill	3 rd	1998



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Course Details:

Class	S. Y. B. Tech. Semester-III
Course Code and Course Title	0FTMC206 - Environmental Studies
Prerequisite/s	--
Teaching Scheme: Lecture	02
Credits	--
Evaluation Scheme: ISE	50 (Grade)

Course Outcomes (COs): Upon successful completion of the course students will be able to:

0FTMC206_1	Explain importance of environmental studies with necessary of acts
0FTMC206_2	Explain importance of public awareness on environmental problems
0FTMC206_3	Write a technical report in team regarding course and impacts of environment related issues
0FTMC206_4	Discuss current concern of environment issues
0FTMC206_5	Describe the need of environment protection and ethics

Course Contents:

		Hrs.
Unit 1	Nature of Environmental Studies Definition, scope and importance. Multidisciplinary nature of environmental studies, Need for public awareness.	02
Unit 2	Natural Resources and Associated Problems a) Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people; b) Water resources: Use and over-utilization of surface and groundwater, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources. d) Food resources: World food problem, changes caused by agriculture effect of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewable and non renewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy, f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources.	04
Unit 3	Ecosystems Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following ecosystem :- a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	04
Unit 4	Biodiversity and its conservation Introduction- Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a	05


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	mega- diversity nation. Western Ghat as a biodiversity region. Hot-spots of biodiversity. Threats to biodiversity habitat loss, poaching of wildlife, man- wild life conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	
Unit 5	Environmental Pollution Definition: Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.	04
Unit 6	Social Issues and the Environment Disaster management: floods, earthquake, cyclone, tsunami and landslides 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. Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products.	03
Unit 7	Environmental Protection From Unsustainable to Sustainable development Environmental 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	06

Mini Project	<p>Mini project based on : Environmental assets River/Forest/Grassland/Hill/Mountain. OR A local polluted site Urban/Rural/Industrial/Agricultural. OR Study of common plants, insects, and birds. OR Study of simple ecosystems - ponds, river, hill slopes, etc. (Mini Project report is Mandatory.)</p>
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Assessment Method:

1. Mini Project report – 05 marks
2. Seminar – 05 marks
3. ISE question paper format will be Multiple Choice Questions- 40 Marks

Unit No.	Topic Name	Weightage
1	Nature of Environmental Studies.	4 Marks
2	Natural Resources.	7 Marks
3	Ecosystems	7 Marks
4	Biodiversity and its conservation	7 Marks
5	Environmental Pollution	7 Marks
6	Social Issues and the Environment	8 Marks


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IMPORTANT NOTES:

1. ISE will be conducted in 14th week of semester.
2. Mini Project report will be submitted to course coordinator in 10th week of semester.
3. Students should get minimum 40% marks to get PP (PASS) grade.
4. Students getting less than 40% marks will be offered NP (NOT PASS) grade.
5. To get B. Tech. Degree PP grade in Environmental Studies is mandatory.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Environmental Studies	Dr. B. S. Chauhan	University Science Press, New Delhi	1 st	2008
2	Environmental Studies	Dr. P. D. Raut	S. U. Kolhapur	3 rd	2011

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Principals of Environmental Science and Engineering	Raman Sivakumar	Cengage learning Singapore	2	2005
02	Elements of Environmental Science and Engineering	P. Meenakshi	Prentice Hall of India Private Limited, New Delhi	-	2006
03	Environmental Science – working with the Earth	G. Tyler Miller Jr	Thomson Brooks /Cole	11	2006



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Course Details:

Class:	S.Y.B.Tech, Semester - III
Course Code and Course Title:	0FTES251- Unit Operations Laboratory
Prerequisite/s:	--
Teaching Scheme:Practical	02
Credits:	01
Evaluation Scheme: ISE/ ESE	25/25

Course Outcomes: After completing this course students will be able to

0FTES251_1	Apply filtration operation in various juice processing
0FTES251_2	Analyze principle and operation of various machineries and equipment's
0FTES251_3	Develop skills related to fluidization in various processes
0FTES251_4	Understand principle of different operations (sedimentation, filtration)
0FTES251_5	Demonstrate practical understanding of osmosis
0FTES251_6	Apply dryers in different food processing

Course Contents:

Minimum 8 experiments from following list and one course project

Exp. No.	Title of Experiment
1	Study of centrifugal separation (centrifugal cream separation, centrifugal machine)
2	Study of Principle, working and demonstration of hammer mill and crushing roll
3	Study on osmosis of fruit
4	Determination of reduction ratio of different size reduction machineries
5	Study of different disintegration operations (slicing, dicing, shredding and pulping) and hot air dryer
6	Study of plate and frame filter press
7	Study of sedimentation
8	Calculation of time of filtration
9	Study of flow through packed bed
10	Study of flow through fluidized bed
11	Project-1: Model on the filtration
12	Project-2: Model on the separation (screening)

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Unit Operations in Food Engineering	Albert Ibarz, Gustavo V. Barbosa-Canovas	CRC Press	1 st	2003
2	Unit Operations for	Wilbur A. Gould	CTI Publications	1 st	1996


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	The Food Industries				
3	Experiments in Unit Operations and processing of Foods	Maria Margarida Cortez Vieira, Peter Ho	Springer	1st	2008

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food powders	Ghustavo v Barbosa – canvosa Enrique Ortega - rivas Pablo Juliano Hong Yan	Kluwer Academic/Plenum	1 st	2005
2	Food engineering operations	Brennan J.G. Butters, J. R., Cowell, N. D. and Lilly, A. E.	Applied science London	3 rd	1990
3	Handbook of Food Processing Equipment	Saravacos GD and Athanasios EK	Springer New York, USA.	2 nd	2015



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Course Details:

Class:	S. Y.B.Tech, Semester– III
Course Code and Course Title:	0FTPC252 - Food Microbiology Laboratory
Prerequisite/s:	--
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE/ ESE	25/25

Course Outcomes:After completing this course students will be able to

0FTPC252_1	Carry out isolation, characterization of various microbes associated with foods and food groups
0FTPC252_2	Investigate microbiological techniques of different food groups
0FTPC252_3	Examine the pathogens in foods.
0FTPC252_4	Analyze the microbiological effect on different types of food commodities
0FTPC252_5	Describe the characteristics of food borne, waterborne and spoilage microorganisms,
0FTPC252_6	Explain the methods for their isolation, detection, and identification

Course Contents:

Exp. No.	Title of Experiment
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	Pure culture techniques (streak plate/pour plate)
5	Isolation of molds from foods, microbial examination of cereal and cereal products
6	Microbial examination of fruits and vegetables.
7	Microbial examination of milk and milk products,
8	Microbial examination of meat and meat products.
9	Microbial examination of water
10	Microbial examination of fermented food.
11	Project-1: Studies on Preservation Techniques of Foods
12	Project-2: Studies in Fermented Foods

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food Microbiology	M.R. Adams, M.O.Moss	Royal society of chemistry	3 rd	2008
2	Food Microbiology	Frazier, W.C., and Westhoff, D.C.	McGraw-Hill, New York.	4 th	1988
3	Modern Food Microbiology	Jay, J. M.	Chapman & Hall. New York, N.Y.	6 th	2000


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57-FT-17142

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Laboratory Manual of Food Microbiology	Neelima Garg, K. L. Garg, K. G. Mukerji	I K International Publishing House	1 st	2010
2	Food Microbiology: A Laboratory Manual	Ahmed E. Yousef, Carolyn Carlstrom	<u>John Wiley & Sons.</u>	1st	2003
3	Essentials of the Microbiology of Foods.	Mossel, D.A.A., Corry, J. E. L., Struijk, C. B., and Baird, R. M.	John Wiley & Sons. New York, NY	1 st	1995



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Course Details:

Class:	S.Y.B.Tech Semester III
Course Code and Course Title:	0FTPC253 - Food Engineering-I Laboratory
Prerequisite/s:	--
Teaching Scheme:Practical	02
Credits:	01
Evaluation Scheme: ISE/ESE	25/25

Course Outcomes: After successful completion of this course, students will able to

0FTPC253_1	Apply concepts of Conduction to given heat transfer system
0FTPC253_2	Calculate heat transfer coefficient in case of convection
0FTPC253_3	Calibrate heat measuring instrument
0FTPC253_4	Evaluate heat transfer due to radiation
0FTPC253_5	Handle heat transfer equipments
0FTPC253_6	Analyze heat exchangers

Course Contents:

Minimum 8 experiments from following list and one course project

Exp. No.	Title of Experiment
1	Study of heat transfer analysis during conduction.
2	Study of heat transfer through composite wall.
3	Determination of thermal conduction of liquid food.
4	Study of heat transfer by natural/Forced convection apparatus.
5	Preparation and calibration of thermocouples.
6	Study of radiation heat transfer through Stefan Boltzmann's apparatus.
7	Study of principle and working of shell and tube heat exchanger.
8	Study of heat transfer rate in plate heat exchanger.
9	Determination of heat transfer through agitated vessel apparatus.
10	Study of principle and working of double pipe heat exchanger.
11	Project-1:
12	Project-2:

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Handbook of food engginering	Dennis R. Heldman.	CRC Press	2 nd	2007
2.	Heat transfer	Alan Jesse chapman	Macmillan Publishers Limited.	4 th	1984
3.	Introduction to Food Engineering,	R. Paul Singh and Dennis R. Heldman.	Elsevier, Amsterdam, The Netherlands.	5th	2014.


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(An Autonomous Institute)
Department of Food Technology

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Heat transfer	J.P Holman	McGraw Hill	10 th	2008
2.	Handbook of heat transfer	Warren M.Rohsenow,james P.Hartnett	McGraw Hill	3 rd	1998

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Teaching and Evaluation Scheme

S.Y.B.Tech.: Semester- IV

Course Code	Course	Teaching Scheme				Evaluation Scheme							
		L	T	P	Credits	Scheme	Theory (Marks)		Practical (Marks)		Max.	Min. for Passing	
							Max.	Min. for Passing	Max.	Min. for Passing			
OFTES207	Fluid Mechanics	3	--	--	3	ISE I	10	40	--	--	--	--	
						MSE	30		--	--			
						ISE II	10		--	--			
						ESE	50		20	--			--
OFTPC208	Food Engineering-II	3	--	--	3	ISE I	10	40	--	--	--	--	
						MSE	30		--	--			
						ISE II	10		--	--			
						ESE	50		20	--			--
OFTPC209	Food Chemistry	3	--	--	3	ISE I	10	40	--	--	--	--	
						MSE	30		--	--			
						ISE II	10		--	--			
						ESE	50		20	--			--
OFTPC210	Chemistry of Food Constituents	3	--	--	3	ISE I	10	40	--	--	--	--	
						MSE	30		--	--			
						ISE II	10		--	--			
						ESE	50		20	--			--
OFTPC211	Principles of Food Preservations	3	--	--	3	ISE I	10	40	--	--	--	--	
						MSE	30		--	--			
						ISE II	10		--	--			
						ESE	50		20	--			--
OFTHS212	Psychology	1	--	--	1	ISE I	25	10	--	--	--	--	
						ISE II	25	10	--	--	--	--	
OFTES254	Fluid Mechanics Laboratory	--	--	2	1	ISE	--	--	25	10	--	--	
OFTPC255	Food Engineering-II Laboratory	--	--	2	1	ESE	--	POE	25	10	--	--	
						ISE	--	--	25	10	--	--	
OFTPC256	Food Chemistry Laboratory	--	--	2	1	ESE	--	POE	25	10	--	--	
						ISE	--	--	25	10	--	--	
OFTPC257	Chemistry of Food Constituents Laboratory	--	--	2	1	ESE	--	POE	25	10	--	--	
						ISE	--	--	25	10	--	--	
OFTPR258	Mini Project	--	--	2	1	ESE	--	PR	25	10	--	--	
OFTPR259*	In-Plant Training	--	--	--	1	ISE	--	--	--	--	--	--	
						ESE	--	PR	50	20	--	--	
Total		16	0	10	22	Total	550		300				
Total Contact Hours/Week: 26 hrs													
Course Category	HS	BS	ES	PC	PE	OE	PR						
Credits	01	00	04	15	00	00	02						
Cumulative Sum	04	29	28	23	00	00	02						

*Evaluation will be done at beginning of semester-V.


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Course Details:

Class:	S. Y. B. Tech Semester IV
Course Code and Course Title:	0FTES207 - Fluid Mechanics
Prerequisite/s:	0FTBS103 - Applied Mathematics-I 0FTBS108 - Applied Physics 0FTBS109 – Applied Mathematics-II
Teaching Scheme: Lecture/Tutorial	03/00
Credits:	03
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After successful completion of this course, students will able to

0FTES207_1	Apply fundamentals of compressible fluid flows to relevant systems
0FTES207_2	Analyze the processes and science of fluids.
0FTES207_3	Demonstrate the basic properties of fluids and their behavior under application of various force systems.
0FTES207_4	Interpret fluid properties in process food industry
0FTES207_5	Rectify problem of the fluid flow systems in beverage industry
0FTES207_6	Implement concept of fluid flow to food process industry

Course Contents:

Course Contents:		Hrs.
Unit 1	Fluid statics Fluid Properties, A. Fluid Statics: Types of Pressure, Pascal's Law, Hydrostatic Law, Pressure Measurement Devices, Pressure Head, Pressure Diagram, Centre of Pressure, Forces on Plane and Curved Surfaces. B. Buoyancy and Floatation: Archimedes's Principle, Metacentre, Stability of Submerged and Floating Bodies.	07
Unit 2	Fluid Kinematics Types of Flows, Streamlines, Equipotential lines, Stream Line, Path Line, Stream Tube, Stream Bundle, Stream Function and Velocity Potential Function, Flow Net- (Properties and Uses), Continuity Equation (3-D Cartesian Form).	07
Unit 3	Fluid Dynamics A. Fluid Dynamics: Forces Acting on Fluid in Motion, Euler's Equation along a Streamline, Bernoulli's Theorem, Limitations. B. Bernoulli's Applications: Venturimeter (Horizontal and Vertical), Orifice meter, Orifices, Time required for Emptying the Tank, Concept of HGL and TEL	07
Unit 4	Pumps Centrifugal Pump: Classification, Component Parts, Working of Centrifugal Pump, Performance Characteristics, Common Pump Troubles and Remedies, Net Positive Suction Head (NPSH)	07
Unit 5	Compressors Air compressor- Types, selection criteria, capacity control, piping layout, fitting and connectors, Pneumatic controls, Direction control	07


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	valves (two way, three way, four way), check valves, flow control valves, pressure control valves, speed regulators, quick exhaust valves, time delay valve, shuttle valve and twin pressure valve. Solenoid operated, pilot operated valves, Pneumatic actuators, Rotary and reciprocating cylinders–types and their mountings, Air motor – types, Comparison with hydraulic and electric motor. Serving of compressed air – types of filters, regulators, lubricators (FRL unit), mufflers, dryers.	
Unit 6	Fluidization Fluidization, Mechanism of fluidization, particulate And aggregative fluidization, minimum fluidization velocity, expansion of -fluidized beds, application of fluidization.	07

Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Fluid Mechanics	Yunus A. Cengel	Tata McGraw-Hill Education	1 st	2004
2.	Fundamentals of fluid mechanics	Bruce R. Munson, Alric P. Rothmayer, Theodore H. Okiishi, Wade W. Huebsch	Wiley	6 th	2009
3.	Fluid mechanics and hydraulic machines _ problems and solutions	K. Subramanya	Tata McGraw Hill)	1 st	2011

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	A Textbook of Fluid Mechanics and Hydraulic Machines 9th Revised Edition SI Units	R.K. Bansal	Laxmi Publications	9 th	2009
2.	Introduction to Fluid Mechanics	Edward J. Shaughnessy Jr., Ira M. Katz, James P. Schaffer	Oxford University Press	1st	2005


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Course Details:

Class:	S.Y.B.Tech Semester IV
Course Code and Course Title:	0FTPC208 - Food Engineering-II
Prerequisite/s:	0FTES203 - Unit Operations 0FTPC - Food Engineering - I
Teaching Scheme:	
Lecture/Tutorial	03/00
Credits:	03
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After successful completion of this course, students will able to

0FTPC208_1	Apply concepts of mass transfer to food processing operations
0FTPC208_2	Evaluate mass transfer coefficients for given mass transfer operation
0FTPC208_3	Select suitable mass transfer operation for given system
0FTPC208_4	Analyze given mass transfer operation
0FTPC208_5	Apply methods to calculate number of stages in columns
0FTPC208_6	Design mass transfer equipments

Course Contents:

		Hrs.
Unit 1	Mass Transfer, Diffusion, Mass transfer coefficient- Fundamentals of mass transfer, Fick's law of diffusion, steady state diffusion of gases and liquids through solids Mass transfer coefficient, application in dairy and food industry.	07
Unit 2	Absorption- Basics of absorption, gas absorption -principle, equipments and application in food processing.	07
Unit 3	Adsorption- Introduction to Adsorption Processes, Batch Adsorption, Design of Fixed-Bed Adsorption Columns	07
Unit 4	Liquid-liquid- liquid-liquid extraction processes, types of equipment and design for liquid-liquid extraction, continuous multistage counter current extraction .	08
Unit 5	solid-liquid extraction-Introduction and Classification solid –liquid Separation Processes, liquid-solid centrifugation, clarifiers, desludging machines, Filtration in Solid-Liquid Separation- Settling and Sedimentation in Particle-Fluid Separation.	08
Unit 6	Distillation - Principles, vapour-liquid equilibrium, continuous flow distillation, batch/differential distillation, fractional distillation, steam distillation, distillation of wines and spirits	08

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Mass-transfer Operations	Robert Ewald Treybal	McGraw-Hill	3 rd	2017


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2.	Food Process Engineering and Technology	Zeki Berk	Elsevier, Academic Press	2 nd	2013
3.	Principles Of Mass Transfer And Separation Processes	<u>Binay K. Dutta</u>	PHI	-	2007

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Principles and Modern Applications of Mass Transfer Operations	Jaime Benitez	Wiley	3 rd	2017
2.	Mass Transfer Operations for Practicing Engineers	Louis Theodore, Francesco Ricci	Wiley	-	2011



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Course Details:

Class:	S. Y. B. Tech Semester IV
Course Code and Course Title:	0FTPC209 - Food Chemistry
Prerequisite/s:	--
Teaching Scheme:	
Lecture/Tutorial	03/00
Credits:	03
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After completing this course students will be able to

0FTPC209_1	Analyze the importance and physicochemical properties of water, protein and lipid in foods
0FTPC209_2	Familiarize with chemistry of carbohydrates and minerals
0FTEC209_3	Quantification of food additives for different food process
0FTEC209_4	Describe the different enzymes with functions
0FTEC209_5	Evaluate the antinutritional factors presents in foods
0FTEC209_6	Analyze the food contaminates during processing

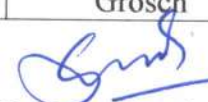
Course contents:

		Hrs.
Unit 1	Water: Role and type of water in foods; Functional properties of water; role of water in food spoilage; Water activity and sorption isotherm. Food Proteins: Physical, chemical, and nutritional changes in protein, functional characteristic of proteins. Food Lipids: chemistry of lipids, hydrogenation of fat, functional characteristics of lipid.	07
Unit 2	Food carbohydrates: Chemistry of carbohydrates (Classification, Structure and Sources and properties), Functional Characteristics of carbohydrates and chemical changes Minerals in food: Mineral composition, Fortification & Enrichment in foods, Chemical and functional properties of mineral.	07
Unit 3	Food additives: preservation, nutritional enhancements, Regulation of additives, safety of foods	07
Unit 4	Food Enzymes: Introduction, nature of enzymes, enzymes in foods and environmental effect of enzymes	07
Unit 5	Antinutritional factors: occurrence, effects and methods of elimination or inactivation- protease inhibitions, lectins, lathrogens, phytates and flatulence factors; Terms in toxicology; Safety evaluation using traditional and modern approach	07
Unit 6	Food contaminant: Pesticidal residues permitted limits; Toxicology and Public health.	07

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food Chemistry	H.-D. Belitz,, W. Grosch	Springer Science & Business Media	4 th	2009


