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. 2023-24

Department of Food Technology

Annasaheb Dange College of Engineering and Technology Ashta

Department of Food Technology

Teaching and Evaluation Scheme

S. Y. B. Tech Semester III

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
1FTPC201	Fluid Mechanics	3		2	4	40	16	30	30	24	100	40	50	20	-	-	50	20	150
1FTPC202	Food Microbiology	3	-	2	4	40	16	30	30	24	100	40	50	20	50	20	100	40	200
1FTPC203	Unit Operation	3	-	2	4	40	16	30	30	24	100	40	50	20	50	20	100	40	200
1FTPC204	Principles of Food Processing	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
1FTVS205	Food Analysis	2	-	2	3	40	16	30	30	24	100	40	50	20	-	-	50	20	150
1FTHS206	Psychology	2	-	-	2	50	20	-	-	-	50	20	-	-	-	-	-	-	50
1FTHS207	Constitution of India	1	-	-	1	25	10	-	-	-	25	10	-	-	-	-	-	-	25
1FTCC208	Aptitude and Reasoning Part – I	-	-	2	1	-	-	-	-	-	-	-	50	20		-	50	20	50
		17	**0**	**10**	**22**														**925**
	Total Contact Hours				**27**														

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SY-FT-01/52

Department of Food Technology

Course Details:

Class:	S.Y. B. Tech Sem III
Course Code and Course Title:	1FTPC201 - **Fluid Mechanics**
Prerequisite/s:	1FTBS101 - Applied Mathematics-I 1FTBS102 - Applied Physics 1FTBS106 – Applied Mathematics II
Teaching Scheme: Lecture/Tutorial/Practical	03/00/02
Credits:	04
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes: After successful completion of this course, students will able to	
1FTPC201_1	Explain the fluid properties, fluid characterstics and governing equations for a given fluid/fluid system by using principles of fluid flow
1FTPC201_2	Classify the fluids, fluid flows and flow measuring devices to analyze its behavior by using fluid mechanics principles.
1FTPC201_3	Calculate pressure drop and flow rates and minor head losses in conduits for compressible as well as incompressible fluids.
1FTPC201_4	Analyze proper Pump Compressor and valves for industrial application.
1FTPC201_5	Implement concept of fluid flow to food process industry.

Course Contents:		**Hrs.**
Unit 1	**Fluid statics** Fluid, Properties of fluid, Classification of fluids, Newton's law of viscosity, Rheological classification of fluids, Pressure and temperature dependence, Buoyancy and Floatation: Archimedes's Principle, Metacentre, Measurement of Pressure, Manometers	**07**
Unit 2	**Fluid Kinematics** Types of Flows, Streamlines, Equipotential lines, Steak Line, Path Line, Stream Tube, Stream Bundle, Stream Function and Velocity Potential Function, Continuity Equation, Forced vortex flow, Free vortex flow.	**07**
Unit 3	**Fluid Dynamics** Fluid Dynamics: Forces Acting on Fluid in Motion, Euler's Equation of motion, Bernoulli's Theorem, Limitations. Bernoulli's Applications: Venturimeter, Orifice meter, Pitot Tube, Friction factor, Major and Minor Losses, Mach no, Sonic, supersonic and subsonic flow.	**07**

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Unit 4	**Pumps** Centrifugal Pump: Classification, Component Parts, Working of Centrifugal Pump, Performance Characteristics, Common Pump Troubles and Remedies, Net Positive Suction Head (NPSH) Reciprocating pumps: Introduction, Classification, Main parts of reciprocating pump, Working ,Discharge through reciprocating pump, Work done by reciprocating pump	**07**
Unit 5	**Compressors and Valves** Air compressor- Types, selection criteria, capacity control, valves (two way, three way, four way), check valves, flow control valves, pressure control valves, Globe valves, Gate valves, butterfly valves and non – Return valves. speed regulators, Solenoid operated.	**06**
Unit 6	**Fluidization** Fluidization, Mechanism of fluidization, particulate and aggregative fluidization, minimum fluidization velocity, expansion of -fluidized beds, Application of fluidization.	**05**

Course Contents: Minimum 10 experiments from following list and one course project

Expt. 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	Determination of Minor Head Losses in Pipe Fittings.
12	Flow through helical coil

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Department of Food Technology

Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1.	Fluid Mechanics	Yunus A. Cenegal	Tata McGraw Hill Education	1st	2004
2.	Fundamentals of fluid mechanics	Bruce R. Munson, Alric P. Rothmayer, Theodore H. Okiishi, Wade W. Huebsch	Wiley	6th	2009
3.	Fluid mechanics and hydraulic machines - problems and solutions	K. Subramanya	Tata McGraw Hill)	1st	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	9th	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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SY-FT-04/52

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Course Details:

Class	S.Y. B. Tech Sem. III
Course Code and Course Title	1FTPC202 **Food Microbiology**
Prerequisite/s	-
Teaching Scheme: Lecture/Tutorial/Practical	03 / 00/02
Credits	04
Evaluation Scheme: ISE/MSE/ESE	40/30/30
Evaluation Scheme: ISE/ESE	25/50

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
1FTPC202_1	Recognize the developments in the discipline of Microbiology and the contributions made by prominent scientists in this field.
1FTPC202_2	Classify microorganisms based on life cycle & structure.
1FTPC202_3	Illustrate the role of microorganisms in food safety.
1FTPC202_4	Identify the different media and nutritional requirements for growth of bacteria.
1FTPC202_5	Determine the methods used for enumeration, identification and preservation of bacteria.

Course Contents:		**Hrs**
Unit 1	**Historical Perspective, Microbial Taxonomy and diversity :** History and scope of Microbiology- Landmark discoveries in the development of Microbiology-Classification, nomenclature of Microorganisms and Characterization according to Bergey's manual Systematic Bacteriology-Three and Five Kingdom concepts-Broad classification of Prokaryotes and Eukaryotes.	06
Unit 2	**Prokaryotic cells and Viruses**: Structure, Function and Replication: Structure and multiplication of bacteria- Introduction to Viruses and its structure - Animal Virus Replication- Bacterial Virus structure and Replication.	06
Unit 3	**Eukaryotic cells: Structure, Function and Replication:** Introduction to Eukaryotic microorganisms - Algae structure- Replication of algae- Life cycle of Red algae (Gracilaria)- Fungi – Mold – structure- Mold replication process- Life cycle of RhizopusStolonifer- Yeast – structure- Replication process of yeast cells – Life cycle of Saccharomyces Cerevisiae-Protozoa structure-Life cycle of Entamoebahistolytica.	07

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SY-FT-05/52

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Unit 4	**Microbial Nutrition and growth :** Nutritional requirements of bacteria- Nutritional types of bacteria-Microbial growth characteristics- growth curve- Kinetics of growth -Batch culture, Continuous culture. Synchronous- Factors affecting the growth of bacteria – Temperature, Oxygen, pH, osmotic pressure, salt concentration etc.- Microbial sporulation and Germination- Bacteriological media: types (complex, synthetic, differential, enrichment and selective media) and their uses, culture characteristics of bacteria on different media.	06
Unit 5	**Techniques for enumeration, Identification and culturing of bacteria** Techniques for isolation and enumeration of bacteria (streak plate technique, pour plate technique, spread plate technique, membrane filtration, most probable number method, direct microscopic count) - biochemical tests of bacteria- maintenance and preservation of microbial culture - Staining methods: fixation, types of dyes, simple staining, differential staining (Gram and Acid-fast staining), staining of specific structures (capsule, flagella and spore staining)-Microscopy- Light microscopy – Bright field and Dark field microscope	07
Unit 6	**Food Spoilage:** Spoilage of cereals & cereal products, milk & milk products, fruit & vegetable products, meat, poultry egg; fish products **Food borne illness:** Bacterial & Non-bacterial food borne illness	07

Expt. No.	Title of Experiment
1.	Introduction to Microbiology and Laboratory safety
2.	Microscopy
3.	Sterilization and Disinfection
4.	Preparation of culture media.
5.	Isolation of bacteria using Streak plate method
6.	Staining techniques - Monochrome staining
7.	Gram staining
8.	Negative staining
9.	Lactophenol cotton blue staining for fungi
10.	Dye reduction test – MBRT
11.	Identification of microorganisms using Emvick's test
12.	Preparation of Fermented Food product

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SY-FT-06/52

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Text Book:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Microbiology	M.J Pelczar, E.C.S Chan, N.R Krein	Tata McGraw Hill	5	2006
2	Textbook of Microbiology & Immunology	S.C.Parija	Elsevier India	2	2012
3	Food Microbiology	M.R. Adams, M.O.Moss	Royal society of chemistry	3	2008
4	Food Microbiology	Frazier, W.C., and Westhoff, D.C.	McGraw-Hill, New York	4	1988
5	Modern Food Microbiology	Jay, J. M.	Chapman & Hall, New York, N.Y	6	2000

Reference Book:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Microbiology	L.M Prescot, J.P Harley, D.A Klein	McGraw-Hill, Education	7	2008
2	Foundations in Microbiology	K.P Talaro, B. Chess	McGraw-Hill, Education	10	2017
3	Laboratory Manual of Food Microbiology	Neelima Garg, K. L.Garg, K.G.Mukerji	I K International Publishing House	1	2010
4	Food Microbiology: A Laboratory Manual	Ahmed E.,Yousef, Carolyn Carlstrom	John Wiley & Sons	1	2003
5	Essentials of the Microbiology of Foods.	Mosse D.A.A., Corry, J. E.L., Struijk, C.B., and Baird,R. M	John Wiley & Sons	1	1995

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SY-FT-07/52

Department of Food Technology

Course Details:

Class:	S.Y. B. Tech Sem. III
Course Code and Course Title:	1FTPC203 **Unit Operations**
Prerequisite/s:	Process Calculations
Teaching Scheme: Lecture/Tutorial/Practical	03/00/02
Credits:	04
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes:	
1FTPC203_1	Understand various unit operations used in food industries for processing raw materials
1FTPC203_2	Apply the knowledge of processing laws to calculate efficiency of unit operation equipment.
1FTPC203_3	Choose appropriate unit operation based on raw material for their further processing
1FTPC203_4	Design unit operation equipments for given food processing system by using fundamental laws.
1FTPC203_5	Develop a model of pumps, filters, screens for given unit operations used in food industries

Course Contents:		**Hrs.**
Unit 1	**Introduction to Handling of Particulate solids** Characterization of solid particles, Properties of Particulate, Storage of solids, mixing of solids, Materials handling from harvesting to finish goods, storage conditions, Sorting and grading: -Size, color, screening, equipment for grading, grading efficiency	**06**
Unit 2	**Size Reduction of Solids** Concept of size reduction, Importance of Size reduction, Principles of comminution in Food processing, factors affecting of size reduction, Size reduction equipments- Principal types, Crushers, Grinders, Ultrafine grinders, cutting machines, Rittenger's law, Kicks law, Bond's law, Crushing efficiency.	**07**
Unit 3	**Size Separation of Solids** Introduction to size separation of solids, Screening & Importance of screening, Classification of Screens, Types of Standard screen series, Capacity & Effectiveness of Screens, Factors affecting screening, Screening equipments, Solid separation based on specific properties	**07**

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SY-FT-08/52

Department of Food Technology

Unit 4	**Storage and Conveying of Bulk Solids, Size Enlargement** Introduction of Storage and Conveying of bulk solids, Storage of solids, characteristics of Bulk solids. Conveyors Working principles, Construction, Advantages, Disadvantages and design calculation of Screw conveyors, Belt Conveyors, Chain & Flight conveyors, Bucket elevators, Pneumatic conveyers	**07**
Unit 5	**Agitation and Mixing** Theory of solid and liquid mixing in Food industries, types of impellers and propellers, mixing index, power requirement for liquid mixing, Mixing equipments- Sigma mixer, ribbon blenders etc., Concept of agitation, Agitator	**06**
Unit 6	**Filtration** Theory of filtration, rate of filtration, pressure drop during filtration, Filtration equipments- Plate and frame filter, Pressure leaf filters, rotary filters, centrifugal filters, air filters, filter aids, applications of filtrations in food industries.	**06**

Course Contents: Minimum 10 experiments from following list and one course project

Expt. 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 pulverizer
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 in plate and filter press
9	Study of flow through packed bed
10	Study of flow through fluidized bed
11	Study of Leaf Filter
12	Project-2: Model on the separation (screening)

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SY-FT-09152

Department of Food Technology

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	1st	2003
2	Unit Operations for The Food Industries	Wilbur A. Gould	CTI Publications	1st	1996
3	Food Science	Norman N. Potter &Joshep H. Hotchkiss	Springer	5th	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	1st	2005
2	Food engineering operations	Brennan J.G. Butters, J. R., Cowell, N. D. and Lilly, A. E.	Applied science London	3rd	1990
3	Unit Operations of Chemical Engineering	McCABE, W. L., SMITH, J. C. and HARRIOTT, P.	McGraw-Hill, New York.	3rd	1975

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SY-FT-10/52

Department of Food Technology

Course Details:

Class:	S.Y. B. Tech Sem. III
Course Code and Course Title:	1FTPC204 - **Principles of Food Processing**
Prerequisite/s:	1FTPC105 - Food Science
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits:	03
Evaluation Scheme: ISE/MSE /ESE	40/30/30

Course Outcomes: After successful completion of this course, students will able to	
1FTPC204_1	Understand the fundamentals of food preservation through drying, dehydration, concentration, high and low temperature processing of food.
1FTPC204_2	Demonstrate basic principles of food preservation in processing industries.
1FTPC204_3	Apply the knowledge of low temperature and high temperature preservation methods for shelf life extension.
1FTPC204_4	Analyze the different methods of food preservation in available food products.

Course Contents:		**Hrs.**
Unit 1	**Introduction** Defining food; classification of food, constituents of foods, food processing, food preservation, food spoilage, causes of food spoilage, food poisoning, food- borne intoxication, food-borne infection, Scope and importance of food processing, worldwide perspectives.	**07**
Unit 2	**Food preservation and processing** Objectives and techniques of food preservation, methodology, principles and methods of food preservation (Traditional and modern), Hurdle technology.	**06**
Unit 3	**High Temperature Preservation** Blanching; pasteurization; sterilization; canning **Low temperature preservation** 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 4	**Preservation by Salt and Sugar** Salting or Curing, Jams, jelly, marmalade, cheese, toffee Preserves, crystallized, glazed, candied fruits etc.	**07**

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SY-FT-11/52

Department of Food Technology

Unit 5	**Drying, dehydration and concentration** Purpose; 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	**06**
Unit 6	**Recent methods in processing** Pulse Electric Field (PEF), High Pressure Processing (HPP), ultrasound, dielectric heating, ohmic heating; infrared heating; Ultraviolet, Membrane processing, high intensity electric field in pulses, etc.	**06**

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	The technology of food preservation	Desrosier N.W.	CBS publisher	4th	1977
2.	Food preservation and processing	Manoranjankalia and Sangitasood	Kalyani publishers	1st	2004
3.	Preservation of Fruits & Vegetables	GirdhariLal, G. S. Siddappa, G. L. Tandon,	Indian Council of Agricultural Research, Publications	1st	1986
4.	Food Processing Technology: Principles and Practice	P. Fellows	CRC Press	4th	2000
5.	Handbook of Food Preservation	ShafiurRahman M.	CRC Press	2nd	2000
6.	Emerging Technologies for Food Processing	Da-Wen Sun	Academic Press	2nd	2005
7.	Introduction to Food Processing	Jelen P.	Prentice Hall	1st	1985
8.	Handbook of Analysis and Quality Control for Fruit and Vegetable Products.	Ranganna S.	2nd Ed. Tata- McGraw-Hill	2nd	2001

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SY-FT-12152

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Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1.	Technology of Food Preservation	Desrosier N.W.	AVI Pub. Co.	4th	1997
2.	Introduction to Food Science and Technology	Stewart GP and Amerine MA	Elsevier	2nd	2012
3.	Food Processing Handbook	Brennan JG	John Wiley & Sons	2nd	2012
4.	Food Science	NN and Hotchkiss JH	Potter Springer Science & Business Media	4th	2013
5.	Food Processing and Preservation	B. Sivasankar	PHI Learning Pvt. Ltd.,	1st	2002
6.	Food processing Technology	Fellows P. and Ellis H	Wood Head	2nd	1990

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SY-FT-13/52

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Department of Food Technology

Course Details:

Class	S.Y. B. Tech Sem. III
Course Code and Course Title	1FTVS205, **Food Analysis**
Prerequisite/s	Chemistry I and II
Teaching Scheme: Lecture/Practical	02/02
Credits	03
Evaluation Scheme: ISE/MSE/ESE **ISE**	40/30/30 50

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
1FTVS205-1	Describe the principles of modern techniques used in food analysis for quality assurance.
1FTVS205-2	Relate the principles behind the analysis of various food components through Spectroscopic and chromatographic techniques.
1FTVS205-3	Categorise analytical techniques for the monitoring of food quality during processing and storage.
1FTVS205-4	Demonstrate the scientific information and develop laboratory skills in the field of food analysis.
1FTVS205-5	Evaluate experimental data through writing concise laboratory reports and presenting their findings.

