Annexure-I

Bachelor of Engineering in Food Technology

3rd SEMESTER

S.No	Subject Code	Subject	Teaching			Sel. Award	Theory	Practical	Total marks	Duration of Examination hrs
			L	T	P					
1	MATH-201E / HUM201E	Mathematics-III/ Basics of Industrial Sociology, Economics & Management	3	1	0	50	100	0	150	3
2	FTT-201E	Food Microbiology	4	1	0	50	100	0	150	3
3	FTT-203E	Food Chemistry	3	2	0	50	100	0	150	3
4	FTT-205E	Unit Operation In Food Engineering-I	4	2	0	50	100	0	150	3
5	FTT-207E	Food Processing (Prostech)	4	2	0	50	100	0	150	3
6	FTT-211E	Food Microbiology Lab	0	0	2	25	0	25	50	3
7	FTT-213E	Food Chemistry Lab	0	0	2	25	0	25	50	3
8	FTT-215E	Unit Operation In Food Engineering-I Lab	0	0	2	25	0	25	50	3
9	FTT-217E	Food Processing Lab	0	0	3	50	0	50	100	3
			18	8	9	375	500	125	1000	
Grand Total			35							

Annexure-I
Bachelor of Engineering in Food Technology

4th SEMESTER

S.No	Subject Code	Subject	Teaching			Sessional Award	Theory	Practical	Total marks	Duration of Examination hrs
			L	T	P					
1	HUM-201E / MATH 201E	Basics of Industrial Sociology, Economics & Management/ Mathematics-III	3	1	0	25	75	0	100	3
2	FTT-202E	Human Nutrition	3	1	0	25	75	0	100	3
3	FTT-204E	Thermal Processing (HMT)	3	2	0	25	100	0	125	3
4	FTT-206E	Unit Operation in Food Engineering –II	3	2	0	25	100	0	125	3
5	FTT-208E	Dairy Technology	3	1	0	25	100	0	125	3
6	FTT-210E	Fruit & Vegetable Processing	3	1	0	25	100	0	125	3
7	FTT-214E	Thermal Processing Lab	0	0	2	25	0	50	75	3
8	FTT-216E	Unit Operation in Food Engineering Lab	0	0	3	25	0	50	75	3
9	FTT-218E	Dairy Technology Lab	0	0	2	25	0	50	75	3
10	FTT-220E	Fruit & Vegetable Processing Lab	0	0	2	25	0	50	75	3
			18	8	9	250	550	200	1000	
Grand Total			35							

BASICS OF INDUSTRIAL SOCIOLOGY, ECONOMICS & MANAGEMENT

HUM – 201 E			Sessional	:	50
L	T	P	Theory	:	100
3	1	-	Total	:	150
			Duration of Exam.	:	3 Hrs.

UNIT-I

Meaning of social change, nature of social change, theories of social change. The direction of social change, the causes of social change, the process of social change. Factors of social change – the technological factors, the cultural factors, effects of technology on major social institutions, social need of status system, social relations in industry.

UNIT-II

Meaning of Industrial Economic, Production Function, its types, Least Cost Combination, Law of Variable Proportion, Laws of Return – Increasing, Constant & Diminishing.

Fixed & variable costs in short run & long run, opportunity costs, relation between AC & MC, U-shaped short run AC Curve.

Price & Output Determination under Monopoly in short run & long run. Price Discrimination, Price Determination under Discriminating Monopoly. Comparison between Monopoly & Perfect Competition.

UNIT – III

Meaning of Management, Characteristics of Management, Management Vs. Administration, Management – Art, Science & Profession, Fayol's Principles of Management.

Personnel Management – Meaning & Functions, Manpower – Process of Manpower Planning, Recruitment & Selection – Selection Procedure.

Training – Objectives & Types of Training, Various Methods of Training. Labour Legislation in India – Main provisions of Industrial disputes Act 1947;

UNIT – IV

Marketing Management – Definition & Meaning, Scope of Marketing Management, Marketing Research – Meaning, Objectives.

Purchasing Management – Meaning & Objectives, Purchase Procedure, Inventory Control Techniques.

Financial Management – Introduction, Objectives of Financial decisions, Sources of Finance.