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2	Principles of Food Chemistry	John M. Deman	Springer Science & Business Media	3 rd	1999
3	Food Chemistry	S.A. Iqbal, Y Mido	Discovery Publishing House	1 st	2011

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Introductory Food Chemistry.	John W. Brady Cornell	Comstock Publishing Associates Cornell University Press, Ithaca, USA.	1 st	2013
2	Fennema's Food Chemistry	Srinivasan Damodaran, Kirk L. Parkin, & Owen R. Fennema	CRC.	4 th	2009
3	Food Biochemistry and Food Processing	Benjamin K. S.	Wiley-Blackwell, London	2 nd	2012



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ST-FT-27142

Course Details:

Class:	S.Y.B. Tech Semester IV
Course Code and Course Title:	0FTPC210 -Chemistry of Food Constituents
Prerequisite/s:	--
Teaching Scheme: Lecture/Tutorial	03/00
Credits:	03
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes:After completing this course students will be able to

0FTPC210_1	Analyze the chemistry of carbohydrates and proteins constituents
0FTPC210_2	Describe the chemistry of vitamins, lipid, and another constituent
0FTPC210_3	Examine water activity and its factors
0FTPC210_4	Analyze the texture of food products by texturometer
0FTPC210_5	Acquire the knowledge of flavors and its commercial uses
0FTPC210_6	Evaluation of pigments and its acceptance

Course Contents:

Course Contents:		Hrs.
Unit 1	Chemistry of carbohydrates: Changes of carbohydrates on cooking, modification of carbohydrates, dietary fibers, and carbohydrates digestibility; Enzymatic and chemical reactions of carbohydrates. Proteins: Processing induced, physical, chemical, and nutritional changes in protein, chemical and enzymatic modification of protein	07
Unit 2	Lipids, vitamins, and other minor constituents: Introduction of lipid component, physicochemical properties of lipid. water soluble & fat-soluble vitamin, Calcium, Iron, Phosphate, Nickel, Copper.	07
Unit 3	Water activity: Definition and measurement, temperature dependence.	07
Unit 4	Texture: Classification, role of firmness, yielding quality, juiciness, chewiness, measurement of texture by different forces, texturometer	07
Unit 5	Flavor: Philosophy and definitions of flavors, flavoring compounds, sensory assessment of flavor, technology for flavor retention	07
Unit 6	Color of foods: Introduction, Pigments in animal and plant tissues and regulatory accepts.	07

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Principals of food	DeMan, John M.	Springer	3 rd	1999


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	Chemistry				
2	Food Chemistry	Meyer, Lillian Hoagland	East West Press	2 nd	1973
3	Analytical Method of Food Additives	Roger Wood, Lucy Foster, Andrew Damant, Pauline Key	CRC Press; Woodhead Pub	1 st	2004

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Chemical & Functional Properties of Food Components	Zdzislaw E. Sikorski	CRC	3 rd	2019
2	Biochemistry of Foods	Eskin NAM, Henderson HM and Townsed RJ	Academic Press, New York	1 st	1973


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ST-FT-29142

Course Details:

Class:	S.Y.B.Tech Semester IV
Course Code and Course Title:	0FTPC211 - Principles of Food Preservations
Prerequisite/s:	Nil
Teaching Scheme: Lecture/Tutorial	03/00
Credits:	03
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After successful completion of this course, students will able to

0FTPC211_1	Apply basic principle of food preservation.
0FTPC211_2	Evaluate the different food preservation methods.
0FTPC211_3	Justify the primary food preservation techniques.
0FTPC211_4	Evaluate the preservation of meat.
0FTPC211_5	Analyze the different cooling methods in food preservation.
0FTPC211_6	Apply the various fish preservation technology.

Course Contents:

		Hrs.
Unit 1	Basic Principle of Food Preservation- Scope and importance of food processing-worldwide perspectives, objectives and techniques of food preservation.	07
Unit 2	Traditional Methods, Modern Technologies in Food Preservation-pulsed electric field processing-high pressure processing- ultrasound-dielectric ohmic heating-infrared heating etc. Light Energy in Food Preservation- Applications of Magnetic Field in Food Preservation	08
Unit 3	Preservation by Salt and Sugar- Salting or Curing- Pickles- principle of Preservation by Sugar- Osmosis- Jams, jellies, marmalade, cheese, toffee Preserves, crystallized, glazed, candied fruits etc.	08
Unit 4	Preservation of Meat- Curing- technology used in meat preservation-chemicals used in it- Smoke-fermentation-	07
Unit 5	Chilling and Freezing- cooling-refrigeration-freeze drying- Freezing- Melting Process in Liquid Food Concentration-	07
Unit 6	Fish Curing and Smoking- Roasting-drying -long smokong- hot and cold smoking- Brine solution-wet salting-dry salting-chilling-fish canning.	08



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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	The Technology of Food Preservation	Desrosier, N.W	CBS Publishers and Distributors	4 th	1977
2.	Hand book of food preservation	M.Shafiur Rahman	CRC press	2 nd	2007
3.	Food preservation and processing	Manoranjan Kalia and Sangita Sood	Kalyani Publishers	2 nd	2004

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Food processing technology: principles and practice	Fellows, P. and Ellis H	Wood Head	2 nd	1990
2.	Introduction to Food Engineering.	Heldman, D.R. and Singh R. P	Elsevier	4 th	2009



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Course Details:

Class:	S. Y. B. Tech, Semester - IV
Course Code and Course Title:	0FTHS212 - Psychology
Prerequisite/s:	-
Teaching Scheme:	
Lecture/Tutorial	01/00
Credits:	01
Evaluation Scheme: ISE I /MSE/ISE II/ESE	25/00/25/00

Course Outcomes: After completing this course students will be able to

0FTHS212_1	Elaborate the basics of psychology and its importance at workplace
0FTHS212_2	Analyze the emotional states and its effects on body and behavior
0FTHS212_3	Differentiate leadership styles and its importance in an industry
0FTHS212_4	Apply the concept of emotional intelligence at work
0FTHS212_5	Analyze the communication style based on transactional analysis

Course Contents:

Course Contents:		Hrs.
Unit 1	Introduction to Psychology , definition, fields in psychology, Introduction to industrial and organizational psychology	02
Unit 2	Personality and Emotions 'Big-five' Model, Personality attributes, matching personalities and jobs Emotions, types of emotions, Emotions- body connection, Emotions- Behavior connection	03
Unit 3	Leadership, characteristics of effective leader , styles of leadership, Trust and Leadership	03
Unit 4	Emotional Intelligence at work , Emotional Intelligence: The Concept Emotional Skills that Managers should Learn, Emotional Intelligence and Your Personality	03
Unit 5	Transactional analysis , Ego types, The four life positions, T.A. and communication	03

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Introduction to Psychology	C.T.Morgan R.A. King J.R. Weisz J. Schopler	McGraw Hill	7 th	2001
2	Emotional Intelligence for Leadership	Jonatan Slane	-	-	2019
3	Essentials of organizational Behavior	Stephen P. Robbins	Prentice Hall	7 th	2002


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4	Emotional Intelligence at Work A Professional Guide	Dalip Singh	Sage Publications	3 rd	2006
5	I'm ok – You're OK	T.A. Harris	New York Times	5 th	2012



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ST-FT-33/42

Course Details:

Class:	S. Y. B. Tech, Semester - III
Course Code and Course Title:	0FTES254 – Fluid Mechanics Laboratory
Prerequisite/s:	--
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE/ ESE	25/25

Course Outcomes: After completing this course students will be able to	
0FTES254_1	Understand basic units of measurement, convert units and utilize basic measurement techniques of fluid mechanics.
0FTES254_2	Demonstrate practical understanding of various equation of Bernoulli
0FTES254_3	Apply the suitable hydraulic or pneumatic components for a specific fluid power application
0FTES254_4	Study the performance characteristics of pumps
0FTES254_5	Develop skills related to fluid flow handling e.g. volumetric flow rate measurement, fluid pressure measurement etc
0FTES254_6	Analyze principles and operations of various flow measurement devices


Course Contents:


Minimum 8 experiments from following list and one course project

Exp. No.	Title of Experiment
1	Study of Centrifugal Pump
2	Verification of Bernoulli's Theorem
3	Calibration of Venturimeter
4	Calibration of Orificemeter
5	Determination of Hydraulic Coefficients of Orifice
6	Calibration of Measuring Tank
7	Study and demonstration of Pressure Measuring Devices
8	To study the properties of Newtonian and Non- Newtonian fluids
9	Reynold's experiment
10	Flow through spiral coils
11	Project-1: Model on the hydraulic lift experiment
12	Project-2: Model on centrifugal pump

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Fluid Mechanics	Yunus A. Cengel	Tata McGraw-Hill Education	1 st	2004
2.	Fundamentals of fluid mechanics	Bruce R. Munson, Alric P. Rothmayer, Theodore H.	Wiley	6 th	2009


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		Okiishi, Wade W. Huebsch			
3.	Fluid mechanics and hydraulic machines _ problems and solutions	K. Subramanya	Tata McGraw Hill)	1 st	2011

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	A Textbook of Fluid Mechanics and Hydraulic Machines 9th Revised Edition SI Units	R.K. Bansal	Laxmi Publications	9 th	2009
2.	Introduction to Fluid Mechanics	Edward J. Shaughnessy Jr., Ira M. Katz, James P. Schaffer	Oxford University Press	1st	2005



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ST-FT-35142

Course Details:

Class:	S. Y. B. Tech, Semester - IV
Course Code and Course Title:	0FTPC255 - Food Engineering-II Laboratory
Prerequisite/s:	--
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE / ESE	25/25

Course Outcomes: After completing this course students will be able to

0FTPC255_1	Carry out the calculations in mass transfer.
0FTPC255_2	Analyze the diffusion process
0FTPC255_3	Determine the absorption and adsorption in gaseous
0FTPC255_4	Design mass transfer equipments.
0FTPC255_5	Evaluate the different extraction methods.
0FTPC255_6	Apply the knowledge to solve the mass transfer at the time of processing.

Course Contents:

Minimum 8 experiments from following list and one course project

Exp. No.	Title of Experiment
1	Design problem on mass balance equations.
2	Experiment on diffusion.
3	Determination of gas absorption.
4	Study of solvent extraction.
5	Study of Fixed-Bed Adsorption Columns.
6	Experiment on liquid-liquid mixing.
7	Study of solid-solid extraction
8	Stage Calculations in tray distillation.
9	Experiment on filtration.
10	Experiment on centrifugation.
11	Project-1:
12	Project-2:

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Transport Process and Unit Operations	Geankoplis C	PHI	4 th	2009
2	Unit Operations	McCabe and Smith	McGraw-Hill	6 th	2018

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Introduction to food engineering	Singh and Heldman	Academic Press		


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Course Details:

Class:	S. Y. B. Tech, Semester – III
Course Code and Course Title:	0FTPC256 –Food chemistry Laboratory
Prerequisite/s:	--
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE / ESE	25/25

Course Outcomes: After completing this course students will be able to

0FTPC256_1	Identify moisture and protein contents
0FTPC256_2	Describe sorption isotherm
0FTPC256_3	Classify the total and reducing sugars
0FTPC256_4	Analyze the food additives
0FTPC256_5	Carry out the edible oil quality
0FTPC256_6	Explain the anti-nutritional factors present in foods

Course Contents:

Exp. No	Title of experiments
1	Determination of moisture content by hot air oven method
2	Determination of protein content
3	Studies on sorption isotherm
4	To check effect of additives in food processing
5	Determination of total sugar in food
6	Estimation of reducing sugar in food
7	Determination of acid value of oil
8	Determination of iodine value of oil
9	Determination of saponification value
10	Studies of antinutritional factors of raw materials
11	Project 1: Determine the effect of Food Additives in bakery products
12	Project 2: Studies in Fried Foods

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food Chemistry	H.-D. Belitz W. Grosch	Springer Science & Business Media	4 th	2009
2	Principles of Food Chemistry	John M. Deman	Springer Science & Business Media	3 rd	1999
3	Food Chemistry	S.A. Iqbal, Y Mido	Discovery Publishing House	1 st	2011



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Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Introductory Food Chemistry.	John W. Brady Cornell	Comstock Publishing Associates Cornell University Press, Ithaca, USA.	1 st	2013
2	Fennema's Food Chemistry	Srinivasan Damodaran, Kirk L. Parkin, & Owen R. Fennema	CRC.	4 th	2009
3	Food Biochemistry and Food Processing	Benjamin K. S.	Wiley-Blackwell, London	2 nd	2012



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Course details:

Class:	S. Y. B. Tech Semester IV
Course Code and Course Title:	0FTPC257 - Chemistry of Food Constituents Laboratory
Prerequisite/s:	--
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE/ESE	25/25

Course Outcomes: After completing this course students will be able to

0FTPC257_1	Examine the protein digestibility
0FTPC257_2	Carry out the determination of micro - nutrients
0FTPC257_3	Identify of tannins and phenol content from foods
0FTPC257_4	Examine the ascorbic acid
0FTPC257_5	Analyze the food colors
0FTPC257_6	Analyze the texture of foods

Exp. No.	Title of experiments
1	Determination of in-vitro digestibility of protein
2	Determination of phosphorus
3	Determination of iron
4	Determination of total carotenoids
5	Determination of ascorbic acid by dye method
6	Estimation of total phenol content
7	Estimation of calcium
8	Estimation of tannins from food
9	Determination of food colors
10	Determination of texture of different food groups
11	Project 1: - Development of Fortified Baby Foods
12	Project 2:- Effect of Food Colors on Dairy Products

Text Books :

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Food Chemistry	Owen R, Fennema	Marcel Dekker, Inc., New York, USA.	3 rd	1996
2	Food Chemistry	Lillian Hoagland Meyer	Reinhold Publishing Corporation,	6 th	1960
3	Analytical Method of Food Additives	Roger Wood, Lucy Foster, Andrew Damant, Pauline Key	CRC Press; Woodhead Pub	1 st	2004



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Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food Biochemistry and Food Processing	Benjamin K. S.	Wiley-Blackwell, London,	2 nd	1983
2	Principles of Food Chemistry	DeMan JM	AVI Publishing Co Inc.,	3 rd	1976
3	Food Chemistry	Meyer L.H.	CBS Publishers & Distributors, New Delhi (India)	2 nd	2004



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Course details:

Class:	S. Y.B. Tech Semester IV
Course Code and Course Title:	0FTPR258 – Mini Project
Prerequisite/s:	--
Teaching Scheme:Practical	02
Credits:	01
Evaluation Scheme: ISE/ESE	25/25

Course Outcomes: After completing this course students will be able to

0FTPR258 1	Apply knowledge of unit operations and process
0FTPR258 2	Carry out material and energy balance calculations of selected problem
0FTPR258 3	Design problem statement
0FTPR258 4	Use modern tools to solve problem
0FTPR258 5	Prepare a project report
0FTPR258 6	Present the solution of problem effectively

Sr. No.	Guidelines/steps to complete Mini Project
1	Identify the problem related to food process/ real life/ industry with the help of supervisor/guide
2	Design the problem statement by applying the knowledge of basic Food Technology/Engineering courses
3	Carry Out Literature Survey
4	Design the experiments/methodology
5	Carry out experimentation/simulation
6	Analyze the Results
7	Compare with standards available in literature
8	Prepare report

Text/Reference Books:

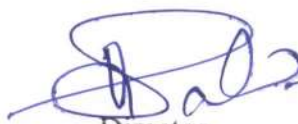
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	How to Write Dissertations & Project Reports	Dr Kathleen McMillan, Dr Jonathan Weyers	Pearson Education Limited	--	2012
2	Dissertations and Project Reports: A Step by Step Guide	Stella Cottrell	Palgrave Macmillan	--	2014
3	Tips For Project Report Writing For Engineering All Streams	Virendra Dilip Thoke	FSP Media Publications	--	2018



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Course details:

Class:	S.Y.B. Tech Semester IV
Course Code and Course Title:	0FTPR259 – In-Plant Training
Prerequisite/s:	--
Teaching Scheme:Practical	--
Credits:	01
Evaluation Scheme: ESE	50

Course Outcomes: After completing this course students will be able to	
0FTPR259_1	Understand industry culture
0FTPR259_2	Work in team
0FTPR259_3	Understand industrial Management
0FTPR259_4	Apply concepts studied in actual industrial problem
0FTPR259_5	Prepare training report
0FTPR259_6	Apply various industrial aspects in real life

Guidelines for In-Plant training

Students are need to undergone in-plant training in food process industry for minimum period of 15 days. During the training, students should report to concern authorities from industry and faculty advisor assigned by department on regular basis.

After completion of training, students should collect training completion certificate and prepare report based on learning from in-plant training and submit to department for evaluation.

Oral examination/presentation will be conducted at the beginning of semester –V.



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Teaching and Evaluation Scheme
T.Y.B. Tech: Semester-V

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks)		Practical (Marks)	
							Max.	Min. for Passing	Max.	Min. for Passing
0OE***	Open Elective-I	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		20	--
0FTPC301	Nutrition	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		20	--
0FTPC302	Processing of Fruits and Vegetables	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		20	--
0FTPC303	Processing of Milk & Milk Products	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		20	--
0FTPC304	Food Additives & Ingredients	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		20	--
0FTPE***	Professional Elective-I	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		20	--
0FTPC351	Nutrition Laboratory	--	--	2	1	ISE	--	--	25	10
0FTPC352	Processing of Fruits and Vegetables Laboratory	--	--	2	1	ESE	--	POE	25	10
0FTPC353	Processing of Milk & Milk Products Laboratory	--	--	2	1	ISE	--	--	25	10
0FTPC354	Food Additives & Ingredients Laboratory	--	--	2	1	ESE	--	OE	25	10
Total		18	0	08	22	Total	600		200	
Total Contact Hours/Week: 26 hrs										
Course Category	HS	BS	ES	PC	PE	OE	PR			
Credits	00	00	00	16	03	03	00			
Cumulative Sum	04	29	28	39	03	03	02			
0FTPE3** Professional Elective-I										
0FTPE305- Wine Technology			0FTPE306- Sugar Technology							


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Open Elective-I		
Courses Code	Course Name	Department
1AEOE311	Introduction to Flight	Aeronautical Engineering
1AEOE312	Introduction to Experimental Aerodynamics	
1AEOE313	Introduction to Gas Dynamics and Jet Propulsion	
1AEOE314	Introduction to Unmanned Aerial Vehicles	
1AUOE301	Product Design and Development	Automobile Engineering
1AUOE302	Automotive Refrigeration and Air Conditioning	
1CVOE301	Air Pollution & Control	Civil Engineering
1CVOE302	Remote Sensing & GIS Applications	
1CSOE301	Database Essentials and Business Intelligence	Computer Science and Engineering
1CSOE302	Software Engineering and Project Management	
1CSOE303	Data Structures and Algorithms	
1EEOE301	Electrical Technology	Electrical Engineering
1EEOE302	Electrical and Electronics Measurements	
0FTOE311	Packaging Technology	Food Engineering
1MEOE301	Industrial Automation and Robotics	Mechanical Engineering
1MEOE302	Composite Materials	
1MEOE303	Solar Technology	


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**Teaching and Evaluation Scheme
T.Y.B. Tech: Semester-VI**

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks)		Practical (Marks)	
							Max.	Min. for Passing	Max.	Min. for Passing
0OE***	Open Elective-II	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		20	--
0FTPC308	Processing of Cereals, Pulses & Oilseeds	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		20	--
0FTPC309	Processing of Meat, Fish & Poultry Products	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		20	--
0FTPC310	Bakery and Confectionary	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		20	--
0FTPE***	Professional Elective-II	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		20	--
0FTPC355	Processing of Cereals, Pulses & Oilseeds Laboratory	--	--	2	1	ISE	--	--	25	10
0FTPC356	Processing of Meat, Fish & Poultry Products Laboratory	--	--	2	1	ESE	--	POE	25	10
0FTPC357	Bakery and Confectionary Laboratory	--	--	2	1	ISE	--	--	25	10
0FTPR361	Minor Project	--	--	2	1	ESE	--	OE	25	10
0FTPR362	In-Plant Training	--	--	--	1	ISE	--	--	25	10
Total		15	--	08	20	Total	500		200	
Total Contact Hours/Week: 23 hrs										
Course Category	HS	BS	ES	PC	PE	OE	PR			
Credits	00	00	00	12	03	03	02			
Cumulative Sum	04	29	28	51	06	06	04			
0FTPE3** Professional Elective-II										
0FTPE311- Fragrance Technology		0FTPE312- Nutraceuticals								


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Open Elective-II		
Courses Code	Course Name	Department
1AEOE321	Lighter Than Air Systems	Aeronautical Engineering
1AEOE322	Airline and Airport Management	
1AEOE323	Flight Scheduling and Operations	
1AUOE310	Vibration based fault diagnosis	Automobile Engineering
1AUOE311	Engineering Tribology	
1CVOE310	Operation Research	Civil Engineering
1CVOE311	Economics And Management	
1CSOE311	Internet of Things	Computer Science and Engineering
1CSOE312	Cyber Laws and Ethical Hacking	
1EEOE306	Electrical Wiring Harnessing	Electrical Engineering
1EEOE307	Electrical Economics & Energy Audit	
0FTOE321	Process Modeling and Simulation	Food Engineering
1MEOE304	Industrial Management and Operation Research	Mechanical Engineering
1MEOE305	Non-Destructive Testing	
1MEOE306	Computational Fluid Dynamics	


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Course Details:

Class:	T.Y
Course Code and Course Title:	0FTOE311 Packaging Technology
Prerequisite/s:	Food Engineering-I-0FTPC205, Food Chemistry-0FTPC209
Teaching Scheme: Lecture	03
Credits:	3
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After successful completion of this course, students will able to	
0FTOE311_1	Understand the functions of packaging materials and its importance in food Industry.
0FTOE311_2	Evaluate the properties, types and applications of plastics in packaging.
0FTOE311_3	Recommend suitable paper packaging and its types.
0FTOE311_4	Evaluate different types of metal cans and glass bottles as packaging.
0FTOE311_5	Design the active food packaging and its role in food industry.
0FTOE311_6	Explain the laws, regulations and environmental standards to food packaging.