Course Contents:		**Hrs**
Unit 1	Basic instrumentation: Principle for pH meter, Dialysis, ultrafiltration, Reverse osmosis, and their applications in food separation and analysis.	04
Unit 2	Calorimetry: Bomb calorimeter, Principle of Rheological Analysis- Rheological parameters, rheological methods, instruments, and application,	04
Unit 3	Texture profile analysis, Densitometry, Refractometry, UV-Vis spectrophotometer, Spetroflurometer, IR, Atomic Absorption Spectroscopy	04
Unit 4	Mass spectroscopy, NMR and ESR. Chromatography: Theory & Principle, chromatographic parameter (partition coefficient, capacity factor, retention & dead time, Resolution & their calculation).	04
Unit 5	Components of chromatography & types (paper, thin layer, partition) Advanced chromatography: GC, HPLC, (principle, instrumentation & application).	05

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SY-FT-14152

Department of Food Technology

Unit 6	Separation techniques: Electrophoresis - Paper & gel electrophoresis, PAGE, iso-electric focusing for protein, Immuno-electrophoresis. Immune techniques: Principle, antigen-antibody interaction for detection of food allergens.	05

Expt. No.	Title of Experiment
1.	Sample collection and preparation for analysis
2.	Qualitative and quantitative estimation of benzoic acid
3.	Identification of amino acids by Paper Chromatography
4.	Textural and Colour profile analysis of food material
5.	Estimation of Ascorbic acid
6.	Analysis of wheat flour
7.	Spectrophotometric method for estimation of total chlorophyll (A & B)
8.	Estimation of Browning intensity
9.	Determination of alcoholic acidity
10.	Estimation of heavy metal using atomic absorption spectroscopy (AAS)
11.	Determination of fruit solids in fruit juices
12.	Determination of Carbonation volume in carbonated beverages

Text books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Methods in Food Analysis	Joslyn, M.A.	Academic Press, New York	7	1978
02	Biochemical & Molecular biology techniques	Wilson& Walker	Cambridge University Press	6	2010
03	Separation Methods in Biochemistry 2nd Ed	Morris, C.J. and Morris, P.	Pitman Pub., London	4	2012
04	Methods in Food Analysis	Joslyn, M.A.	Joslyn, M.A.	7	2006

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SY-FT-15/52

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Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Spectroscopy	Chatwal and Anand	Himalaya Publishing house	2	2009
02	Instrumental methods for chemical analysis	Willard H. W. & Meritt L. L.	East West Publications	7	1998
03	Bioinstrumentation and Biosensors	Wise, Donald L.	Marcel Dekker Inc	1	1991

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SY-FT-16/52

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Course Details

Class	S.Y. B. Tech Sem. III
Course Code and Course Title	1FTHS206 **Psychology**
Prerequisite/s	-
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00
Credits	02
Evaluation Scheme : ISE	50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1FTHS206_1	Identify types of emotions, domains of emotional intelligence and their effects on individual and group behavior for fostering empathy and positive relationships.
1FTHS206_2	Explain human behavior, cognition, and emotions by psychological theories in real-life scenarios and contexts.
1FTHS206_3	Discuss effective time management strategies to overcome time-related challenges.
1FTHS206_4	Interpret psychological factors that contribute procrastination to recognize the situational triggers.
1FTHS206_5	Apply the A-B-C model to manage stress for well-being.

Course Contents:		**Hrs.**
Unit 1	**Psychology** –Definition of Psychology, Different fields of Psychology, Introduction and Need of psychology	2
Unit 2	**Emotional Intelligence (EI) (Part one)–** Role of Emotions, Types of Emotions, Emotions/ stress and performance	4
Unit 3	**Emotional Intelligence (EI) (Part Two)–** Definition of Emotional Intelligence, Key signs of emotional Intelligence, How EI helps students, Marshmallow Experiment, Five domains of Emotional Intelligence	6
Unit 4	**Time Management–** Definition of Time Management, Need and importance of Time management for an individual, Effective steps/ strategies of Time Management, Obstacles of Time Management	4
Unit 5	**Procrastination** – Definition of Procrastination, Types of Procrastination excuses , How to work on excuses, Why Do People Procrastinate?, Procrastination Cycle, Challenging Your assumptions, techniques to beat Procrastination	6

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SY-FT-17/52

Unit 6	**Stress Management –** Definition of Stress, A-B-C model for Stress, Identifying Stressful Thoughts and identifying cognitive distortions, Restructuring, Behavioural Coping Strategies	6

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Organizational Behaviour- An Evidence-Based Approach	Fred Luthan	McGraw-Hill/Irwin	12th	2011
2	Essentials of Organizational Behaviour	Stephen P. Robbins Timothy A. Judge Katherine E. Breward	Pearson	-	2018
3	Essentials of organizational Behaviour	Stephen P. Robbins	Prentice Hall	7th	2002
4	Understanding and Managing Organizational Behaviour	Jennifer M. George Gareth R. Jones	Pearson	6th	2012
5	Emotional Intelligence at Work A Professional Guide	Dalip Singh	Response Books A division of Sage Publications	3rd	2006

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SY-FT-18/52

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Course Details:

Class	S.Y. B. Tech Sem. III
Course Code and Course Title	1FTHS207 **Constitution of India**
Prerequisite/s	……..
Teaching Scheme: Lecture/Tutorial/Practical	01/00/00
Credits	01
Evaluation Scheme: ISE	25

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
1FTHS207_1	**Explain** the meaning, important acts and history related to Indian constitution.
1FTHS207_2	**Illustrate** the features of Indian constitution and interpretation of Preamble.
1FTHS207_3	**Interpret** fundamental rights and duties of the Indian Citizen to inculcate morality and their social responsibilities.
1FTHS207_4	**Identify** different laws and regulations based upon Information Acts.
1FTHS207_5	**Distinguish** the functioning of Indian parliamentary system and legislative system at the center and state level.

Course Contents:		**Hrs**
Unit 1	**Constitution: Basic Structure** Meaning of the constitution law and constitutionalism, Historical perspective of the constitution of India, Government of India Act of 1935 and Indian Independence Act of 1947.	02
Unit 2	**Making of Indian Constitution :** Enforcement mof the Constitution, Meaning and importance of Constitution, Making ofIndian Constitution – Sources, Salient features of Indian Constitution, Preamble.	02
Unit 3	**Fundamental Rights:** Fundamental Rights – Features and characteristics, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies.	03
Unit 4	**Fundamental Duties:** Directive Principles-Definition and Meaning, 42nd Constitutional Amendment Act, Listand Importance of Fundamental Duties.	02

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SY-FT-19/52

Department of Food Technology

Unit 5	**Regulation to Information :** Introduction, Right to Information Act:2005, Information Technology Act 2000, Electronic Governance in India, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Limitations of an Information Technology Act	03
Unit 6	**Government of The Union and States:** President of India = Election and Powers, Prime Minister of India - Election and Powers, Loksabha - Structure, Rajyasabha – Structure, Governor of State, Chief Minister and Council of Ministers in a state.	02

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Indian Polity	M.Laxmikanth	McGraw Hill Publications Delhi	7th	2023
2	The Constitution ofIndia	P.M. Bakshi	Lexis Nexis	19th	2023
3	Introduction to the Constitution of India	Durga Das Basu	Lexis Nexis	26th	2022
4	Governance in India	M. Laxmikanth	McGraw Hill Publications Delhi	3rd	2021

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Constitution of India	V.N.Shukla	EBC	14th	2022
2	The Constitutional Law of India,	J.N. Pandey	Allahabad; Central Law Agency	59th	2022
3	Constitution of India	V.N.Tripathi	Premier Publishing Company	9th	2021
4	India's Constitution	M.V.Pylee	S. Chand Publications New Delhi	18th	2020

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SY-FT-20/52

Department of Food Technology

Course Details:

Class	S.Y. B. Tech Sem. III
Course Code & Course Title	**1FTCC208** Aptitude and Reasoning Part- I
Prerequisite/s	-
Teaching Scheme (Lecture/Tutorial /Practical)	00/00/02
Credits	1
Evaluation Scheme: ISE	50

Course Outcomes (COs) : The students will be able to:	
1FTCC208_1	Solve problems based on Vedic Mathematics, Calendar, Average, Age,
1FTCC208_2	Solve problems based on Speed Time distance and equations
1FTCC208_3	Solve problems based on Blood Relations, Directions, Time Rate Work, Pipes and Tanks, Percentage, Profit and Loss
1FTCC208_4	Solve Problems based on Spot the Error and Jumbled Para

Course Contents:

Sr. No.	Unit Name	Hours
Unit 1	Vedic Mathematics, Calendar	4 Hrs
Unit 2	Average, Ages	4 Hrs
Unit 3	Speed Time Distance, Equations	4 Hrs
Unit 4	Blood Relations, Directions, Time Rate Work, Pipes and Tanks	4 Hrs
Unit 5	Percentage, Profit and Loss	4 Hrs
Unit 6	Spot the Error, Jumbled Para	4 Hrs
	Self-Study Module	6 Hrs

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SY-FT-21/52

Department of Food Technology

Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	R.S. Agarwal (Quantitative aptitude)	R.S.Agarwal	S Chand	-	2019
2	R.S. Agarwal (Verbal & Non-verbal Reasoning)	R.S.Agarwal	S Chand	-	2010
3	Wren & Martin (Verbal, Grammar)	P.C.Wren	S Chand	-	2017

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	APTIPEDIA (Quantitative, Logical, Verbal Aptitude)	Face	Wiley	-	2017
2	Wiley (Quantitative Aptitude)	P.A.Anand	Maestro	-	2015
3	Arun Sharma (Verbal Ability)	MeenakshiUpadhyay	McGraw Hill	-	2020

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SY-FT-22/52

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Department of Food Technology

Teaching and Evaluation Scheme

ADCET

S. Y. B. Tech Semester IV

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
1FTPC209	Processing of Fruits and Vegetable	3		2	4	40	16	30	30	24	100	40	50	20	50	20	100	40	200
1FTPC210	Process Calculation	3	1		4	40	16	30	30	24	100	40	-	-	-	-	-	-	100
1FTPC211	Food Engineering I	3	-	2	4	40	16	30	30	24	100	40	50	20	50	20	100	40	200
1FTPE***	Professional Elective- I	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
1FTFE/FP***	Minor Course – I	2	-	-	2	40	16	30	30	24	100	40	-	-	-	-	-	-	100
1FTHS217	Universal Human Values	2	-	-	2	50	20	-	-	-	50	20	-	-	-	-	-	-	50
1FTHS218	Environment Studies	2	-	-	2	50	20	-	-	-	50	20	-	-	-	-	-	-	50
1FTEL219	Innovation / Prototype	-	-	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
1FTCC220	Aptitude Part – II	-	-	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
		18	**1**	**8**	**23**														**900**
	Total Contact Hours				**27**														

Professional Elective - I	
1FTPE212	Industrial Microbiology
1FTPE213	Post-Harvest Management of Fruits, Vegetables, and Spices
1FTPE214	Food Chemistry and Micronutrients

Minor Course - 1	
1FTFE215	Fundamentals of Food Technology
1FTFP216	Food Process Engineering

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SY-FT-23/52

Department of Food Technology

Course Details:

Class:	S.Y. B. Tech Sem IV
Course Code and Course Title:	1FTPC209- **Processing of Fruits and Vegetable**
Prerequisite/s:	1FTPC204 - Principles of Food Processing 1FT PC105 - Food Science
Teaching Scheme: Lecture/Tutorial/Practical	03/00/02
Credits:	04
Evaluation Scheme: ISE/MSE/ESE **ISE/ESE**	40/30/30 50/50

Course Outcomes: After successful completion of this course, students will able to	
1FTPC209_1	Interrelate the world Production and processing scenario of fruits and vegetables
1FTPC209_2	Modify the post-harvest handling, storage and ripening process
1FTPC209_3	Apply the knowledge of processing of fruits and vegetables for development of new product
1FTPC209_4	Utilize the knowledge of advance storage techniques for fruits and vegetables

Course Contents:		**Hrs.**
Unit 1	**Fruits and Vegetables** Production and processing scenario of fruits and vegetables in India and World, Scope, Types, Structure and composition, development, maturity indices, Methods, importance and overall quality of fruit and vegetables for harvesting.	**07**
Unit 2	**Post-harvest Processing** Harvesting, physical characteristics, ripening methods and control of ripening, chemical changes etc. of fruits and vegetables. Primary processing and pack house handling of fruits and vegetables; Peeling, slicing, cubing, cutting.	**06**
Unit 3	**Processing Technology of Fruits** Technology of Juices, Jams, Marmalades, Jelly, Squashes, Cordial, RTS, Nector, Syrup, toffee, Leather and other traditional products.	**07**

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SY-FT-25/52

Department of Food Technology

Unit 4	**Processing Technology of Vegetables** Technology of Vegetables preservation, Ketchup/sauces, Chutneys, Soup powders, pickles, Sauerkraut, fermented pickles, Dried powders (Onion, garlic, potato, carrot starch), Dried Leafy Vegetables. (Spinach, Fenugreek, Coriander leaves, Curry leaves) and other traditional products.	**07**
Unit 5	**Tubers** Processing and products (Potato, Sweet potato, turnips, beetroot, Taro, yam and others)	**05**
Unit 6	**Storage methods** Storage of fruit and vegetables - under ambient conditions, cold store, Zero emerge cool chamber, Freezing –Air blast, Fluidized bed and immersion freezer. Controlled and modified atmosphere storage - concepts and methods.	**07**

Course Contents: Minimum 10 experiments from following list and one course project

Exp. No.	Title of Experiment
1	Study and demonstration Canning of fruits
2	Preparation and sensory analysis of Jam.
3	Preparation and sensory analysis of Jelly.
4	Preparation and sensory analysis of marmalade.
5	Preparation and sensory analysis of RTS.
6	Preparation and sensory analysis of Squash.
7	Preparation and sensory analysis of Pickle.
8	Preparation and sensory analysis of Banana and potato wafers.
9	Preparation and sensory analysis of tomato ketchup.
10	Preparation of dehydrated leafy vegetables
11	Project-1: Dehydration of grapes.
12	Project-2: To analyze quality of dehydrated powder of any vegetable

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SY-FT-26/52

Department of Food Technology

Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1.	Fruit and Vegetable Preservation Principles and Practices	Srivastava R.P. and Sanjeev Kumar	International Book Distributing Company, New Delhi	2nd	2005
2.	Post Harvest Technology of Fruits and Vegetables : Handling, Processing, Fermentation and Waste Management vol. I & II	Varma L. R. and Joshi V.K.	Indus Publishing,	1st	2000
3.	Preservation of Fruits and Vegetables	G. Lal, G.S. Siddappa, G.L. Tandan	ICAR Publication, New Delhi	1st	1996
4.	Handbook of Fruits Science and Technology: Production, Composition, Storage and Processing	Salunkhe D.K. and Kadam S.S.	CRC press	1st	1995

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1.	Fruit and Vegetable Processing	M.G. Danthy	FAO, Rome		
2.	Preservation of Fruits and Vegetables	Lal G., Siddappa G. and Tondon G.L.	Indian Council of Agricultural Research	1st	1986
3.	Handbook of Fruit and Vegetable Processing	I.S. Singh	Sinha and Hui	1st	2010
4.	Handbook of Fruit Science & Technology: Production, Composition and Processing.	Salunkhe DK &Kadam SS.	Marcel Dekker	1st	1995

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SY-FT-27/52

Department of Food Technology

Course Details:-

Class	S.Y. B. Tech Sem IV
Course Code and Course Title	1FTPC210- **Process Calculations**
Prerequisite/s	Applied Mathematics-I Applied Physics Applied Mathematics-II
Teaching Scheme: Lecture/Tutorial/Practical	03/01/00
Credits	04
Evaluation Scheme: ISE/MSE//ESE	40/30/30

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1FTPC210_1	Explain mass balance and energy balance concepts with respect to food processing.
1FTPC210_2	Apply knowledge of material balance with and without chemical reactions to obtain efficiency of specific food process.
1FTPC210_3	Calculate mass balance & energy balance by applying knowledge of various unit operations for calculation of process efficiency.
1FTPC210_4	Evaluate calorific values of different fuels used in various food operations for maintaining process economy.