Note : Eight questions are to be set taking two from each unit. The students are required to attempt five questions in all, taking at least one from each unit.

TEXT BOOKS :

1. "Modern Economic Theory" Dewett, K.K., S. Chand & Co.
2. "Economic Analysis" K.P. Sundharam & E.N. Sundharam (Sultan Chand & Sons).
3. "Micro Economic Theory" M.L. Jhingan (Konark Publishers Pvt. Ltd.).

4. "Principles of Economics" M.L. Seth (Lakshmi Narain Aggarwal Educational Publishers – Agra).
5. "An Introduction to Sociology", D.R. Sachdeva & Vidya Bhusan.
6. "Society – An Introductory Analysis", R.M. Maclver Charles H. Page.
7. "Principles and Practices of Management : R.S. Gupta; B.D. Sharma; N.S. Bhalla; Kalyani.

REFERENCE BOOKS

1. "Organization and Management : R.D. Aggarwal, Tata McGraw Hill.
2. Business Organization and Management : M.C. Shukla

MATH-201 E MATHEMATICS - III

L	T	P
3	1	-

Theory	:	100
Sessional	:	50
Total	:	150
Duration of Exam		: 3 Hrs.

UNIT – I

Fourier Series : Euler's Formulae, Conditions for Fourier expansions, Fourier expansion of functions having points of discontinuity, change of interval, Odd & even functions, Half-range series.

Fourier Transforms : Fourier integrals, Fourier transforms, Fourier cosine and sine transforms. Properties of Fourier transforms, Convolution theorem, Perseval's identity, Relation between Fourier and Laplace transforms, Fourier transforms of the derivatives of a function, Application to boundary value problems.

UNIT-II

Functions of a Complex Variables : Functions of a complex variable, Exponential function, Trigonometric, Hyperbolic and Logarithmic functions, limit and continuity of a function, Differentiability and analyticity.

Cauchy-Riemann equations, Necessary and sufficient conditions for a function to be analytic, Polar form of the Cauchy-Riemann equations, Harmonic functions, Application to flow problems, Conformal transformation, Standard transformations (Translation, Magnification & rotation, inversion & reflection, Bilinear).

UNIT-III

Probability Distributions : Probability, Baye's theorem, Discrete & Continuous probability distributions, Moment generating function, Probability generating function, Properties and applications of Binomial, Poisson and normal distributions.

UNIT-IV

Linear Programming : Linear programming problems formulation, Solution of Linear Programming Problem using Graphical method, Simplex Method, Dual-Simplex Method.

Text Book

1. Higher Engg. Mathematics : B.S. Grewal
2. Advanced Engg. Mathematics : E. Kreyzig

Reference Book

1. Complex variables and Applications : R.V. Churchil; Mc. Graw Hill
2. Engg. Mathematics Vol. II: S.S. Sastry; Prentice Hall of India.
3. Operation Research : H.A. Taha
4. Probability and statistics for Engineer : Johnson. PHI.

Note : Examiner will set eight question, taking two from each unit. Students will be required to attempt five questions taking at least one from each unit.

FTT-201E Food Microbiology

L	T	P		
4	1	0	Marks Sessional	50
			Marks Exam.	100
			Exam Duration	3 hrs.

Unit-I

Introduction – History of microbiology, cellular organization- eukaryotic and prokaryotic organisms, Food borne and related organisms-bacteria, yeast, molds & viruses.

Unit-II

Type & Growth Pattern - Growth pattern in microbes, biochemical activities and survival of microorganisms in food, physical & chemical factors affecting growth and destruction of microbes- aerobes and anaerobes, psychrophiles, psychrotrophs, mesophiles, thermoduric, thermopiles, halophiles, osmophiles & spore formers.

Unit-III

Metabolism and analysis – Fermentation, putrefaction, lipolysis, antagonism and synergism in microorganisms. Rapid methods of microbial analysis: immunoassays, nucleic acid probes & PCR in food analysis.

Unit-VI

Food borne infections – Food borne infections, microbial toxins, mushrooms and algae as foods, probiotics, indicator organisms, detection & quantification of microbes and their products including toxins, sources and control of microorganisms-asepsis, sanitation.