Course Contents:		Hrs.
Unit 1	INTRODUCTION TO FOOD PACKAGING: Packaging terminology –definition. Protection of Food products - major role of food packaging - Functions of packaging, Effect of environmental factors like Light, Oxygen, Moisture, Temperature and mechanical forces and biological factors on food quality and shelf life.	07
Unit 2	POLYMERS PACKAGING Types of plastics used in packaging – PE, PP, PET, PVC, EVOH, PVA. Secondary conversion techniques – film, extrusion and thermal lamination. Printing of plastic films and rigid plastic containers. Food contact and barrier properties. Sealability and closure. Application of plastics for food packaging.	07
Unit 3	PAPER PACKAGING Paper and Paperboard Packaging: Properties of paper and paperboard. Paper and paperboard manufacture - SBB, SUB, FBB, and WLC. Package types – paper, pouches, sachets, cartons, boxes, tubes, tubs, containers, drums, tapes, cushion, cap liners and diaphragm. Application of paper and paperboards for food packaging. Laminated Paper board Cartons, Fiber Board and Corrugated Card Board	07

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	packaging and their applications	
Unit 4	METAL CANS AND GLASS BOTTLES AS PACKAGING Metallic can types employed Tin cans and Aluminum cans, relative merits and demerits, specialty of Open top sanitary cans (OTS), Three piece cans and Two piece cans, Aerosol Cans, Relative merits and demerits. Basics of Canning operations, Can closures. Glass - Composition, Glass bottle design and specification Glass jars and Bottles in food packaging, Design features and applications, Sterilization of bottles, advantages and problems, Bottle and jar closures, Different types of caps and liners used.	07
Unit 5	ACTIVE PACKAGING AND INTELLIGENT PACKAGING Special packaging methods- TETRA Packs, Active packaging, Moisture control, CO ₂ and Oxygen scavenging, CAP, modified atmosphere packaging, Inner gas & vacuum packaging, Edible Packaging, Biodegradable packages, shrink wrapping, retort pouches, nano packaging, antimicrobial packaging, self-heating and cooling cans. Convenient packages-blister pack, stand up and zip lock pouch.	09
Unit 6	LAWS, REGULATIONS AND ENVIRONMENTAL ISSUES IN PACKAGING Packaging Laws and Regulations, Safety aspects of packaging materials; sources of toxic materials and migration of toxins into food materials; Packaging material residues in food products; Environmental & Economic issues, recycling and water disposal.	05

Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Food Packaging: Principles and Practice	Robertson Gordon L.,	Marcel Dekker Inc, USA	3rd	2012
2.	Food Packaging and Preservation	Mathlouthi M.	Elsevier Applied Science Publications Essex, UK	1 st	1986

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3.	Plastic Packaging Materials for Food	Otto G. Piringer and A.L. Baner	Wiley VCH, Germany	1 st	2008
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Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Innovations in Food Packaging	Han Jung H.,	Academic Press, USA	2 nd	2013
2.	Novel Food Packaging Techniques	Ahvenainen,R.	CRC Press.	2 nd	2003

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Course Details:

Class:	T.Y.B.Tech Semester V
Course Code and Course Title:	0FTPC301 Nutrition
Prerequisite/s:	Food Chemistry -0FTPC209
Teaching Scheme: Lecture	03
Credits:	03
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After completion of this course students will be able to

0FTPC301_1	Apply the knowledge of dietary recommendations and nutrient facts in daily routing
0FTPC301_2	Evaluate the food energy balance and imbalance in terms of a biological system
0FTPC301_3	Preparations of diet chart for the prevention and control of diseases
0FTPC301_4	Estimation of food energy balance by using different methods
0FTPC301_5	Validated for nutrient intake recommendations across the lifespan
0FTPC301_6	Conclude the effect of nutrients on human body

Course Contents:

		Hrs.
Unit 1	Introduction of Nutrients: Scope, concepts and importance of nutrition, human digestive system, dietary recommendations; nutrition facts, daily values. Sources, functions, digestion, absorption, prebiotics, probiotics	07
Unit 2	Lipids and Proteins Food Sources, Lipid digestion, absorption and transport; Functions of the triglycerides, Health effects and recommended intakes of lipids. Digestion and absorption of proteins; Functions of proteins; amino acids; Protein quality, methods of assessing protein quality. Enzyme actions	07
Unit 3	Carbohydrates, Vitamins & Minerals Digestion and absorption of carbohydrates, lactose intolerance; Glycemic and Non-glycemic carbohydrates, blood glucose regulation, recommendations of sugar intake for health, health effects of fiber and starch intake, artificial sweeteners; Nutrition and Diabetes.	07
Unit 4	Metabolism and Energy Balance Review of catabolic and anabolic pathways of glucose, fats and amino acids; bomb calorimeter, energy balance, direct and indirect calorimetry, physiological energy value of foods; Body Composition, obesity, BMR and BMI calculations, hunger, satiety and satisfaction	07

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Unit 5	Nutrition Food diseases: Type of Malnutrition- protein energy, Micronutrient deficiency diseases, Multi-factorial causes; Epidemiology of under nutrition and over nutrition; Nutrition infection and immunity; Nutrition education – fortification , formulations of products	07
Unit 6	Nutrient requirements at different life stages; For various age group; Pregnant and lactation women, physiological status; Athletic and sports man; Geriatric persons	07

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Essentials of Human Nutrition.	Mann, Jim and Stewart Truswell	Oxford University Press,	2 nd	2002
2	Introduction to Human Nutrition	Gibney, Michael J., et al	Blackwell	2 nd	2009
3	Hand book of nutrition and science	Carolyn D. Berdanier, Jyohana Dwyer, Elaine B. Feldman	CRC press Taylor and francis group	2 nd	2008

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food Science, Nutrition and Health	Fox, B. A. and Cameron, A.G	Edward Arnold, London	5 th	2005
2	Food Chemistry	Srinivasan Damodaran, Kirk L. Parkin, and O.R. Fennema, E	CRC Press, New York	4th	2007
3	Advanced Nutrition and Human Metabolism	Gropper, Sareen S. and Jack L. Smith	Wadsworth Publishing	5 th	2008


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Course Details:

Class:	T.Y.B.Tech, Semester – V
Course Code and Course Title:	0FTPC302 Processing of Fruits and Vegetables
Prerequisite/s:	Food Chemistry 0FTPC209, Principles of Food Preservations 0FTPC211
Teaching Scheme: Lecture	03
Credits: Theory	03
Evaluation Scheme: ISE I /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After completing this course students will be able to	
0FTPC302_1	Recommend suitable preservation method for various food products
0FTPC302_2	Distinguish different processing methods
0FTPC302_3	Design the process for value added products from fruits and vegetables
0FTPC302_4	Recommend suitable method for processing of fruits and vegetables
0FTPC302_5	Design storage methods of foods and vegetables
0FTPC302_6	Identify processing equipment for given fruits &vegetables

Course Contents:		Hrs.
Unit 1	Introduction to Fruits and Vegetables: Structural, compositional and nutritional aspects of fruits and vegetables; Post-harvest handling, storage, control of ripening of Fruits; Post-harvest handling, storage, control of ripening of vegetables; kinetics of quality changes: physical, chemical, sensory and nutritional changes during processing; Influence of elevated temperature on microbial population, product quality,	07
Unit 2	Canning: Blanching techniques and purpose of blanching, determination of blanching processes, concept of commercial sterilization, heating and cooling of food in container, Canning, Materials for canning, different machineries in cannery plant, defects in canning and plant layout of ideal canning unit. Aseptic packaging, freezing	07
Unit 3	Processing Technology of fruits: Technology of Jams, Jellies marmalade, Glazed fruits, Crystallized fruits, fruits candy, and fruit preserve, Fruit Bars , Fruit juice Tomato Products: sauces, ketchups, puree, pastes, chutneys and pickles,	07
Unit 4	Drying and dehydration dehydrated fruitsand vegetables: powders, Fruit juice concentrates – methods of concentration –evaporators used for concentration of fruit	07

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	juices and pulp - Tubular, Plate and scraped surface evaporators and Fruit Powders - Preparation of Fruit material for powder production - Drying, dehydration, water activity and relative humidity; factors affecting rate of drying and dehydration; drying methods; changes during drying and dehydration; different driers; concentration- methods of concentration, changes; effect of drying, dehydration and concentration on quality of foods Working of Spray Dryer and Drum, Concept of hurdle technology, thermal heating approach to minimal processing	
Unit 5	Non thermal preservation Low temperature preservation: Introduction; methods of low temperature preservation; chilling; refrigeration and cold storage; factors affecting refrigerated & frozen storage of foods; effect of freezing on constituents of foods	07
Unit 6	Preservation by Chemical use Preservation using sugar, salt and acids: Sugar - Introduction, factors affecting osmotic pressure of sugar solution, foods preserved using sugar; salt: introduction, antimicrobial activity of salt, estimation of salt, food products preserved using salt; acid - Introduction, mechanism, common foods preserved using acids, Preservation by use of chemicals	07

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Preservation of fruits and vegetables	Girdhari Lal, G. S. Siddappa, G.L. Tandon	Indian Council of Agricultural Research	1st	1967
2.	Handbook of Analysis and Quality Control for Fruits and Vegetable Products	Ranganna S.	Tata-McGraw Hill	2nd	2001
3.	Fruit And Vegetable Preservation: Principles and Practices	R. P. Srivastava	International Book Distributing Company	3rd	2005


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Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Handbook of Vegetable Science and Technology: Production, Composition, Storage & Processing	Salunke D. K. Kadam S. S.	Marcel Dekker Inc, New York	1 st	1988
2.	Fruits & vegetables juice processing technology	Tressler D.K.& Joslyn M.A.	AVI publishing Co. Westport, Connecticut	1 st	1961

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Course Details:

Class:	T.Y
Course Code and Course Title:	0FTPC303 Processing of Milk and Milk Products
Prerequisite/s:	Food Chemistry 0FTPC209, Food Microbiology 0FTPC204
Teaching Scheme: Lecture	03
Credits:	3
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After successful completion of this course, students will able to	
0FTPC303_CO1	Evaluate the basic composition and properties of milk.
0FTPC303_CO2	Improve the primary processing of milk.
0FTPC303_CO3	Identify the milk processing equipment.
0FTPC303_CO4	Design the different types of dairy products.
0FTPC303_CO5	Analyze the fermented dairy products.
0FTPC303_CO6	Recommend to adapt new technology for cleaning of dairy equipment

Course Contents:		Hrs.
Unit 1	INTRODUCTION Introduction, Milk – Types, composition, nutritive value, factors affecting composition, physico- chemical properties- Color, Flavour, Specific Gravity, Boiling point, Freezing point, Refractive Index, Acidity and pH, Viscosity, Surface Tension, System of pricing of milk.	07
Unit 2	PRIMARY PROCESSING OF MILK Raw milk collection – cooling and transportation – milk reception – Platform tests- Quality and Quantity tests at reception- contaminants, Smell, Appearance, Temperature, Sediment, Acidity, Lactometer Reading, Fat, Solids-Not-Fat, Dye Reduction Test: MBRT test, Resazurin tests, Mastitis test -Processing of milk, filtration, clarification, Bactofugation of milk, Cooling and storage of raw milk, Bulk transportation technologies – carbon dioxide impregnation. Milk Standardization, cream separation, Homogenization, Milk Pasteurization & heat treatment of milk-Milk Sterilization	07
Unit 3	MILK PROCESSING EQUIPMENTS Milk processing terminology, Processing flow sheet, Equipment employed, Pasteurisers – HTST, LTLT, UHT methods, Plant piping, Pumps, Cream separating Centrifuges, Clarifiers, Homogenizers, Bottle	07

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	and pouch fillers, Milk Chillers, Ice Cream Freezers. Vacuum Evaporators, Spray and Drum Dryers, Product instantizing equipment. Packaging of milk in bottles and sachets, Form – fill packs.	
Unit 4	MANUFACTURE OF DAIRY PRODUCTS Milk product Processing – cream, Butter, Khoa, Paneer, Ice- cream, condensed milk & evaporated milk. Judging & grading of milk & its products. Dried milk products -Buttermilk powder, Whey Powder, Ice Cream mix Powder, Infant milk food, WMP& SMP. Manufacturing of Fermented products – Yoghurt, Curd, acidophilus milk, buttermilk, and Cheddar cheese, Introduction, Manufacturing process, packaging, storage, defects and their prevention	08
Unit 5	FERMENTED DAIRY PRODUCTS Fermented products – Yoghurt, Curd, acidophilus milk etc.- Concept of Probiotics and prebiotic foods Applications of enzymes in dairy industry	05
Unit 6	CLEANING AND SANITATION OF DAIRY EQUIPMENTS Dairy plant sanitization – Basic principles, Cleaning in place-types and design of CIP System, agents and methods – bottle and can washing- Rotary type and Straight through type, cleaning of tankers and silos – Energy use in Dairy plant - sources and cost of energy, Control of energy losses and Energy conservation.	08

Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Outlines of Dairy Technology	Sukumar De.	Oxford University Press	2 nd	1994
2.	Principles of Dairy Processing	James N. Warner	Wiley Eastern Ltd	3 rd	1998
3.	Dairy Technology: Principles of milk properties and processes	Walstra P.	CRC Press	1 st	1999


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Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Dairy Processing	Gerret Smit. G	Woodhead Publishing Limited, England	1 st	2005
2.	Judging of Dairy Products	J.A.Nelson and Trout	The Olsen publishing Co. Milwankee, Wisconsin, USA	3 rd	1951


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Course Details:

Class:	T. Y. B. Tech Semester V
Course Code and Course Title:	0FTPC304 Food Additives & Ingredients
Prerequisite/s:	Food Chemistry 0FTPC209
Teaching Scheme: Lecture	03
Credits:	3
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: Students able to	
0FTPC304_1	Identify the preservatives for food products
0FTPC304_2	Application of colors and flavors during processing
0FTPC304_3	Categorize sugar replacers for functional food products
0FTPC304_4	Recommend the emulsifiers and stabilizers for specific food groups
0FTPC304_5	Evaluate organoleptic quality of the food products
0FTPC304_6	Recognized safer additives for human consumptions

Course Contents:		Hrs
Unit 1	Introduction: Definition, function in processing and preservation; classification; natural preservatives; chemical preservatives; Permitted preservatives in foods and regulations	07
Unit 2	Food colors and flavors: Natural and synthetic colors; applications in food industry, Effect of processing on pigments, and their retention, Regulatory aspects. Flavoring agents – chemistry of flavoring compounds, Classification, Application of flavors in foods, Sensory assessment of flavors	07
Unit 3	Sweetener: Natural and chemical sweeteners; nutritive and non-nutritive sweeteners; chemical structure & sweetness; Restricted sweeteners in foods; Nutritive additives; chemistry, solubility and interaction with food matrix. Water soluble vitamins, fat soluble vitamins, minerals, enrichment strategy for different food products.	07
Unit 4	Stabilizations & thickening: Introduction; Types; Applications in food processing , Starch modifiers: Introduction; Chemical nature; Role in food processing, Antioxidants & its application in foods	07


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Unit 5	Anti-caking agents and Humectants: Introduction; Different Anti-caking agents and Humectants; Role in food processing. Antimicrobial agents, Clarifying agents, antifoaming agents	07
Unit 6	Safety Evaluation of Food Additives: Effects, Food Additives generally recognized as safe (GRAS); Tolerance levels & Toxic levels in Foods; Legal safeguard; Risks of food additives. Food labeling, nutritive values.	07

Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food science	Norman N. Potter and Joseph H. Hotchkiss	Springer Science New York	5 th	1995
2	Food Additive	R. M. Pandey and S. K. Upadhyay	In Tech	1 st	2012
3	Essential guide to food additives	Victoria Emerton and Eugenia Choi	Leatherhead Food International Ltd	3 rd	2008

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food Science, Nutrition and Health	Fox, B. A. and Cameron, A.G	, Edward Arnold, London	5 th	2005
2	Food Chemistry	Srinivasan Damodaran, Kirk L. Parkin, and O.R. Fennema, E	CRC Press, New York	4th	2007
3	Methods of Analysis of Food Components and Additives	Semih Ötles	Taylor & Francis Group, LLC CRC Press	2 nd	2012


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Course Details:

Class	T.Y.B.Tech Semester V
Course Code and Course Title	0FTPE305 Wine Technology
Prerequisite/s	Unit Operations-0FTES203, Food Engg-I & II-0FTPC205 and 0FTPC208
Teaching Scheme: Lecture	03
Credits	03
Evaluation Scheme: ISE-I /MSE/ISE-II/ESE	10/30/10/50

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

0FTPE305_1	Describe the terminologies involved in wine technology
0FTPE305_2	Describe the various raw materials for manufacture of wine
0FTPE305_3	Prepare flow chart for wine manufacturing process
0FTPE305_4	Evaluate the characteristics of wine
0FTPE305_5	Evaluate economic aspects involved in wine production
0FTPE305_6	Analyze the wine market scenario

Course Contents:

		Hrs.
Unit 1	Introduction to wine technology: Winemaking: Introduction to winemaking, definition and terminologies. Viticulture: Introduction to viticulture, definition and terminologies. History of wine-making and viticulture: Wine-producing regions of the world and different practices of wine making & viticulture. Status of Indian viticulture and winemaking.	7
Unit 2	Introduction to grapevine and concept of Terrior: Grapevine: Classification, anatomy and function of various parts of grapevine. Cultivars and development of hybrids varieties of grapevine. Introduction of soil and influence on the grapevine: Structure of soil and growth of grapevine roots and shoot. Effect of climatic condition on the cultivation of grapevine (sunlight, temperature, wind, rain, hail, frost). Terrior: Concept of Terrior, Terrior units and importance of Terrior	7
Unit 3	Wine-making: Classification of wine: Generic classification, varietal classification, Vinification classification and classification on the basis of chemical	7