Course Contents:		**Hrs.**
Unit 1	**Introduction:** Unit Processes and Operations and their Symbols, Process Flow Sheet, Concept of Steady and Unsteady State Operations, Units and Dimensions, Moles, Normality, Molarity, Ideal Gas Law, Dalton's law, Amagat's law, Mole Fractions and Partial Pressures, average molecular weight, Density of gas mixture, Concept of Vapour Pressure, Raoult's Law	**06**
Unit 2	**Material balance without Chemical Reactions:** Concept of material balance, Law of conservation of mass, material balance without chemicals reactions, Procedure for material balance calculations, Recycling, bypass and Purge operations, Material balances on unsteady state processes	**08**
Unit 3	**Material balance with Chemical Reactions:** Introduction to Stoichiometry, Stoichiometry ratio, concept of limiting reactant, excess reactant, % excess, conversion and yield, recycle and bypass, purging operations in reacting systems.	**07**

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SY-FT-28/52

Unit 4	**Stoichiometry and Unit Operations:** Distillation, humidification, extraction, crystallization, psychometric, drying, evaporation and industrial problems.	**05**
Unit 5	**Energy Balance:** Energy balance concept, forms of energy, General energy balance procedure, Sensible heat & Specific heat, Heat capacities of gas mixture, Heat of reaction, heat of formation, heat of combustion, Standard heat of reaction from heat of formation, Standard heat of reaction from heat of combustion, Latent heat of condensation, latent heat of vaporization,	**07**
Unit 6	**Combustion:** Concept of combustion, Solid fuels, Liquid fuels, Gaseous fuels, Calorific value, Gross Calorific Value, Net Calorific Value, Air requirement, flue gases	**06**

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Stoichiometry and Process Calculations	K.V Narayan, B. Lakshmi kutty	PHI Learning Pvt. Ltd.	2nd	2016
02	Stoichiometry	B. I. Bhatt and S. B. Thakore	McGraw Hill Education	5th	2017
03	Basic Principles and Calculations in Chemical Engineering	David Mautner, Himmelblau, James B Riggs	PHI Learning Pvt. Ltd.	8th	2014

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Calculations Process	K. Asokan	CRC Press	1st	2008
02	Handbook of Chemical Engineering Calculations	Tyler G, Hicks, P.E. Nicholas, P. Chopey	McGraw Hill Education	4th	2012

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SY-FT-29/52

Department of Food Technology

Course Details:

Class:	S.Y. B. Tech Sem IV
Course Code and Course Title:	1FTPC211 **Food Engineering- I**
Prerequisite/s:	-
Teaching Scheme: Lecture/Tutorial/Practical	03/00/02
Credits:	4
Evaluation Scheme: ISE/MSE//ESE **ISE/ESE**	40/30/30 50/50

Course Outcomes : After completion of this course students will be able to,	
1FTPC211_1	Apply the knowledge of heat transfer modes that is conduction convection and radiation in various food operations to understand heat transfer phenomenon of particular unit operation.
1FTPC211_2	Classify various food processing operations based on heat transfer modes to calculate rate of heat transfer.
1FTPC211_3	Combine various heat transfer modes in food industry equipment to achieve efficient heat transfer rate of various foods.
1FTPC211_4	Evaluate heat transfer rate of heat exchangers to modify the design and process of operations in food industry.

Course Contents:		**Hrs.**
Unit 1	**Introduction to heat transfer -** Basic heat transfer processes, Modes of Heat Transfer, General laws for heat transfer, Applications of heat transfer modes in food industry.	**04**
Unit 2	**Conduction -** Theory of heat conduction, Fourier's law and its derivation, Heat transfer through composite walls one-dimensional steady state heat conduction with heat generation, Heat flow through slab, hollow sphere and cylinder with linear heat transfer, Insulators – Properties and applications in food industry	**08**
Unit 3	**Convection-** Types, Natural convection from vertical plates or horizontal cylinders. Forced convection: In laminar flow-Heat transfer in plate or tubes. In turbulent flow-Empirical equations for individual coefficients: inside tubes, outside tubes, outside bundle of tubes, flow past spheres. Significance of Prandtl number, Nusselt number, Grashof number, Graetz number and Peclet number etc.	**08**

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SY-FT-30/52

Unit 4	**Radiation-** Radiation laws like Stefan Boltzmann's law, Kirchhoff's law, Wien's law, Plank's law etc. Black body, Grey body. Transmissivity, Absorptivity, Reflectivity, Emissivity of black bodies and gray bodies. Application of thermal radiation.	**06**
Unit 5	**Evaporation -** Principles of evaporation, mass and energy balance, factors affecting rate of evaporation, Evaporation equipment: Natural circulation evaporators, horizontal/vertical short tube, natural circulation, long tube, forced circulation; design of evaporation systems, single effect, multiple effect evaporators, industrial applications	**08**
Unit 6	**Heat Exchange Equipment -** Classification, Double pipe heat exchangers. Individual and overall heat transfer coefficient, LMTD(Log Mean Temperature Difference), Variable overall Heat transfer coefficient, fouling factors, Shell & tube heat exchangers, plate heat exchangers,	**05**

Sr. No.	Title of the Experiment
1	Study of heat transfer analysis during conduction.
2	Study of heat transfer through composite wall.
3	Study of thermal conductivity of insulating powder
4	Study of heat transfer by Natural convection apparatus
5	Study of heat transfer by Forced convection apparatus
6	Study of radiation heat transfer through Stefan Boltzmann's apparatus.
7	Determination of overall Heat transfer coefficient by using 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	Determination of overall Heat transfer coefficient by using Double pipe heat exchanger

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SY-FT-31/52

Department of Food Technology

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

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Fundamentals of Food Engineering.	Rao DG	Elsevier, Amsterdam, The Netherlands.	3rd	2009
2	Food Process Engineering: Theory and Laboratory Experiments.	Sharma K, Mulvaney SJ, and Rizvi SSH	CRC Press	2nd	2012
4	Fundamentals of Food Process Engineering.	Toledo RT.	Macmillan Publishers Limited.	Second Edition.	2000

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SY-FT-32/52

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Course Details:

Class:	S.Y. B. Tech Sem IV
Course Code and Course Title:	1FTPE212 – **Industrial Microbiology**
Prerequisite/s:	Food Microbiology
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits:	3
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes: After completing this course students will be able to	
1FTPE212_1	Describe primary and secondary metabolites
1FTPE212_2	Explain the different bioreactors used for processing
1FTPE212_3	Demonstrate the methods of cell disruption
1FTPE212_4	Apply the knowledge of microbiology to develop value added products

Course Contents:		**Hrs.**
Unit 1	History of industrial microbiology Primary and secondary metabolites produced by the microorganisms, strain improvement	**06**
Unit 2	Fermentation media, Industrial sterilization; Fermenter: Components of a fermenter, parts of fermenters, peripheral parts and accessories, additional accessories and peripherals. Types of fermenters	**07**
Unit 3	Industrially important secondary metabolites, their production and downstream processing, bio pesticides, antibiotics, enzymes, exopolysaccharides, biopolymers, steroids, biomers	**07**
Unit 4	Cell disruption methods: Mechanical disruption methods and non- mechanical disruption methods; Extraction; Purification; Concentration; Product recovery	**06**
Unit 5	Microbial cell products i.e. Mushroom, Single Cell Protein, Baker's yeast, blue green algae and sprulina, intracellular and extra cellular products, ultrasonication, salting in/out	**06**
Unit 6	Production of microbial enzymes; Downstream processing, Oriental and traditional fermented foods; Measures to improve yield of fermented products	**07**

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SY-FT-33152

Department of Food Technology

Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Industrial Microbiology	Casida LE	Wiley		--
2	Industrial Applications of Microbiology	Rajvaidya N.	APH Publishing	6th	2006
3	Prescott & Dunn's Industrial Microbiology	G. Reed	AVI Publishers, Connecticut, USA.	4th	2004
4	Brewing Science and Practice.	Dennis EB,	Woodhead Publishing Ltd. Cambridge, England.		2004

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Modern Industrial Microbiology and Biotechnology	NdukaOkafor	Science Publishers, USA		2004
2	Handbook of Indigenous Fermented Foods	Steinkraus KS	Marcel Dekker		1996

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SY-FT-34/52

Department of Food Technology

Course Details:

Class:	S.Y. B. Tech Sem IV
Course Code and Course Title:	1FTPE213– **Post Harvest Management of Fruits, Vegetables and Spices**
Prerequisite/s:	Food Science,
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits:	3
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes: After completion of this course students will be able to	
1FTPE213_1	Classify required postharvest treatment for fruits, vegetables and spices for better quality and storage as per conditions
1FTPE213_2	Apply knowledge of postharvest processing on fruits, vegetables and spices toobtain good quality product.
1FTPE213_3	Analyse and combine various postharvest treatments to the fruits, vegetables andspices to avoid shortage of food supply
1FTPE213_4	Categorize various spices based on their requirement and production for creating awareness among society to increase the production and consumption of spices.

Course Contents:		**Hrs.**
Unit 1	**Introduction** - Importance and scope of postharvest management of fruits and vegetables and spices in Indian economy. Morphology, structure and composition of fruits, vegetables and spices; maturity indices and standards for selected fruits and vegetables; methods of maturity determinations	**05**
Unit 2	**Harvesting and Handling** - Harvesting and handling of important fruits and vegetables, Harvesting tools; primary processing for sorting and grading at farm and cluster level; factors affecting postharvest losses; Standards and specifications for fresh fruits, vegetable and spices. Handling and packaging of fruits, vegetables and spices Physical and chemical treatment.	**07**
Unit 3	**Post-Harvest Process** - Post-harvest physiological and biochemical changes in fruits and vegetables; ripening of climacteric and non-climacteric fruits; regulations, methods; Storage practices: CA and MA, hypobaric storage, pre-cooling and cold storage; Commodity pretreatments - chemicals, wax coating. Storage of fresh fruits and vegetables	**07**

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SY-FT-35152

Department of Food Technology

Unit 4	**Spices** – Introduction, Classification **Major spices**: Post harvest technology, composition, processed products of spices – ginger, chilli, turmeric, onion, garlic, pepper, cardamom, cashew nut and coconut	**08**
Unit 5	**Minor spices** - herbs and leafy vegetables: processing and utilization, All spice, annie seed, sweet basil, caraway seed, cassia, cinnamon, clove, coriander, cumin, dill seed, Fern seed nutmeg, mint, marjoram, Rose merry, saffron, sage, etc	**09**
Unit 6	**Other Spices and packaging** - Tea, Coffee, Cocoa: Processing quality control, Spice oil and oleoresins, Standards specification of spices and flavors, Packaging of spices and spice products	**06**

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	A Handbook on Post harvest Management of Fruits and Vegetables	P. Jacob John	Daya Publishing House, Delhi ISBN: 9788170355328		
2	Postharvest: An introduction to the physiology and handling of fruit and vegetables,	Wills R. and Golding J.	UNSW Press ISBN: 9781742247854	6th edition	
3	Handbook of Analysis and Quality Control for Fruits and Vegetable Products	Ranganna S.	Tata-McGraw Hill,	2 nd Edition,	2001

Reference Books:

Sr.No.	Title	Author	Publisher	Edition	Year of Edition
1	Handbook of Postharvest Technology	Chakraverty A. Mujumdar A. S. Ramaswamy H.	Marcel Dekker Inc., New York ISBN: 0824705149	2nd	
2	Handbook of Vegetable Science and Technology	Salunke D. K. Kadam S. S.	Marcel Dekker Inc., New York ISBN: 0824705149	2nd	

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SY-FT-36/52

Department of Food Technology

Course Details:

Class	S.Y. B. Tech Sem IV
Course Code and Course Title	1FTPE214 **Food Chemistry and Micronutrients**
Prerequisite/s	Chemistry- I
Teaching Scheme: Lecture/Tutorial/Practical	03 / 00/00
Credits	03
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
1FTPE214_1	Discuss the chemistry of food constituents
1FTPE214_2	Apply molecular interaction between food constituents in developing technologies / processes
1FTPE214_3	Develop skills for experimenting with food systems and to test various approaches for manipulating the chemical and/or functional properties of foods
1FTPE214_4	Detect changes in overall composition are likely to change the reactivity of individual food components
1FTPE214_5	Determine the approaches that may be used to control the reactivity of those food components that are likely to impact the overall quality of finished products

Course Contents:		**Hrs**
Unit 1	**Chemistry of Water :**Water in food systems - Structure of water & ice - bound & free water – Water Activity – Sorption isotherms – basic principles, construction and applications – Thermodynamically unstable food systems– Types, factors affecting stability and methods of stabilization.	06
Unit 2	**Chemistry of Carbohydrates:** Nomenclature, classification & structure of carbohydrates, Reactions of carbohydrates, Chemistry and Technology of homo and heterloglycans , process flow sheet for the production of starch hydrolysis products	06
Unit 3	**Chemistry of Lipids:** Nomenclature and classification of lipids. Basic Structures and chemistry of fatty acids. physical &chemical characteristics of fats & oils Phospholipids, and un-saponifiables – Oxidative reactions of lipids– types – prevention – Action of antioxidants. Process flow sheet for the manufacture of edible oils (refined and hydrogenated), Modification of fats.	06

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SY-FT-37/52

Department of Food Technology

Unit 4	**Chemistry of Proteins:** Chemistry of amino acids – Classification of amino acids - peptides & Proteins. Functional properties of Protein, Protein denaturation. **Enzymes:** Introduction, classification & nomenclature of enzymes and classification. Specificity, Application of enzymes in Foods	07
Unit 5	**Chemistry of Vitamins and Minerals :** Overview of Fat-soluble and water soluble vitamins — Toxicity and sources of vitamins –Bioavailability of vitamins – Summary of vitamin stability- Reasons for the loss of vitamins in foods, Introduction & Classification of minerals	**07**
Unit 6	**Introduction to Natural Colorants and Flavor :** Overview of natural colorants- sources, chemistry and applications of anthocyanin, betalain, carotenoids and chlorophyll. Introduction to flavor – Classification, Flavoring compounds, Flavor enhancers, Biosynthetic production of flavor	**07**

Text books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Fennema's Food Chemistry	SrinivasanDamodaran, Kirk L. Parkin	Taylor &Francis group	5	2017
02	Food Chemistry	H.D. Belitz, W. Grosch, P.Schieberle	Springer-Verlag Berlin Heidelberg	4	2009
03	Chemical and functional Properties of Food Components	Zdzislaw and E.Sikroski.	CRC Press, Taylor & Francis group USA	3	2006

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Principles of Food Chemistry	John M. deMan, John W. Finley, W. Jeffrey Hurst and Chang Yong Lee	Springer International Publishing	4	2018
02	Biochemistry of Foods	N. Michael Eskin.	Academic Press, USA	2	1990
03	Physical Chemistry of Foods	Pieter Walstra	Marcel Dekker Publishing, New York	3	2006

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SY-FT-38/52

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Course Details:

Class:	S.Y. B. Tech Sem IV
Course Code and Course Title:	1FTFE215 - **Fundamentals of Food Technology**
Prerequisite/s:	---
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00
Credits:	02
Evaluation Scheme: ISE/MSE/ ESE	40/30/30

Course Outcomes: After successful completion of this course, students will able to	
1FTFE215_1	Understand the functional aspects of food components and to study their role in food chemistry
1FTFE215_2	Know the important genera of microorganisms associated with food and their characteristics and to understand the role of microbes in food processing
1FTFE215_3	Acquaint with fundamentals of food engineering and its process
1FTFE215_4	Study the processing of milk, fruits, vegetables and its products