Note:-
The examiner will set eight questions, taking two from each unit. The students will be required to attempt at least one from each unit. All questions will carry equal marks.

Text Books

Author	Title
W.C. Frazier	Food Microbiology

Reference Book

J. Heritage	Introductory Microbiology

FTT-211E Food Microbiology
Practical

P		Marks Sessional	25
2		Marks Exam.	25
		Exam Duration	3 hrs.

1. Microscopic examination of foods for bacteria and yeast and molds
2. Standard plate count
3. Yeast and mould count
4. Spore count
5. MPN of coliform
6. Enumeration of physiological groups- psychrophiles, thermodurics osmophiles and halophiles,
7. Detection of aflatoxin.

FTT-203E Food Chemistry

L	T	P		
3	1	2	Marks Sessional	50
			Marks Exam.	100
			Exam Duration	3 hrs.

Unit-I

Introduction:- Development of food chemistry and its role in food processing

Unit-II

Proteins:- Proteins in human's diet, classification and properties of amino acids, chemical and physical properties of protein, structure of amino acids, essential and non-essential amino acids, isolation of amino acids, criteria of purity of proteins, separation, qualitative and quatitative analysis of proleins. Changes during processing, protein determination methods.

Carbohydrates: Nomenclature and classification, structure, physical and chemical properties of polysaccharides (cellulose, starch, fructans, galactans, hemi-cellulose, pectic substances) and their functions, changes in carbohydrates during processing.

Unit-III

Lipids:- Structure, physical and chemical properties, utilization of fats and oils, margarine, shortenings, salad and cooking oils in diet, introduction to hydrogenation and its importance.

Browning Reactions:- Enzymatic and non-enzymatic browning. Advantages and disadvantages factors affecting their reaction and control.

Vitamins:- Types of vitamins, chemistry and functions, source and deficiency diseases.

Unit-IV

Plant Pigment:- Structure and properties of chlorophyll, anthocyanins and carotenoids, chemical changes during processing.

Flavour and Aroma of Foods:- Importance and method of retention of flavour and aroma in foods, recent developments in flavour technology

Note:-

The examiner will set eight questions, taking two from each unit. The students will be required to attempt at least one from each unit. All questions will carry equal marks.

Text Books

Author	Title
Fennama	Food Chemistry
Lehhninger	Principles of Biochemistry

Reference Book

L.H. Meyer	Food Chemistry

FTT-213E Food Chemistry Lab.

P		Marks Sessional	25
2		Marks Exam.	25
		Exam Duration	3 hrs.

1. Proximate analysis of foods for moisture, fats, pro., crude pibre, ash & canbo.
2. TSS by RI and conductivity
3. PN, acidity, estimation of browning intensity
4. Determination of Vit C&A sugars
5. Estimation of Ca, P content & and nutri factors in foods
6. Analysis of lipids saponification value, acid val, I value
7. Estimation of preservatives, ant oxidation & tannins.

FTT-205E Unit Operation in Food Engineering-I

L	T	P		
4	2	0	Marks Sessional	50
			Marks Exam.	100
			Exam Duration	3 hrs.

Fluid Transport:- Analogy between Momentum, Heat and Mass transfer, Transport estimation, Dependence of velocity on temperature, pressure and composition, boundary conditions, velocity profiles thro pipes & flat plates, annulus space, Euler's equation & its application in stationary & moving fluid bodies, moment urn transport in turbulent flows. Flow of fluids, Nozzies and diffusers, Transportation of fluids, pumps, centrifugal reciprocating, Plunger, gear pump and vaccum pump, compressors, single and multistage, Ejectors.

How Measurement Techniques: Venturi meter, orifice meter Rotameter, V-notch, Square notch and weirs, pitot tube, simple numerical problems.

Mixing And Agitation: Different type of Agitators such as Propeller, paddle and Turbine, power calculation in agitation for Newtonian and non-Newtonian fluids, various types of mixers such as Ribbon mixer, Halical mixer etc. Mixing index, difference between mixing and Agitation.

Fluidization:- Flow through packed beds, Mechanism of fluidization, Minimum porosity, bed height minimum fluidization velocity. Two phase flow, pneumatic conveying and applications.