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	Constituents. Flow chart of white wine-production and recommended varieties. Flow chart of Red wine-production and recommended varieties. Flow chart of Fortified wine-production and recommended varieties. Production of wine from fruits other than grapes.	
Unit 4	Introduction to sensory evaluation of wine: Sensory evaluation and terminologies. Importance of sensory Evaluation of wine and study of terminologies used in describing wine. The basic tastes of wine and sensory perception: The taste of bitterness, acidity, salt, sweetness, glycerol and alcohol on the tongue, study of 7tongue anatomy with reference to sensory response and study of perception.	7
Unit 5	Commercial aspects of wine production: Comparison of wine with other beverages: Wine with vodka, Gin, Brandy, Whiskey, Rum, Beer, fruit wines fruit juice, carbonated drinks. Traditional and commercial wine-making: A comparison of traditional and new wine-making practices. Raw materials and equipment use in wine production: crusher, press fermentor, filtration and additives used in wines.	7
Unit 6	The world of wine: Wine appellations and regulations: Study of wine laws. Chemical constituents of grapes and wines: Sugar, Acids, Phenolics and Alcohol. Wine and health: Beneficial and harmful effects of wine on the human health. Wine marketing: Importance of marketing in wine industry and the current wine marketing scenario.	7

Text Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Understanding Wine Technology	Bird, David	Board and Bench Publishing	3 rd	2011
02	Red Wine Technology	Antonio Morata	Elsevier Science	---	2018
03	Concepts in Wine Technology, Small Winery Operations	Yair Margalit,	Wine Guild Appreciation	3 rd	2012


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Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Science and Technology of Fruit Wine Production	V. Joshi, Maria K. Kosseva, P.S. Panesar	Elsevier Science	--	2016
02	Wine Science Principles and Applications	Ronald Jackson	Elsevier Science	--	2008


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Course Details:

Class:	T. Y. B. Tech, Semester - V
Course Code and Course Title:	0FTPE306- Sugar Technology
Prerequisite/s:	Food chemistry 0FTPC209, Chemistry of Food Constituents 0FTPC210
Teaching Scheme: Lecture	03
Credits: Theory	03
Evaluation Scheme: ISE I /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After completing this course students will be able to	
0FTPC310_1	Identify various equipment for sugar production
0FTPC310_2	Design raw and refined sugar manufacturing plant
0FTPC310_3	Analyze the market of sugar in India and in the World
0FTPC310_4	Suggest improvements in production of white sugar
0FTPC310_5	Suggest improvements in storage condition of sugar
0FTPC310_6	Identify problems in sugar production

Course Contents:		Hrs.
Unit 1	Sugar and sugarcane Origin of Sugar and Sugarcane, Growth of Indian Sugar Industry, World Sugar Industry, Sugarcane: Composition, Process of Sugar Manufacture Place of Sugar in Human Life, Composition of Cane, Cane Quality in Different Regions of India, Post-harvest Deterioration, Extraneous Matter	07
Unit 2	Juice Extraction Milling: Introduction, Cane weighing, Cane Carriers and Cane Feeding, Mills: Design and Operation, Other Ancillary Unit, Process of Extraction: Imbibition, Mill Capacities, Mill Feeding, Arcing of Rollers; Lotus Roll, Factors Influencing Extraction, Automation, Mill Construction, Mill Juice Characteristics Diffusion: Introduction, Process of Diffusion, Types of Diffusers: Percolation, Maceration, Thin Juice Treatment	07
Unit 3	Clarification Composition of mixed juice, Aim of clarification, Chemicals used, Role of pH, temperature, & reaction time, reactions during clarification, Carbonation, Equipment employed in clarification	07
Unit 4	Evaporation, Syrup Treatment Introduction, Principles used in equipment, Construction, Capacity of	07

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	multiple effect evaporator, working of evaporator, Cleaning of evaporator set, modern equipment Syrup Treatment : Introduction, Chemical Treatment, Syrup Sulphitation, Syrup Bleaching by Hydrogen Peroxide	
Unit 5	Crystallization Pan Boiling, Function, Location, Air Cooled Crystallisers, Water Cooled Crystallisers, Continuous Crystallisers, Design Aspects, Continuous Vertical Crystallisers, Conditioning of Cooled Masecutes, Water Requirement for Cooling, Control of Crystalliser Station	07
Unit 6	Technique of white sugar production Introduction, Influence of Operating Conditions, Clarification Juice Concentration and Syrup Treatment, Crystallisation and Separation, Bold Grain Manufacture, Special White Sugar, Colour Development in Storage, Size and Shape of Crystals, sugar storage	07

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Cane sugar manufacture in India	D.P. Kulkarni	The sugar technologists' association of India	1st	1996
2.	Cane sugar processing: principles and practices	S.V.Karmarkar		1st	1990
3.	Introduction to cane sugar technology	G. H .Jenkins	Elsevier Scientific Publishing Company	2nd	1979

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Manufacture and Refining of Raw Sugar	V.E. Baikow	Elsevier Scientific Publishing Company	1st	1967
2.	Cane Sugar Handbook	James C.P. Chen.	Wiley	11th	1985


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Course Details:

Class:	S.Y.B.Tech, Semester- V
Course Code and Course Title:	0FTPC351 - Nutrition laboratory
Prerequisite/s:	Food Chemistry Laboratory - 0FTPC256
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE/ ESE	25/25

Course Outcomes: After completing this course students will be able to

0FTES351_1	Carry out the analysis of proximate composition of all food products.
0FTES351_2	Develop the healthy food products
0FTES351_3	Examine the natural & added sugars from foods
0FTES351_4	Calculate the energy value by using calorimeter
0FTES351_5	Extract the pigments from vegetables
0FTES351_6	Design the healthy diet for various age groups

Course Contents:

Exp. No.	Title of Experiment
1	Determination of protein content from grains
2	Estimation of starch by Anthrone reagent method
3	Determination of crude fiber content from raw material
4	Estimation of vitamin A
5	Measurement of BMI
6	Measurement of calorific value using bomb calorimeter
7	Estimation of lycopene from vegetables
8	Estimation of ascorbic acid in fruit juices using dye method
9	Analysis of nutritional quality of food
10	Preparation of functional food
11	Project-1: Food products development for lactating women
12	Project-2: Preparation of iron and calcium rich staple food


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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Essentials of Human Nutrition.	Mann, Jim and Stewart Truswell	Oxford University Press,	2 nd	2002
2	Introduction to Human Nutrition	Gibney, Michael J., et al	Blackwell	2 nd	2009
3	Hand book of nutrition and science	Carolyn Berdanier, Jyohana Dwyer, Elaine B. Feldman	CRC press Taylor and francis group	2 nd	2008

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food Science, Nutrition and Health	Fox, B. A. and Cameron, A.G	, Edward Arnold, London	5 th	2005
2	Food Chemistry	SrinivasanDamo daran, Kirk L. Parkin, and O.R. Fennema, E	CRC Press, New York	4th	2007
3	Advanced Nutrition and Human Metabolism	Gropper, Sareen S. and Jack L.Smith	Wadsworth Publishing,	5 th	2008


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Course Details:

Class:	S. Y B.Tech, Semester - VI
Course Code and Course Title:	0FTPC352- Processing of Fruits and Vegetables Laboratory
Prerequisite/s:	Food Chemistry 0FTPC209, Principles of Food Preservations 0FTPC211
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE / ESE	25/25

Course Outcomes: After completing this course students will be able to	
0FTPC352_1	Understand various processing of fruits and vegetables
0FTPC352_2	Use of different machineries and equipment for various unit operations
0FTPC352_3	Develop value added product
0FTPC352_4	Improve shelf life of products made from fruits and vegetables
0FTPC352_5	Improve nutritional quality of traditional products
0FTPC352_6	Recommend solution to agriculture related problem

Course Contents:	
Minimum 8 experiments from following list and one course project	
Exp. No.	Title of Experiment
1	Primary processing of selected fruits and vegetables
2	Estimation of adequacy of blanching
3	Canning of fruits and vegetables
4	Determination of TSS and viscosity of fruit jam
5	Determination of TSS of RTS beverage
6	To analyze quality of fruit squash
7	Determination of acidity of tomato ketchup
8	Determination of moisture content of fruit leather
9	To analyze sensory analysis banana/ potato wafers at different time-temperature combination
10	To analyze quality of dehydrated tomato powder
11	Project-1 Dehydration of grapes
12	Project-2 To analyze quality of dehydrated powder of any vegetable


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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Preservation of fruits and vegetables	GirdhariLal, G. S. Siddappa, G.L. Tandon	Indian Council of Agricultural Research	1st	1967
2.	Handbook of Analysis and Quality Control for Fruits and Vegetable Products	Ranganna S.	Tata-McGraw Hill	2nd	2001
3.	Fruit And Vegetable Preservation: Principles and Practices	R. P. Srivastava	International Book Distributing Company	3rd	2005

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Post-Harvest Physiology & Handling of Fruits and Vegetables	Hosahalli S. Ramaswamy	DEStech Publications, Inc.	1 st	1996
2.	Handbook of Vegetable Science and Technology: Production, Composition, Storage & Processing	Salunke D. K. Kadam S. S.	Marcel Dekker Inc, New York	1 st	1988
3.	Fruits & vegetables juice processing technology	Tressler D.K. & Joslyn M.A.	AVI publishing Co. Westport, Connecticut	1st	1961


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Course Details:

Class:	T.Y
Course Code and Course Title:	0FTPC353 Processing of Milk and Milk Products Laboratory
Prerequisite/s:	Food Chemistry 0FTPC209, Food Microbiology 0FTPC204
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE / ESE	25/25

Course Outcomes: After completing this course students will be able to	
0FTPC353_CO1	Evaluate the basic composition and properties of milk.
0FTPC353_CO2	Design the primary processing of milk.
0FTPC353_CO3	Apply the milk processing equipment.
0FTPC353_CO4	Demonstrate the different types of dairy products.
0FTPC353_CO5	Prepare the fermented dairy products.
0FTPC353_CO6	Improve the shelf life of dairy products.

Course Contents:	
Minimum 8 experiments from following list and one course project	
Exp. No.	Title of Experiment
1	Sampling of milk and milk production.
2	Study of milk testing by methylene blue reduction test
3	Determination of fat content of milk.
4	Detection of adulterants in milks.
5	Determination of pH of butter
6	Study on sensory evaluation of ice-cream.
7	Determination of acidity of fermented milk products (Shrikhand)
8	Determination of moisture content of khoa
9	Study on ash content in channa based sweet (Rasogulla)
10	Determination of protein content in paneer.
11	Project-1: Waste utilization of milk whey
12	Project-2: Visit to Dairy plant.


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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Outlines of Dairy Technology	Sukumar De.	OxfordUniversity Press	2 nd	1994
2	Principles of Dairy Processing	JamesN. Warner	Wiley Eastern Ltd	3 rd	1998
3	Dairy Technology: Principles of milk properties and processes	Walstra P.	CRC Press	1 st	199

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Dairy Processing	Garret Smit. G	Woodhead Publishing Limited, England	1 st	2005
2	Judging of Dairy Products	J.A.Nelson and Trout	The Olsen publishing Co. Milwaukee, Wisconsin, USA	3 rd	1951


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Course Details:

Class:	T.Y.B.Tech Semester V
Course Code and Course Title:	0FTPC354 Food Additives & Ingredients Laboratory
Prerequisite/s:	Principles of Food Preservations - 0FTPC211 Food Microbiology- 0FTPC204
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE/ESE	25/25

Course Outcomes: After completion of this course students will be able to	
0FTPC354_1	Optimize the food additives for commercial use
0FTPC354_2	Examine the emulsifiers and stabilizers for food products
0FTPC354_3	Specify the leavening agents for bakery products.
0FTPC354_4	Implement the analytical techniques
0FTPC354_5	Extend the shelf life of fruit juices
0FTPC354_6	Qualitative detection of food products

Course Contents:	
Exp. No	Title of Experiment
1	Evaluation of GRAS aspect of food additives
2	Determination of diacetyl content in dairy products
3	Study of effect of acidulates in fruit juices
4	Study of effect of stabilizers/thickeners on quality of foods
5	Role of leaving agent in baked food product
6	Role and mode of action of antioxidant in food products
7	Determination of total chlorophyll by Spectrophotometric method
8	Identification of food colors by TLC
9	Qualitative Tests for presence of benzoic acid in foods
10	Study of effect of clarifying agents on the fruit juices
11	Project 1: Preparation of dairy products
12	Project 2: Preparation of value added fruit products


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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food science	Norman N. Potter and Joseph H. Hotchkiss	Springer Science New York	5 th	1995
2	Food Additive	R. M. Pandey and S. K. Upadhyay	In Tech	1 st	2012
3	Essential guide to food additives	Victoria Emerton and Eugenia Choi	Leatherhead Food International Ltd	3 rd	2008

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food Science, Nutrition and Health	Fox, B. A. and Cameron, A.G	Edward Arnold, London	5 th	2005
2	Food Chemistry	Srinivasan Damodaran, Kirk L. Parkin, and Fennema, E	CRC Press, New York	4th	2007
3	Methods of Analysis of Food Components and Additives	Semih Ötles	Taylor & Francis Group, LLC CRC Press	2 nd	2012


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Course Details:

Class	T.Y.B.Tech Semester VI
Course Code and Course Title	0FTOE321 – Process Modeling and Simulation
Prerequisite/s	..
Teaching Scheme: Lecture	03
Credits	03
Evaluation Scheme: ISE-I /MSE/ISE-II/ESE	10/30/10/50

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

0FTOE321_1	Understand types of models and its applications
0FTOE321_2	Exercise model building procedure for steady and unsteady processes
0FTOE321_3	Use fundamental laws for development of models
0FTOE321_4	Formulate mathematical model for various operations
0FTOE321_5	Formulate mathematical model for given process
0FTOE321_6	Carry out simulation by using simulation software packages

Course Contents:

		Hrs.
Unit 1	Introduction to modeling: Definition of model, types of models, formation & applications of mathematical model, definition of simulation and its applications, Scope of the modeling and simulation in process industries, fundamental laws: continuity equation, energy equation, equation of motion, transport equation, equation of state, phase and chemical equilibrium, chemical kinetics.	7
Unit 2	Models in Fluid Flow Operations: The continuity equation, Flow through Packed bed column, Laminar Flow in narrow Slit, Flow of Film on the outside of circular tube, Momentum fluxes for creeping flow in to slot.	7
Unit 3	Modeling of Process Equipment: Agitated vessels, pressure change equipment, mixing process, fluid – solid operations, storage tanks, two heated tanks, Heat exchangers, evaporators	7
Unit 4	Modeling of Mass Transfer Equipment: Flash distillation, differential distillation, and continuous binary distillation in tray and packed column, vaporizers, single phase and multiphase separation, multi-component separation, drying equipment, adsorption, absorbers and strippers	7

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Unit 5	Modeling of Reaction Equipment: Examples of mathematical models of chemical engineering systems, batch reactor, constant volume CSTRS, gas phase pressurized CSTR, non-isothermal CSTR.	7
Unit 6	Introduction to simulation software's: Aspen Hysys. Simulation of steady state systems. Techno Economical aspects of processes.	7

Text Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Process Modeling, Simulation, and Control for Chemical Engineers	William L. Luyben	McGraw-Hill	--	1990
02	Process Modelling and Simulation in Chemical, Biochemical and Environmental	Ashok Kumar Verma	Taylor & Francis	--	2014

Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Process Modelling and Simulation	Costas Pantelides	Mdpi AG	---	2019
02	Process Modeling and Simulation for Chemical Engineers Theory and Practice	Simant R. Upreti	Wiley	--	2017


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Course Details:

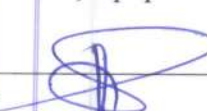
Class:	T.Y.B.Tech Semester VI
Course Code and Course Title:	0FTPC308 Processing of Cereals, Pulses & Oilseeds
Prerequisite/s:	Unit Operations-0FTES203
Teaching Scheme:Lecture	03
Credits:	3
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After completion of this course students will able to	
0FTPC308_1	Classify the post harvest handling methods of cereals and legumes
0FTPC308_2	Relate the processing technology to extend the shelf life of food grains
0FTPC308_3	Demonstrate the methods which affect on cooking quality of food
0FTPC308_4	Identify the anti nutritional compounds from food grains.
0FTPC308_5	Explore the traditional and novel products derived from seeds
0FTPC308_6	Waste / by products utilization in valuable products

Course Contents:		Hrs.
Unit 1	Geometry of grains Morphology of legumes and oilseeds; Classification and types of legumes and oilseeds, Varieties of grains, cereals and legumes grown and consumed in various countries. Post harvest handling and storage	07
Unit 2	Milling effects: Rice, Wheat, Corn, Sorghum, Rye, Barley, - Morphology, Structure, composition, milling, Parboiling, Products. Processing operations such as milling, pearling, par boiling, Milling of legumes: home scale, cottage scale and modern milling methods, milling quality, efficiency and factors affecting milling	07
Unit 3	Physicochemical effect of soaking and germination: Soaking and germination of pulses, Cooking quality, factors affecting on cooking quality. Dehusking in Pulse, Water conditioning, splitting of pulses in Pulse splitter, process flow chart, Merits and demerits, Mini dal mill, working principle, advantages and disadvantages, Grinding of split pulses, pulse flour products, their applications, equipment used	07


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Unit 4	Anti-nutritional & allergens: Methods of removal of anti-nutritional compounds. Physical Processing, soaking, moist heat, Food, legumes, antinutrients, toxins, processing, detoxification, antinutritional effects, beneficial effects, protease inhibitors, phytic acid, saponins, lectins, alpha-amylase inhibitors, gluten products.	07
Unit 5	Processing of oilseeds: Chemical composition of oilseeds, anti-nutritional factors, and utilization of oilseed meals, processing of protein products, minor and non-edible oilseeds as source of proteins. Extraction of oil by mechanical expelling and solvent extraction, composition, methods of extraction. Desolventization and refining of oils: degumming, neutralization bleaching, filtration, deodorization, etc.	07
Unit 6	Products formulations: Development of nutritive multigrain formulations, gelatinization process. By product of oil seed meals for food uses i.e. high protein products like concentrate, isolates. Animal feed, Soap and detergents, personal care products etc	07

Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Cereals processing technology	Gavin Owens	CRC Woodhead Publishing Limited	1 st	2001
2	Bailey's industrial Oil and fat Products	Fereidoon Shahidi	Wiley- interscience	6 th	2005
3	Principles of cereal science and technology	Hoseney R.S.	AACC	2 nd	1994

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Cereal and Cereal Products	Dendy DAV & Dobraszczyk BJ	Springer US	1 st	2001
2	Cereal Science	Matz SA	AVI Publication	4 th	1969

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3	Chemistry of Cereal Grains	Peter Koehler and Herbert Wieser	Springer Science & Business Media New York	6 th	2013
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Course Details:

Class:	T.Y
Course Code and Course Title:	0FTPC309 Processing of Meat, Fish & Poultry Products
Prerequisite/s:	Food Chemistry -0FTPC209, Food Microbiology-0FTPC204
Teaching Scheme: Lecture	03
Credits:	3
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After successful completion of this course, students will able to	
0FTPC309_1	Evaluate the basic composition and chemistry of meat.
0FTPC309_2	Illustrate the primary processing and pre-slaughtering of animals.
0FTPC309_3	Differentiate to Optimize Technology for processing of meat.
0FTPC309_4	Estimate the meat tenderization.
0FTPC309_5	Design the processing of poultry products.
0FTPC309_6	Improve the preservation techniques of fish and marine products.