Course Contents:		**Hrs.**
Unit 1	**Introduction to Food** Food groups: Basic 4, 5 and 7 food groups, Functional food groups-energy yielding, body building and protective foods (only sources and not properties and functions). Food Pyramid,	**05**
Unit 2	**Introduction to Food chemistry** Definition, scope and importance; Composition and nutritive value of common foods, chemical properties of food constituents, characteristics of food quality.	**05**
Unit 3	**Food Microbiology** Introduction to microbiology and its significance in foods, beneficial organisms; Major groups of microorganisms - bacteria, yeasts, molds and viruses.	**04**
Unit 4	**Introduction to Food Engineering** Mode of heat transfer- conduction, convection and radiation and its application in food industry; fluid flow- classification of fluid, properties of fluid, Heat exchanger.	**05**

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SY FT - 39/52

Department of Food Technology

Unit 5	**Introduction of milk and milk products** Chemical composition, types of milk, Use of milk in formulated foods, Technology of milk and milk products (flavored milk, shrikhand, Paneer, Khoa).	**05**
Unit 6	**Introduction of Fruits and Vegetables products** Chemical composition, Jam, Jelly, Marmalade, RTS, Squash	**04**

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Food facts and Principle	N. Shakuntala Manay, M. Shadakshara Swamy	New age international publications	3rd	2021
2.	Food Microbiology	W. C. Frazier,D. C.Westhoff	McGraw-Hill	5th	2013
3.	Outline of Dairy Technology	Sukumar De	Oxford University Press	1st	2008
4.	Handbook of Fruits Science and Technology: Production, Composition, Storage and Processing	Salunkhe D.K. and Kadam S.S.	CRC press	1st	1995

Reference Books:

Sr.No.	Title	Author	Publisher	Edition	Year of Edition
1.	Fennema's Food Chemistry,	Kirk Lindsay Parkin, SrinivasanDamodaran, Owen R. Fennema	CRC Press	5th	2017
2.	Food Processing Technology: Principles and Practice	P.J. Fellows	ElsevierScience	4th	2016
3.	Handbook of Fruit and Vegetable Processing	I.S. Singh	Sinha and Hui	1st	2010

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SY-FT-40152

Department of Food Technology

Course Details:

Class:	S.Y. B. Tech Sem IV
Course Code and Course Title:	1FTFP216 – **Food Process Engineering**
Prerequisite/s:	--
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00
Credits:	2
Evaluation Scheme: ISE /MSE /ESE	40/30/30

Course Outcomes: After completing this course students will be able to	
1FTFP216_1	Explain and develop basic flow sheet in food processing operation
1FTFP216_2	Analyse the design aspects of different thermal processes and equipment
1FTFP216_3	Design different non-thermal processes and bakery equipment
1FTFP216_4	Analyse the critical process control parameters and develop plant layout of a food industry

Course Contents:		**Hrs.**
Unit 1	Product & Process Development: Important aspects of product and process development. Basic flow sheet development for food processing	**04**
Unit 2	Boiler & Heat Exchanger: Thermodynamic properties of steam; Steam as heating medium in Food operations; Fire and water tube boiler; Design of heat exchangers for food operations	**05**
Unit 3	Thermal Processing & Equipment: design and equipment aspects of Thermal processing; Continuous sterilization; Canning and retort processing. Equipment design aspects of pasteurizer, evaporators, and concentrators. Non thermal processes.	**05**
Unit 4	Mechanical Operations & Equipment: Process design aspects of homogenizer, centrifugal separators, extruder, filtration system, Bakery Machines and Equipment: Sheeting, mixing and blending	**05**
Unit 5	Dryer and their Design Parameters: Tray dryer, spray dryer, fluidized bed dryer, heat-pump assisted dryer, and freeze dryer	**04**
Unit 6	Plant Layout and Costing: Food processing Plant layout, continuous Good Manufacturing Practice, material of construction and corrosion, waste utilization, Process control, optimization and preliminary project costing.	**05**

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SY-FT-41/52

Department of Food Technology

Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Toledo, R.T. Fundamentals of Food Process Engineering, Chapman and Hall;	S. P Narang	APH	1st	2000
2	Introduction to Food Engineering	Heldman, D.R. & Singh, R.P.	Academic Press; Elsevier;	4th	2009

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Food Processing Operations Analysis;	Das, H.	Asian Books Pvt. Ltd	4th	2008
2	Manufacturing Facilities, Design and Material Handling	Meyers, F.E. & Stephens, M.P.	Pearson Education Inc.;	6th	2013

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SY-FT-42152

Department of Food Technology

Course Details:

Class	S.Y. B. Tech Sem IV
Course Code and Course Title	1FTHS217 **Universal Human Values**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00
Credits	2
Evaluation Scheme: ISE	50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to	
1FTHS217_1	**Integrate** the process of self-exploration to achieve Harmony in the human being's based on Holistic perspective of value education.
1FTHS217_2	**Understanding** Harmony in human being, family, society and nature /existence, based on methods to fulfill human aspiration.
1FTHS217_3	**Apply** the human values for maintaining the relationships with one self and others using the principals of harmony.
1FTHS217_4	**Adopt** the methods of maintaining harmony with the society, nature, and its existence by utilizing the human order systems.

Course Contents:

Unit No	Unit Name	Hours
Unit 1	**Introduction to Value Education** Introduction , Need, Purpose and motivation for the course, recapitulation from Universal Human Values-I **Self-Exploration**–what is it? - Its content and process; 'Natural Acceptance' and **Experiential Validation**- as the process for self-exploration. **Continuous Happiness and Prosperity**- A look at basic Human Aspirations, **Right understanding**, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.	4
Unit 2	**Understanding Happiness and Prosperity Understanding Happiness** and Prosperity correctly, **Prevailing sources of happiness,** Prosperity and its implications Method to fulfil the human aspirations: understanding and living in harmony at various levels.	4

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SY-FT-43/52

Department of Food Technology

Unit 3	**Understanding Harmony in the Human Being - Harmony in Myself** **Understanding human** being as a co-existence of the sentient 'I' and the material 'Body', **Understanding the needs of Self ('I') and 'Body'** - happiness and physical facility **Understanding the Body as an instrument of 'I'** (I being the doer, seer and enjoyer) **Understanding the characteristics and activities of 'I' and harmony in 'I'** **Understanding the harmony of I with the Body**: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Health.	6
Unit 4	**Understanding Harmony in the Family - Harmony in Human-Human Relationship** **Understanding values in human-human relationship**; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; **Trust and Respect** as the foundational values of relationship **Understanding the meaning of Trust**; Difference between intention and competence **Understanding the meaning of Respect**, Difference between respect and differentiation; **Peer Pressure** the Concerns and its Resolution the other salient values in relationship	7
Unit 5	**Understanding Harmony in the Society** **Understanding the harmony in society**: Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals **Human order systems** and dimensions	4
Unit 6	**Understanding Harmony in the Nature and Existence Understanding the harmony in the Nature,** Inter-connectedness and mutual fulfilment among the four orders of nature, recyclability and self- regulation in nature	3

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Understanding Human Being, Nature and Existence Comprehensively	UHV Team	UHV	1st	2022
2	A Foundation Course in Human Values and Professional Ethics	R. R. Gaur, R Asthana,G P Bagaria	Excel Books	2nd	2019
3	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics	R. R. Gaur, R Asthana, G P Bagaria	Excel Books	2nd	2019
4	Human Values	A.N Tripathy	New Age International	2nd	2006

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SY-FT-44/52

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	A Foundation Course in Human Values and Professional Ethics	R.R. Gaur, R. Sangal, G.P. Bagaria	Excel Books	3rd	2010
2	Indian Ethos and Modern Management: Amalgam of the Best of the Ideas from the East and the West	B.L. Bajpai	New Royal Book	1st	2004
3	Small Is Beautiful	E. FSchumacher.	Hartley & Marks	1st	1999
4	An Introduction to Ethics	William Lilly	Allied	1st	1967

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SY-FT-45/52

Department of Food Technology

Course Details:

Class	S.Y. B. Tech Sem IV
Course Code and Course Title	1FTHS218 **Environmental Studies**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00
Credits	2
Evaluation Scheme: ISE	50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1FTHS218_1	**Comprehend** the concepts and principles of sustainable development and its importance in environmental preservation.
1FTHS218_2	**Explain** ethical and legal responsibility of an engineer and his role in effective implementation of sustainable activities through EIA and EMS in the corporate sector.
1FTHS218_3	**Predict** impact of contemporary issues (Population Explosion, Climate change, Environmental pollution) on the environment.
1FTHS218_4	**Classify and analyze** different types of environmental pollution, understand their causes and effects, and propose control measures.
1FTHS218_5	**Prepare** a technical report highlighting importance of environment in human life by using techniques like survey, case studies, mini project.

Course Contents:

Unit No.	Title	Hrs.
Unit 1	**Introduction to Environment and concept of Sustainable development:** Natural and Built Environment, Environmental Education: Definition, Scope, Objectives and importance. Components of the Environment: Atmosphere, Hydrosphere, Lithosphere and Biosphere. Biological Diversity: Introduction, Values of biodiversity, Threats to biodiversity, Conservation of biodiversity. Sustainable development goals, pillars of sustainable development.	**4**

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SY-FT-46/52

Unit 2	**Energy and Natural Resources** Energy Scenario: Future projections of Energy Demand, Utilization of various Energy Sources, Conventional Energy Sources and Non-Conventional Energy Sources, Urban problems related to energy. Natural Resources: Food, Water, Forest, Geological, Equitable Use of Resources for Sustainable lifestyle. Concept of life cycle analysis, Case studies.	**4**
Unit 3	**Introduction to global environmental issues, Impact of modernization** Climate change: Global warming, Ozone depletion, Acid Rain etc. Environmental Impact: Impact of Modern agriculture on the Environment, Impact of Mining on the Environment, Impact of Large dams on the Environment. Environmental pollution: Air, Water, Soil, Noise, Marine, classification of pollutants, their causes, effects and control measures. Case studies.	**4**
Unit 4	**Environmental Pollution** Definition: Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Solid waste Management: Causes, effects and control measures of urban and industrial wastes. E waste management. Role of an individual in prevention of pollution.	**4**
Unit 5	**Environmental Management and Legislation** Environmental ethics: Introduction, Ethical responsibility, issues and possible solutions. Environmental Management: Introduction to Environmental Impact Assessment, Environmental Management System: ISO 14001Standard, Environmental Auditing, National and International Environmental protection agencies pertaining to Environmental Protection. Introduction to Environmental Legislation	**4**
Unit 6	**Cleaner technology:** Consumerism and Waste Products, Green buildings, Green products, Minimization of Hazardous Products, Reuse of Waste, By-products, Rainwater Harvesting, Translocation of trees. Some Success Stories. Role of Information Technology in Environment protection.	**4**

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SY-FT-47/52

Department of Food Technology

Text Books					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Environmental Studies	AninditaBasak	PEARSON	First edition	2017
02	Environmental Studies	N.K Uberoi,	Excel Books Publications New Delhi,	First edition	2005.
03	Environmental Studies from crisis to cure	R. Rajagopalan,	Oxford university press,	Second edition	2011

Reference Books / Handbooks					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Environmental Science: A Global Concern	William Cunningham and Barbara Woodworth Saigo	WCB/McGraw Hill publication	Fifth Edition	1999
02	Peter. H. Raven, Linda. R. Berg, George. B. Johnson	Environment	McGraw Hill publication	Second edition	1998
03	"Adaptive Environmental Management	Catherine Allan & George H. Stanley (Editors),	Springer Publications	--	2009.
04	Elements of Environmental Science and Engineering	P. Meenakshi	Prentice Hall of India Private Limited, New Delhi	-	2006

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S.Y-FT-48/52

Department of Food Technology

Course Details:

Class	S.Y. B. Tech. Semester.-IV
Course Code and Course Title	**1FTEL219-** Innovation /Prototype
Prerequisite/s	----
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
1FTEL219_1	Apply the product development process and adapt it to meet specific product requirements during new product development/innovations
1FTEL219_2	Analysis the design process, function and its stage
1FTEL219_3	Generate and evaluate innovative product concepts using systematic methods such as concept screening, scoring, and testing.
1FTEL219_4	Identify customer needs, including latent needs, and establish target specifications aligned with market requirements.
1FTEL219_5	Plan and execute prototyping activities considering factors such as time, cost, and resources, utilizing appropriate technologies

LIST OF EXPERIMENTS	
Expt. No	**Title of the Experiment**
1	Identification of Problem, design process and conceptualization
2	Functional Analysis (Function, Constraints, Functional Decomposition)
3	Concept Development (Appropriate Investigation and Selection)
4	Project Development (Project Planning, Cost Estimation, Managing Property Issues)
5	Prototyping and Intellectual Property Rights
6	Identifying Customer Needs and Product Specifications
7	Testing of the Model
8	Customer product unveiling and report
9	Pros Cons of Model identification and scope Analysis
10	Effective Report Making

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SY:FT-49/52

Department of Food Technology

Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Product Design: Technique in Reverse Engineering and New Product Development	Kevin Otto, Kristin Wood	Prentice Hall Edition	First	2013
2	Product design and development.	Eppinger, S., & Ulrich, K	McGraw-Hill Higher Education.	Fifth	2017
3	Engineering Design Process	YousefHaik	Florida State University	Fourth	2010
4	Product design and Manufacturing	A.K. Chitale, R. C. Gupta	PHI Publication	Fourth	2009
5	Engineering Design Process	YousefHaik, T. M. M. Shahin	Cengage Learning	Second	2010

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Product Design	Kevin Otto, Kristin Wood	Pearson Education Indian Reprint	--	2004
2	Engineering Design	George E.Dieter, Linda C.Schmidt	McGraw-Hill International	Fourth	2009
3	Engineering Design: A Project-based Introduction	Clive L.Dym, Patrick Little	John Wiley & Sons	Third	2009
4	Product Design and Development	Anita Goyal, Karl T Ulrich, Steven D Eppinger	Tata McGraw-Hill Education	Fourth	2009

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SY-FT-50/52

Department of Food Technology

Course Details:

Class	S Y B. Tech Sem IV
Course Code & Course Title	**1FTCC220** Aptitude and Reasoning Part- II
Prerequisite/s	-
Teaching Scheme (Lecture/Practical/Tutorial)	00/00/02
Credits	1
Evaluation Scheme: ISE	50

Course Outcomes (COs) : The students will be able to:	
1FTCC220_1	**Solve** problems based on HCF, LCM, Interest, Clock, Cubes and Puzzles
1FTCC220_2	**Solve** problems based on Coding and Decoding, Seating Arrangements and Venn diagrams.
1FTCC220_3	**Solve** problems based on Ratio Proportion, Partnership, Allegation, Divisibility and Number Theory
1FTCC220_4	**Demonstrate** presentations using concepts delivered on confidence building and time management skills.