Note:-
The examiner will set eight questions, taking two from each unit. The students will be required to attempt at least one from each unit. All questions will carry equal marks.

Text Books

Author	Title
M.C code and Smith	Unit operations of Chemical Engineering

Reference Book

Cadger & Bancharo	Introduction to Chem. Engg.

FTT-207E Food Processing

L	T	P		
4	2	0	Marks Sessional	50
			Marks Exam.	100
			Exam Duration	3 hrs.

Unit-I

Scope and Trends in Food Industry:- Status of Indian food industry with emphasis of Jammu and Kashmir. Definition of food-Food technology, Food science, Food preservation and food engineering basic consideration. Importance of Food processing and preservation. Classification of foods on the basis of shelf life, pH, origin: Different types of Food spoilage viz. microbiological, bio-chemical and physical and their effects on food spoilage viz. microbiogical, bio-chemical, Chemical and Physical and their effects on food quality.

Unit-II

Preservation by sugar and salt:- Principle of salt (pickling, fermentation etc.) and sugar preservation. Preparation of intermediate moisture food (IMF)

Preservation by Low Temperature:- Low temperature required for different foods-Refrigeration-refrigeration load: refrigeration systems: Slow and fast freezing, freezing process: Types of freezer advantages and disadvantages: storage and thawing of frozen food.

Preservation by High Temperature:- Pasteurization, Sterilization, Canning: Definition, advantages and disadvantages, can formation. Unit operations in camming selection of raw material peeling coring. Blanching filling, brining/syruping, exhausting, sealing. Processing, cooling labeling and storage.

Unit-III

Moisture Removal:- Evaporation, concentration, drying, and dehydration, types of dryers, advantages and disadvantages, operation and maintenance of different drying system, selection of dryers, basics of drying calculations

Chemical preservatives in Food Preservation:- Types of chemical preservative used in different food products and their stability during processes.

Unit-IV

Radiation preservation of foods:- Irradiation of Foods, dozes of dozer of irradiation- its effect on food quality

New and unconventional Methods of Processing:-

Principles of :

- High pressure Technology of Food preservation
- Infra Ted (IR) technique
- Microwave heating

Asepsis and removal of micro organism

Note:-

The examiner will set eight questions, taking two from each unit. The students will be required to attempt at least one from each unit. All questions will carry equal marks.

Text Books

Author	Title
Norman N. Potter	Principles of Food Processing

FTT-217E Food Processing Lab.

P		Marks Sessional	25
2		Marks Exam.	25
		Exam Duration	3 hrs.

1. Determination of Salt
2. Estimation of Ascorbic Acid
3. (i) Determination of amount of tin coating
   (ii)Sulphide stain test & crystal forms
4. Testing flexible films for
   (i) Water vapour transmission rate
   (ii)Greeze persistence
   (iii)Determination of the shelf life of the packed products
5. (i) The soponification value of given ail sample
   (ii) Crismer test
   (iii) Aeid value
6. Evaluation of dehydrated & canned foods.
7. Can reforming, seaming and canning of fruits and vegetables. Microwave cooking of foods, frozen storage, pasteurization and sterilization of foods.

FTT-202E Human Nutrition

L	T	P		
3	1	0	Marks Sessional	25
			Marks Exam.	75
			Exam Duration	3 hrs.

Unit-I

Relationship of nutrition to health, growth and human welfare, Definitions of terms used in nutrition- adequate, nutrition, over nutrition, under nutrition. Malnutrition.

Unit-II

Classification, functions, sources, digestion, requenaments, and effects of deficiencies and excess of carbohydrates, fats and proteins.
Water:- its functions and requirement for human body.

Unit-III

Energy value of foods and factors affecting energy expenditure by an individuals.
Vitamins and minerals (Ca, Fe, P, F, Zn, I, Na, K)
Classification, Functions, sources, deficiencies and toxicity.

Unit-VI

Minimal Nutritional requirement and RDA formulation of RDA and dietary guidelines reference man and reference woman

FTT-204E Thermal Processing

L	T	P		
3	2	0	Marks Sessional	25
			Marks Exam.	100
			Exam Duration	3 hrs.