Course Contents:		Hrs.
Unit 1	INTRODUCTION Meat composition from different sources; Definitions and measurements, Explanation of muscle structure and compositions and its modifiers, White and Red Meat, Description of animal fat and its modifiers, description of bone and its modifiers; Post mortem muscle chemistry, Meat color, flavors of meat products, meat microbiology and safety.	07
Unit 2	SLAUGHTERING AND STUNNING METHODS Ante mortem inspection and handling , Stunning types, Slaughtering types. Steps in slaughtering (Pig, Cattle, Sheep/ Goat) and dressing .Slaughter house operations-Hoisting rail and traveling pulley system; .Modern abattoirs, typical layout and features, Offal handling and inspection. Grading of meat- retail and whole sale cuts. Operational factors affecting meat quality. By product utilization .Meat plant hygiene – GMP and HACCP.	07
Unit 3	PROCESSING OF MEAT Canned meat, Frozen meat, Cooked and Refrigerated meat, Dried and preserved meat, Cured meat, Prepared meat products, Production methods for Intermediate moisture and dried meat products, Different kinds of sausages	07

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Unit 4	MEAT TENDERIZATION. – principles an methods Factors affecting post-mortem changes, properties and shelf life of meat Meat emulsions ,Equipment used for all the process operations	05
Unit 5	PROCESSING OF POULTRY PRODUCTS: Poultry: methods of slaughtering, Slaughtering equipment and operations, dressing, handling, storage and preservation of poultry meat . Spoilage and its control. Freezing and chilling of poultry. Whole sale and retail cuts. Eggs: Composition, handling, candling, washing, coating, packaging and storage. Egg processing (Egg powder manufacturing, pasteurization, etc., Spoilage and its control. Waste management of poultry products.	07
Unit 6	FISH AND OTHER MARINE PRODUCTS PROCESSING: Commercially important marine products from India, Product export and its sustenance, Basic biochemistry, spoilage factors of fish, field refrigeration and icing practice, Use of dry ice and liquid nitrogen as preservation elements, use of Refrigerated Sea Water (RSW) for preservation, Freeze preservation; freezing of prawn,surmai and shrimp, weighing, filling and glazing, Individual quick freezing, in pack freezing, relative merits and demerits, Canning operations, Salting and drying of fish, pickling and preparation of fish protein concentrate, fish oil and other by products.	09

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Meat Science and Applications	Hui, Y.H., Nip, W.K., Rogers, R.W,	Marcel Dekkar Inc. New York	1 st	2001
2.	Handbook of Poultry Science and Technology	Legarreta,I.G.	John Wiley & Sons, Inc., Hoboken	1 and 2	2010
3.	Processed Meat	Pearson, A.M. & Gillett, T.A	Chapman & Hall,	3rd	2006.


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Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Meat Processing	Joseph Kerry, John Kerry and David Ledwood,	Woodhead Publishing Limited, CRC Press,	1st	2002
2.	Post Harvest Technology of Fish and Fish Products	Balachandran, K.K.,	”, Daya Publishing House, New Delhi	1 st	2001

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Course Details:

Class:	T.Y.B.Tech, Semester - VI
Course Code and Course Title:	0FTPC310 Bakery and Confectionary
Prerequisite/s:	Food Chemistry 0FTPC209, Food Microbiology 0FTPC204, Chemistry of Food Constituents 0FTPC210
Teaching Scheme:	
Lecture	03
Credits: Theory	03
Evaluation Scheme: ISE I /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After completing this course students will be able to	
0FTPC310_1	Identify equipment and machineries in food industry
0FTPC310_2	Understand the regulations in processing
0FTPC310_3	Design production procedure of bakery and confectionary products
0FTPC310_4	Design suitable method to improve shelf life of products
0FTPC310_5	Understand functions of various ingredients
0FTPC310_6	Design process for new products

Course Contents:		Hrs.
Unit 1	Wheat Processing Operations such as milling, pearling, par boiling Wheat processing – flour mills, , Physico-chemical and Rheological properties, Enzymes in wheat, damage of wheat, Flour processing, Methods of flour treatment	07
Unit 2	Analytical Equipment for dough Analysis Farinograph, Mixograph, Extensograph, Alveograph, Amylograph, Texture analyser.	07
Unit 3	Bakery products Bread, biscuits, cookies, Cake, Pastry (Role of ingredients, processing, major machineries, Quality control),Multigrain products Other bakery products: using very hard wheat. pizza, pastry and its types.	07
Unit 4	Confectionary History; Traditional confectionary goods; Types of confectionary; Classification of confectionery products. Sugar qualities, physical, chemical, optical properties of sugar. Other Ingredients:Properties of invert sugar, glucose syrup, dextrose, fructose, lactose, caramel, maltose, honey, sorbitol, xylitol, iso-malt, soy maltose.	07

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	polydextrose, lactitol, maltitol, replacers of sugar in confectionery product Additives used in confectionery.	
Unit 5	Cocoa and Chocolate processing Cocoa:cocoa bean processing, roasting, fermentation, production of cocoa butter, cocoa powder, its quality Chocolate :Ingredients, mixing, refining, conching, tempering, molding, cooling, coating, fat bloom	07
Unit 6	High boiled sweets and Toffee, Caramel Introduction, Definition, composition, types of ingredient and their rolecomposition, properties of high boiled sweets,recipes,preparation of high boiled sweets, traditional, batch and continuous method of preparation. Different types of higher boiled sweets, Batch and continuous method of Toffee, Caramel	07

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Bakery Products and Science Technology	Weibiao Zhou, Y. H. Hui	Wiley-Blackwell	2 nd	2014
2.	Sugar Confectionery and Chocolate Manufacture	R. Lees and E.B. Jackson	Springer	1st	1995
3.	Dough Rheology and Baked Product Texture	Juan A. Menjivar Hamed Faridi Ph.D., Jon M. Faubion	Springer	1st	1990

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Baked Products: Science, Technology and Practice	Stanley P. Cauvain, Linda S. Young	Wiley-Blackwell	1st	2006
2.	Chocolate, Cocoa and Confectionery: Science and Technology	Bernard W. Minifie	Springer	1st	1989


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Course Details:

Class:	S.Y.B.Tech Semester V
Course Code and Course Title:	0FTPE311- Fragrance Technology
Prerequisite/s:	Food Chemistry-0FTPC209
Teaching Scheme:Lecture	03
Credits:	3
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes:After completion of this course students able to

0FTPE311_1	Acquire knowledge regarding basic concepts of flavor technology
0FTPE311_2	Describe fragrance quality evaluation and fragrance applications
0FTPE311_3	Explain the recent developments in processing, retention, and recovery of fragrance
0FTPE311_4	Identify the aromatic compounds for various products
0FTPE311_5	Recommend suitable the different extraction techniques
0FTPE311_6	Recognize the need of fragrance technology

Course Contents:		Hrs.
Unit 1	Introduction, family- citrus, floral, fruity. Fragrance chemicals commercially available materials, classification on the basis of origin, physical characteristic, Flavor perception,	07
Unit 2	Production of Fragrance: liquid and solid flavor production; flavoring remixing: flavor intensifiers: synthetic and artificial, quality characteristics	07
Unit 3	Essential oil composition, extraction methods. Fragrances types; floral, fruity, woody, flower, natural, etc. and has applications in different field; soap and toiletries, cosmetics, household applications etc.	07
Unit 4	Fragrance analysis :Aroma compounds, non volatile compounds, the stability of aroma compounds, structure – odour relationships and identification of aroma compounds	07


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Unit 5	Changes in food flavor due to processing: Maillard reaction, Flavours from lipids, flavor formed in fermentation, other cooking and processing methods.	07
Unit 6	Specific Fragrance / flavor applications- culinary, sauces, seasonings, and marinade, meat products, baked goods and bakery Products, snack foods, Sensory evaluations	07

Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Flavor chemistry and technology	Reineccius, G.	CRC	2 nd	2005
2	The Chemistry of Fragrances	Charles S. sell.	Royal Society of Chemistry	2 nd	1994
3	Arranging fine Perfumery ingredients	G.O. Brechbill	Library of congress Science	1 st	2009

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Chemistry and Technology of Flavours and Fragrances	NIIR Board	Asia Pacific Business Press Inc	1 st	2011
2	Science and Technology of Aroma, Flavor, and Fragrance in Rice	Deepak Kumar Verma, Prem Prakash Srivastav	Apple Academic Press	1 st	2018
3	Practical Analysis of Flavor and Fragrance Materials	Kevin Goodner	Wiley-Blackwell	1 st	1999


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Department of Food Technology
Course Details:

Class:	T.Y
Course Code and Course Title:	0FTPE312 Neutraceuticals
Prerequisite/s:	Food Chemistry-0FTPC209.
Teaching Scheme: Lecture	03
Credits:	3
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After successful completion of this course, students will able to	
0FTPE312_1	Identify the nutritional deficiencies in human body
0FTPE312_2	Differentiate types of nutraceuticals.
0FTPE312_3	Identify the omega-3 fatty acids Lipoprotein.
0FTPE312_4	Identify use of the phytochemicals as antioxidants.
0FTPE312_5	Differentiate the probiotics and prebiotics.
0FTPE312_6	Recommend food for in metabolic disorders.

Course Contents:		Hrs.
Unit 1	INTRODUCTION NUTRITIONAL DEFICIENCIES : Nutritional deficiencies and its correction through fortification and supplementation of foods. Beneficial effect of spices, honey, spirulina etc.	07
Unit 2	CLASSIFICATION OF NUTRACEUTICALS Historical Reviews - Teleology of nutraceuticals - Organization models for nutraceuticals - Classification of Nutraceuticals based on the sources- Animal, Plant and Microbial - Nutraceuticals in specific foods - Mechanism of Action - Chemical nature.	07
Unit 3	OMEGA-3 FATTY ACIDS AND CLA: Introduction to Lipoprotein metabolism - PUFA and Cardiac Arrhythmias - Preventative role of n-3 fatty acids in cardiac arrhythmias - Mechanism of action on n-3 PUFA's - ω - 3 fish oils and their role in Glycemic control- ω - 3 fatty acids and rheumatoid arthritis - Chemistry and Nomenclature of CLA - Analysis of CLA in food and biological samples - CLA in food products and biological samples - Biological actions and potential health benefits of CLA - Mechanisms of CLA .	07
Unit 4	FLAVANOIDS AND CAROTENOIDS AS ANTIOXIDANTS: General background on phytochemicals as antioxidants - Flavonoids and Lipoprotein oxidation - Evidence for specific Antioxidant mechanisms of Flavonoids - Dietary carotenoid and carotenoid absorption - Approaches	07

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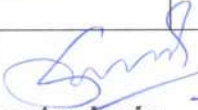
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	to measurement of absorption - Metabolism of Carotenoids - Carotenoids as anticancer agents.	
Unit 5	FUNCTIONAL FOODS, PROBIOTICS AND PREBIOTICS: Lycopene overview - lycopene and disease - Garlic - Chemistry - Implication in Health - Olive oil - CHD - Cancer - Nuts - Nutrient components and Composition - Nut Consumption and CHD epidemiological evidence, Human nutritional studies on nut consumption and serum lipid changes, Mechanism of action- Probiotics- criteria - products on market - probiotic products - Microbiology of the gastrointestinal tract - Prebiotics - future for probiotics and prebiotics.	07
Unit 6	FOODRECOMMENDED FOR METABOLIC DISORDER: Food recommended and restricted in metabolic disorders and disturbances, gastrointestinal disorders; fever and infection; liver, gall, bladder and pancreatic disturbances; blood, circulatory and cardiac diseases; urinary and muscular skeletal diseases; allergies.	07

Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Handbook of Nutraceuticals and Functional Foods	Robert E.C Wildman.	Robert E.C. Wildman, CRC Press LLC.	----	2001
2.	Food Chemistry	Belitz, H.D., Grosch	Springer Berlin, Heidelberg	4 th	2009
3.	Food Chemistry	Mayer Lillian H	AVI Publishing Co., Westport, CT	3 rd	1978

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Nutraceutical and food processing technology	Joyce Irene Boye	Wiley	1 st	2014
2.	Nutraceutical and food components	Charis Galanakis	Elsevier	1 st	2017


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Course Details:

Class:	T.Y.B.Tech Semester VI
Course Code and Course Title:	0FTPC355 Processing of Cereals, Pulses & Oilseeds Laboratory
Prerequisite/s:	Unit Operations Laboratory- 0FTES251
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE/ESE	25/25

Course Outcomes: After completing this course students will be able to

0FTPC355_1	Distinguish the physicochemical properties of raw material.
0FTPC355_2	Analyze the wheat quality for preparation of cake, biscuit etc
0FTPC355_3	Characterize the quality of legumes and pulses
0FTPC355_4	Analyze the physicochemical properties of the oil
0FTPC355_5	Recognize the anti nutritional factors present in cereals, legumes and pulses
0FTPC355_6	Correlate the raw material and finish product quality

Course Contents:

Exp. No	Title of Experiment
1	Physiochemical Properties of grains and flours
2	Determination of Gluten content
3	Preparation of Bread/cookies/cake
4	Determination of starch content of cereal
5	Puffing of legumes
6	Cooking quality of dhal
7	Anti-nutritional factors from legumes
8	Extraction of oil from oil seeds
9	Measurement of physico-chemical properties of oils
10	Preparation of peanut butter
11	Project 1: To check the quality parameters of bakery products
12	Project 2: Development of nutritional bar



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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Technology of Cereals	Kent NL	Woodhead Publishing ISBN: 9780080408347	4 th	1994
2	Bailey's industrial Oil and fat Products	Fereidoon Shahidi	Wiley- interscience	6 th	2005
3	Principles of cereal science and technology	Hoseney R S	AACC	2 nd	1994

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Cereal and Cereal Products	Dendy Dav & Dobraszczyk BJ	Aspen Publication,	1 st	2001
2	Cereal Science	Matz SA	AVI Publication,	1 st	1971
3	Chemistry of Cereal Grains	Peter Koehler and Herbert Wieser	Springer Science & Business Media New York	6 th	2013



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Course Details:

Class:	T.Y
Course Code and Course Title:	0FTPC356 Processing of Meat, Fish & Poultry laboratory.
Prerequisite/s:	Food Chemistry-0FTPC209, Food Microbiology-0FTPC204
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE / ESE	25/25

Course Outcomes: After completing this course students will be able to	
0FTPC356_CO1	Evaluate the basic composition and chemistry of meat.
0FTPC356_CO2	Design the primary processing and pre-slaughtering of animals.
0FTPC356_CO3	Apply to Optimize Technology for processing of meat.
0FTPC356_CO4	Evaluate the meat tenderization.
0FTPC356_CO5	Demonstrate the quality of poultry products.
0FTPC356_CO6	Improve the preservation techniques of fish and marine products.

Course Contents:	
Minimum 8 experiments from following list and one course project	
Exp. No.	Title of Experiment
1	Slaughtering and dressing of poultry bird
2	Determination of water holding capacity of meat
3	Determination of meat pH
4	Determination of metmyoglobin content of meat
5	Determination of Microbial count of meat products
6	Determination of Tenderization of meat
7	Composition and structure of egg.
8	Determination of egg quality by Haugh unit
9	Preparation of Fish pickle.
10	Study of anatomy and dressing of fish
11	Project-1: Quality evaluation of dried fish.
12	Project-2: Quantitative analysis of fat content in meat.


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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Meat Science and Applications	Hui, Y.H., Nip, W.K., Rogers, R.W,	Marcel Dekkar Inc. New York	1 st	2001
2	Handbook of Poultry Science and Technology	Legarreta, I.G.	John Wiley & Sons, Inc., Hoboken	1 and 2	2010
3	Processed Meat	Pearson, A.M. & Gillett, T.A	Chapman & Hall,	3rd	2006.

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Meat Processing	Joseph Kerry, John Kerry and David Ledwood,	Woodhead Publishing Limited, CRC Press,	1 st	2002
2	Post Harvest Technology of Fish and Fish Products	Balachandran, K.K,	”, Daya Publishing House, New Delhi	1 st	2001

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Course Details:

Class:	S.Y B.Tech. Semester - VI
Course Code and Course Title:	0FTPC357- Bakery and Confectionary Laboratory
Prerequisite/s:	Food Chemistry 0FTPC209, Food Microbiology 0FTPC204, Chemistry of Food Constituents 0FTPC210
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE / ESE	25/25

Course Outcomes: After completing this course students will be able to	
0FTPC357_1	Use equipment in bakery and confectionary industry
0FTPC357_2	Understand processing parameters
0FTPC357_3	Develop production flow sheet of different products
0FTPC357_4	Demonstrate analytical parameters of products
0FTPC357_5	Understand function of various ingredients
0FTPC357_6	Improve packaging of the products

Course Contents:	
Minimum 8 experiments from following list and one course project	
Exp. No.	Title of Experiment
1	Determination of gluten content of wheat
2	Determination of falling number
3	Determination of dough rising capacity
4	To determine fat percentage and moisture content of biscuit
5	To analyze carbohydrate percentage and sensory parameters of sponge cake
6	Determination of protein content of bread
7	Determination total sugar content of high boiled sweets
8	Rheological Testing (farinograph, mixograph, extensiograph, alveograph, amylograph)
9	Production of invert sugar
10	Determination of moisture content of toffee
11	Project-1: Making of bread by using rice flour
12	Project-2: To analyze quality of lozenge

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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Bakery Products Science and Technology	Weibiao Zhou, Y. H. Hui	Wiley-Blackwell	2 nd	2014
2.	Sugar Confectionery and Chocolate Manufacture	R. Lees and E.B. Jackson	Springer	1st	1995
3.	Dough Rheology and Baked Product Texture	Juan A. Menjivar Hamed Faridi Ph.D., Jon M. Faubion	Springer	1st	1990

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Baked Products: Science, Technology and Practice	Stanley P. Cauvain, Linda S. Young	Wiley-Blackwell	1st	2006
2.	Chocolate, Cocoa and Confectionery: Science and Technology	Bernard W. Minifie	Springer	1st	1989
3.	Industrial Chocolate Manufacture and Use	S. T. Beckett	John Wiley & Sons Inc.	5th	2017


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Course Details:

Class	T.Y.B.Tech Semester VI
Course Code and Course Title	0FTPR361 – Minor Project
Prerequisite/s	Mini Project 0FTPR258, Food Engg-I, II-0FTPC205 & 0FTPC208, Unit Operations-0FTES203, Process Calculations 0FTES201, Engg. Thermodynamics 0FTES202
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE/ESE	25/25

Course Outcomes: After completing this course students will be able to

0FTPR258_1	Apply knowledge of food engineering
0FTPR258_2	Carry out material and energy balance calculations of selected problem
0FTPR258_3	Design problem statement
0FTPR258_4	Use modern tools to solve problem
0FTPR258_5	Prepare a project report
0FTPR258_6	Present the solution of problem effectively

Sr. No.	Guidelines/steps to complete Mini Project
1	Identify the problem related to food process industry with the help of supervisor/guide
2	Design the problem statement by applying the knowledge of basic Food Technology/Engineering courses
3	Carry Out Literature Survey
4	Design the experiments/methodology
5	Carry out experimentation/simulation
6	Analyze the Results
7	Compare with standards available in literature
8	Prepare report


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Text/Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	How to Write Dissertations & Project Reports	Dr Kathleen McMillan, Dr Jonathan Weyers	Pearson Education Limited	--	2012
2	Dissertations and Project Reports: A Step by Step Guide	Stella Cottrell	Palgrave Macmillan	--	2014
3	Tips For Project Report Writing For Engineering All Streams	Virendra Dilip Thoke	FSP Media Publications	--	2018

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Course Details:

Class	T.Y.B.Tech Semester VI
Course Code and Course Title	0FTPR362 – In-plant Training
Prerequisite/s	Mini Project 0FTPR208, Food Engg-I, II-0FTPC205 & 0FTPC208 Unit Operations-0FTES203, Process Calculations 0FTES201, Engg. Thermodynamics 0FTES202
Teaching Scheme: Practical	--
Credits:	01
Evaluation Scheme: ISE/ESE	25/25

Course Outcomes: After completing this course students will be able to

0FTPR259_1	Understand industry culture and processes
0FTPR259_2	Work in team
0FTPR259_3	Understand industrial Management
0FTPR259_4	Apply concepts studied in actual industrial problem
0FTPR259_5	Prepare training report
0FTPR259_6	Apply various industrial aspects in real life

Guidelines for In-Plant training

Students should undergone in-plant training in food process industry for minimum period of 30 days. During the training, students should report to concern authorities from industry and faculty advisor assigned by department on regular basis.

After completion of training, students should collect training completion certificate and prepare report based on learning from in-plant training and submit to department for evaluation.

Oral examination/presentation will be conducted at the beginning of semester –VII.