Course Contents:

Sr. No.	Unit Name	Hours
Unit 1	HCF LCM, Simple Interest, Compound Interest	**4 Hrs**
Unit 2	Coding- Decoding, Seating Arrangement Venn Diagrams	**4 Hrs**
Unit 3	Clocks, Cubes, Puzzles,	**4 Hrs**
Unit 4	Ratio Proportion, Partnership	**4 Hrs**
Unit 5	Confidence Building, Time Management	**4 Hrs**
Unit 6	Allegation, Divisibility and Number Theory	**4 Hrs**
	Self-Study Module	**6 Hrs**

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SY-FT-51/52

Department of Food Technology

Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	R.S. Agarwal (Quantitative aptitude)	R.S.Agarwal	S Chand	-	2019
2	R.S. Agarwal (Verbal & Non-verbal Reasoning)	R.S.Agarwal	S Chand	-	2010
3	Wren & Martin (Verbal, Grammar)	P.C.Wren	S Chand	-	2017

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	APTIPEDIA (Quantitative, Logical, Verbal Aptitude)	Face	Wiley	-	2017
2	Wiley (Quantitative Aptitude)	P.A.Anand	Maestro	-	2015
3	Arun Sharma (Verbal Ability)	Meenakshi Upadhyay	McGraw Hill	-	2020

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SY-FT-52/52

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Department of Food Technology

Teaching and Evaluation Scheme

T.Y.B.Tech Semester-V																				
Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
1ILOE***	Open Elective – I	3	-	-	3	50	20	-	-	-	50	20	-	-	-	-	-	-	50
1FTPC301	Processing of Milk and Milk Products	3		2	4	40	16	30	30	24	100	40	50	20	50	20	100	40	200
1FTPC302	Food Engineering II	3	-	2	4	40	16	30	30	24	100	40	50	20	-	-	50	20	150
1FTPC303	Processing of Cereals, Pulses and Oilseeds	2	-	-	2	40	16	30	30	24	100	40	-	-	-	-	-	-	100
1FTPE***	Professional Elective – II	3		2	4	40	16	30	30	24	100	40	50	20	50	20	100	40	200
1FTFE/FP***	Minor Course – II	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
1FTHS309	Entrepreneurship	-	-	2	1	-	-	-	-	-	-	-	25	10	-	-	25	10	25
1FTEL310	Industrial Training / Internship	-	-	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
1FTCC311	Aptitude and Reasoning Part - III	-	-	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
		17	**0**	**12**	**23**														**925**
	Total Contact Hours				**29**														

Professional Elective - II		Minor Course - II	
1FTPE304	Fermentation Technology	1FTFE307	Food Analytical Techniques
1FTPE305	Nutrition	1FTFP308	Food Engineering Operations
1FTPE306	Instrumentation and Process Control		

Open Elective-I			
1ILOE351	Economics of Health and Education	1ILOE358	Quantitative Investment Management
HLOE352	Business to Business Marketing (B2B)	1ILOE359	Human Resource Development
1ILOE353	Patent Law for Engineers and Scientists	1ILOE360	Advanced Business Decision Support Systems
1ILOE354	Economics of Innovation	1ILOE361	Introduction to Japanese Language and Culture - II
1ILOE355	E-Business	1ILOE362	German - I
1ILOE356	Management Accounting	1ILOE363	Operations and Supply Chain Management
1ILOE357	Economics of Banking and Finance Markets		

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TY-FT-01/46

ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA
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Department of Food Technology

Course Details:

Class:	**Third Year B.Tech** Semester- V
Course Code and Course Title:	1FTPC301 – **Processing of milk and milk products**
Prerequisite/s:	1FTPC105-Food Science 1FTPC202- Food Microbiology
Teaching Scheme: Lecture/Tutorial/Practical	03/00/02
Credits:	04
Evaluation Scheme: (T) ISE/MSE/ESE	40/30/30
Evaluation Scheme: (P) ISE/ESE	50/50

Course Outcomes: After successful completion of this course, students will able to	
1FTPC301-1	Evaluate the basic composition and physico-chemical properties of milk.
1FTPC301-2	Study primary processing of milk and milk products processing.
1FTPC301-3	Study different types of fermented and non fermented dairy products.
1FTPC301-4	To adapt new technology for sanitation and hygiene of dairy industry.

Course Contents:		**Hrs.**
Unit 1	**INTRODUCTION** Introduction to Milk and milk products in India; Importance of milk processing plant in the country, Milk – types, composition, nutritive value, factors affecting composition, physico- chemical properties of milk.	**06**
Unit 2	**PRIMARY PROCESSING OF MILK** Dairy plant operations viz. receiving, separation, clarification, pasteurization, standardization, Bactofugation of milk, homogenization, sterilization, storage, transport and distribution of milk, Platform tests of milk.	**06**
Unit 3	**MILK PROCESSING EQUIPMENTS** Milk Processing flow sheet, Equipment employed, Pasteurizers – HTST, LTLT, UHT, Plant piping, Pumps, Cream separators, Clarifiers, Homogenizers, Bottle and pouch fillers, Milk Chillers, Ice Cream Freezers. Vacuum Evaporators, Spray and Drum Dryers, Packaging of milk.	**07**
Unit 4	**DAIRY PRODUCTS** Manufacturing of Milk products- Acid coagulated milk products (Paneer, Channa, Sandesh). Heat desiccated milk products (Khoa, Rabri, Basundi) cream, Ice- cream, condensed milk, evaporated milk, Dried milk products (whole milk, skimmed milk, Buttermilk, Whey powder).	**07**

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TY-FT-02/46

Unit 5	**FERMENTED DAIRY PRODUCTS** Introduction to Fermented products and manufacturing process – Yoghurt, Curd, shrikhand, Butter, Ghee, Butter milk and Cheddar cheese. Enzymes in dairy processing.	**07**
Unit 6	**CLEANING AND SANITATION OF DAIRY EQUIPMENTS** Dairy plant sanitization – properties and classification of detergents, basic principles cleaning and sanitation, methods of cleaning, Clean in place equipments and methods. Scope and functioning of milk supply schemes. Various national and international regulatory bodies.	**06**

Course Contents: Minimum 10 experiments from following list	
Expt. No.	**Title of Experiment**
1	Study of milk testing by Methylene blue reduction test
2	Determination of fat content of milk.
3	Determination of pH of butter
4	Determination of Acidity of milk.
5	Detection of adulterants in milk and milk products
6	Preparation of channa based sweet (*Rasogulla*)
7	Preparation of channa based sweet (*Sandesh*)
8	Preparation of khoa.
9	Preparation of flavored milk.
10	Preparation and sensory evaluation of coagulated milk product (paneer).
11	Preparation of indigenous fermented milk products Shrikhand
12	Preparation of indigenous fermented milk products curd.

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1.	Outlines of Dairy Technology	Sukumar De.	Oxford University Press	3rd	2001
2.	Principles of Dairy Processing	James N.Warner	Wiley Eastern Ltd	3rd	1998
3.	Dairy Technology: Principles of milk properties and processes	Walstra P.	CRC Press	2nd	2005
4.	Technology of Milk Processing	Khan QA and Padmanabhan	ICAR, New Delhi	1st	1993
5.	Indian Dairy Industry	K.S.Rangappa and K L Acharya	Asia publishing house, Mumbai	1st	1974

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1.	Dairy Processing	Gerret Smit. G	Wood head Publishing Limited, England	1st	2003
2.	Judging of Dairy Products	J.A.Nelson and Trout	The Olsen publishing Co. Milwankee, Wisconsin, USA	4th	1965
3.	Principles of Dairy Processing	J.N.Warner,	Wiley Eastern Ltd, New Delhi	1st	1976
4.	Technology of Dairy Products	Early R.	Springer	1st	1998
5.	Dairy Technology: Principles of milk properties and processes	Walstra P.	CRC Press	2nd	2005

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ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA
(An Autonomous Institute)
Department of Food Technology

Course Details:

Class:	**T.Y. B.Tech** Semester- V
Course Code and Course Title:	1FTPC302–**Food Engineering- II**
Prerequisite/s:	1FTPC203- Unit Operations 1FTPC211- Food Engineering-I
Teaching Scheme: Lecture/Tutorial/Practical	03/00/02
Credits:	04
Evaluation Scheme: (T) ISE/MSE/ESE	40/30/30
Evaluation Scheme: (P) ISE	50

Course Outcomes: After successful completion of this course, students will able to	
1FTPC302_1	Apply concept of mass transfer to food processing operations by using different techniques
1FTPC302_2	Evaluate mass transfer coefficient for given mass transfer operation by using analysis methods
1FTPC302_3	Analyze concepts of extraction and absorption for industrial applications to maintain process efficiency
1FTPC302_4	Compute number of stages in the column by using different feed conditions

Course Contents:		**Hrs.**
Unit 1	**Diffusion:** Fundamentals of mass transfer, Fick's Law of diffusion, molecular diffusion in gases, liquids and solids, Mass transfer coefficient, applications in food industry. Theories of mass transfer.	**06**
Unit 2	**Absorption:** Concept of absorption, gas absorption principles, solvent selection criteria, absorption equipments: packed columns, plate columns, types of packings, application in food processing.	**06**
Unit 3	**Adsorption:** Introduction, types of adsorbents, adsorption isotherms: Langmuir, Freundlich and BET isotherm, adsorption equipments: Fixed bed adsorption, continuous moving bed adsorption, applications in food industry.	**07**
Unit 4	**Liquid-Liquid Extraction:** Introduction, distribution coefficient, solvent selection for extraction, extraction equipments: mixer settler, rotating disc, pulse column, design considerations, significance.	**07**
Unit 5	**Solid-Liquid Extraction:** Introduction and classification of solid-liquid separation systems, solvent selection criteria, oil extraction from seeds, SLE equipment's: Batch extractor, Bollman extractor, continuous belt extractor.	**06**

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TY-FT-05/46

Unit 6	**Distillation:** Introduction to distillation process, vapour-liquid equilibrium, methods of distillation: Simple distillation, fractional distillation, steam distillation and vacuum distillation, analysis of distillation columns, tray efficiency, distillation of wines and spirits.	**07**

Course Contents: Minimum 10 experiments from following list	
Expt. No.	**Title of Experiment**
1	Determination of diffusivity of given volatile food products in air
2	Determine percentage absorption of CO_2 in NaOH solution
3	Measurement of adsorption coefficient using fixed bed adsorption column
4	Study of Langmuir and Freundlich isotherms using adsorption column
5	Determination of Distribution coefficient using liquid-liquid extraction
6	Study of solid-liquid extraction
7	Study of centrifugation
8	Performance of simple distillation of methanol and water
9	Measure purity of the distillate in fractional distillation
10	Determination of heat transfer through agitated vessel
11	Determination of Rheological properties of liquid foods
12	Study of hygrometer

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Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1.	Mass Transfer Operations	Robert Ewald Treybel	McGraw Hill	3rd	2003
2.	Food Process Engineering and Technology	Zeki Berk	Elsevier Academic Press	2nd	1965
3.	Principles of mass transfer and Separation processes	Binay K Datta	PHI Learning Pvt. Ltd.	-	1976

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1.	Principles and Modern applications of mass transfer operations	Jaime Benitez	Wiley	3rd	2017
2.	Mass Transfer Operations for Practicing Engineers	Louis Theodore, Francesco Ricci	Wiley	-	2011

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ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA
(An Autonomous Institute)
Department of Food Technology

Course Details:

Class:	**T.Y. B.Tech** Semester- V
Course Code and Course Title:	1FTPC303– **Processing of Cereals, Pulses and Oilseeds.**
Prerequisite/s:	1FTPC209- Processing of Fruit and Vegetable
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00
Credits:	02
Evaluation Scheme: (T) ISE/MSE/ESE	40/30/30

Course Outcomes: After successful completion of this course, students will able to	
1FTPC303_1	Study the processing technology for extending the shelf life of food grains.
1FTPC303_2	Demonstrate the methods that affect the cooking quality of food.
1FTPC303_3	Understand the traditional and novel products derived from seeds.
1FTPC303_4	Study by-products utilization and valuable formulations.

Course Contents:		**Hrs.**
Unit 1	**Introduction:** Definition, Varieties of grains, cereals and legumes grown and consumed in various countries, Introduction to morphology and classification of legumes and oilseeds, Morphology of legumes and oilseeds; Classification and types of legumes and oilseeds. Post harvest handling and storage.	**05**
Unit 2	**Milling operations:** Rice, Wheat, Corn, Sorghum, Rye, Barley. Structure, composition and by-products. Processing operations: pearling, par boiling. Milling of legumes: home scale, cottage scale and modern milling methods, efficiency and factors affecting milling.	**04**
Unit 3	**Physicochemical effect of soaking and germination:** Soaking and germination of pulses, Cooking quality, factors affecting on cooking quality. Dehusking of Pulse, Water conditioning, Mini dal mill, working principle, advantages and disadvantages.	**04**
Unit 4	**Anti-nutritional factors & allergens**: Methods of removal of anti-nutritional compounds: Physical Processing, soaking, moist heat. Legumes anti-nutrients, toxins, detoxification, anti-nutritional effects, beneficial effects, protease inhibitors, phytic acid, saponins, lectins, alpha-amylase inhibitors, gluten products.	**05**
Unit 5	**Processing of oilseeds:** Chemical composition of oilseeds, Minor and non-edible oil seeds as source of proteins. Methods of extraction, desolventization and refining of oils: degumming, neutralization, bleaching, filtration, deodorization.	**04**

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TY-FT-08/46

Unit 6	**Products formulations:** Development of nutritive multigrain formulations. Gelatinization process. By-product of oil seed meals for food uses: High protein products like concentrate, isolates. Animal feed, Soap and detergents, personal care products	04

Text Books:

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

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Cereal and Cereal products	Dendy DAV & Dobraszczyk BJ	Springer US	1st	2001
2	Cereal Science	Matz SA	A VII Publication	4th	1969
3	Chemistry Cereal Grains	Peter Kohler and Herbert Wieser	Springer Science & Business Media New York	6 th	2013

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TY-FT-09/46

ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA
(An Autonomous Institute)
Department of Food Technology

Course Details:

Class	**Third Year B. Tech** Semester-V
Course Code and Course Title	1FTPE304 – **Fermentation Technology (Professional Elective-II)**
Prerequisite/s	0FTPC205- Food Chemistry and Micronutrients 0FTPC208- Food Microbiology
Teaching Scheme: Lecture/Tutorial/Practical	03/00/02
Credits	04
Evaluation Scheme: (T) ISE /MSE/ESE	40/30/30
Evaluation Scheme: (P) ISE/ESE	50/50

Course Outcomes : After successful completion of this course, students will able to	
1FTPE304_1	Understand fundamental governing microbial fermentation.
1FTPE304_2	Analyze industrial microorganisms, design considerations of bioreactors.
1FTPE304_3	Apply knowledge of fermentation media preparation, sterilization techniques, and optimization strategies.
1FTPE304_4	Understand product recovery and downstream processing techniques.

Course Contents:		**Hrs.**
Unit 1	**Introduction to Fermentation Technology:** Definition, Scope, and Importance, Types of Fermentation, Historical Development and Milestones.	**06**
Unit 2	**Microbial Metabolism and Growth Kinetics:** Overview of Microbial Metabolism, Microbial Growth Phases, Kinetics of Microbial Growth and Death kinetics, Enzyme Kinetics.	**07**
Unit 3	**Industrial Microorganisms and Strain Development:** Characteristics and Selection ,Techniques for Strain Improvement, Maintenance and Preservation	**06**
Unit 4	**Design and Operation of Fermentation Processes:** Types and Design of Bioreactors, Fermentation Systems, Scale-Up Principles, Instrumentation and process Control.	**06**
Unit 5	**Fermentation Media and Sterilization:** Components of Fermentation Media, Media Preparation and Formulation, Media and Air Sterilization, Additional Considerations.	**07**
Unit 6	**Downstream Processing and Applications**: Techniques for Recovery and Purification, Product Recovery, Applications in Food Industry, Quality Control and Economic Considerations, Principles of over production of metabolites.	**07**

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TY-FT-10/46

Course Contents: Minimum 10 experiments from following list	
Expt. No.	**Title of Experiment**
1	Study of instrumentation and process control in fermentation.
2	Study of different parts of laboratory and commercial fermentors.
3	Measurement of microbial growth during fermentation.
4	Assessment of amylase activity from a given samples.
5	Study of alcohol production through bioconversion.
6	Formulation and sterilization of fermentation media.
7	Study of Filtration and centrifugation for extracellular product recovery.
8	Cell disruption methods and product extraction.
9	Study of thermal stability of peroxidase enzyme.
10	Determination of cell turbidity using colorimeter.
11	Determination of reducing sugar levels during fermentation
12	Isolation of lactobacilli from fermented food product

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Bioprocess Engineering Principles	P. M. Doran	Academic Press	2nd	2012
2	Biotechnology: A Textbook of Industrial Microbiology	W. Crueger, A. Crueger	Sinauer Associates	2nd	1989
3	Principles of Fermentation Technology	P. F. Stanbury, A. Whitaker	Butterworth-Heinemann	3rd	2016
4	Bioprocess Engineering: Basic Concepts	M. L. Shuler, F. Kargi	Prentice Hall	2nd	2002
5	Principles of Fermentation Technology	P. F. Stanbury, A. Whitaker	Butterworth-Heinemann	3rd	2016
6	Fermentation Microbiology and Biotechnology	M. El-Mansi, C. Bryce	CRC Press	3rd	2011

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TY-FT-11/46

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Fermentation Microbiology and Biotechnology	M. El-Mansi, C. Bryce	CRC Press	3rd	2011
2	Industrial Microbiology: An Introduction	M. J. Waites, N. L. Morgan	Blackwell Science	1st	2001
3	Fermentation and Biochemical Engineering Handbook	H. C. Vogel, C. L. Todaro	Noyes Publications	2nd	1996
4	Biochemical Engineering Fundamentals	J. E. Bailey, D. F. Ollis	McGraw-Hill	2nd	---
5	Comprehensive Biotechnology	M. Moo-Young	Elsevier	2nd	---

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TY-FT-12/46

ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA

(An Autonomous Institute)

Department of Food Technology

Course Details:

Class	**Third Year B. Tech** Semester-V
Course Code and Course Title	1FTPE305 – **Nutrition** **(Professional Elective-II))**
Prerequisite/s	0FTPC205- Food Chemistry and Micronutrients 0FTPC208- Food Microbiology
Teaching Scheme: Lecture/Tutorial/Practical	03/00/02
Credits	04
Evaluation Scheme: (T) ISE/MSE/ESE	40/30/30
Evaluation Scheme: (P) ISE/ESE	50/50

Course Outcomes : After successful completion of this course, students will able to	
1FTPE305_1	Understand the fundamental principles of nutrition.
1FTPE305_2	Adapt metabolism of carbohydrates, lipids, and proteins.
1FTPE305_3	Demonstrate knowledge of micronutrients and their role in human health.
1FTPE305_4	Apply principles of diet therapy and therapeutic nutrition in personalized medicine.