Unit-I

Introduction:- basic concepts of heat and mass transfer, importance of heat and mass transfer in Food Processing.

Unit-II

Modes of heat transfer:-

(A) Conduction:- Principle of conduction, derivation of general heat conduction equation in Cartesian and cylindrical coordinates, steady state heat transfer through slabs. Composite walls, cylinders, spheres etc; insulation and its purposes, critical thickness of insulation for cylinders and spheres, general heat transfer equation for extended surfaces (Fins)

(B) **Convection:-** Natural and forced convection, dimensional analysis for free and forced convection, dimensionless numbers used in convective heat transfer, Important correlations for free and forced convection.

(C) **Radiation:-** Introduction, reflection, absorption and transmission of radiation, characteristics of black, grey and real bodies in relation to thermal radiation, Stefan Boitzman low; kirchoffs law; Wein displacement law, intensity of radiation, radiation between two bodies.

Unit-III

Heat exchangers:- Classification, overall heat transfer coefficient, fouling factors, log-mean temperature difference for parallel and counter flow heat exchangers, heat transfer in shell and tube heat exchangers, effectiveness of parallel and counter flow heat exchanger by general and NTU (Number of Transfer Units) method, design of heat exchanger, applications of plate heat exchanger in HTST pasteurizer.

Unit-IV

Mass Transfer:- Introduction to mass transfer and diffusion, Flick's law of diffusion of mass transfer derivation of general diffusion mass transfer equation, molecular diffusion of gases, solid, liquid and biological materials, convective mass transfer coefficient, Natural and forced convective mass transfer, dimensional analysis for free and forced convective mass transfer.

Note:-
The examiner will set eight questions, taking two from each unit. The students will be required to attempt at least one from each unit. All questions will carry equal marks.

Text Books

Author	**Title**
D.S. Kumar	Heat & Mass Transfer
G.K. Roy	Fundamentals of Engineering heat & Mass Transfer

Reference Book

R.C. Scahdeva	Fundamentals of Engineering heat & Mass Transfer

FTT-206E Unit Operation in Food Engineering-II

L	T	P		
3	2	0	Marks Sessional	25
			Marks Exam.	100
			Exam Duration	3 hrs.

Unit-I

Flow of Incompressible Fluids:- Shear stress distribution in a cylindrical tube, velocity distribution for Newtonion fluids, elementary knowledge of laminar and turbulent flow. Reynolds number, Reynolds experiment, continuity equations, Bernoulli's theorem, fluid head and power requirement, calculation of friction loss due to enlargement, contraction, fitting and value, definition of hydraulic radius, equivalent length and diameter, effect of roughness, entry length, net positive suction head, cavitation, suction lift and suction head.

Unit-II

Transportation of Fluids:- Classification of pumps, construction and operation of reciprocating, rotary, centrifugal and gear pumps, different types of value, fans, blowers and compressors.

Measurement of Flowing Fluids:- Orifice meter, venturimeter, pitot tube, rotameter, weirs and notches, simple numerical problem, properties of discharge.

Unit-III

Solid Handling:- Characteristics of solid particles. Properties of particular masses, storage of solids.

Size Reduction:- Energy and power requirements law. Rittinger's law. Bond's law , classification and names of size reduction equipment, construction and working of blake. Jaw and dodge crusher, rol mill, ball mill grinders, uitrafine grinders and cutting machines.

Unit-IV

Separation:- Methods of solid-solid separation, screening and screening equipment. Methods of soild-liquid separation, filteration, continuous and batch filters, pressure and vacuum filters thickeners classifiers etc. methods of solid gas separation, cyclone separator.

Note:-

The examiner will set eight questions, taking two from each unit. The students will be required to attempt at least one from each unit. All questions will carry equal marks.

Text Books

Author	Title
M.C code and Smith	Unit operations of Chemical Engineering

Reference Book

Cadger & Bancharo	Introduction to Chem. Engg.

FTT-208E Dairy Technology

L	T	P		
3	1	0	Marks Sessional	25
			Marks Exam.	100
			Exam Duration	3 hrs.