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Curriculum Structure

B.Tech

FOOD TECHNOLOGY

SEMESTER-VII & VIII

w.e.f. 2022-23

Department of Food Technology

Teaching and Evaluation Scheme
B. Tech: Semester-VII

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks)		Practical (Marks)	
							Max.	Min. for Passing	Max.	Min. for Passing
0OE***	Open Elective-III	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		20	--
0FTPC401	Food Biotechnology	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		20	--
0FTPC402	Food Hygiene and Sanitation	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		20	--
0FTPC403	Process Instrumentation & Control	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		20	--
0FTPE***	Professional Elective-III	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		20	--
0FTPC451	Food Biotechnology Laboratory	--	--	2	1	ISE	--	POE	25	10
						ESE	--	POE	25	10
0FTPC452	Process Instrumentation & Control Laboratory	--	--	2	1	ISE	--	POE	25	10
						ESE	--	POE	25	10
0FTPE***	Professional Elective-III Laboratory	--	--	2	1	ISE	--	OE	25	10
						ESE	--	OE	25	10
0FTPR456	Project (Phase-I)	--	--	4	2	ISE	--	PR	50	20
						ESE	--	PR	50	20
Total		15	--	10	20	Total	500		250	
Total Contact Hours/Week: 25 hrs										
Course Category	HS	BS	ES	PC	PE	OE	PR			
Credits	00	00	00	11	04	03	02			
Cumulative Sum	04	29	28	62	10	09	06			
0FTPE*** Professional Elective-III										
0FTPE404- Biochemical Engineering				0FTPE405- Wealth from Food Waste						
0FTPE*** Professional Elective-III Laboratory										
0FTPE453- Biochemical Engineering				0FTPE454- Wealth from Food Waste						
0OE***- Open Elective-III										
0FTOE411 – Process Optimization				0FTOE412- Cold Storage and Supply Chain Management						


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Open Elective-III		
Courses Code	Course Name	Department
1AEOE421	Air Traffic Control and Airport Design	Aeronautical Engineering
1AEOE422	Aircraft General Engineering Maintenance	
1AEOE423	Design of Fixed wing unmanned aerial vehicles	
1AUOE401	Vehicle maintenance and safety	Automobile Engineering
1AUOE402	Vehicle Aerodynamics	
1CVOE401	Structural Auditing	Civil Engineering
1CVOE402	Disaster Management	
1CSOE401	Introduction to image processing and computer vision	Computer Science and Engineering
1CSOE402	Introduction to machine learning	
1EEOE401	Electric Vehicles	Electrical Engineering
1EEOE402	Wind and Solar Energy Systems	
0FTOE411	Process Optimization	Food Technology
0FTOE412	Cold Storage and Supply Chain Management	
1MEOE401	Total Quality Management	Mechanical Engineering
1MEOE402	Reliability engineering	
1MEOE403	Renewable Energy Engineering	



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Teaching and Evaluation Scheme
B. Tech: Semester-VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks)		Practical (Marks)	
							Max.	Min. for Passing	Max.	Min. for Passing
0FTPC407	Food Quality and Assurance	3	--	--	3	ISE I	10	40	--	--
						MSE	30			
						ISE II	10			
						ESE	50			
0FTPC408	Process Equipment Design	3	--	--	3	ISE I	10	40	--	--
						MSE	30			
						ISE II	30			
						ESE	50			
0FTPC409	Project Management & Economics	3	--	--	3	ISE I	10	40	--	--
						MSE	30			
						ISE II	10			
						ESE	50			
0FTPE***	Professional Elective-IV	3	--	--	3	ISE I	10	40	--	--
						MSE	30			
						ISE II	10			
						ESE	50			
0FTPC457	Process Equipment Design Laboratory	--	--	2	1	ISE	--	POE	25	10
						ESE	--	OE	25	10
0FTPE***	Professional Elective-IV Laboratory	--	--	2	1	ISE	--	OE	25	10
						ESE	--	PR	50	20
0FTPR461	Project (Phase-II) / Internship	--	--	10	5	ISE	--	PR	100	40
0FTMC462	Constitution of India	2	--	--	--	ISE	Audit			
Total		14	0	14	19	Total	400		250	
Total Contact Hours/Week: 28 hrs										
Course Category	HS	BS	ES	PC	PE	OE	PR			
Credits	00	00	00	10	04	00	05			
Cumulative Sum	04	29	28	72	14	09	11			
Credits (AICTE)										
0FTPE*** Professional Elective-IV										
0FTPE410- Design and Development of Special Foods				0FTPE411- Food Allergies						
0FTPE*** Professional Elective-IV Laboratory										
0FTPE458- Design and Development of Special Foods				0FTPE459- Food Allergies						

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Course Details:

Class	B.Tech Semester VII
Course Code and Course Title	0FTOE411 – Process Optimization (Open Elective-III)
Prerequisite/s	Engineering Mathematics I & II
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE-I /MSE/ISE-II/ESE	10/30/10/50

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

0FTOE411_1	Apply optimization methods for given process parameters
0FTOE411_2	Analyze the Optimize first order models
0FTOE411_3	Apply concept of experimental design to given first order model
0FTOE411_4	Analyze the optimization of second order models
0FTOE411_5	Apply concept of experimental design to given second order model
0FTOE411_6	Evaluate the statistical inference in process optimization

Course Contents:

		Hrs.
Unit 1	Introduction to Process Optimization: Process Optimization and Design of Experiments, Brief Historical Account of Process Optimization Methods for Noisy Processes, Basic Ideas in Response Surface Methods, a first order polynomial model, second order polynomial model, Steps in a Classical RSM Study, Case study: Optimization of a machining process, Statistical Inference in Process Optimization: Frequentist and Bayesian Methods, Basic Ideas in Experimental Design	7
Unit 2	Optimization Of First Order Models: New Region Exploration, Steepest Ascent/Descent Procedure, Case Study: Optimization of a Chemical Process, Experimenting along the direction of maximum improvement,	7
Unit 3	Experimental Designs For First Order Models: Variance Properties of 2-level Factorial Designs for a First Order Model, Useful 2-level First Order Designs: 2^k Designs, 2^{k-r} Designs, Group Theory Aspects of 2^k and 2^{k-r} Factorials, Plackett-Burman Designs and Other Screening Designs, Randomization and Blocking	7
Unit 4	Analysis And Optimization Of Second Order Models: Unconstrained Optimization and Characterization of Second Order Models: “Canonical” Analysis, Constrained Optimization and Analysis of Second Order Models: “Ridge” Analysis, Optimization of Multiple Response Processes, Desirability Approach,	7
Unit 5	Experimental Designs For Second Order Models: Rotatable Designs, Central Composite Designs, Blocking in Second Order Models, Box-Behnken Designs, Roquemore’s (Hybrid) Designs,	7


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Unit 6	Statistical Inference In Process Optimization: Statistical Inference In First Order RSM Optimization, Statistical Inference In Second Order RSM Optimization	7
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Text Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Process Optimization A Statistical Approach	Enrique Del Castillo	Spinger	--	2007
02	Experimental Design and Process Optimization Engineering	Maria Isabel Rodrigues, Antonio Francisco Iemma	Taylor & Francis	--	2014

Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Energy and Process Optimization for the Process Industries	Frank Xin X. Zhu	Wiley	---	2013



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Course Details:

Class:	B.Tech Semester VII
Course Code and Course Title:	0FTOE412 Cold storage & supply chain management (Open Elective-III)
Prerequisite/s:	Food Engineering I&II, Food Preservation
Teaching Scheme: Lecture	3
Credits:	3
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After successful completion of this course, students will able to

0FTOE412_1	Evaluation of the basic principles of refrigeration
0FTOE412_2	Analyze the primary processing of a cold storage.
0FTOE412_3	Differentiate between different chilling techniques.
0FTOE412_4	Apply different freezing methods.
0FTOE412_5	Apply cold preservation techniques.
0FTOE412_6	Examine Cooling chain management.

Course Contents:

		Hrs.
Unit 1	INTRODUCTION PRINCIPLES OF REFRIGERATION: Refrigeration—Ton of refrigeration, Vapor Compression and Vapor Absorption cycles, Refrigerants, characteristics of different refrigerants, net refrigerating effect—Components of a Refrigeration system: Compressor, condenser, Expansion valve sipping and different controls. Atmospheric air and its properties, Psychrometrics.	07
Unit 2	COLD STORAGE DESIGN AND CONSTRUCTION: Cold Room temperatures, Insulation, properties of insulating materials, air diffusion equipment, Doors and other openings. Cold load estimation; prefabricated systems, walk-in-coolers, and Refrigerated container trucks: Freezer Storages, Pre-cooling and pre freezing. Cold Storage practice, Stacking and handling of materials, Optimum temperatures of storage for different food materials	07
Unit 3	CHILLING OF FOODS: Chilling equipment for liquid foods. Secondary refrigerants and direct expansion techniques in chilling. Chilled foods transport and display cabinets—Basics of Chilled foods microbiology, Packaging of Chilled foods—Hygienic design on considerations for chillers and chilled Storages. Cool storages and their applications. Evaporative cooling and its applications.	07
Unit 4	FREEZING OF FOODS: Freezing equipment, freezing rates, growth rate of ice crystals, crystal size and its effect of texture and quality of foods, Freezer types, Blast freezers, Contact Plate Freezers, conveyORIZED quick freezers, Individual quick freezing. Freezing practices applied to marine foods, meat and poultry, fruits and vegetables.	05


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Unit 5	COLD PRESERVATION TECHNOLOGY Ice Manufacture, Principle and systems of ice production, Treatment of water for ice making, brines, Freezing tanks, ice cans, air agitations, Quality of ice, Preservation of Different Products-dairy plant refrigeration system, meat and poultry refrigeration system, seafood refrigeration system	
Unit 6	COLD CHAIN MANAGEMENT: Supply chain system - Important Factors to consider-logistic supply- Protocols for Domestic, Sea and Airfreight- Traceability and barcode –Product Temperature and Moisture monitoring-Refrigeration systems and Refrigerant types during field chilling, transportation vial and, air and sea, At Grocery stores and display cases, home refrigerators-Cooling chain summary- Storage and packaging, Govt. scheme for cold chain management.	09

Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Cold and Chilled Storage Technology	Dellino, C.V.J	Chapman Hall India	-	1997
2.	A Comprehensive Guide	Colin Dennis and Michael Stringer	M Wood Head	-	2008
3.	Hand book of Frozen Food Processing and Packaging	Da-WenSun	CRC Press, Taylor and Francis Group	Second	2012

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Frozen Food Science and Technology	Judith A. Evans	Blackwell PublishingLtd	Fifth	2008
2.	Refrigeration and Air Conditioning Technology	William C. Whitman, William M. Johnson, John A. Tomczyk, and Eugene Silberstein	Delmar, Cengage Learning	Sixth	2009

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Course Details:

Class:	B.Tech Semester VII
Course Code and Course Title:	0FTPC401 Food Biotechnology
Prerequisite/s:	Food Microbiology
Teaching Scheme: Lecture	03
Credits:	3
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After completing this course students will be able to	
0FTPC401_1	Articulate the applications of molecular biology in food industry
0FTPC401_2	Illustrate the use of tissue culture in food
0FTES401_3	Analyze the different recombinant technologies
0FTES401_4	Apply immobilization strategy to increase product yield
0FTES401_5	Identify the role of biosensors in food processing
0FTES401_6	Develop healthy products with the knowledge of nutrigenomics

Course Contents:		Hrs.
Unit 1	Introduction to Biotechnology Basics of molecular Biology – DNA, RNA, Transcription and translation: RNA synthesis, types of RNA, genetic code; Mutation and DNA repair, mechanisms to repair of damaged DNA	06
Unit 2	Genetic Engineering Gene, plasmids, genetic recombination in bacteria, Strain Improvement Techniques, Natural selection and mutation; Recombination; Vectors; Immobilization of microbial and cultured plant cells. Plant and animal tissue culture	08
Unit 3	Recombinant DNA technology Concept of macromolecules: Function and synthesis, Restriction enzymes, plasmid vectors, gene cloning ;DNA sequencing , Polymerase Chain reaction(PCR) and Manipulation techniques of DNA	07
Unit 4	Immobilization of enzymes Immobilizing cells in insoluble matrix, immobilized cell systems, cell attachment in a surface, aggregation, entrapment, containment, physical adsorption, covalent bonding, cross linking, entrapment into polymeric films, microencapsulation, large scale cell immobilization, Role of immobilized enzymes in food processing-Endogenous enzymes in food quality- colour, texture, flavour and nutritional quality.	06
Unit 5	Biosensors and Nanobiotechnology Biosensors: Definition, Classification; Its role in food analysis; Enzyme biosensors Application of biosensors in food and beverage industry. Nanoparticles and its role in agriculture, food processing & packaging	06
Unit 6	GM and Functional Foods Nutrogenomics-concepts, working, significance and relevance Nutraceuticals and Functional Foods.	08


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	Genetically Modified Foods-Plant and Animal origin. Ethical issues concerning GM Foods, testing for Genetically modified organisms. Current guidelines-production, release and movement of GMO's, labelling and traceability-Biosafety- Public perception of GM foods, GMO Act- 2004	
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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Fundamentals of Food Biotechnology	Byong H. Lee	John Wiley & Sons, Ltd	3 rd	2014
2	Food Biotechnology	Anthony Pometto et al.	CRC Press	2 nd	2005

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food Biotechnology: Principles and Practices	V. K. Joshi, R. S. Singh	I. K. International Publishing House Pvt. Ltd.	--	2012
2	Food Science and Food Biotechnology	Gustavo F. Gutierrez-Lopez	CRC Press	--	2003
3	Basic Molecular and Cell Biology	David S. Latchman	Indian Reprint	3 rd	2006



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Course Details:

Class:	B.Tech, Semester VII
Course Code and Course Title:	0FTPC402 Food Hygiene and Sanitation
Prerequisite/s:	Food Chemistry, Food Microbiology
Teaching Scheme: Lecture	03
Credits: Theory	03
Evaluation Scheme: ISE I /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After completing this course students will be able to	
0FTPC402_1	Illustrate the link between personal hygiene and food safety
0FTPC402_2	Configure the internal and external unit in food establishment
0FTPC402_3	Identify measures/ procedures that will reduce accidents in food preparation
0FTPC402_4	Interpret the quality assurance for sanitation
0FTPC402_5	Design and develop sanitation equipment
0FTPC402_6	Examine the factors influencing on cleaning

Course Contents:		Hrs.
Unit 1	Hygiene and Sanitation Hygiene and sanitation, the importance of hygiene and sanitation during handling, processing, storage, establishment of sanitary Practices.	06
Unit 2	Hygiene and sanitation practices in food operating Hygiene and sanitation before production, Precautions to be taken during the production, Precautions to be taken after the production, Sanitation design and construction for food industry, Pest control of food industry – Insects, Rodents ,Birds, Domestic Animals and Wild Animals	07
Unit 3	Personnel Hygiene and Sanitary Food Handling Personnel Hygiene, Rules For The Personnel, Employer Responsibilities, Sanitary Food Handling, HACCP in Sanitation	07
Unit 4	Food Safety Contamination – Food contamination sources, protection against sources, Disinfection, Foodborne, Diseases, Rope Disease, Moldiness Food Poisoning Symptoms, Quality Assurance for sanitation, sanitation laws, regulations, and guidelines,	07
	The Microorganisms and Sanitation How microorganisms relate to food sanitation,What causes microorganisms to grow, Effects of microorganisms on spoilage, Effects of microorganisms on foodborne illness, Foodborne illnesses, Microbial destruction, Microbial growth control, Microbial load determination, Diagnostic tests	07
Unit 6	Sanitizers and Sanitation Equipment Sanitizing methods, Sanitation costs, Sanitation costs, Cleaning equipment, Sanitizing equipment, Lubrication equipment, Cleaning Compounds - Effects of surface characteristics on soil deposition, e	08


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	Cleaning compound characteristics, Classification of cleaning compounds	
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Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Principles of food sanitation	Norman G. Marriott, PhD and Robert B. Gravani	Springer	5 th	2006
2.	Food hygiene, microbiology and HACCP	S J Forsythe, P R Hayes	Springer	3 rd	2000
3.	Basic concepts of Industrial hygiene	Ronald M Scott	CRC press	1 st	1997

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Hygiene and sanitation Handbook				
2.	Industrial Hygiene and toxicology	Josef Brozek	Interscience Publ.	Volume 2	1949


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Course Details:

Class:	B. Tech Semester VII
Course Code and Course Title:	0FTPC403 Process Instrumentation and Control
Prerequisite/s:	Unit Operations, Food Engineering-I, Food Engineering-II
Teaching Scheme: Lecture/Tutorial	03
Credits:	03
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes:

0FTPC403_1	Apply principles of process control to analyze the performance of industrial processes.
0FTPC403_2	Evaluate concepts of measurement and sensor selection to specify, install, configure and calibrate.
0FTPC403_3	Apply the measurement techniques for Pressure and Temperature
0FTPC403_4	Apply the measurement techniques for Flow and Level
0FTPC403_5	Explain recording, indicating and signaling instruments
0FTPC403_6	Analyze repeatability, precision and accuracy of instruments

Course Contents:

Course Contents:		Hrs.
Unit 1	<p>Introduction: Definitions - Instrument, Controller and recorder, Principle of measurement, Static and dynamic characteristics of instrument, Error analysis and its calibration.</p> <p>Temperature Measurement: Mercury thermometers, Bimetal thermometers, Capillary type thermometers, Recording thermometers, Thermocouples, Resistance thermometers, thermister</p>	07
Unit 2	<p>Pressure Measurement: Pressure gauge, Elastic deformation elements, Basic concept of pneumatic pressure transmitter, Pressure current and Pressure resistance transducers.</p> <p>Level Measurement: Direct measurement of liquid level, level measurement in pressure vessels, measurement of interface level, level of dry materials.</p>	07
Unit 3	<p>Flow Measurements: Head flow meters, open channel meters, area flow meters, flow of dry materials, viscosity measurement.</p> <p>Miscellaneous Measurements: Weight measurement - Mechanical scale, Electronic tank scale, Conveyor scale and measurement of specific gravity, Measurement of humidity, Measurement of density, Automatic valves.</p>	07
Unit 4	<p>Process Control: Simple system analysis, Dynamic behavior of simple process, Laplace transforms, Process control hardware, Transfer functions and the</p>	07


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	inputoutput models, Dynamics and analysis of first,second and higher order systems.	
Unit 5	Basic control actions: Characteristics of ON-OFF, P, I and D control, PI, PD and PID control modes, Response of controllers for different types of test inputs, pneumatic and electronic controllers to realize various control actions, selection of control mode for different processes, optimum controller settings, tuning of controllers – process reaction curve method, continuous cycling method, damped oscillation method, Ziegler Nichols methods.	07
Unit 6	Feedback Control Schemes: Concept of feedback control, Dynamics and analysis of feedback-controlled processes, Stability analysis, Controller design, Frequency response analysis and its applications. Feedback control of systems with dead time or inverse response, Control systems with multiple loops, Feedforward and ratio control.	07

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Principles of Industrial Instrumentation	Patranabis, D.	Tata McGraw Hill Publishing Company	2 nd	1999
2	Industrial Instrumentation	Eckman, D. P.	Wiley Eastern Ltd.	-	2004
3	Process Control Instrumentation Technology	Johnson C.D.	PrenticeHall of India.	8 th	2014
4	Fundamentals of Industrial Instrumentation and Process Control	Dunn, W.C.	Tata McGraw-Hill Education Private Limited	1 st	2009

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Transducers and Instrumentation	Murty, D.V.S.	Prentice Hall of India.	2 nd	2008
2	Process system analysis and control	Donald, R.C. and LeBlanc, S.E.	McGraw-Hill	3 rd	1990
3	Chemical process control: an introduction to theory and practice	Stephanopoulos, G.	Prentice-Hall	-	1984


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Course Details:

Class:	B. Tech Semester VII
Course Code and Course Title:	OFTPE404 Biochemical Engineering (Professional Elective-III)
Prerequisite/s:	Food Microbiology, Food Engineering
Teaching Scheme: Lecture/Tutorial	03/00
Credits:	3
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After completing this course students will be able to