Course Contents:		**Hrs.**
Unit 1	**Introduction to Nutrition:** Food Composition and Nutrients, Food Exchanges and Measures: Tools for dietary planning. Energy Value of Foods: Bomb calorimeter, physiological fuel value, estimation from proximate composition, Basal Metabolic Energy (BME): Factors affecting BME, calorie needs, physical activity, diet-induced thermogenesis, Energy Imbalance and Body Weight Regulation, Nutrition Through Lifecycle: Nutritional requirements at different life stages.	**07**
Unit 2	**Carbohydrates and Lipids:** Role of Carbohydrates, Dietary Fiber, Resistant Starch, Carbohydrates as Prebiotics, Glycemic Index and Load: Importance in dietary planning ,Role of Lipids: Nutritionally important lipids, physiological functions ,Digestion and Absorption of Lipids , Essential Fatty Acids	**07**
Unit 3	**Proteins and Amino Acids:** Role of Proteins: Essential/non-essential amino acids, complete/incomplete proteins, limiting amino acid, complementary proteins ,Physiological Functions, Daily Protein Requirements, Digestion, Absorption, and Utilization of Proteins , Protein Deficiency (PEM/PCM), Protein Quality: Concept and estimation methods (in vitro and in vivo).	**07**

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TY-FT- 13/46

Unit 4	**Micronutrients and Water:** Role of Micronutrients: Vitamins and minerals, physiological roles, deficiency diseases, food sources, Factors Affecting Bioavailability and RDA's ,Role of Water in Nutrition.	**06**
Unit 5	**Diet Therapy and Therapeutic Nutrition:** Principles of Diet Therapy and Therapeutic Nutrition, Formulation of Diets for Special Needs, Techniques of Diet and Health Surveys, Assessment of Nutritional Status.	**06**
Unit 6	**Food Processing and Nutrition:** Effect of Food Processing, Preservation, and Storage on Nutritional Quality, Sports Nutrition, Nutritional Labeling of Foods, Nutraceuticals and Functional Foods ,Fortification: Chemical and biofortification methods.	**06**

Course Contents: Minimum 10 experiments from following list.	
Exp. No	**Title of Experiment**
1	Determination of reducing sugars.
2	Estimation of Vitamin C in food samples.
3	Analysis of Mineral Content in Food Samples
4	Determination of dietary fiber in food sample.
5	In vitro digestion of proteins.
6	Study of lipase activity.
7	Determination of Amylase activity.
8	Estimation of Basal metabolic rate.
9	Preparation of geriatric food product.
11	Formulation and Preparation of Balanced Diet Plans
12	**Micro-project**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Nutrition Science	B. Srilakshmi	New Age International	5th	2019
2	Essentials of Human Nutrition	J. Mann, A. S. Truswell	Oxford University Press	5th	2017
3	Advanced Nutritionand Human Metabolism	S. Sareen, D. Ensminger	Wadsworth Publishing	7th	2018
4	Understanding Nutrition	E. Whitney, S. Rolfes	Cengage Learning	14th	2018

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Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Modern Nutrition in Health & Disease	M. E. Shils, J. A. Olson, M. Shike, A. C. Ross	Jones & Bartlett Learning	Subsequent	1999
2	Food, Nutrition and Diet Therapy	Krause and Mahan	W.B. Saunders	-	1996
3	Nutritive Value of Indian Foods	C. Gopalan, B. V. Rama Sastri, S. C. Balasubramanian	National Institute of Nutrition	-	1989
4	Introduction to Human Nutrition	Gibney, Lahnam-New, Cassidy and Vorster	Wiley Blackwell	2nd	2009
5	Molecular Basis of Human Nutrition	Sanders and Emery	Taylor & Francis	-	2003
6	Principles of Human Nutrition	M. Eastwood	Blackwell Science	-	2003

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TY-FT-15/4C

ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA
(An Autonomous Institute)
Department of Food Technology

Course Details:

Class:	**Third Year B. Tech** Semester - V
Course Code and Course Title:	1FTPE306- **Instrumentation and Process Control (Professional Elective-II)**
Prerequisite/s:	Food Engineering-I Food Engineering-II
Teaching Scheme: Lecture/Tutorial/Practical	03/00/02
Credits	04
Evaluation Scheme: (T) ISE/MSE/ESE	40/30/30
Evaluation Scheme: (P) ISE/ESE	50/50

Course Outcomes: After successful completion of this course, students will able to	
1FTPE306 _1	Understand basic principles & importance of process control in industrial process plants
1FTPE306_2	Evaluate concepts of measurement and sensor selection to specify, install, configure and calibrate.
1FTPE306_3	Apply the measurement techniques for Pressure and Level, Flow and other measurements and basic process control aspects.
1FTPE306_4	Understand basic principles & importance of process control in industrial process plants

Course Contents:		**Hrs.**
Unit 1	**Fundamentals of Process Instrumentation** Need and scope of process instrumentation, Elements of instruments, Static and dynamic characteristics of instrument, Error analysis and its calibration. Transducer elements (types and classification). **Temperature Measurement:** Introduction, classification, temperature scales (units), mechanical temperature sensors (filled- system thermometers, expansion thermometers), electrical temperature sensors (RTD, thermistors, thermocouples), radiation pyrometer, Mercury thermometers, Bimetal thermometers, Capillary type thermometers, Recording thermometers, Thermocouples, Resistance thermometers, thermister.	07
Unit 2	**Pressure Measurement:** Introduction, classification, low , medium, and high pressure measuring instruments, pressure scales (units), manometers, elastic element pressure gauges with pressure equations (using bourdon tube, diaphragms, capsule, and bellows), **Level Measurement:** Introduction, classification, direct methods (point contact methods, sight or gauge glass methods, buoyancy methods using floats and displacers), indirect methods (hydrostatic pressure methods, capacitance methods, radiation methods, ultrasonic methods , weighing method, sonic methods)	07

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TY-FT-16/46

Unit 3	**Flow Measurements:** Head flow meters, open channel meters, area flow meters, flow of dry materials, viscosity measurement. **Miscellaneous Measurements:** Weight measurement - Mechanical scale, Electronic tank scale, Conveyor scale and measurement of specific gravity, Measurement of humidity, Measurement of density, Automatic valves.	06
Unit 4	**Process Control:** Introduction, Classification of process variables, selection of controlled variable , manipulated variables , disturbance or load variables, block diagram with essential variables and instrument elements Dynamic behavior of simple process, Process control hardware, Transfer functions and the input output models,	06
Unit 5	**Industrial process control Systems:** Control system symbols used in process and instrumentation (P&ID) diagrams and drawings, basic regulatory control loops for controlling temperature of liquid heated in stirred-tank heater using electrical (or steam) heating, pressure of air/ gas in pressure vessel, level of liquid inside surge vessel, 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.	07
Unit 6	**Feedback Control Schemes:** Introduction to feedback control system, Dynamics and analysis of feedback-controlled processes, Stability analysis, Introduction to controllers. Control systems with multiple loops, Feed forward and ratio control.	06

Course Contents: Minimum 10 experiments from following list

Expt. No	Title of Experiment
1	Measurement of basic quantities using static and dynamic instruments.
2	Measurement of temperature using 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.
9	Measurement of pH value.
10	Study of controllers.
11	Calibration of thermocouple.
12	Micro Project

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TY-FT-17/46

Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Principles of Industrial Instrumentation	Patranabis, D.	Tata McGraw Hill PublishingCompany	2nd	2008
2	Industrial Instrumentation	Eckman, D. P.	Wiley Eastern Ltd.	3rd	2009
3	Process Control Instrumentation Technology	Johnson C.D.	PrenticeHall of India.	8th	2014
4	Fundamentals of Industrial Instrumentation and Process Control	Dunn, W.C.	Tata McGraw-Hill Education Private Limited	1st	2009

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Transducers and Instrumentation	Murty, D.V.S.	Prentice Hall of India.	2nd	2008
2	Process system analysis and control	Donald, R.C. and LeBlanc, S.E.	McGraw-Hill	3rd	2009
3	Chemical process control: an introduction to theory and practice	Stephanopoulos, G.	Pearson Education India	1st	2015

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TY-FT-18/46

ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA
(An Autonomous Institute)
Department of Food Technology

Course Details:

Class:	**Third Year B. Tech** Semester - V
Course Code and Course Title:	1FTFE307, **Minor course - II Food Analytical Techniques**
Prerequisite/s:	Chemistry-I, Chemistry-II, Food Analysis
Teaching Scheme: Lecture/Tutorial/Practical	03 / 00/00
Credits:	03
Evaluation Scheme: (T) ISE/MSE/ESE	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
1FTFE307-1	Summarize the significance, purpose and principle of food analysis using instruments.
1FTFE307-2	Analyze appropriate analytical techniques for specific food components.
1FTFE307-3	Compare advanced and conventional techniques and instruments to analyze chemical and physical properties of foods.
1FTFE307-4	Adapt the appropriate detection technique for a range of analytes and contaminants in food.

Course Contents:		**Hrs**
Unit 1	**Sampling and its techniques**: Introduction - definitions of population, laboratory sample, sample, precision, accuracy, sensitivity, reproducibility of analysis, basic principles of spectrophotometer, colorimeter and its application.	**06**
Unit 2	**Carbohydrate analysis - I**: Introduction, importance of carbohydrate analysis, methods of analysis, sample preparation, extraction of monosaccharide, oligosaccharides, chemical methods for carbohydrates - gravimetric methods, titrimetric methods.	**07**
Unit 3	**Carbohydrate analysis – II:** Colorimetric methods: phenol sulphuric acid, enzymatic methods, physical methods: polarimetric method, density, infrared radiation,immuno assays, analysis of starch and crude fiber.	**06**
Unit 4	**Protein analysis**: Protein concentration by kjeldhal method, enhanced dumas method usingu. V. Visible spectroscopy, direct measurement at 280 nm, biuret method, lowry method, dye binding method, turbido metric method.	**07**

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TY-FT-19/46

Unit 5	**Lipid analysis:** Basic principles of chromatography, types of chromatography and its applications, analysis of lipids: introduction, importance of analysis of lipids, solvent extraction, non-solvent extraction methods, instrumentation methods, determination of lipid composition: separation and analysis by chromatography, lipids fractions of TLC.	**07**
Unit 6	**Chemical techniques**: Analysis of minerals: introduction, importance, principle and working of mineral analysis, dry ashing, wet ashing, low plasma ashing, adsorption spectroscopy.	**06**

Text books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food Analysis and Quality Control.	M. Kalia	Kalyani Publishers, New Delhi	1	2002
2	Biochemical & Molecular biology techniques	Wilson& Walker	Cambridge University Press	6	2010
3	Separation Methods in Biochemistry 2nd Ed	Morris, C.J. and Morris, P.	Pitman Pub., London	4	2012
4	Methods in Food Analysis	Joslyn, M.A.	Joslyn, M.A.	7	2006

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food Analysis: Theory and practice	Y. Pomeranz and C.E. Meloan	A.V.I Publishing Company	3	2014
2	Instrumental methods for chemical analysis	Willard H. W. & Meritt L. L.	East West Publications	7	1998
3	Bioinstrumentation and Biosensors	Wise, Donald L.	Marcel Dekker Inc	1	1991

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TY-FT-20/46

ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA

(An Autonomous Institute)

Department of Food Technology

Course Details:

Class:	**Third Year B. Tech** Semester - V
Course Code and Course Title:	1FTFP308 – **Minor course - II** **Food Engineering Operations**
Prerequisite/s:	1FTPC203- Unit Operations 1FTPC211- Food Engineering-I
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits:	03
Evaluation Scheme:(T) ISE/MSE/ESE	40/30/30

Course Outcomes: After successful completion of this course, students will able to	
1FTPC302_1	Apply concept of unit operations to food processing operations by using different techniques
1FTPC302_2	Identify the different size reduction equipment's used in food industries for economical process
1FTPC302_3	Analyze proper used of homogenization and pasteurization for effective processing of raw materials
1FTPC302_4	Classify centrifugation and filtration based on the separation of different food products

Course Contents:		**Hrs.**
Unit 1	**Introduction:** Food engineering operations, classifications, batch and continuous process, heat and mass transfer in unit operations, applications in food industries.	**06**
Unit 2	**Size Reduction Operations:** Introduction to size reduction, Size reduction equipment's: Crushers, Grinders, Hammer mill, Ball mill, cutting machines, Size reduction laws, Crushing efficiency	**07**
Unit 3	**Homogenization:** definition, milk homogenization, types of homogenizers, engineering aspects of a homogenizer, homogenizer for cream, butter and ghee.	**07**
Unit 4	**Pasteurization:** Definition, types of pasteurizers: HTST, LTLT, UHT, process flow diagram of pasteurization, conditions of pasteurization, applications in food industries	**06**
Unit 5	**Centrifugation:** Introduction to centrifugation, principle of centrifugation, components of centrifuge, centrifugation equipments: low speed, high speed and ultracentrifuge, applications in food industries.	**06**
Unit 6	**Filtration:** Introduction, types of filtrations, constant rate filtration, filter medium and its characteristics, filter Aids, factors affecting rate of filtration, filtration equipment's: Batch, continuous, vacuum and centrifugal, filtration in milk industries.	**07**

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TY-FT-21/46

Course Details:

Class	**Third Year B. Tech** Semester - V
Course Code and Course Title	1FTHS309 - Entrepreneurship
Prerequisite	NIL
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme : (P) ISE	25

Course Objectives:

1. This course aims to equip engineering students with the knowledge and skills to identify opportunities, develop innovative solutions, and launch successful engineering-based ventures.

Course Outcomes: After successful completion of this course, students will able to	
1FTHS309_1	Identify and evaluate potential business opportunities in the engineering domain.
1FTHS309_2	Conduct market research and analyze the competitive landscape.
1FTHS309_3	Craft a comprehensive business plan, including financial projections.
1FTHS309_4	Understand the fundamentals of marketing, sales, and operations for engineering ventures.
1FTHS309_5	Pitch their business ideas to potential investors.
1FTHS309_6	Grasp the legal and ethical considerations of starting a business.