Unit-I

Introduction:- Status of dairy industries in India, introduction of basic unit operations involved in the processing of milk and milk products.

Composition of Milk:- Composition and physico-thermal properties of milk, their interaction with processing

Unit-II

Homogenization of Milk:- Principle of homogenization, single and two stage homogenizers, care and maintenance of homogenizers, application of homogenization in dairy industry.

Thermal Processing of Milk:- Pasteurization of milk; batch, flash and continuous pasteurizer, care and maintenance, UHT processing of milk.

Unit-III

Concentration of Milk:- Concentration of milk and machineries, heat and mass balance in single and multiple effect evaporator, types of evaporators and their performances characteristics and selection criteria.

Drying and Dehydration of milk:- Drying theories, estimation of drying rates and drying time, drying equipment (Spray drier, drum drier)

Unit-IV

Food Freezing:- Kinetics of food freezing, freezing methods and equipment, recent advances in food freezing, technology of ice-cream manufacturing.

Cleaning and Sanitation :- Selection and use of dairy cleaners and sanitizers, washing equipment working and maintenance of can washers, steam sterilization of canes clean in place system. Factors affecting, washing operation.

Note:-

The examiner will set eight questions, taking two from each unit. The students will be required to attempt at least one from each unit. All questions will carry equal marks.

Text Books

Author	**Title**
Sukuma DE	Outlines of Dairy Technology

Reference Book

Lamport Lincoln M. Milk & Milk Products

Arbuckle's Ice-Cream

FTT-218E Dairy Technology Lab.

P		Marks Sessional	25
2		Marks Practical	50
		Exam Duration	3 hrs

1. Platform tests
2. Determination of fat, S.N.F& T.S.
3. Determination of Protein, Lactose and ash contents of milk
4. Layout plan for setting up of milk plant
5. Preparation of paneer, Chhana, Ghee, Dahi, Khoa, Kulfi etc.
6. Evaluation of different types of milk and milk products.

FTT-210E Fruit & Vegetable Processing

L	T	P		
3	1	0	Marks Sessional	25
			Marks Exam.	100
			Exam Duration	3 hrs.

Unit-I

Introduction:- Status & scope of fruit & vegetable processing industry in India general principles and methods of preservation and processing, packaging material and containers, chemical preservatives and additives, canning of fruit & vegetables, Tin can, glass containers & plastic pouches, dehydration by hot air, vacuum and freeze drying, Intermediate moisture fruit & vegetables.

Unit-II

Post Harvest:- Classification of fruits & vegetables, factors influencing maturity and ripening, biological & environmental factors involved in post harvest deterioration, control of post harvest losses, Harvesting technology, post harvest handling procedures & treatments- hot& cold,, preservatives & chemicals, protective coatings, irradiation, commercial cooling systems, packaging and packing house operations, storage systems: CA & MA storage, natural cooling by evaporation, storage disorders, quality & safety factors & export standards.

Unit-III

Vegetable Processing :- Tomato Products, pectic substances, fermented fruits, pickling & preparation of chutneys, vinegar production, Standards for processed products & regulations, waste utilization.

Unit-IV

Fruit Processing:- Preparation of syrups, cordials & nectars, concentration of juices, canning, standards for processed products & regulations, waste utilization.

Note:-
The examiner will set eight questions, taking two from each unit. The students will be required to attempt at least one from each unit. All questions will carry equal marks.

Text Books

Author	Title
Girdharilal & Siddappa	Preservation of Fruit & vegetable

Reference Book

Woodruf & lun	Commercial fruit processing

FTT-220E Fruit & Vegetable Processing Lab.

P		Marks Sessional	25
2		Marks Practical	50
		Exam Duration	3 hrs

1. Determination of Maturity indices for fruits & vegetables
2. Quality evaluation of fruits & vegetables.
3. Processing of fruit juices & beverages, canning & bottling
4. Preparation of jam, jelly, marmalade, preserves & candies
5. Preparation of potato & tomato products
6. Pickling & other fermented products,
7. Dehydration & freezing.

Text Books

Author	**Title**
Ranganna	Hand book of analysis F & V products

Reference Book

Kramer & Twig	Quality control in food Industry (Vol. I & II)