OFTPE404_1	Estimate the substrate conversion under known conditions
OFTPE404_2	Calculate the kinetic parameters of enzymatic reactions
OFTPE404_3	Determine oxygen requirements for any biological processes
OFTPE404_4	Illustrate the operation and choice of sterilization
OFTPE404_5	Compare the different parts of a fermenter and their application
OFTPE404_6	Design and optimize cost-effective separation techniques

Course Contents:

Course Contents:		Hrs.
Unit 1	Kinetics of Enzyme action Enzyme Kinetics, simple kinetics model for enzyme substrate interaction. Estimation of Michelis Menten parameters Complex enzyme kinetics: Oxidation – reduction form of enzymes, observed apparent rate constant, factors affecting the inhibition, competitive, non-competitive inhibition, substrate interaction	08
Unit 2	Sterilization Air sterilization, aeration and agitation, Definition, thermal death time, media heat sterilization, advantages of continuous sterilization. Aeration and agitation :Oxygen requirement of industrial fermentations, determination of K La Value, factors affecting K La Value	07
Unit 3	Fermenter Basic functions of fermenter - Design of fermenter - types of fermenter - different parts - agitator, impellers, aerator, baffles, mode of configurations, process control, function and maintenance of various parts of fermenter- Recovery and purifications of food products	07
Unit 4	Introduction to fermentation processes Introduction to fermentation industry, general requirements of fermentation processes, main parameters to be monitored and controlled in fermentation processes, media for industrial fermentation, medium composition, energy, CO ₂ , nitrogen and other growth factors, buffering and foam agents. Types of fermentation- ethanolic fermentation – mixed alcoholic and acid fermentation – lactic acid fermentation.	08
Unit 5	Downstream processing Recovery of particulates, product isolation, precipitation, chromatography and membrane separations; Product recovery trains of commercial enzymes, polysaccharides, organic acids and ethanol	06


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Unit 6	Bioprocess Economics Process economics, Bioproduct regulation, General fermentation process economics; Fine chemicals –Enzymes, proteins, Antibiotics, Single Cell Protein (SCP)	06
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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Introduction to Biochemical Engineering	D G Rao	McGraw Hill Education (Asia)	2 nd	2010
2	Biochemical Engineering Fundamentals	James E. Bailey & David F. Ollis	Elsevier Science	2 nd	2011
3	Biochemical Engineering and Biotechnology	G.D. Najafpour	Elsevier Science	2 nd	2015

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Enzymes: Biochemistry, Biotechnology, Clinical Chemistry	Palmer, Bonner	Elsevier Science	2 nd	2007
2.	Bioprocess Engineering: Basic Concepts	Shuler, M.L. and Kargi, F.	Prentice Hall	3 rd	2002
3.	Biochemical Engineering	<u>Shigeo Katoh, Fumitake Yoshida, Jun-ichi Horiuchi</u>	Wiley	2 nd	2015


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Course Details:

Class:	B.Tech Semester VII
Course Code and Course Title:	0FTPE405 Wealth from Food Waste (Professional Elective-III)
Prerequisite/s:	Principles of Food Preservations
Teaching Scheme: Lecture/Tutorial	03
Credits:	3
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes:After completion of this course students will be able to

0FTPE405_1	Identify generated waste
0FTPE405_2	Analyze the characteristics of waste
0FTPE405_3	Develop the process for food waste management at small scale
0FTPE405_4	Minimize waste generation from different food processing units and study impact of waste generated in food industries on health and the environment
0FTPE405_5	Formulate value-added products from waste
0FTPE405_6	Utilize organic waste as a fertilizer

Course Contents:

		Hrs.
Unit 1	Introduction Types of waste and magnitude of waste generation in different food processing industries, concept, scope and importance of waste management and effluent treatment, Environmental Protection Act and specification for effluent of different food industries	07
Unit 2	Waste characterization Geographical waste or regional waste; Solid Waste management tools – techniques for reducing production of waste, managing through segregation and scientific disposal, Categories of Solid Wastes - Domestic Waste, Market Waste, Food Waste, Agricultural waste, Fruit- vegetable market waste, e-Waste, Industrial Inert Waste, Industrial Hazardous Waste, Bio-Medical Waste and Radioactive Waste, Hazardous waste,	08
Unit 3	Food Waste Management Consequences on Environment, Present Disposal Methods, Treatment by Physical, Chemical and Biological Methods, Effluent Treatment Plants and Solid Waste Utilization and Management – SCP, Biogas, Plant-derived Fuels, Landfill Gas, Biomethanation and Biocomposting Technology for Organic Waste, Incineration and Combustion Technology Waste Water Management – Quality, Treatment, Recycle, Reuse, BOD, COD, Role of Macrophytes and Microphytes, Integration of New and Renewable Energy Sources for Waste Utilization	08
Unit 4	Waste Generated from Processing Units Grains, Legumes and Oilseeds, Fruits and Vegetables, Sugar Factories, Breweries, and Distilleries, Dairy Industry, Flesh Foods Processing Units – Meats, Poultry and Sea foods	05
Unit 5	Waste utilization Status and utilization of by-products of cereals, legumes & oilseeds, Utilization of by-products from fruits and	08


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	vegetables processing industries, sugar and agro based industries, and brewery & distillery waste, dairy by-products i.e. whey, buttermilk and ghee residues, Availability & utilization of by-products of meat industry, poultry industry and fish processing units.	
Unit 6	Biomethanation and biocomputing technology for organic waste utilization, incineration & efficient combustion technology, Integration of new and renewable energy sources for waste utilization	06

Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Waste Management for the Food Industries	Ioannis Arvanitoyannis	Academic Press.	1 st Edition	2010
2	Food Processing Waste Management: Treatment and Utilization Technology	V.K. Joshi (Editor)	CRC Press	-	2011
3	Principles of Food Sanitation.	Marriott PhD Norman G. and Gravani Robert B.	Springer	5 th Edition	2006
4	Postharvest Technology of Fruits and Vegetables: Handling, Processing, Fermentation and Waste Management.	Verma L.R. and Joshi V.K.	Indus Publishing Co. New Delhi	Volume 2	2000
5	Handbook of Solid Waste Management.	Tchobanoglous George and Kreith Frank	The McGraw-Hill Companies	2 nd Edition	2002


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Course Details:

Class:	B.Tech Semester VII
Course Code and Course Title:	0FTPC451 Food Biotechnology Laboratory
Prerequisite/s:	Food Microbiology
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE/ESE	25/25

Course Outcomes: After completion of this course students will be able to

0FTPC451_1	Apply the knowledge of mutational theory
0FTPC451_2	Isolation and separation of DNA and proteins.
0FTPC451_3	Handle tools and equipment used for various biotechnology experiments
0FTPC451_4	Analyze the food sample using the biotechnological tools
0FTPC451_5	Generate biomass from food waste
0FTPC451_6	Degrade the food sludge using microbial culture

Course Contents:

Exp. No	Title of Experiment
1	Micropropagation through Tissue Culture
2	Strain Improvement through UV Mutation for Lactose Utilization
3	Chemical mutagenesis using chemical mutagens
4	Isolation of DNA from bacterial cell
5	Separation of protoplast using cellulytic enzymes
6	Immobilizing cells using alginate solution
7	Production of biomass from kitchen waste
8	SDS-PAGE for food analysis
9	Use of chromatographic technique to separate dyes
10	ELISA test
11	Agarose gel electrophoresis for DNA separation
12	Pesticide degradation by pseudomonas species

Text Books and references:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Biotechnology procedures and experiments handbook	S.Harisha	Laxmi Publications Pvt. Ltd	--	2008
2	Food Biotechnology Practical Manual	Stuart Smith	Deakin University	--	2010


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Course Details:

Class:	B.Tech Semester VII
Course Code and Course Title:	0FTPC452 Process Instrumentation and Control Laboratory
Prerequisite/s:	Unit Operations, Food Engineering-I, Food Engineering-II
Teaching Scheme:Practical	02
Credits:	01
Evaluation Scheme: ISE/ESE	25/25

Course Outcomes: After completion of this course students will be able to

0FTPC452_1	Illustrate the different methods for the measurement of process parameters
0FTPC452_2	Elucidate the construction and working of various industrial devices used to measure pressure, temperature and flow
0FTPC452_3	Explicate the construction and working of various industrial devices used to measure level, vibration, viscosity and humidity
0FTPC452_4	Analyze, formulate and select suitable sensor for the given industrial applications
0FTPC452_5	Apply the mathematical basis for the design of control systems
0FTPC452_6	Specify the required instrumentation and final elements to ensure that well-tuned control is achieved

Course Contents:

Exp. No	Title of Experiment
1	Measurement of basic quantities using static and dynamic instruments
2	Measurement of temperature thermocouple and pyrometer.
3	Measurement of pressure using Bourdon gauge.
4	Measurement of liquid level through differential method.
5	Measurement of flow through venture meter.
6	Calibration of rotameter.
7	Determination of relative humidity using wet and dry bulb temperature method.
8	Measurement of viscosity by drop method.
9	Measurement of pH value.
10	Study of controllers.
11	Project 1: Development of temperature sensors
12	Project 2: Development of level sensors

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Principles of Industrial Instrumentation	Patranabis, D.	Tata McGraw Hill Publishing Company	2 nd	1999
2	Industrial Instrumentation	Eckman, D. P.	Wiley Eastern Ltd.	-	2004
3	Process Control	Johnson C.D.	Prentice Hall of	8 th	2014


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	Instrumentation Technology		India.		
4	Fundamentals of Industrial Instrumentation and Process Control	Dunn, W.C.	Tata McGraw-Hill Education Private Limited	1 st	2009

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Transducers and Instrumentation	Murty, D.V.S.	Prentice Hall of India.	2 nd	2008
2	Process system analysis and control	Donald, R.C. and LeBlanc, S.E.	McGraw-Hill	3 rd	1990
3	Chemical process control: an introduction to theory and practice	Stephanopoulos, G.	Prentice-Hall	-	1984
4	Industrial Control and Instrumentation	Bolton, W L.	Universities Press	-	1991


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B-Tech - FT - 17/4

Course Details:

Class:	B.Tech Semester VIII
Course Code and Course Title:	0FTPE453 Biochemical Engineering Laboratory
Prerequisite/s:	Principles of Food Preservations, Food Microbiology
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE/ESE	25/25

Course Outcomes: After completion of this course students will be able to

0FTPE453_1	Demonstrate the use of different parameters of the fermenter
0FTPE453_2	Perform tests to understand the enzyme activity of the product
0FTPE453_3	Evaluate the different stages of microbial growth
0FTPE453_4	Use enzymes to carry out different processes
0FTPE453_5	Illustrate the different types of fermentations
0FTPE453_6	Develop a fermented product

Course Contents:

Exp. No	Title of Experiment
1	Instrumentation and their control in fermentation industry - physical parameter
2	Instrumentation and their control in fermentation industry – chemical parameter,
3	To study the different parts and operation of laboratory fermentors
4	To study the thermal stability of peroxidase enzyme in potato
5	To assess the amylase activity from given foods sample
6	To measure the microbial growth during fermentation
7	Digestion of protein into amino acid
8	Starch hydrolysis by amylase
9	Batch submerged fermentation of baker's yeast in a shaker flask
10	Wine fermentation of fruit juices
11	To study the time temperature relationship for destruction of microorganisms
12	To study the ethyl alcohol production through bioconversion

Text Books and References:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Biochemical Engineering A Laboratory Manual	Das-Das	Routledge	1 st	2021


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Course Details:

Class:	B.Tech, Semester VIII
Course Code and Course Title:	0FTPE454 Wealth from Food Waste laboratory
Prerequisite/s:	Principles of Food Preservations
Teaching Scheme:Practical	02
Credits:	01
Evaluation Scheme: ISE/ ESE	25/25

Course Outcomes:After completing this course students will be able to

0FTPE454_1	Analyze and compare Waste water and treated water
0FTPE454_2	Minimize and control waste generation and environment pollution
0FTPE454_3	Extraction of value-added products from waste
0FTPE454_4	Modify process of manufacturing to lower the waste

Course Contents:

Exp. No.	Title of Experiment
1	Identification of useful products from agricultural waste and food processing waste
2	Estimation of COD, BOD, TDS, sludge value of effluent and treated water
3	Fat, oil and grease content, heavy metal contents of effluent and treated water
4	Extraction of oilseed or cake proteins
5	Extraction of pectin from waste of fruits
6	Extraction of banana fiber
7	Extraction of lycopene from tomato waste
8	Extraction of oil from wheat germ
9	Oil extraction from different waste
10	Preparation of beverages from whey
11	Project 1 – Value added product preparation from waste
12	Project 2 – Industrial visit (ETP Plant)

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Waste Management for the Food Industries	Ioannis Arvanitoyannis		1st Edition	2007
2	Food Processing Waste Management: Treatment and Utilization Technology	V.K. Joshi (Editor)			2011
3	Principles of Food Sanitation.	Marriott PhD Norman G.		5th Edition	2006


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		and Gravani Robert B.			
4	Postharvest Technology of Fruits and Vegetables: Handling, Processing, Fermentation and Waste Management.	Verma L.R. and Joshi V.K.	Indus Publishing Co. New Delhi		2000
5	Solid Waste Management in Developing Countries.	Bhide A. D. and Sundaresan B. B.			2010
6	Handbook of Solid Waste Management.	Tchobanoglous George and Kreith Frank			2002



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Course Details:

Class	B.Tech Semester VII
Course Code and Course Title	0FTPR456 – Project (Phase-I)
Prerequisite/s	Mini project, Minor Project
Teaching Scheme: Practical	04
Credits:	02
Evaluation Scheme: ISE/ESE	50/50

Course Outcomes: After completing this course students will be able to

0FTPR456_1	Apply knowledge of food engineering
0FTPR456_2	Design problem statement
0FTPR456_3	Carry out material and energy balance calculations of selected problem
0FTPR456_4	Use modern tools to solve problem
0FTPR456_5	Prepare a project report
0FTPR456_6	Present the solution of problem effectively

Sr. No.	Guidelines/steps to complete Mini Project
1	Identify the problem related to food process industry with the help of supervisor/guide
2	Design the problem statement by applying the knowledge of basic Food Technology/Engineering courses
3	Carry Out Literature Survey
4	Design the experiments/methodology
5	Carry out experimentation/simulation
6	Analyze the Results
7	Compare with standards available in literature
8	Prepare report
9	Present project idea in National/International conference

Text/Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	How to Write Dissertations & Project Reports	Dr Kathleen McMillan, Dr Jonathan Weyers	Pearson Education Limited	--	2012
2	Dissertations and Project Reports: A Step by Step Guide	Stella Cottrell	Palgrave Macmillan	--	2014
3	Tips For Project Report Writing For Engineering All Streams	Virendra Dilip Thoke	FSP Media Publications	--	2018


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Course Details:

Class:	B.Tech Semester VIII
Course Code and Course Title:	0FTPC 407 Food Quality and Assurance
Prerequisite/s:	Principles of Food Preservations
Teaching Scheme: Lecture/Tutorial	03
Credits:	3
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes:After completion of this course students will be able to

0FTPC407_1	Analyze food quality by knowing general terms regarding food quality.
0FTPC407_2	Identify hazards in food manufacturing system and minimize them.
0FTPC407_3	Evaluate food quality by using sensory evaluation
0FTPC407_4	Identify startups in nearest area and suggest them mandatory documents and pre-requisite programs with respect to quality.
0FTPC407_5	Create documents, files about audits and related program for small scale business
0FTPC407_6	Arrange various certification programs to the food business operators

Course Contents:

Course Contents:		Hrs.
Unit 1	Introduction to food quality & Food safety management Food quality, its role in industry, official methods for analysis in food industry, Importance and functions of quality control, Factors affecting quality control, Methods for determining quality, Quality attributes: dominant and hidden attributes.	06
Unit 2	Food safety - definition, elements, sources of contamination: Definition of hazards, Types of hazards, biological, chemical, physical hazards, Factors affecting Food Safety, Importance of Safe Foods	07
Unit 3	Sensory evaluation - Introduction -Panel Screening, Selection of Panel members, Requirements for conducting Sensory Evaluation and serving procedures, Methods of Sensory Evaluation Food Adulteration – type, Common adulterants in food and method of detection.	06
Unit 4	Regulatory aspects in food processing Food laws and standards: FSSAI, Concept of Codex Alimentations/ /USFDA Food Safety Modernization Act (FSMA)/, BIS standards, BRC standards, International Food Standard (IFS) Voluntary standards Food Safety management system: ISO 22000, HACCP, PRP and OPRP: GMP, GLP. GAP, GHP, GDP. 5S, Six sigma, Total Quality Management	10
Unit 5	Functions of a Quality Assurance Program – Quality control, evaluation, and audits; QA Responsibilities and Operational Interactions, The Need for and Roles of QA, QA Audits -Purpose, process, types; QA Documentation System	07
Unit 6	Quality Certificate and standards - Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS	06


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	9000 – ISO 14000 – Concepts, Requirements and Benefits –Quality Council – Leadership, Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward.	
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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Quality Assurance for Food Industry – A Practical Approach	J. Andres Vasconcellos	CRC Press Boca Raton [ISBN: 9780849319129]		2003
2	Food Industry Quality Control Systems	Mark Clute	CRC Press, Boca Raton [ISBN: 978-0-8493-8028-0]		2008
3	Handbook of Analysis and Quality Control for Fruit and Vegetable Products.	Ranganna S.	Tata-McGraw-Hill.	2nd Ed.	2001

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	HACCP and ISO 22000 – Application to Foods of Animal Origin	Arvanitoyannis I.S.	Wiley-Blackwell Publication Oxford [ISBN: 978-1-4051-5366-9]		2009
2	Sensory Evaluation of Foods	Piggot JR	Elsevier.		2011
3	Total Quality Management	Besterfield, D. H., Besterfield-Michna, C., Besterfield-Sacre, M., Besterfield, G. H., &Urdhwareshe, H.	Pearson Education Asia	4 th Edition,	2011


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Course Details:

Class:	B. Tech Semester VIII
Course Code and Course Title:	0FTPC408 Process Equipment Design
Prerequisite/s:	Process calculations, Unit Operations
Teaching Scheme: Lecture/Tutorial/Practical	03
Credits:	03
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes:

0FTPC408_1	Implement the material properties for design of process equipments
0FTPC408_2	Explain and interpret essential design documents such as PFD, P&ID, vessel specification
0FTPC408_3	Calculate size of various process equipment components using design rules as well as IT tools.
0FTPC408_4	Apply design principles for vessels, heat exchangers and allied auxiliary components.
0FTPC408_5	Determine loadings, failure modes for process equipment design
0FTPC408_6	Analyze equipment fabrication and testing methods

Course Contents:

Course Contents:		Hrs.
Unit 1	Introduction: Materials and properties: Materials for fabrication, mechanical properties, ductility, hardness, corrosion, protective coatings, corrosion prevention linings equipment, choice of materials, material codes	07
Unit 2	Design considerations: Stresses created due to static and dynamic loads, combined stresses, design stresses and theories of failure, safety factor, temperature effects, radiation effects, effects of fabrication method, economic considerations	07
Unit 3	Design of pressure and storage vessels: Operating conditions, design conditions and stress; Design of shell and its component, stresses from local load and thermal gradient, mountings and accessories	07
Unit 4	Design of heat exchangers: Design of shell and tube heat exchanger, plate heat exchanger, scraped surface heat exchanger, sterilizer and retort	07
Unit 5	Design of evaporators and crystallizers: Design of single effect and multiple effect evaporators and its components; Design of rising film and falling film evaporators and feeding arrangements for evaporators; Design of crystallizer and entrainment separator	07
Unit 6	Design of centrifuge separator and Fermenters: Design of equipment components, design of shafts, pulleys, bearings, belts, springs, drives, speed reduction systems, Requirement for construction of bioreactor, guidelines for fermenter design, fermenter vessels, geometry of vessel, Design of flange, design procedures.	07


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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Process Heat Transfer: Principles and Applications	Serth, R.W.	Elsevier Ltd.	-	2007
2	Joshi's Process Equipment Design	Mahajani, V.V. and Umarji, S.B.	Macmillan Publishers	4 th	2009
3	Process Equipment Design	Dawande S. D.	Denett & Co	7 th	2015

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Coulson & Richardson's Chemical Engineering series: Chemical Engineering Design	Sinnott, R. K.	Elsevier Butterworth-Heinemann.	4 th	2005
2	Process Equipment Design	Brownell, L.E. and Young, E.H.	John Wiley & Sons	-	2009
3	Handbook of Food Processing Equipment	Saravacos, G. and Kostaropoulos, A.E.	Springer International Publishing	2 nd	2015
4	Process Equipment and Plant Design	Ray, S. and Das, G.	Elsevier Ltd.	1 st	2020



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Course Details:

Class	B.Tech Semester VIII
Course Code and Course Title	0FTPC409 Project Management and Economics
Prerequisite/s	Process Calculations
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE-I /MSE/ISE-II/ESE	10/30/10/50

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

0FTPC409_1	Apply concepts of project management
0FTPC409_2	Apply concepts of project planning and scheduling
0FTPC409_3	Analyze the various project resources
0FTPC409_4	Use project management software's for monitoring and controlling project activities
0FTPC409_5	Apply concepts of economics for given project
0FTPC409_6	Analyze the economics of the project in terms of breakeven point, economic feasibility, etc.