Course Contents:	
1	The Entrepreneurial Ecosystem
2	Idea Identification and Prototyping
3	Testing, Validation and Commercialization
4	Market Analysis and Competitive Landscape
5	Legal Procedure to setup an Startup Business
6	Understanding Finance Basics
7	Business Planning and Development
8	Marketing and Sustainability
9	Pitching and Fundraising
10	Startup Case Studies

Assessment Activities:

Assessment 1	Business Plan
Assessment 2	Peer Review of Business Plan
Assessment 3	Elevator Pitch Competition
Assessment 4	Shark Tank" Simulation

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Reference Materials:

1. https://www.startupindia.gov.in/content/sih/en/international/go-to-market-guide/indian-startup-ecosystem.html
2. https://www.startupindia.gov.in/content/sih/en/learning-and-development_v2.html
3. https://onlinecourses.nptel.ac.in/noc24_mg93/preview

Assessment Modes:

Sr. No	Method/ Technique	Course Outcomes						Marks		Weightage
		1	2	3	4	5	6	Max	Min	
1	ISE : BP	☑	☑	☑	☑	☐	☑	10	20	20 %
2	ISE : PR	☑	☑	☑	☑	☐	☑	10		20 %
3	ISE : EPC	☑	☑	☐	☑	☑	☐	10		20 %
4	ISE : STS	☑	☑	☑	☑	☑	☑	20		40 %

- ISE - In-Semester Examination,
- BP - Business Plan, PR - Peer Review of Business Plan
- EPC - Elevator Pitch Competition, STS - "Shark Tank" Simulation

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TY-FT-23/46

ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA

(An Autonomous Institute)

Department of Food Technology

Course Details:

Class	**Third Year. B. Tech, Semester–V**
Course Code and Course Title	1FTEL310 –**Industrial Training/Internship**
Prerequisite/s	1FTEL219-Innovation/Prototype
Teaching Scheme: Practical	02
Credits:	01
Evaluation Scheme: (P) ISE	50

Course Outcomes: After completing this course students will be able to	
1FTEL310_1	Apply knowledge of food engineering
1FTEL310_2	Design problem statement
1FTEL310_3	Carry out material and energy balance calculations of selected problem
1FTEL310_4	Use modern tools to solve problem
1FTEL310_5	Prepare a project report
1FTEL310_6	Present the solution of problem effectively

Guidelines for Industrial Training/Internship
Students should undergone internship in food process industry for minimum period of 15 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. Oral examination/presentation will be conducted for evaluation.

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TY-FT-24146

ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA

(An Autonomous Institute)

Department of Food Technology

Course Details:-

Class	**Third Year B. Tech** Semester - V
Course Code and Course Title	1FTCC311 Aptitude and Reasoning Part-III
Prerequisite/s	-
Teaching Scheme: Lecture/Tutorial /Practical	02
Credits	01
Evaluation Scheme: (P) ISE	50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to	
1FTCC311_1	**Solve** problem based on basic and advance Permutation and Combination
1FTCC311_2	**Solve** problem based on Probability, Application of Probability, Cubes, Dices, cube painting and Syllogism
1FTCC311_3	**Solve** problem based on Mensuration 3D, Circle & Triangle
1FTCC311_4	**Demonstrate** on Resume writing skill, closed, advanced grammar, Synonyms and Antonyms

Course Contents:		
Unit No.	**Title**	**Hrs.**
Unit 1	• Basic Permutation and Combination • Advance Permutation and Combination	**04 Hrs.**
Unit 2	• Probability • Application of Probability	**04 Hrs.**
Unit 3	• Cubes, Dices & cube painting • Syllogism	**04 Hrs.**
Unit 4	• Mensuration 3D • Circle & Triangle	**04 Hrs.**
Unit 5	• Resume writing & resume making • Interview Techniques	**04 Hrs.**
Unit 6	• Closed Test & advanced Grammar • Synonyms & Antonyms	**04 Hrs.**

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TY-FT-25/46

Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Quantitative Aptitude for Competitive Examinations	R.S. Agarwal	S Chand	Revised	2022
02	A Modern Approach to Verbal & Non-Verbal Reasoning	R.S. Agarwal	S Chand	Revised	2024
03	English Grammar And Composition	P C Wren, H Martin	S Chand	2nd	2019

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Annasaheb Dange College of Engineering and Technology Ashta
Department of Food Technology
Teaching and Evaluation Scheme

T. Y. B. Tech Semester VI																			
Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
1ILOE***	Open Elective – II	3	-	-	3	50	20	-	-	-	50	20	-	-	-	-	-	-	50
1FTPC312	Food Packaging Technology	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
1FTPC313	Beverage Technology	3	-	2	4	40	16	30	30	24	100	40	50	20	50	20	100	40	200
1FTPE***	Professional Elective-III	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
1FTVS317	Bakery and Confectionary Technology	2	-	2	3	40	16	30	30	24	100	40	50	20	50	20	100	40	200
1FTFE/FP***	Minor Course - III	3	-	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
1FTEL320	Mini Project	-	-	4	2	-	-	-	-	-	-	-	50	20	50	20	100	40	100
1FTCC321	Aptitude and Reasoning Part - IV	-	-	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
		17	0	10	22														900
	Total Contact Hours				27														

Professional Elective - III		Minor Course - III	
1FTPE314	Flavour Technology	1FTFE318	Introduction to Plant Design and Process Engineering
1FTPE315	Food Additives	1FTFP319	Nanotechnology in Food Industry
1FTPE316	Plant Design and Process Engineering		

Head of Department

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TY-FT-27/46

Course Details:

Class	**Third Year B.Tech** Semester- VI
Course Code and Course Title	1FTPC312, **Food Packaging Technology**
Prerequisite/s	-
Teaching Scheme: Lecture/Tutorial/Practical	03 / 00/00
Credits	03
Evaluation Scheme:(T) ISE/MSE/ESE	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
1FTPC312-1	To study basic packaging materials, their properties, types of packaging, sealing and lamination process.
1FTPC312-2	To study newer packaging technologies used for food products.
1FTPC312-3	To Evaluate packaging material for different food and beverage types.
1FTPC312-4	To study packaging of soft drink and alcoholic beverages.
1FTPC312-5	To apply the packaging laws, regulations and appropriate packaging machineries for food industries.

Course Contents:		**Hrs**
Unit 1	**Introduction:** Basic concept of packaging, functions of a food package, package development factors, food package development, current status and trends in food packaging in India and abroad.	06
Unit 2	**Packaging materials:** Metal containers made up of tin-plate, tin free steel, aluminum. Protective lacquers and coatings for metal containers. Glass containers and closures. Paper and paper-based packaging materials. Plastic polymers and plastic based flexible and rigid packaging materials.	07
Unit 3	**Special packaging:** Gas, vacuum and aseptic packaging, MAP, CAS, advances in food packaging: Smart packaging, Intelligent Packaging, Active Packaging and Antimicrobial packaging, Retortable pouches, biodegradable and edibles packaging materials and films.	07
Unit 4	**Evaluation of packaging material:** Destructive and non-destructive test, testing of rigid, semi rigid and flexible packaging material, shelf-life study etc. corrosion and toxicity of packaging material.	07
Unit 5	**Packaging laws and regulations:** Printing techniques; Package labeling: functions and regulations; Environmental aspect of food packaging, Bar coding.	06

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TY-FT-28/46

Unit 6	**Packaging machinery:** Types of packaging machineries, form fill and seal machine, liquid filling machine, vacuum packaging machinery and other advance machineries.	6

Text books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Food Packaging Principles and Practices.	G. L. Robertson, Marcell Decker	CRC Press	3	2012
2	Innovations in Food Packaging.	Jung H. Han	Elsevier Ltd.	2	2014
3	Food Packaging Technology.	R. Coles, D. McDowell and M. J. Kirwan	2003 by Blackwell Publishing Ltd, CRC Press	2	2003

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Packaging for Nonthermal Processing of Food.	Melvin A. Pascall, Jung H. Han	Publishing Ltd., Oxford, UK.	2	2018
2	Novel Food Packaging Techniques	R. Ahvenainen	Woodhead Publishing	1	2003
3	Hand Book of Canning and aseptic Packaging	S. Ranganna	Tata McGraw Hill, Delhi	1	2000

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TY-FT-29/46

Course Details:

Class	**Third Year B.Tech** Semester- VI
Course Code and Course Title	1FTPC313, **Beverage Technology**
Prerequisite/s	Food Microbiology
Teaching Scheme: Lecture/Tutorial/Practical	03 / 00/02
Credits	04
Evaluation Scheme:(T) ISE/MSE/ESE	40/30/30
Evaluation Scheme:(P) ISE/ESE	50/50

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
1FTPC313-1	Be able to understand various concepts, principles and procedures involved in processing of beverages.
1FTPC313-2	Demonstrate various unit operations involved in the food beverage manufacturing.
1FTPC313-3	Able to understand production of carbonated and non-carbonated beverages.
1FTPC313-4	To adapt to newer technologies in brewing and fermentation.
1FTPC313-5	To apply the knowledge of quality control for wine and beverage industries.

Course Contents:		**Hrs**
Unit 1	**Introduction:** Classification, production and consumption of beverages- Alcoholic beverages & non- alcoholic beverages- carbonated and non-carbonated. Concept of fermentation for production of beverages- Raw materials, equipment, quality control and legislation of beverage products.	07
Unit 2	**Coffee and tea processing:** Coffee-Production practice, processing of coffee beans into powder, instant coffee, decaffeination- Tea-Leaf processing, various classes of tea, changes during processing of tea leaves, instant tea.	06
Unit 3	**Fruit juices:** Fruit Juices Squashes & Cordials: Equipment for fruit juices, double operations process- Pulping equipment, flash pasteurization, fruit beverage -preparation & preservation- Straining, filtration & clarification - Preservation of fruit juices preservation by addition of sugar, freezing, by carbonation & by filtration.	07
Unit 4	**Chemistry of fermentation:** composition of wine - mold & yeast of grape & wine- Production of red & white table wine, production of sherry sparkling wine, dessert wine vermouth wine, flavored wine, fruit wine etc- Non-bacterial & bacterial spoilage of wine- winery by-products.	07
Unit 5	**Brewing:** Fermented Beverages: Beer –Brewing, raw material & manufacture, storage finishing & packaging- Brandy & whisky production - Definition, compounds & methods for manufacturing.	06

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TY-FT-30/46

Unit 6	**Quality control in wine and beverage industry:** Effective application of quality controls, brix, acidity to brix ratio, single strength of juice- sanitation and hygiene in beverage industry-Quality of water used in beverages - threshold limits of various ingredients according to PFA, EFSA and FDA – Absolute requirements of Soluble solids and titrable acidity in beverages	06

Course Contents: Minimum 10 experiments from following list

Expt. No	Title of Experiment
1	Preparation of fruit squash
2	Preparation of cordial
3	Preparation of ready to serve beverage
4	Preparation of fruit nectar AND SHARBETS
5	Preparation of fruit sharbets
6	Preparation of fruit-based carbonated drinks
7	Determination of Caffeine (Spectrophotometric Method)
8	Determination of Crude Fibre in Tea
9	Determination of Total acidity (as tartaric acid)
10	Preparation of Grape Wine and sensory analysis
11	Detection of malo-lactic fermentation
12	Micro-project

Text books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Chemistry and technology of soft drink and fruit juices	G. L. Robertson, Marcell Dècker	Blackwell Publishing Ltd	2	2005
2	Food, fermentation and microorganisms	Charles,W.Bamforth	Blackwell Science Publishing Ltd.	3	2016
3	Wine and Beverage Technology	J. R. Piggott	Tata McGraw Hill Publishing Company	2nd	1999
4	"Wine Technology: AGuide to the Winemaking Process"	Robert W. Hodgson	Springer	1st	2015

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TY-FT-31/46

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Brewing: Science and Practice	P. R. Hird, S. J. Taylor, and A. M. Thompson	Woodhead Publishing (an imprint of Elsevier)	4	2015
2	Beverages: Emerging Issues, Challenges and Innovations	C. A. Brannan and J. E. Kinsella	Academic Press (an imprint of Elsevier)	1	2019
3	Hand Book of Canningand aseptic Packaging	S. K. Singh and K. K. Singh	Tata McGrawHill, Delhi	2	2015

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TY-FT-32/46

Course Details:

Class:	**Third Year B.Tech** Semester- VI
Course Code and Course Title:	1FTPE314- **Flavour Technology (Professional Elective-III)**
Prerequisite/s:	0FTPC205- Food Chemistry and Micronutrients 0FTPC208- Food Microbiology
Teaching Scheme: Lecture	03
Credits:	03
Evaluation Scheme:(T) ISE/MSE/ESE	40/30/30

Course Outcomes: After successful completion of this course, students will able to	
1FTPE314_1	Understand the Fundamentals of Flavour Production and Processing
1FTPE314_2	Analyze Flavour Compounds and their Biogenesis
1FTPE314_3	Develop Skills in Flavour Extraction and Analysis Techniques
1FTPE314_4	Apply Knowledge of Flavour Formulation and Sensory Evaluation

Course Contents:		**Hrs.**
Unit 1	**Introduction to Flavour Technology:** **Production and Processing Scenario of Flavours** Overview of the flavour industry, Current trends in flavour production and processing, Economic and market perspectives.	05
Unit 2	**Sources and classification of Flavors:** Natural and synthetic flavourings, Classification: Natural, processed, and added flavours, Characteristics and applications. Natural sources: Plant, animal, microbial. Processed sources: Heat-treated, fermented. Added flavours: Artificial, synthetic, Flavours from specific sources: Vegetables, cocoa, chocolate, coffee, vanilla beans, spices ,Flavour composites: Natural, semi-synthetic, and synthetic ,Flavour production in fermented foods.	07
Unit 3	**Biogenesis and Stability of Flavours:** **Biogenesis of Flavours** :Biochemical pathways and precursor compounds, Flavour formation in natural and processed foods , Mallaird reaction: Mechanism and contribution to flavour, Lipid oxidation: Pathways and impact on flavour, Enzymatic and non-enzymatic reactions **Stability of flavours during food processing**: Factors affecting flavour stability Techniques to preserve flavour stability during processing.	07
Unit 4	**Extraction and Analysis of Flavour Components:** Extraction Techniques: Solvent extraction, distillation, supercritical fluid extraction, Conditions and extracting agents, Factors affecting extraction efficiency. Analysis of Flavour Components: Subjective methods, Sensory evaluation, flavour profile analysis. Objective methods: Chromatography, spectroscopy, mass spectrometry, Integration of subjective and objective analyses, Sample handling, artefacts, and data handling, Evaluation tests for flavours.	08

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TY-FT-33146

Unit 5	**Flavour perception and sensory analysis:** Smell and taste sensation, olfaction, Flavour compounds and volatile flavour compounds ,Chemesthesis and chemesthetic responses ,Tactile response and aroma compounds ,Flavour profile, bio-flavour, and reconstituted flavour ,Psychophysics and sensory evaluation. Instrumental Analysis :Instrumental methods for flavour analysis ,Sample handling and artefacts , Data handling and interpretation	07
Unit 6	**Applications of Flavoring agents** Principles of flavour formulation, Role of flavourists in product development ,Challenges in flavour stability and consistency. Industry-Specific Flavours: Flavours in soft drinks: Types, formulation, stability ,Baking and confectionery: Key flavour profiles, formulation challenges ,Standards and specifications for industrial flavours.	05

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Food Flavorings	Ashurst, P.R.	Blackie	2nd	1994
2.	Fenaroli's Handbook ofFlavor Ingredients	Burdock, G.A.	CRC Press	5th	2004
3.	Handbook of Flavor, Characterization: SensoryAnalysis, Chemistry and Physiology	Deibler, D. & Delwiche, J.	Marcel Dekker	-	2004
4.	Flavor Chemistry and Technology	Heath, H.B. & Reineccius, G.	AVI Publ	-	1986
5.	Food Flavour Technology	Taylor, A.	Sheffield Academic Press	-	2002

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Food Flavours: Biology and Chemistry	Fisher, C., & Scott, T.R.	The Royal Society of Chemistry	-	1997
2.	Flavor Chemistry and Technology	Heath, H.B., &Reineccius, G.	CBS Publishers	-	1996
3.	Sweeteners and Sugar Alternatives in Food Technology	O'Donnell, K., et al.	Wiley & Sons	-	2012
4.	Flavor Chemistry and Technology	Reineccius, G.	CRC Press	2nd	2016
5.	Food Flavourings	Ashurst, P.R.	Aspen Publications	3rd	1999
6.	Flavour Chemistry of Ethnic Foods	Shahidi, F., & Ho, C.T.	Kluwer Academic Plenum	-	1999

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Course Details:

Class:	**Third Year B.Tech** Semester- VI
Course Code and Course Title:	1FTPE315–**Food Additives (Professional Elective-III)**
Prerequisite/s:	1FTPE214- Food chemistry, and Micronutrients 1FTPC209- Processing of Fruit and Vegetable
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits:	03
Evaluation Scheme: :(T) ISE/MSE/ESE	40/30/30

Course Outcomes: After successful completion of this course, students will able to	
1FTPE315_1	Study different types of food additives used in Food industry.
1FTPE315_2	Understand various applications of colors and flavour in food industry.
1FTPE315_3	Evaluate the emulsifiers and stabilizers for specific food groups.
1FTPE315_4	Study safety and regulatory aspects of additives.