Course Contents:

Course Contents:		Hrs.
Unit 1	Introduction to project management: Importance, Objectives & Functions of Management , Principles of Management, Categories of Project, Project Failure, Project - Life Cycle Concept and Cost Components, Importance of organizational Structure in Management- Authority / Responsibility Relation, Management by objectives (MBO)	7
Unit 2	Project planning and scheduling: Work Breakdown Structure, Gantt/Bar chart & its Limitations, Network Planning, Network analysis, C. P. M.- . Activity on Arrow (A.O.A.), Critical path and type of Floats, Precedence network analysis (A.O.N.), Types of precedence relationship, P. E. R.T. Analysis	7
Unit 3	Project Resources and Site Planning: Objectives of Materials Management – Primary and Secondary Material Procurement Procedures - Material requirement - raising of Indents, Receipts, Inspection, Storage, Delivery, Record keeping – Use of Excel Sheets, ERP Software, Inventory Control - ABC analysis, EOQ, Introduction to Equipment Management – Fleet Management, Productivity Studies, Equipment Down Time, Sizing - Matching , Site Layout and Planning, Safety Norms – Measures and Precautions on Site, Implementation of Safety Programs	7
Unit 4	Project Monitoring and Control: Resource Allocation – Resource Smoothing and Levelling, Network Crashing – Time- Cost – Resource optimization, Project Monitoring - Methods, Updating and Earned Value Analysis, Introduction to use of Project Management Softwares – MS Project, Case study of food process plant.	7


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Unit 5	Introduction to Project Economics - Definition, Principles, Difference between Cost, Value, Price, Rent, Simple and Compound Interest, Profit, Annuities, Demand, Demand Schedule, Law of Demand, Demand Curve, Elasticity of Demand, Supply, Supply Schedule, Supply Curve, Elasticity of Supply Equilibrium, Equilibrium Price, Equilibrium Amount, Factors affecting Price Determination, Law of Diminishing Marginal Utility, Law of Substitution, Concept of Cost of Capital, Time Value of Money, Sources of Project Finances –Concepts of Debt Capital and Equity Capital. Types of Capital – Fixed and Working, Equity Shares and Debenture Capital, FDI in Infrastructure	7
Unit 6	Project appraisal: Types of Appraisals such as Political, Social, Environmental, Techno-Legal, Financial and Economical, Criteria for Project Selection - Benefit - Cost Analysis, NPV, IRR, Pay-Back Period, Break Even Analysis [Fundamental and Application Component], Study of Project Feasibility report and Detailed Project Report (DPR), Role of Project Management Consultants in Pre-tender and Post-tender.	7

Text & Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Engineering Economics	J. K. Yates	CRC Press	-	2016
2.	Economic and Financial Analysis for Engineering and Project Management	Abol Ardalan	CRC Press	-	1999
3.	Project Management	Sadhan Choudhury	Tata McGraw-Hill	-	2008
3.	Project Management Absolute Beginner's Guide	Greg Horine	Pearson Education	-	2017
4.	Project Management	Adedeji B. Badiru	CRC Press	2 nd	2019
5.	Project Life Cycle Economics	Massimo Pica	Taylor & Francis	-	2016
6.	Economic and Cost Analysis For Operations and Project Managers	Mahmoud A. Al-Odeh	Linus Publications, Incorporated	2 nd	2020



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Course Details:

Class:	B.Tech Semester VIII
Course Code and Course Title:	0FTPE410 Design & Development of Special Foods (Professional Elective-IV)
Prerequisite/s:	Food chemistry, Food Nutrition, Food Additives & Ingredients.
Teaching Scheme: Lecture	03
Credits:	3
Evaluation Scheme: ISEI /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After successful completion of this course, students will able to

0FTPE410_1	Identify the basic need of special foods
0FTPE410_2	Improve the primary processing special foods.
0FTPE410_3	Identify the sources for special foods.
0FTPE410_4	Design the different types of Special products.
0FTPE410_5	Analyze the therapeutic foods.
0FTPE410_6	Develop special consumer food.

Course Contents:

Course Contents:		Hrs.
Unit 1	INTRODUCTION Need and scope of specialty foods, Speciality foods based on growing condition - organic, inorganic farming, Specialty food based on ease in preparation for cost health benefits- Functional foods, Convenience food, Health care and medical benefits Nutritional status Low-cost foods.	08
Unit 2	PRIMARY PROCESSING OF SPECIAL FOOD Speciality foods based on process, innovative process technology, food additives basis, bioactive component novel, nutraceutical products, Packaging techniques, adaptable technology, basis fast and PET foods.	
Unit 3	Speciality foods based on sources , Cereals and millets, Legumes and pulses ,Fruits and vegetables, Animal food sources, By product based Non-conventional foods	06
Unit 4	Speciality food based ongenetics, Genetically modified foods, Transgenic foods, Biotechnological aspects of detoxification , Proprietary foods , Proprietary foods.	06
Unit 5	Therapeutic foods Modification of diets in disorders, feeding purposes Disease oriented of different organs ex: digestive trac, liver, cardiovascular system, kidney, metabolic disorders, allergy, endocrine disorders.	08
Unit 6	Specific consumer-oriented foods, Defence persons and diabetic persons, Space / a stronought, High altitude mountain climbers, Disaster situation – crises, care, maintenance.	06

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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Food Science	Potter	CBS Publishers & Distributors	Fifth	2007
2.	Processed Protein Food Stuffs	Alchule	Academic Press	First	1958
3.	Food and Nutrition	M.Swaminathan	Bappco	Second	

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Therapeutic Diets	-	NIN	-	-
2.	Supplementary Foods	-	NIN	-	-


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Course Details:

Class:	B.Tech, Semester VIII
Course Code and Course Title:	0FTPE459 Food Allergies (Professional Elective-IV)
Prerequisite/s:	Food chemistry, Food Microbiology, Chemistry of Food Constituents
Teaching Scheme: Lecture	03
Credits: Theory	03
Evaluation Scheme: ISE I /MSE/ISE II/ESE	10/30/10/50

Course Outcomes: After completing this course students will be able to

0FTPE459_1	Recognizing the food allergy in food
0FTPE459_2	Recommend the different solutions for food allergy
0FTPE459_3	Develop food product to reduce risk of food allergy
0FTPE459_4	Apply the different process to eliminate allergens
0FTPE459_5	Analyze the different allergens in present in food
0FTPE459_6	Identify the risk management based on food allergen

Course Contents:

Course Contents:		Hrs.
Unit 1	Introduction - Food allergy Food allergy, History of Food Allergy, mechanism of food allergy, Allergic reactions, Symptoms of an allergic reaction, the mucosal immune system, the immunological basic of IgE and non IgE mediated reaction, food allergens –molecular and immunological characteristics	07
Unit 2	Types and structure of food allergens Plant food allergens – the cupin superfamily, the prolamin superfamily, the bet v 1 superfamily, the profilins, other plant derived allergens family, Animal food allergens – calcium binding proteins, tropomyosin, casein , other animal food allergens, gross allergy	07
Unit 3	Manifestation of food allergy Anaphylaxis, the respiratory tract, gastrointestinal tract, the skin, systematic reactions, genitourinary tract, musculoskeletal system, nervous system, miscellaneous allergic manifestation	07
Unit 4	Food and its allergy Lactose intolerance, protein as allergens, allergenicity of soya been lecithin, seafood allergy and allergens, sesame allergy, gluten allergy	07
Unit 5	Food processing to eliminate food allergens Physical Modification Heat treatment, Irradiation treatment, Ultrasound treatment, Ultra high pressure, Pulsed ultraviolet light, combination method Chemical modification- Glycosylation, Acid-base treatment, Biological Modification- Enzymatic technology, Fermentation	09
Unit 6	Food allergen risk management Introduction, prevalence, symptoms, case studies, key risk factors for allergic reaction, the role of food industry, allergen labelling, aims of the anaphylaxis campaign, recent regulation in India for food allergens	05


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Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Food Allergy : From molecular mechanism to control strategies	Linglin Fu, Bobby J. Cherayil, Haining Shi	Springer	1 st	2019
2.	Food Allergens Best Practices for Assessing, Managing and Communicating the Risks	Kathiravan Krishnamurthy, Lauren S. Jackson,	Springer	1 st	2017
3.	Food Allergy	Frederic Speer	Elsevier Science	2 nd	2013

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Food Allergy Adverse Reactions to Foods and Food Additives	Dean D. Metcalfe, Hugh A. Sampson, Ronald A. Simon	Wiley	4 th	2011


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Course Details:

Class:	B. Tech, Semester VIII
Course Code and Course Title:	0FTPC457 Process Equipment Design Laboratory
Prerequisite/s:	Process calculations, Unit Operations
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE/ESE	25/25

Course Outcomes: After completion of this course students will be able to

0FTPC457_1	Implement standard symbols of process flow diagrams.
0FTPC457_2	Assess basics of process equipment design and important parameters of equipment design
0FTPC457_3	Impart the knowledge of mechanical aspects of pressure vessel design
0FTPC457_4	Apply mechanical design specifications in to fabrication drawings for plant erection.
0FTPC457_5	Draw detailed dimensional drawings include sectional front view, Full Top/side view depending on equipment.
0FTPC457_6	Analyze loadings, failure modes for process equipment design

Course Contents:

Exp. No	Title of Experiment
1	Design of pressure vessel
2	Design of shell and tube heat exchangers and plate heat exchanger
3	Design of sterilizers and retort
4	Design of single and multiple effect evaporators
5	Design of rising film and falling film evaporator
6	Design of crystallizer
7	Design of dryers
8	Design of extruders
9	Design of Fermenters
10	Design of drive systems
11	Project 1: Design and fabricate model of fermentor
12	Project 2: Design and fabricate model of dryer

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Process Heat Transfer: Principles and Applications	Serth, R.W.	Elsevier Ltd.	-	2007
2	Joshi's Process Equipment Design	Mahajani, V.V. and Umarji, S.B.	Macmillan Publishers	4 th	2009


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3	Process Equipment Design	Dawande S. D.	Denett & Co	7 th	2015
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Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Coulson & Richardson's Chemical Engineering series: Chemical Engineering Design	Sinnott, R. K.	Elsevier Butterworth-Heinemann.	4 th	2005
2	Process Equipment Design	Brownell, L.E. and Young, E.H.	John Wiley & Sons	-	2009
3	Handbook of Food Processing Equipment	Saravacos, G. and Kostaropoulos, A.E.	Springer International Publishing	2 nd	2015
4	Process Equipment and Plant Design	Ray, S. and Das, G.	Elsevier Ltd.	1 st	2020


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Course Details:

Class:	B. Tech, Semester VIII
Course Code and Course Title:	0FTPE458 Design & Development of Special Foods laboratory
Prerequisite/s:	Food chemistry, Food Nutrition, Food Additives & Ingredients.
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE / ESE	25/25

Course Outcomes: After completing this course students will be able to

0FTPE458_1	Evaluate the basic organic farming conditions
0FTPE458_2	Design the primary processing Special food.
0FTPE458_3	Apply the processing equipment to special food.
0FTPE458_4	Demonstrate the different types of Special foods products.
0FTPE458_5	Prepare and examine the Therapeutic foods.
0FTPE458_6	Improve the shelf life of Specific consumer-oriented foods.

Course Contents:

Minimum 8 experiments from following list and one course project

Exp. No.	Title of Experiment
1	Evolution of food cultivated under organic farming conditions
2	Preparation of speciality foods based on Functionality.
3	Preparation of speciality foods based on Convenience.
4	Preparation of speciality foods based on Low cost/ Nutritional purpose.
5	Preparation of speciality food using locally available foods crops, fruit and vegetables few products
6	Assessment of byproduct for preparation of value added speciality food
7	Preparation of special food for the diabetic patients.
8	Preparation of speciality food as per requirement of Location.
9	Preparation of speciality food as per requirement Nature of work
10	Preparation of nutritious protein content food
11	Project-1: Preparation of space food
12	Project-2: Preparation of food for the malnutrius .

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Food Science	Potter	CBS Publishers & Distributors	Fifth	2007
2.	Processed Protein Food Stuffs	Alchule	Academic Press	First	1958
3.	Food and Nutrition	M.Swaminathan	Bappco	Second	


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Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Therapeutic Diets	-	NIN	-	-
2.	Supplementary Foods	-	NIN	-	-



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Course Details:

Class:	B.Tech, Semester VIII
Course Code and Course Title:	0FTPE459 Food Allergies Laboratory
Prerequisite/s:	Principles of Food Preservations
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: ISE/ ESE	25/25

Course Outcomes: After completing this course students will be able to

0FTPE459_1	Analyze the allergens in food
0FTPE459_2	Develop Functional food for food allergy
0FTPE459_3	Detect the different food allergens
0FTPE459_4	Create allergen free food products

Course Contents:

Exp. No.	Title of Experiment
1	Development of gluten free Cake
	Development of gluten free Biscuits
2	Detection of tomato allergens
3	Measurement of gluten contamination in foods
4	To study detection of soy residues in food
5	To study detection egg allergen
6	To study Detection of shell fish toxins with surface Plasmon resonance
7	To study Assessing the allergenicity of products from GM plants
8	To study Detection of mustard allergens and markers in food
9	To study Assessing the allergenicity of products from GM animals
10	To study Development of functional food with anti-food allergic activities
11	Project I Survey
12	Development of special food for different allergens

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Handbook of Food Allergen Detection and Control	Simon Flanagan	Elsevier Science	-	2014
2	The Allergen-Free Baker's Handbook	Cybele Pascal	Ten Speed press	-	2009



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Course Details:

Class	B.Tech Semester VIII
Course Code and Course Title	0FTPR461 Project (Phase-I)/Internship
Prerequisite/s	Mini project, Minor Project, Project (Phase-I)
Teaching Scheme: Practical	10
Credits:	05
Evaluation Scheme: ISE/ESE	50/100

Course Outcomes: After completing this course students will be able to

0FTPR461_1	Apply knowledge of food engineering
0FTPR461_2	Design problem statement
0FTPR461_3	Carry out material and energy balance calculations of selected problem
0FTPR461_4	Use modern tools to solve problem
0FTPR461_5	Prepare a project report
0FTPR461_6	Present the solution of problem effectively

Sr. No.	Guidelines/steps to complete Mini Project
1	Identify the problem related to food process industry with the help of supervisor/guide
2	Design the problem statement by applying the knowledge of basic Food Technology/Engineering courses
3	Carry Out Literature Survey
4	Design the experiments/methodology
5	Carry out experimentation/simulation
6	Detailed Analysis of experimental/simulated results
7	Compare with standards available in literature
8	Prepare report
9	Present findings in National/International Conference/Journals

Guidelines for internship

Students should undergone internship in food process industry for minimum period of 90 days. During the internship, students should report to concern authorities from industry and faculty advisor assigned by department on regular basis.

After completion of internship, students should collect internship completion certificate and prepare report based on learning from internship and submit to department for evaluation.

The internship report will be considered as Project (Phase-II) report.

Oral examination/presentation will be conducted during practical examination.

Note: Students opting internship option has to complete theory courses through MOOCs/Online mode and complete the requirement of laboratory courses.


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Text/Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	How to Write Dissertations & Project Reports	Dr Kathleen McMillan, Dr Jonathan Weyers	Pearson Education Limited	--	2012
2	Dissertations and Project Reports: A Step by Step Guide	Stella Cottrell	Palgrave Macmillan	--	2014
3	Tips For Project Report Writing For Engineering All Streams	Virendra Dilip Thoke	FSP Media Publications	--	2018



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Course Details:

Class	B. Tech, Semester VIII
Course Code and Course Title	0FTMC462 Constitution of India
Prerequisite/s	--
Teaching Scheme: Lecture	02
Credits	2
Evaluation Scheme: MSE / ESE	50/50 (Audit)

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0FTMC462_1	Explore the basic features and modalities about Indian constitution
0FTMC462_2	Differentiate the functioning of Indian parliamentary system at the center and state level
0FTMC462_3	Describe different aspects of Indian Legal System and its related bodies
0FTMC462_4	Discuss different laws and regulations related to engineering practices
0FTMC462_5	Correlate role of engineers with different organizations and governance models

Course Contents:		
Unit 1	<p>Constitution:- Structure and Principles Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947, Enforcement of the Constitution Meaning and importance of Constitution Making of Indian Constitution – Sources Salient features of Indian Constitution. Preamble.</p>	04 Hrs
Unit 2	<p>Fundamental Rights and Directive Principles:- Fundamental Rights: Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies Fundamental Duties: Directive Principles-Definition, State to secure a social order for the promotion of welfare of the people, Certain principles of policy to be followed by the State, Equal justice and free legal aid, Right to work, to education and to public assistance in certain cases, Provision for just and humane conditions of work and maternity Living wage, etc., for workers, Participation of workers in management of industries etc.</p>	04 Hrs
Unit 3	<p>Union Executive and State Executive Powers of Indian Parliament Functions of Rajyasabha, Functions of Loksabha, Powers and Functions of the President, Powers and Functions of the Prime Minister, Lokpal, Lokayukta, State Executives-Powers and</p>	06 Hrs


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	Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature	
Unit 4	The Judiciary: Features of judicial system in India Supreme Court –Establishment and constitution of Supreme Court Salaries, etc., of Judges Appointment of acting Chief Justice Appointment of ad hoc judges Attendance of retired Judges at sittings of the Supreme Court Supreme Court to be a court of record Seat of Supreme Court Original jurisdiction of the Supreme Court ,High Court – Structure and jurisdiction, Attorney general of india.	06 Hrs
Unit 5	Regulation to Information: Introduction, Right to Information Act, 2005, Information Technology Act, 2000, Electronic Governance, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act The Limited Liability Partnership Act, 2008. Companies Act 2013.The Central Goods and Services Tax Act, 2017	04 Hrs
Unit 6	Business Organizations and E-Governance Sole Traders, Partnerships Companies: The Company’s Act: Introduction, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up. E-Governance and role of engineers in E-Governance, Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in a few states creating hurdles in Industrial development.	04 Hrs

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	The Constitution Of India	Dr. B. R. Ambedkar	Law literature Publications	--	2020
02	Introduction to the Constitution of India	Durga Das Basu	Gurgaon; LexisNexis	23 rd	2018
03	Governance in India	M. Laxmikanth	Mc Graw Hill Publications Delhi	3 rd	2021
04	The Constitution of India	P.M. Bakshi	LexisNexis	--	2019

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Introduction to the Constitution of India	Durga Das Basu	Gurgaon; LexisNexis	23 rd	2018
02	The Constitutional Law of India,	J.N. Pandey	Allahabad; Central Law Agency	55 th	2018
03	. Constitution of India	India.gov.in	National Portal of	--	--

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Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
	(Full Text)		India		
04	India's Constitution	M.V.Pylee	S. Chand Publications New Delhi	16 th	2017



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