Course Contents:		**Hrs**
Unit 1	**Introduction:** Definition, function in processing and preservation; classification; natural preservatives; chemical preservatives; Permitted preservatives in foods and regulations.	**06**
Unit 2	**Food colors and flavours:** Natural and synthetic colors; applications in food industry, Effect of processing on pigments, and their retention, Regulatory aspects. Flavouring agents – chemistry of flavouring compounds, Classification, Application of flavours in foods, Sensory assessment of flavours	**07**
Unit 3	**Food Sweeteners:** 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; Role in food processing, Antioxidants & its application in foods.	**07**
Unit 5	**Anti-caking agents and Humectants:** Introduction; Different Anti-caking agents and Humectants; Role in food processing. Antimicrobial agents, Clarifying agents, antifoaming agents	**06**
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.	**06**

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TY-FT-35/46

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	5th	1995
2.	Food Additive	R. M. Pandey and S. K. Upadhyay	In Tech	1st	2012
3.	Essential guide to food additives	Victoria Emerton and Eugenia Choi	Leatherhead Food International Ltd	3rd	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	5th	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 Otles	Taylor & Francis Group, LLC CRC Press	2nd	2012

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TY-FT-36/46

Course Details:

Class:	**Third Year B. Tech.** Semester - VI
Course Code and Course Title:	1FTPE316 **Plant Design and Process Engineering (Professional Elective-III)**
Prerequisite/s:	Food Engineering-I Food Engineering-II
Teaching Scheme: Lecture	03
Credits:	03
Evaluation Scheme:(T) ISE/MSE/ESE	40/30/30

Course Outcomes: After successful completion of this course, students will able to	
1FTPE316_1	Analyze alternative processes and equipment for manufacturing a product.
1FTPE316_2	Design plant layout and engineering flow diagrams.
1FTPE316_3	Perform economic analysis related to process design.
1FTPE316_4	Evaluate project profitability.

Course Contents:		**Hrs.**
Unit 1	**Process Development :** Process selection, study of alternative processes, pilot plant, flow sheet preparation, Plant Design: Design basis, specification material of construction, plant location, plant layout and installation, safety, start up, shutdown and operating guidelines.	07
Unit 2	**Cost Engineering :** Time value of money and equivalence, Capital Investment and working Capital. interest-simple, compound and continuous, annuities, perpetuities and capitalized cost methods, depreciation, nature of depreciation, methods of determining depreciation	07
Unit 3	**Cost Estimation:** Cash flow for industrial operations, capital investments, start-up costs, process equipment cost estimation, cost index, estimation of total product cost, manufacturing cost, general expenses. Profitability: Criteria of profitability, payout period, return on investment, present value, cash flow analysis, alternative investment analysis.	07
Unit 4	**Economic Optimization and Optimum Design:** Nature of optimization, optimum conditions, break even chart for production schedule, optimum production rates in plant operation, optimum conditions in batch and cyclic operation. project scheduling and its importance.	06
Unit 5	**Design Report:** Types of Reports, Organization of reports, physical process of preparing a report, Tables, Graphs, Illustrations, References to Literature, Sample Calculations, Mechanical Details, Nomenclature, Check list for final report.	06
Unit 6	**Scheduling and Networking of Project:** Role of project engineering in project organization, start up and shut downs of project; preliminary data for construction projects; process engineering; plot plans, scheduling the project.	06

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TY-FT-37/46

Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Plant Design and economics for chemical engineers	M. S. Peters & K. D. Timmerhaus	Mc Graw Hill	3rd	2002
2	Analysis, Synthesis and Design of Chemical Processes	Richard Turton, R.C. Bailie, W.B. Whiting, J.A. Shaeiwitz	Prentice Hall	--	--
3	Optimization For Engineering Design-Algorithms and Examples	Kalyanmoy Deb	PHI Learning Private Limited	--	--

Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Cost and Optimization Engineering	Kenneth Humphreys	McGraw Hill College,	3rd	1991
2	Project Management with CPM and PERT	Joseph Moder	Van Nostrand Reinhold	3rd	1983

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TY-FT-38/46

Course Details:

Class:	**Third Year B. Tech.** Semester - VI
Course Code and Course Title:	1FTVS317- **Bakery and Confectionary Technology**
Prerequisite/s:	FTPC303-Processing of cereal pulses and oilseeds, 1FTPC204-Principles of food processing, 1FTPC105-Food Science
Teaching Scheme: Lecture/Practical	02/02
Credits:	03
Evaluation Scheme: (T) ISE/MSE//ESE	40/30/30
Evaluation Scheme: (P) ISE/ESE	50/50

Course Outcomes: After completing this course students will be able to	
1FTVS317_1	Evaluate the basic composition and physico-chemical properties of wheat.
1FTVS317_2	Understand functions of various ingredients and process of bakery products.
1FTVS317_3	Study various ingredients used in confectionary products and cocoa processing
1FTVS317_4	Understand process of confectionary products.

Course Contents:		**Hrs.**
Unit 1	**Wheat Processing** Structure and components of wheat, Types of wheat, Chemical constituents. Wheat milling process – Milling, types of wheat flour, by-products and enzymes in wheat flour.	05
Unit 2	**Dough Analysis** Parameters used in dough analysis: Farinograph, Mixograph, Extensograph, Alveograph, Amylograph.	04
Unit 3	**Bakery products** Role of bakery ingredients. Processed products of bakery-Bread making using straight and sponge dough methods, role of each ingredient. Baked products: biscuits, cookies, cake, pastry	04
Unit 4	**Confectionary** History and types of confectionary. Types of sugar (Granulate, Caster, Icing, Liquid, Brown, Molasses, Micro Crystalline Sugars). Alternative bulk sweeteners (glucose, dextrose, fructose, lactose), Sugar Alcohols (sorbitol, xylitol, iso-malt, soy maltose, polydextrose, lactitol, maltitol,), applications, Additives in confectionary.	05
Unit 5	**Cocoa and Chocolate processing** Cocoa processing: cocoa bean processing, roasting, fermentation, production of cocoa butter, cocoa powder. Chocolate: Ingredients, mixing, refining, conching, tempering, molding, cooling, coating, fat bloom.	04
Unit 6	**Confectionary products** Role of ingredients used in confectionary industry, Caramel, toffee processing different types of toffee, high boiled sweets, recipes, preparation of high boiled sweets, Marshmallow.	04

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TY-FT-39/46

Course Contents: Minimum 10 experiments from following list and one course project	
Expt. No.	**Title of Experiment**
1	Determination of gluten content of wheat.
2	Determination of moisture content of biscuit.
3	Determination of dough rising capacity.
4	Preparation of bread.
5	Preparation of biscuit.
6	Preparation of cookies.
7	Preparation of Chocolate.
8	Preparation of toffee.
9	Preparation of invert sugar.
10	Preparation of ground nut chikki.
11	Preparation of petha.
12	Micro-project

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Bakery Products Science and Technology	Weibiao Zhou, Y. H. Hui	Wiley-Blackwell	2nd	2014
2.	Industrial Chocolate Manufactory and Use	S. T. Beckett	Wiley-Blackwell	4th	2009
3.	Sugar Confectionery and Chocolate Manufacture	R. Lees and E.B. Jackson	Chemical publishing co.inc, U.S	1st	1975
4.	Dough Rheology and Baked Product Texture	Juan A. Menjivar Hamed Faridi Ph.D., Jon M. Faubion	Springer	1st	1990
5.	Sugar Confectionary Manufacture	Jackson EB	Aspen Publication	2nd	1995

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	3rd	1989

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TY-FT-40/46

Course Details:

Class:	**Third Year B. Tech.** Semester - VI
Course Code and Course Title:	1FTFE318 **Minor Course-III Introduction to Plant Design and Process Engineering**
Prerequisite/s:	Engineering Mathematics
Teaching Scheme: Lecture	03
Credits:	03
Evaluation Scheme:(T) ISE/MSE/ESE	40/30/30

Course Outcomes: After successful completion of this course, students will able to	
1FTFE318_1	Analyze alternative processes and equipment for manufacturing a product.
1FTFE318_2	Design plant layout and engineering flow diagrams.
1FTFE318_3	Perform economic analysis related to process design.
1FTFE318_4	Evaluate project profitability.

Course Contents:		**Hrs.**
Unit 1	**Process Development :** Process selection, study of alternative processes, pilot plant, flow sheet preparation, Plant Design: Design basis, specification , plant location, plant layout and installation, safety, start up, shutdown and operating guidelines.	07
Unit 2	**Materials and Fabrication Selection** Materials of Construction, Metals, Alloys, Nonmetals, Brick and cement materials, Rubber and Elastomers, Plastics, Gasket materials, Selection of materials, Economics in selection of materials, Layout of materials, Cutting, forming, fastening, heat treating, finishing.	06
Unit 2	**Cost Engineering :** Time value of money and equivalence, Capital Investment and working Capital. interest-simple, compound and continuous, annuities, perpetuities and capitalized cost methods, depreciation, Cash flow for industrial operations	07
Unit 3	**Profitability:** Criteria of profitability, payout period, return on investment, present value, cash flow analysis, alternative investment analysis. estimation of total product cost, manufacturing cost, general expenses.	06
Unit 5	**Design Report:** Types of Reports, Organization of reports, physical process of preparing a report, Tables, Graphs, Illustrations, References to Literature, Sample Calculations, Mechanical Details, Nomenclature, Check list for final report.	07
Unit 6	**Scheduling and Networking of Project:** Role of project engineering in project organization, start up and shut downs of project; preliminary data for construction projects; process engineering; plot plans, scheduling the project.	06

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TY-FT-41/46

Text Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Plant Design and economics for chemical engineers	M. S. Peters & K. D. Timmerhaus	Mc Graw Hill	3rd	2002
2	Analysis, Synthesis and Design of Chemical Processes	Richard Turton, R.C. Bailie, W.B. Whiting, J.A. Shaeiwitz	Prentice Hall	--	--
3	Optimization For Engineering Design-Algorithms and Examples	Kalyanmoy Deb	PHI Learning Private Limited	--	--

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Cost and Optimization Engineering	Kenneth Humphreys	McGraw Hill College,	3rd	1991
2	Project Management with CPM and PERT	Joseph Moder	Van Nostrand Reinhold	3rd	1983

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TY-FT-42/46

Course Details:

Class	**Third Year B. Tech** Semester VI
Course Code and Course Title	1FTPE319 – **Minor Course-III Nanotechnology in Food Industry**
Prerequisite/s	0FTPC205- Food Chemistry and Micronutrients 0FTPC208- Food Microbiology
Teaching Scheme: Lecture	03
Credits	03
Evaluation Scheme: :(T) ISE/MSE/ESE	40/30/30

Course Outcomes : After successful completion of this course, students will able to	
1FTPE319_1	Understanding basics of Nanotechnology.
1FTPE319_2	Apply knowledge of Nanotechnology in Food technology.
1FTPE319_3	Adapt to innovations in Food Processing and Packaging.
1FTPE319_4	Study Safety and Quality monitoring agencies/bodies

Course Contents:		**Hrs.**
Unit 1	**Introduction to Nanotechnology:** Developments in domain of Nanotechnology, Definitions and Scales ,Measuring the Nano Scale: Nature of Light, Electron Microscope, Scanning Probe Microscope, Nanomaterials: Formation of nano Materials	06
Unit 2	**Nanotechnology in Food processing** Nano-encapsulation& Micro-encapsulation: Flavor & Aroma Encapsulation Nano Formulations for the Delivery of Bioactive Compounds. Electro spinning and Electro spraying Technologies: Applications in the Food Industry,Nano-filtration, Nanoclusters, Nanochelates, Bioavailability of Nanoparticles in Nutrient and Nutraceutical Delivery	07
Unit 3	**Nano-food ingredients** Metal Oxides, Functionalized Nanomaterials, Nano Additives ,Encapsulation and Release Efficiency of Nanoparticles:Applications of Nanoencapsulation in Food Industry ,Importance of Nanotechnology in Food Processing in Terms of Texture, Appearance, Taste, Nutritional Value, and Shelf-Life ,Nanoparticles as Ingredients and Additives in Nutrients and Food Supplements.	06
Unit 4	**Nano Packaging:** Potential of Nanomaterials in Food Packaging, Nanopolymers, Nano-composites, Nanolaminates, and Nano-structured Coatings in Food Packaging ,Smart/Intelligent Packaging ,Nano Antimicrobials in Enhancement of Shelf-Life of Foods.	06

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TY-FT-43/46

Unit 5	**Nano Sensors:** Nanotechnology in Microbial Food Safety & Bio-security: Electrochemical Sensors for Food Analysis and Contaminant Detection, Monitoring and Separation of Food-Borne Pathogens Using Nanoparticles. Safety Assessment for Use of Nanomaterials in Food and Food Production: Efficacy Evaluation and Risk Assessment, Regulatory Framework for Food Nanotechnology.	07
Unit 6	**Ethical, Safety, and Regulatory Aspects**: Ethical Considerations for Use of Nanotechnology in Food ,Risk Assessment and Management ,Regulatory Frameworks and Guidelines: Global Regulatory Perspectives: FDA, EFSA. ,Labeling and Consumer Awareness. Case Studies: Successes and Challenges in Food Nanotechnology, Nanoencapsulation of Flavors and Nutrients, Nanopackaging for Extended Shelf Life, Nanoemulsions for Food Texture and Stability, Nanoformulations for Bioactive Compounds Delivery, Nanoemulsions for Food Texture and Stability.	07

Textbooks:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Introduction to Nanotechnology	Charles P. Poole,Frank J. Owens	Wiley	1st	2008
2	Bionanotechnology	David S. Goodsell	John Wiley & Sons	1st	2004
3	Nanobiomaterials Handbook	BalajiSitharaman	Taylor & Francis	1st	2011

References:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Nanotechnologies in Food	Qasim Chaudhary, Laurence Castle, Richard Watkins	RSC Publishing	1st	2010
2	Nanoparticle Assemblies and Superstructures	Nicholas A. Kotov	CRC	1st	2006
3	Nanotechnology in Agriculture and Food Production	Jennifer Kuzma, Peter VerHage	Woodrow Wilson International	1st	2006

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Course details:

Class:	**Third Year B. Tech** Semester VI
Course Code and Course Title:	1FTEL320 – Mini Project
Prerequisite/s:	--
Teaching Scheme: Practical	04
Credits:	02
Evaluation Scheme: (P) ISE/ESE	50/50

Course Outcomes: After completing this course students will be able to	
1FTEL320_1	Apply knowledge of unit operations and process
1FTEL320_2	Carry out material and energy balance calculations of selected problem
1FTEL320_3	Design problem statement
1FTEL320_4	Use modern tools to solve problem
1FTEL320_5	Prepare a project report

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 a 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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TY-FT-45/46

Course Details:-

Class	**Third Year B. Tech** Semester VI
Course Code and Course Title	1FTCC321 **Aptitude and Reasoning Part-IV**
Prerequisite/s	-
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme:(P) ISE	50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to	
1FTCC321_1	Solve problem based on basic and advance probability, Permutation and Combination
1FTCC321_2	Solve problem based on Syllogism, graphs, data interpretations
1FTCC321_3	Solve problem based on gaming round
1FTCC321_4	Demonstrate on Resume writing skill, closed, advanced grammar, Synonymsand Antonyms

Course Contents:

Unit No.	Title	Hrs.
Unit 1	Advance Probability Advance Permutation Combination	**04**
Unit 2	Statement Assumption Syllogism	**04**
Unit 3	Mixed Bar Graph, Pie Chart Data Interpretation (Avg & Ratio Proportion based)	**04**
Unit 4	Gaming Round OR Capgemini Part 1 Gaming Round OR Capgemini Part 2	**04**
Unit 5	Company Specific Revision for arithmetic (S.T.D., Time Rate Work) Revision of Calendar Reminder theorem Power Cycle	**04**
Unit 6	Verbal Ability Revision Part 1 Verbal Ability Revision Part 2 Interview Etiquettes & Grooming	**04**

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Quantitative Aptitude for Competitive Examinations	R.S. Agarwal	S Chand	Revised	2022
02	A Modern Approach to Verbal & Non-Verbal Reasoning	R.S. Agarwal	S Chand	Revised	2024
03	English Grammar And Composition	P C Wren, H Martin	S Chand	2nd	2019

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